Annual Report

2014-2015

Indian Statistical Institute

INDIAN STATISTICAL INSTITUTE

Annual Report

April 2014 – March 2015

203 Barrackpore Trunk Road
Kolkata – 700 108
(http://www.isical.ac.in)

INDIAN STATISTICAL INSTITUTE
EIGHTY THIRD ANNUAL REPORT
April 2014 – March 2015

CONTENTS

		Page
Director's Report		**i**
Brief History of the Institute		**iii**
Summary of Activities at a Glance		**vii**
Part I.	**Teaching & Training, Research and Publications**	
1.	**Teaching & Training**	**1**
	Degrees and Training Courses	1
	Ph.D. Degrees Awarded	4
	International Statistical Education Centre	10
2.	**Research and other Scientific Activities**	**11**
	Theoretical Statistics and Mathematics Division	**11**
	Stat-Math Unit (SMU), Kolkata	11
	Stat-Math Unit (SMU), Delhi	13
	Stat-Math Unit (SMU), Bangalore	16
	Stat-Math Unit (SMU), Chennai	18
	Applied Statistics Division	**22**
	Applied Statistics Unit (ASU), Kolkata	22
	Interdisciplinary Statistical Research Unit (ISRU), Kolkata	26
	Applied Statistics Unit (ASU), Chennai	30
	Applied and Official Statistics Unit (AOSU), N-E Centre, Tezpur	31
	Computer and Communication Sciences Division	**32**
	Advanced Computing and Microelectronics Unit (ACMU), Kolkata	32
	Computer Vision and Pattern Recognition Unit (CVPRU), Kolkata	36
	Electronics and Communication Sciences Unit (ECSU), Kolkata	46
	Machine Intelligence Unit (MIU), Kolkata	50
	Documentation Research and Training Centre (DRTC), Bangalore	55
	Systems Science and Informatics Unit (SSIU), Bangalore	58
	Computer Science Unit, Chennai	61
	Physics and Earth Sciences Division	**64**
	Geological Studies Unit (GSU), Kolkata	64
	Physics and Applied Mathematics Unit (PAMU), Kolkata	67
	Biological Sciences Division	**71**
	Agricultural & Ecological Research Unit (AERU), Kolkata	71
	Biological Anthropology Unit (BAU), Kolkata	75
	Human Genetics Unit (HGU), Kolkata	76

Social Sciences Division **79**

Economic Research Unit (ERU), Kolkata 79
Linguistic Research Unit (LRU), Kolkata 87
Population Studies Unit (PSU), Kolkata 91
Psychology Research Unit (PRU), Kolkata 92
Sampling and Official Statistics Unit (SOSU), Kolkata 95
Sociological Research Unit (SRU), Kolkata 97
Economics and Planning Unit (EPU), Delhi 107
Economic Analysis Unit (EAU), Bangalore 108

Statistical Quality Control and Operations Research Division **108**

SQC & OR Unit, Kolkata 108
SQC & OR Unit, Delhi 112
SQC & OR Unit, Bangalore 113
SQC & OR Unit, Chennai 113
SQC & OR Unit, Coimbatore 113
SQC & OR Unit, Hyderabad 114
SQC & OR Unit, Mumbai 114
SQC & OR Unit, Pune 114

Library, Documentation and Information Sciences Division **114**

Library, Kolkata 114
Library, Delhi 119
Library, Bangalore 121
Library, Chennai 122
Library, Tezpur 122
PCM Memorial Museum and Archives, Kolkata 123

Centre for Soft Computing Research: A National Facility, Kolkata **124**

Computer and Statistical Services Centre, Kolkata **127**

R.C. Bose Centre for Cryptology and Security, Kolkata **128**

3. Projects **131**

Internally Funded Projects **131**
Ongoing Projects 131
Completed Projects 135

Externally Funded Projects **137**
Ongoing Projects 137
Completed Projects 144

North East Projects **147**
Ongoing Projects 147
Completed Projects 147

4. Symposia, Conferences, Workshops, Lectures and Seminars **148**

Symposia and Conferences 148

North East Symposia and Conferences 149

Workshops and Training Programme 149
North East Workshops and Training Programme 155

Lectures and Seminars 157

5. Publication of Sankhyā 177

6. Scientific Papers and Publications 179

Books Published 179
Papers Published in Journals 181
Papers Published in Conference Proceedings 216
Papers Published in Books 228

7. Visiting Scientists, Honours and Awards 233

Visiting Scientists 233
Honours and Awards 246

8. Editorial and other Scientific Assignments 250

Editorial Assignments 250
Scientific Assignments/Academic Visits Abroad 254
Scientific Assignments/Academic Visits in India 265

9. Mathematical Olympiad Organised 283

Part II. Administration and Office Bearers

10. General Administration 285

11. List of Members of the Academic Council and other Committees of the Institute as on 31 March 2015 293

Part III. Audited Statement of Accounts and Auditor's Report for the year 2014-2015

Director's Report

I feel immensely proud to present to you the activities of Indian Statistical Institute, and highlight our performance over the past year, in the form of Annual Report 2014-15. The name of the Institute as you know is synonymous with higher education in Statistics, Mathematics and Sciences in the country as well as around the world. I have been associated with this Institute of National Importance for more than three decades and as the Director of the Institute for last five years. We have continued with our efforts to strengthen our achievements and fill the gaps wherever the need be and being in the last year of my assignment as the Director urge the forthcoming leaders to continue with their noble efforts to further the growth and dissemination statistical scientific knowledge.

Our students are our brand ambassadors. Their accomplishments and triumphs, at both national and international platforms, reinforce our belief in our system. I convey my hearty wishes to all the students and the faculty members for helping me to earn accolades for the Institute.

The Institute is one of the pioneers to develop several key technologies by partnering with the industry, make scientific contribution in generating new knowledge in science and engineering, and above all, produce around 2,600 alumni who have established themselves as leaders in their respective domains by their distinguished contributions.

It is worth mentioning that the Government of India has always considered Indian Statistical Institute a premier Institute of research and never failed to acknowledge the contribution of eminent scientists. Professor Prasanta Chandra Mahalanobis the great visionary, founder Director of our Institute along with his immediate successor Professor C.R. Rao were awarded Padma Vibhushan, Professor Shankar Pal and Professor Jayanta Kumar Ghosh both former Directors of the Institute have been conferred Padma Shri by the Government of India for their significant contributions in the field of Science and Engineering and as the present Director I have been conferred Padma Shri by the Government of India in the field of Education and Literature in the year 2015. I sincerely hope that the future generation will endeavour to keep the ISI flag flying high.

The faculty and students continued to win laurels for their labours in academic as well as research arena and reporting about the awards and honours won by our faculty members and students is always a proud moment for the Director.

The many prestigious awards and honours received by some of my colleagues and students during the year have been a matter of pride and pleasure for us and require a special mention in this Annual Report. Dr. Antar Bandopadhyay was awarded with the NASI Scopus Young Scientist Award; Dr. Neena Gupta awarded Ramanujan Prize, 2014 by Ramanujan Institute for Advanced Study in Mathematics; Prof. Siva Athreya elected as Fellow of the Indian Academy of Sciences; Prof. B. Sury elected as Fellow of the National Academy of Sciences, 2015; Prof. Debashish Goswami also elected as Fellow of the Indian Academy of Sciences, 2015; Dr. Sushmita Ruj awarded Samsung Global Research Outreach Award, 2014; Shri Jiban Krishna Pal conferred with the prestigious Info Share Award, 2015; Prof. K.R. Parthasarathy awarded Indian National Science Academy Ramanujan Medal awarded in 2014; Prof. Nikhil Ranjan Pal conferred with Fuzzy Systems Pioneer Award by IEEE Computational Intelligence Society, USA; Prof. S.K. Pal elected Raja Ramanna Fellowship by Department of Atomic Energy; Prof. S. Bandyopadhyay selected as Senior Associate, International Centre for Theoretical Physics and as a Fellow of West Bengal Academy of Science and Technology, 2014; Prof. Ayanendranath Basu elected as a Fellow of West Bengal Academy of Science and Technology, 2014; Prof. Umapada Pal elected as a Fellow of International Association For Pattern Recognition; Dr. Chetan Ghate appointed as member of the External Expert Panel in Reserve Bank of India.

The Bangalore centre of the Institute has started the Post Graduate course on M.S. (QMS) from this academic year.

Director's Report

The Ministry of Statistics and Programme Implementation, Government of India has sanctioned an outlay of Rs.115 Crores under the XIIth Five Year Plan (EFC scheme) for setting up the R.C. Bose Centre for Cryptology and Security. An agreement has been signed with National Buildings and Construction Corporation Limited for the construction work of the Centre and a work order of Rs.80 Crores has been given to the National Buildings and Construction Corporation Limited. It has also been decided to restore the existing building named as Gupta Niwas in the area earmarked for setting up the R.C. Bose Centre for Cryptology and Security and preserve the same as a heritage building for future use and reference.

A partial list of the conferences and workshops organized by the Institute are International Conference on India Biodiversity Meet, 2014; 8th International Conference on Advances in Pattern Recognition; International Workshop and Conference on Recent Advances in Operator Theory and Operator Algebra; International Conference on Robust Statistics; International Symposium on Data Science; National Conference on Human Genetics: Techniques and Statistical Analyses; National Conference on Adolescent Development: Issues & Challenges; National Conference on Agriculture and Rural Development Issues in Eastern India; National Conference on Human Diversity: Biological Anthropological Approaches.

The Institute undertook a large number of externally funded projects over the years. At present there are about 115 ongoing projects in the Institute. The major funding agencies of the projects are Government of India, Ministry of Home Affairs, Department of Biotechnology, Ministry of Science & Technology, Department of Atomic Energy, Ministry of Commerce & Industry, Ministry of Tourism, Airport Authority of India, Reserve Bank of India, Office of Registrar General & Census Commissioner, State Government of Gujarat, DRDO, CSIR, DST, DGCIS, Mother Dairy (Delhi), IBM, Intel Corporation (USA), and European Union Commission.

With a view to academic collaboration and exchanges, development of research etc., several Memorandum of Understandings (MoUs) have been signed between ISI an London School of Economics; University of Warwick; Tata Consultancy Service Ltd.; All India Institute of Hygiene & Public health; GE, India technology Centre Pvt. Ltd.; Airports Authority of India; ISIT Security Laboratory, Japan; City University of Hong Kong.

To conclude, I convey my gratitude to Dr. C. Rangarajan, President of the Institute and also to Shri A.K. Antony and Dr. Arun Shourie the Chairman of ISI council for their co-operation, and unstinted guidance for smooth functioning of the Institute. I also thank Dr. T.C.A. Anant, Secretary, Ministry of Statistics and Programme Implementation, Government of India, all the Council members, and all other officials of the Administrative Ministry for their co operation and advice from time to time. Lastly I express my sincere gratitude to all the office bearers and other workers of the Institute for their continued co operation through their respective activities.

March 31, 2015 Bimal K. Roy

INDIAN STATISTICAL INSTITUTE

203 B. T. Road Kolkata 700108.

Founder
Professor Prasanta Chandra Mahalanobis

The Indian Statistical Institute, a premier and internationally acclaimed research, teaching and training institute, founded in 1931, is recognized as an institute of national importance by an act of Parliament in 1959.

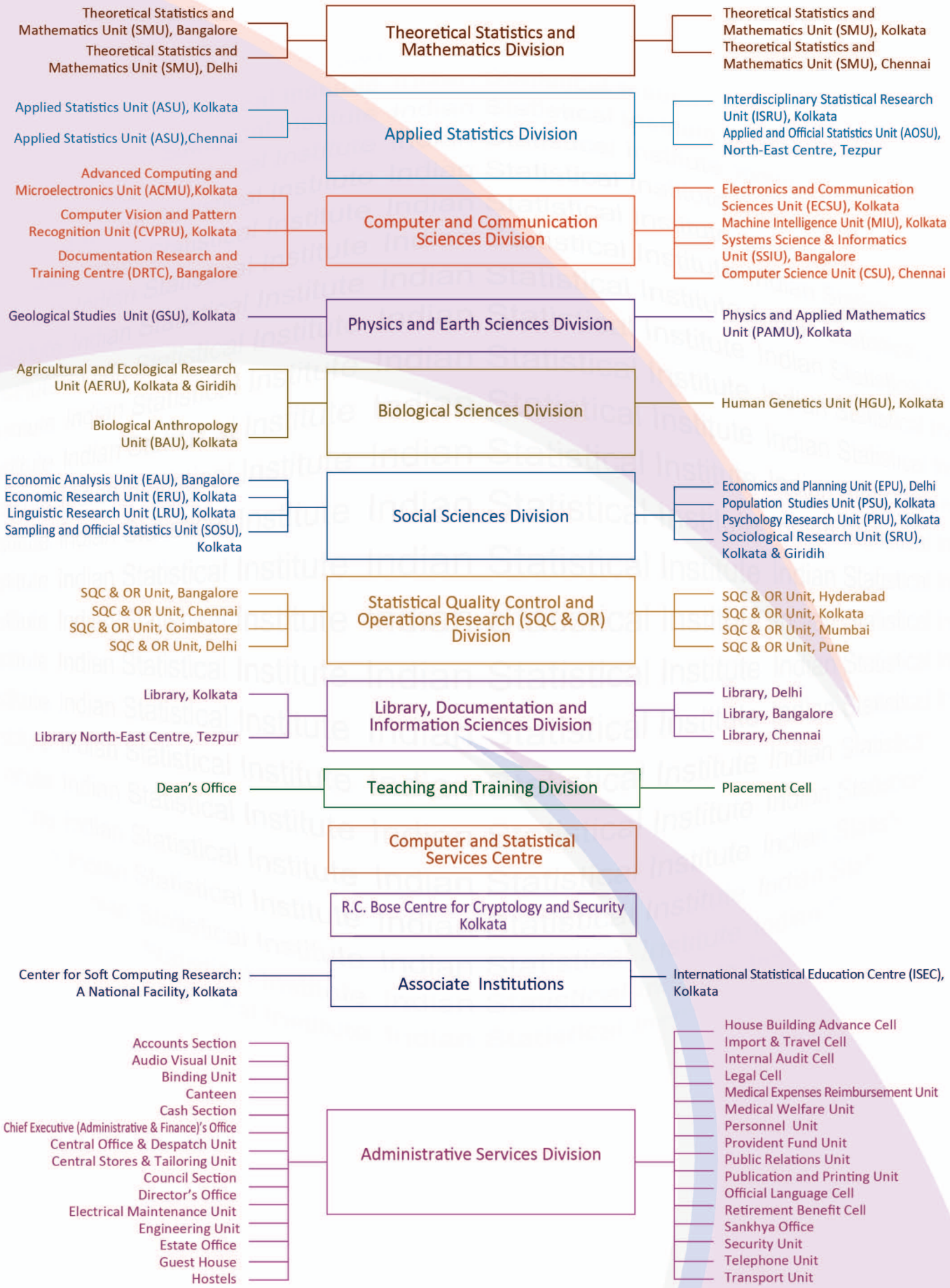
The Institute has distinguished faculty in statistics, mathematics, computer science, economics and other disciplines of natural and social sciences. Many of them are fellows of Indian National Science Academy, Indian Academy of Sciences, Indian National Academy of Engineering, National Academy of Sciences, India, Institute of Electrical & Electronics Engineers (IEEE) and many other distinguished scientific societies in India and abroad, and also recipients of prestigious awards like S.S. Bhatnagar Prize, Homi Bhaba Award etc.

The Institute offers -

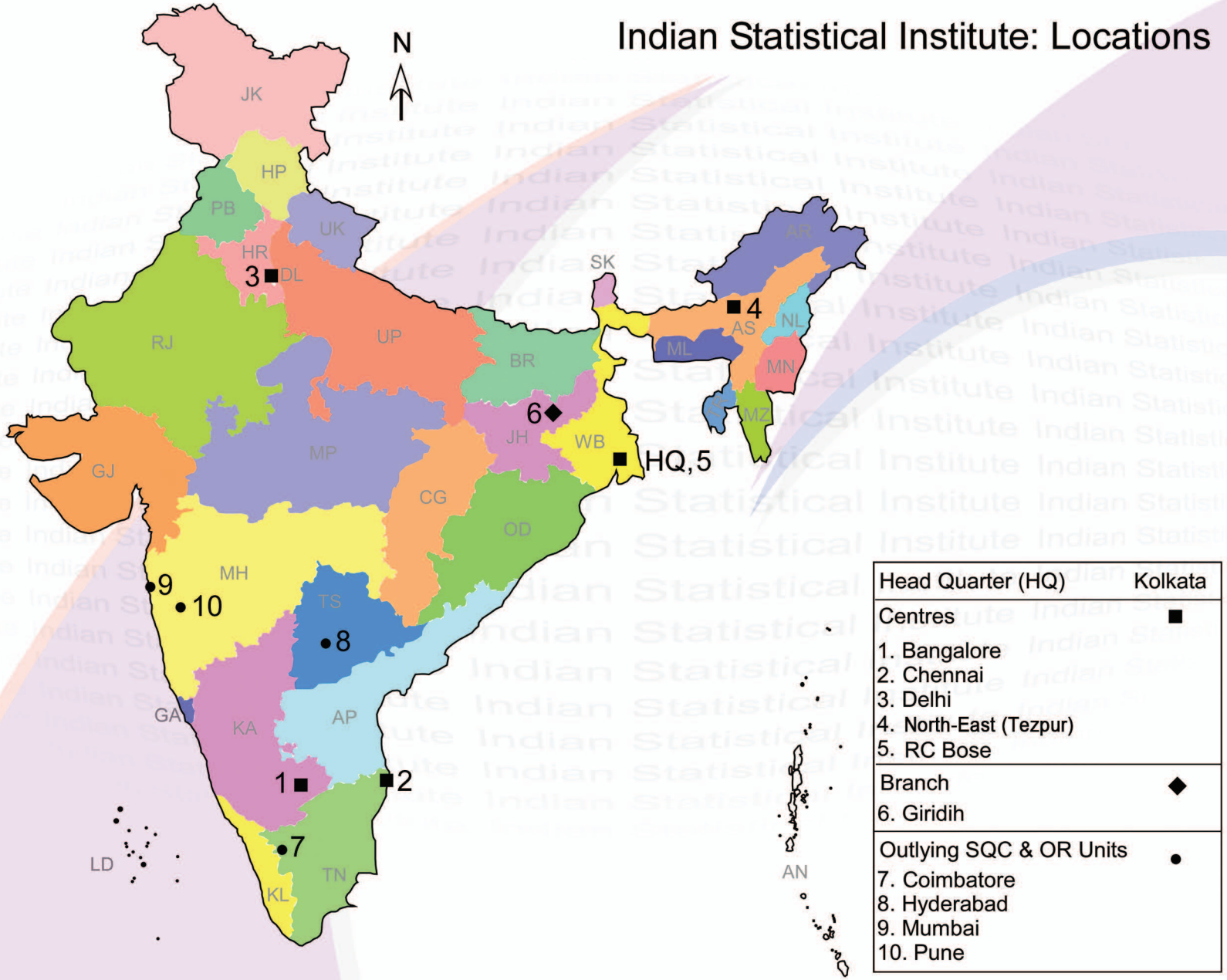
- B.Stat.(Hons.), B.Math.(Hons.), M.Stat., M.Math., M.S. in Quantitative Economics, M.S. in Quality Management Science, M.S. in Library and Information Science, M.Tech. in Computer Science, M.Tech. in Quality, Reliability and Operations Research
- Post Graduate Diploma in Statistical Methods with Applications
- Junior/Senior Research Fellowships in several areas of natural and social sciences
- Ph.D. degrees in Statistics, Mathematics, Quantitative Economics, Computer Science and Quality, Reliability & Operations Research

The Institute also confers D.Sc. (Honoris Causa).

Organization of ISI by Divisions, Constituent Units and Associate Institutions



Indian Statistical Institute: Locations



Head Quarter (HQ)	Kolkata
Centres	■
1. Bangalore 2. Chennai 3. Delhi 4. North-East (Tezpur) 5. RC Bose	
Branch	◆
6. Giridih	
Outlying SQC & OR Units	●
7. Coimbatore 8. Hyderabad 9. Mumbai 10. Pune	

International Seminar on Dynamics of Museum and Social Inclusion organized by P C M Memorial Museum & Archives, ISI during 26-27 February 2015

VI-MSS workshop on Environmental Statistics organized by ASU during 2-4 March 2015

Taking oath on Swachh Bharat Mission at ISI Bangalore Centre on 2 October 2014

4th West Bengal Growth Workshop organized by SOSU on 26 December 2014

Prof. Bimal K Roy, Director, ISI taking part on Swachh Bharat Mission at ISI Kolkata on 2 October 2014

Census Data Dissemination Workshop organized by SOSU on 19 December 2014

Workshop on Design and Analysis of Experiments organized by SQC & OR during 10-14 November 2014

Hindi Workshop at ISI Kolkata on 19 December 2014

Celebration of 125th Birth Anniversary of Pandit Jawaharlal Nehru organized by Reprography and Photography Unit, Library on 14 November 2014

Workshop on Statistical Methods and Applications organized by AOSU, ISI Tezpur Centre on January 30 – February 02, 2015

Kannada Rajyotsava: Flag Hoisting by Dr. Doreswamy Iyengar at ISI Bangalore on 28 November 2014

Business Analytics (BA-4) at ISI Chennai Centre during February and March 2015

National Conference on Agriculture and Rural Development Issues in Eastern India at ISI Giridih Centre during 12-13 March 2015

Workshop on R-Programming for Students and Researchers organized by AERU during 16-17 September 2014

Prof. Bimal K Roy, Director, ISI, inaugurating the Placement Cell of ISI on 4 September 2014

Workshop on Data and Security organized by ECSU on 22 September 2014

One day workshop on Sodar Technology : Applications in Environmental and Disaster Management organized by ECSU on 26 September 2014

North East Training Program on Statistical Data Analysis organized by ASU during 1-12 September 2014

5th Workshop on Digital Pictorial Photography and Photography Exhibition organized by Reprography and Photography Unit, Library at ISI during 2-6 February 2015

International Conference on Robust Statistics 2015 organized by ISRU during 12-16 January 2015

National Conference on Adolescent Development : Issues and Challenges organized by PRU during 29-30 January 2015

Celebration of 123rd Birth Anniversary of Dr. B. R. Ambedkar organized by ISI SC/ST/BC Employees' Coordination Council on 10 September 2014

Summer School on Fundamentals of Digital Design Automation organized by ACMU during 22-26 July 2014

Inauguration of Hindi Workshop organized by ISI, Kolkata on 15 September 2014

National Conference on Human Diversity : Biological Anthropological Approaches organized by BAU during 26-27 March 2015

Prof. Bimal K Roy, Director ISI delivering inaugural speech at the Data Dissemination Workshop on Census organized by Library, ISI, Kolkata on 10 March 2015

Special Hindi Workshop for Heads of Divisions/Units at ISI Kolkata on 27 June 2014

Felicitation of Prof. Bimal K Roy, Director recipient of Padmasri at ISI Kolkata on 29 January 2015

Training on Official Statistics and Related Methodologies organized by SOSU during 21-25 July 2014

Prof. Fernand Meyer delivering his lecture at the ICAPR-2015 organized by ECSU during 4-7 January 2015

Sri Arun Shourie, Chairman, ISI speaking at 121st Birth Anniversary of Professor Prasanta Chandra Mahalanobis

Meeting of Academic advisory body of R. C. Bose Centre for Cryptology & Security on 10 July 2014

Prof. Samir K Brahmachari speaking at the Annual Seminar organized by MIU on 30 March 2015

Celebration of Independence Day at ISI Kolkata

49th ISI Convocation (from left to right) Prof. Bimal K. Roy, Director, ISI, Dr. C Rangarajan, President, ISI, Sri Arun Shourie, Chairman, ISI, Prof. Eric Stark Maskin Nobel Laureate, Chief Guest, on 9 January 2015

Workshop on Applied Optimization Models and Computation organized by SQC & OR during 28-30 January 2015 at the ISI Delhi Centre

Workshop on SEMAT organized by ECSU on 4 June 2014

Celebration of Rabindra Jayanti organized by ISI Club on 26 May 2014

ISI Annual Sports on 19 February 2015

P C M Memorial Football Match Final held at ISI on 28 March 2014

Prof. Lina Mallozzi, Department of Mathematics and Applications, University of Naples delivering lecture at the ISI Delhi Centre during 28-30 January 2015

Winter School on Data Mining in Psychological Research organized by Psychological Research Unit during 19-21 February 2015

A BRIEF HISTORY OF THE INSTITUTE

In the 1920's, Prasanta Chandra Mahalanobis, then a Professor at Presidency College, Calcutta conducted several studies employing statistical methods with results that vindicated his ideas about the efficacy and possibilities of the emerging science of Statistics. In a meeting on 17th December 1931 presided by Sir R. N. Mukherjee, the first President of the Institute, the Indian Statistical Institute (ISI) was formally established and Prasanta Chandra Mahalanobis was appointed the Honorary Secretary. The Indian Statistical Institute was registered on 28th April, 1932, as a non-government and non-profit distributing learned society under the Societies' Registration Act No. XXI of 1860. The Institute is now registered under the West Bengal Societies Registration Act XXVI of 1961, amended in 1964. It has the following objectives:

(i) To promote the study and dissemination of knowledge of Statistics, to develop statistical theory and methods, and their use in research and practical applications generally, with special reference to problems of planning for national development and social welfare;

(ii) To undertake research in various fields of natural and social sciences with a view to the mutual development of Statistics and these sciences;

(iii) To provide for, and undertake, the collection of information, investigations, projects, and operational research for purposes of planning and the improvement of efficiency of management and production.

(iv) To undertake any other ancillary activities in fulfillment of the objectives (i), (ii) and (iii).

The Institute started functioning initially from a room of the Presidency College with enduring support from a number of distinguished personalities and devoted scholars in Kolkata. Over the first two decades, which turned out to be a glorious chapter in the annals of Indian science and institution building, the ISI embarked upon a series of pioneering programmes involving the application of Statistics in search of solution of the urgent and live problems of the country. Such programmes included innovative projects on sample surveys of yield and land utilisation of crops, socio-economic after-effects of Bengal famine and problems of flood research. These innovations and methodological research have since become classics in Statistics. At the same time, the training of scientific personnel began to grow. This also encouraged high level research and brought into focus the need for publication of the research results, for which *Sankhyā*, the first international journal of the country in Statistics, came into being in 1933.

Apart from the impact made in the world of Statistics, the Institute held a pivotal role in the task of nation building, when India became independent, through the brilliant choice of the area of surveys, which were socially and nationally relevant. The patronage and invaluable contribution of Sir Ronald A. Fisher played an important role. Led by Professor Mahalanobis and a very able group of younger statisticians including R.C. Bose, S.N. Roy and C.R. Rao, the Institute was poised to take on the larger role. The Institute is proud to have C.R. Rao, who is among the world leaders in statistical science over the last six decades and still active at the age of 93 as the Director of the Center for Multivariate Analysis at Pennsylvania State University, USA, in its list of alumni.

The 1950s saw the Institute establishing (i) a full fledged research and training school in Statistics and Probability, with its application in natural and social sciences, (ii) a planning wing entrusted with the formulation of the Second Five-Year Plan of India, (iii) publication of *Sankhyā*, (iv) the National Sample Survey wing engaging in comprehensive socio-economic data collection for the nation, (v) a string of Statistical Quality Control units for promoting the quality movement at various industrial centres in the country, (vi) a collaboration with the International Statistical Institute to train Government statisticians from Asia and Africa, and (vii) an Electronic Computer Laboratory that was responsible for

developing (a) the 1st mechanical hand computing machine, (b) the 1st Analog computer, (c) the 1st Punched Card storing machine and (d) the 1st Solid State Computer in India, to name some of the principal activities. In 1954 Pandit Jawaharlal Nehru, the then Prime Minister of India, entrusted Professor Mahalanobis and ISI with the responsibility of preparing the draft Second Five-Year Plan for the country. The draft submitted by Prasanta Chandra Mahalanobis and the planning models formulated by him and his colleagues have since been regarded as major contributions to economic planning in India. In 1956, the Institute installed the first electronic computer in the country. In 1961, the ISI, in collaboration with Jadavpur University, undertook the design, development and fabrication of a fully transistorized digital computer, called ISI-JU-1, which was commissioned in 1966. The Institute, from its formative period till present times, received as guests eminent scientists, some of whom were Nobel Laureates. Besides Ronald A. Fisher, J.B.S. Haldane and Walter A. Shewhart, the luminaries included Frederic and Irene Curie, Neils Bohr, A.N. Kolmogorov, P.M.S. Blackett, J.D. Bernal, Joan Robinson, Genichi Taguchi and George Akerlof, 2001 Nobel prize winner in economics and a visiting professor of ISI during 1967-68. In recent times, the visit of Amartya K. Sen, Robert Aumann, Lotfi A. Zadeh, Joseph E. Stiglitz, Sir James A. Mirrlees, Eric Maskin and S.R.S. Varadhan, 2007 Abel Prize winner for his contributions to probability theory and an alumnus of the institute, may be specially mentioned.

The formal recognition came in December 1959, when Pandit Jawaharlal Nehru piloted in the Parliament the enactment of the Indian Statistical Institute Act of 1959, which designated ISI as an 'Institution of national importance'. The activities steadily grew, existing interests became more broad-based and a number of science units were created in the interest of live interaction between Statistics and Natural and Social Sciences. Empowered by the Act to award degrees, the Institute started the B. Stat. and M. Stat. courses. An excellent library was founded at Kolkata and the Documentation Research and Training Centre began functioning in Bangalore. Other developments in infrastructure also began.

During 1971-72, two decisions of the Government of India produced serious repercussions on the functioning of the ISI. One was de-linking of the Institute from the Perspective Planning Division of the Planning Commission in 1971, while the other was the separation of National Sample Survey from the ISI and its take-over by the Central Government in 1972. Professor Mahalanobis passed away on 28th June, 1972. It was a critical period for the Institute. To overcome the problem, the ISI sought to strike a judicious balance between the individual academic work on truly fundamental problems and the work that called for a greater engagement with the social and economic problems of the country. The members of the Institute, under the Chairmanship of Shri P.N. Haksar, held a Special General Body Meeting on 26th July, 1974 and amended the Memorandum of Association and the Regulations of the Institute, encouraging more inter-disciplinary research and enhancing active participation of the scientists of the ISI in decision-making process of the Institute. The organisational amendments were implemented, with the concurrence of Government of India, in August, 1976. The various research units in natural, social and computer sciences were grouped under a number of scientific Divisions.

Over the decades diversity in research thrusts began to grow manifold, with emphasis on Computer Science and application of Statistics in the new areas of research in natural and social sciences. Two centres, one at Delhi and one at Bangalore were created with full-fledged research and teaching programmes. The Delhi Centre, initially housed within the Planning Commission premises, was started in 1974, and shifted to its present campus in 1975. The Bangalore Centre was conceived by Prof. P.C. Mahalanobis during 1960s. With the Statistical Quality Control unit functioning in Bangalore from 1956, and Documentation Research and training Centre from 1962, Professor Mahalanobis thought of starting a centre of ISI around the mid-sixties. However, the activities of the Bangalore Centre started in September 1978 in a rented building under the Directorship of Professor G. Kallianpur. The various units moved to the present campus in May 1985 and in September 1996, the Bangalore Centre was formally declared as a Centre of ISI. The Chennai centre of the Institute came into being on 26th July, 2008 and has to its credit several theoretical and applied research work in Statistics and Mathematics, and many of the projects undertaken have been breakthrough applications. A North-East Centre of the Institute has been established at Tezpur, Assam on 23rd July, 2011 and it is also expected to focus

on such diversity of teaching, training and research. This centre is currently housed in Tezpur University campus.

The Institute is fully funded by the Ministry of Statistics & Programme Implementation, Govt. of India. The support and encouragement of the Ministry of Statistics & Programme Implementation, Govt. of India are among the major factors which are helping the Institute to sustain its academic growth and excellence. The Ministry provides funds to the Institute under Plan & Non-Plan budget as per the recommendations of a committee set up for the purpose by the Ministry of Statistics & Programme Implementation, Govt. of India under Section 8(1) of the "Indian Statistical Institute Act. 1959, No. 57 of 1959" based on the programme of research, teaching, training and various academic activities. The grants-in-aid provided by the Ministry of Statistics & Programme Implementation, Govt. of India to the Institute includes the funds required for construction of buildings, hostels, guest house, purchase of equipments, hiring manpower etc. The Ministry plays a pivotal role in expansion of the research & training activities of the Institute by way of opening its new Centres in various parts of the country. The North-East Centre at Tezpur, Assam which was inaugurated by Shri Prabab Mukherjee, the then Finance Minister, Govt. of India and the then Chairman, Indian Statistical Institute Council in the presence of Shri Srikant Jena, Hon'ble Union Minister for Ministry of Statistics & Programme Implementation, Govt. of India; Shri Tarun Gogoi, Hon'ble Chief Minister, Govt. of Assam; Dr. T.C.A. Anant, Secretary, Ministry of Statistics & Programme Implementation, Govt. of India and other dignitaries. In July 2012, the Ministry of Statistics & Programme Implementation, Govt. of India approved establishment of R.C. Bose Centre for Cryptology and Security as a separate Centre of the Institute.

The present structure of eight divisions has been arrived at through some further changes. Recently there have been some changes. Systems Science and Informatics Unit (SSIU) has been started as a part of the Computer and Communication Sciences Division (CCSD) at ISI Bangalore centre in August 2009. The Documentation Research and Training Centre (DRTC) has been made a part of CCSD. The Indian Statistical Institute Act of 1959 was amended by the Parliament in 1995 to empower the Institute to award Degrees/Diplomas not only in Statistics, but also in Mathematics, Quantitative Economics, Computer Science and such other subjects related to Statistics as may be determined by the Institute from time to time. Several new courses have also been added since: M. Tech. in Computer Science, M. Tech. in Quality, Reliability and Operations Research, M.S. in Quantitative Economics, B. Math. and M. Math.

In conclusion, a list of the distinguished scientists and statesmen who have served the Institute during the 81 years of its existence in the capacities of President, Chairman or Director is presented. A list of recipients of the honorary D. Sc. degree given by the Institute is also provided.

Presidents of the Institute

1	Sir Rajendra Nath Mookerjee	1932-35
2	Shri E.C. Benthall	1936-37
3	Shri James Reid-Kay	1938
4	Shri Badridas Goenka	1939-41
5	Dr. Nalini Ranjan Sarkar	1942-43
6	Dr. Chintaman D. Deshmukh	1944-63
7	Shri Y.B. Chavan	1964-66
8	Prof. Satyendra Nath Bose	1967-75
9	Shri Subimal Dutt	1976-89
10	Prof. M.G.K. Menon	1990-2012
11	Dr. C. Rangarajan	2012-till date

Chairmen of the Institute

1	Shri B. Rama Rao	1954
2	Shri D.N. Mitra	1955-63
3	Shri K.P.S. Menon	1964-70
4	Shri S.C. Roy	1971
5	Dr. Atma Ram	1972
6	Shri. P.N. Haksar	1973-97
7	Dr. Bimal Jalan	1998-2001
8	Dr. N.R. Madhava Menon	2002-03
9	Shri Pranab Mukherjee	2004-12
10	Shri A.K. Antony	2012-14
11	Dr. Arun Shourie	2014-till date

Directors of the Institute

1	Prof. P.C. Mahalanobis	Dec	1931	-	June	1972
2	Prof. C.R. Rao	July	1972	-	June	1976
3	Prof. G. Kallianpur	July	1976	-	Sept	1978
4	Prof. B.P. Adhikari	Aug	1979	-	Oct	1983
5	Prof. Ashok Maitra	April	1984	-	Jan	1987
6	Prof. J.K. Ghosh	Jan	1987	-	Jan	1992
7	Prof. B.L.S. Prakasa Rao	Jun	1992	-	Feb	1995
8	Prof. S.B. Rao	July	1995	-	July	2000
9	Prof. K.B. Sinha	Aug	2000	-	July	2005
10	Prof. S.K. Pal	Aug	2005	-	July	2010
11	Prof. Bimal K. Roy	Aug	2010	-	till date	

List of persons awarded the D.Sc. (Honoris Causa) by the Institute

February 1962	Prof. Satyendra Nath Bose, Prof. Ronald A. Fisher, Pandit Jawaharlal Nehru, Dr. Walter A. Shewhart
April 1962	Prof. A.N. Kolmogorov
May 1965	Dr. Chintaman Dwarkanath Deshmukh
December 1974	Prof. Raj Chandra Bose, Dr. M.V. Keldysh, Prof. Jerzy Neyman
February 1977	Prof. Harald Cramer
February 1978	Shri Morarji Desai, Prof. L.V. Kantorovich
December 1989	Prof. C.R. Rao
January 2001	Prof. Gopinath Kallianpur
February 2004	Prof. S.R. Srinivasa Varadhan
March 2006	Prof. L.A. Zadeh
December 2006	Dr. Manmohan Singh
February 2011	Dr. Subhas Mukherjee (Posthumously)
January 2013	Prof. K.R. Parthasarathy, Prof. Jayanta Kr. Ghosh, Prof. Pranab Bardhan

Summary of Activities at a Glance

- **MoU with other Organisations (8 Nos.)** : **London School of Economics & Political Science (LSA); University of Warwick, UK; ISIT Security Laboratory, Japan; City University of Hong Kong; Tata Consultancy Service Ltd.; All India Institute of Hygiene & Public Health; GE, India Technology Centre Pvt. Ltd.; Airports Authority of India**

- **Number of books published** : **25**

- **Number of papers published** : **677**

- **Number of Conferences, Workshops and Seminars held (Total – 512)** : **32 (Conference) 143 (Workshop) 337 (Seminar)**

- **Prestigious Awards and Honours**

  - **Bimal Kumar Roy (Director)** : **Padma Shri (Education & Literature), Govt. of India, 2015;**
  - **Neena Gupta (Stat-Math Unit, Kolkata)** : **Ramanujan Prize 2014;**
  - **Ashis Sen Gupta (ASU, Kolkata)** : **Lifetime Achievement Award, Indian Association for Reliability & Statistics;**
  - **B.B. Bhattacharya (ACMU, Kolkata)** : **Outstanding Teachers Award 2014, INAE;**
  - **Nikhil Ranjan Pal (ECSU, Kolkata)** : **Fuzzy Systems Pioneer Award 2015, IEEE, USA;**
  - **V.K. Ramachandran (EAU, Bangalore)** : **Distinguished Achievement Award 2014, World Association for Political Economy;**
  - **Susmita Ruj (RCBCCS, Kolkata)** : **Global Research Outreach Award 2014, Samsung, Korea**

- **Regional Mathematical Olympiad (RMO), 2014**
  - **Date** : **07 December, 2014**
  - **Participants** : **761 (West Bengal), 2074 (Karnataka)**
  - **Successful Students** : **34 (West Bengal), 30 (Karnataka)**

  Indian National Mathematical Olympiad (INMO), 2015
  - **Date** : **01 February, 2015**
  - **Participants** : **37 (West Bengal)**

- **International Statistical Education Centre (ISEC)**
  - **Founded** : **1950**
  - **Commencement date of 68th Term (2014-15)** : **04 August, 2014**
  - **Number of Trainees** : **14**
  - **Countries participated** : **Afghanistan, Gambia, Ghana, Mongolia, Myanmar, Niger, Nigeria, Tanzania, & Togo**

1. TEACHING AND TRAINING

A brief account of teaching and training activities of the Teaching and Training Division during the academic session 2014-2015 is given below.

Degree and Training Courses

During the academic session **2014-2015,** a total of **20958** candidates applied for admission and were called for written selection tests for various courses offered by the Institute, viz., B. Stat. (Hons.), B. Math. (Hons.), M. Stat., M. Math., Master of Science (M.S.) in Quantitative Economics, Master of Science (M.S.) in Quality Management Science, Master of Science (M.S.) in Library and Information Science, M. Tech. in Computer Science, M. Tech. in Quality, Reliability and Operations Research, Post-Graduate Diploma in Statistical Methods and Analytics, Post-Graduate Diploma in Computer Applications, **Research Fellowships** in Statistics, Mathematics, Quantitative Economics, Computer Science, Quality, Reliability and Operations Research, Physics and Applied Mathematics, Agriculture & Ecology, Human Genetics, Geology, Library and Information Science, and Linguistics. Admission tests were conducted at **36** different centres (35 centres were all over the country and 01 centre was at Jeddah in Saudi Arabia). A total of **13477** candidates finally appeared for admission tests, of which a total of **843** candidates qualified in the written tests and were called for interviews. Based on the performance in the written tests, interview and the academic records, **340** candidates were offered admission to various courses during the academic session under review.

The annual examinations for all the regular courses during 2013-2014 academic session were held during May 2014. The 2014-15 academic session commenced from **July, 2014**.

The number of candidates admitted to the different degree, Diploma programmes and in Junior Research Fellowship during 2014-2015 and the number of students who passed the annual examinations in 2014, are given in **Table 1**.

Till **31st March, 2015, 121** trainees of Engineering and Technology courses from various Universities/ Institutions (A. K. Choudhury School of Information Technology, Academy of Technology, Hooghly; Amity University, Uttar Pradesh; Assam University, Silchar; Asutosh College, Kolkata; B. P. Poddar Institute of Management and Technology, Banasthali University – Rajasthan, Barrackpore Rastraguru Surendranath College, Bengal College of Engineering & Technology; Bengal Engineering and Science University, Shibpur; Birla Institute of Technology & Science, Pilani; Birla Institute of Technology, Mesra; Calcutta Institute of Technology; Central University of Jharkhand, Ranchi; Gitam University, Visakhapatnam; Government College of Engineering and Ceramic Technology; Government College of Engineering and Leather Technology; Guru Ghasidas University, Bilaspur; Haldia Institute of Technology; Heritage Institute of Technology; Himalayan Pharmacy Institute, Sikkim; Ideal Institute of Engineering; Indian Institute of Engineering, Science and Technology- Shibpur; Indian Institute of Science, Education and Research – Pune; Indian Institute of Science – Bangalore; Indian Institute of Technology – Kanpur; Indian Institute of Technology, Kharagpur; Indian Institute of Technology, Roorkee; Indira Gandhi National Open University – Delhi; Institute of Engineering and Management; Institute of Mathematics and Applications – Bhubaneswar; Jadavpur University; Kalyani Government Engineering College; KIIT University; Malaviya National Institute of Technology – Jaipur; MCKV Institute of Technology; Meghnad Saha Institute of Technology; Narula Institute of Technology; National Institute of Technology, Durgapur; National Institute of Technology, Tiruchirappalli; Neotia Institute of Technology, Management and Sciences; Presidency University, Kolkata; Punjab University; Queens University, Belfast – UK; Ramakrishna Mission Vidyamandir, Belur Math; Regent Education and Research Foundation; School of Biosciences & Technology; School of Biotechnology; South Asian University, New Delhi; Supreme Knowledge Foundation Group of Institutions; Symbiosis School of Economics; Techno India; University of Calcutta; University of Kalyani; University of Madras; University of North Bengal; VIT University; West Bengal University of Technology, Salt Lake) received four weeks/six weeks/two months/three months/four months and six months Project training in different Units of the Institute, viz., ACMU, AERU, BAU, CSSC, CVPRU, DEAN'S OFFICE, ECSU, ERU, GSU,

Teaching and Training

HGU, ISRU, MIU, PAMU, SMU and SQC & OR under the guidance of different faculty members of the Institute.

Convocation

The **49th Convocation** of the Indian Statistical Institute was held on **9th January, 2015 at 3.30 P.M.** It was started with The Vedic Hymn by ISI Club, followed by a welcome address by Dr. C. Rangarajan, President, ISI, annual review by Prof. Bimal K. Roy, Director, ISI, and Chairman's Address by Dr. Arun Shourie, Chairman of ISI Council, followed by a Convocation Address by Professor Eric S. Maskin, Nobel Laureate, Harvard University. The degrees and diploma were awarded to students by Dr. C. Rangarajan. The medals and prizes to the recipients were awarded by Dr. Arun Shourie. The Convocation was closed by Dr. C. Rangarajan, President, ISI, after a vote of thanks by Prof. Pradipta Bandyopadhyay, Dean of Studies, ISI, and the National Anthem by ISI Club. The list of recipients of various medals and prizes is given below.

Prasanta Chandra Mahalanobis Gold Medal for the most outstanding performance in ***M. Stat. (Hons.)*** students (2012-2014) was given to:

Soumendu Sundar Mukherjee

ISI Alumni Association ***Mrs. M.R. Iyer Memorial Gold Medals*** for outstanding performances were given to:

B. Stat. (Hons.): Partha Sarathi Chowdhury **M. Stat. :** Soumendu Sundar Mukherjee

M. S. (Q.E.) : Richa Bhojnagarwala **M. Tech. (QROR):** Abhay Shukla

ISI Alumni Association ***Rashi Ray Memorial Medals*** for outstanding performance in ***M. Tech. (CS)*** (2012-2014) was given to:

Gopinath Mishra

ISI Alumni Association ***P.C. Panesar Gold Medal*** for outstanding performance in ***M. Math.*** (2012-2014) was given to:

Nikhilesh Dasgupta

D. Basu Memorial Gold Medal for outstanding performance in ***B. Stat. (Hons.)*** (2011-2014) was given to:

Pratyay Datta

Nikhilesh Bhattacharya Memorial Gold Medal for the best student in ***B. Stat. (Hons.)*** (2011-2014) was given to:

Partha Sarathi Chowdhury

S.H. Aravind Gold Medal for outstanding performance in ***B. Math. (Hons.)*** (2011-2014) was given to:

Kannappan S.

Sunity Kumar Pal Gold Medal for the best dissertation in ***M. Tech. (CS)*** (2012-2014) was given to:

Kaushik Chakraborty

TCS award for the best dissertation in ***M. Tech. (CS)*** (2012-2014) was given to:

Sayantan Sarkar Soumi Chattopadhyay

Dr. N.S. Iyenger Award for best student of ***Econometrics*** (2014) was given:

Allena Rohit

In addition to regular teaching duties in various academic programmes of the Institute, the faculty members of the Institute offer research courses in consultation with the research fellow advisory committees of respective divisions for the research fellows of the Institute.

Table – 1

Number of students who passed during 2014 and number of existing students/fellows during 2014-2015

Sl. No.	Courses		Number of students who passed the Annual Examination	
			In 2014	**During the year 2014-15**
01.	**B. Stat. (Hons.)** (Offered at Kolkata)	1st year 2nd year 3rd year	24 16 28	26*** 24 17****
02.	**B. Math. (Hons.)** (Offered at Bangalore)	1st year 2nd year 3rd year	12 14 23	26 16* 14
03.	**M. Math.** (Offered at Kolkata & Bangalore- in alternative year)	1st year 2nd year	13 06	24** 13
04.	**M. Stat.** (Offered at Kolkata, Delhi & Chennai)	1st year 2nd year	46# =(26+13+7) 59	53# =(29+15+9) 47***
05.	**M.S. (QMS)** (Offered at Bangalore)	1st year	-	12
06.	**M.S.(QE)** (Offered at Kolkata & Delhi)	1st year 2nd year	29^= (09+20) 34^ =(13+21)	34^ = (11+23) 30^ = (10***+20)
07.	**M. Tech. (CS)** (Offered at Kolkata)	1st year 2nd year	28 15	31*** 28
08.	**M. Tech. (QROR)** (Offered at Kolkata)	1st year 2nd year	17 14	14 17
09.	**M.S. (Library and Information Science)** (Offered at Bangalore)	1st year 2nd year	10 05	06 10
10.	**Post-Graduate Diploma in Statistical Methods and Analytics** (Offered at North-East Centre, Tezpur)	1st year	03	14
11.	**Post-Graduate Diploma in Computer Applications** (Offered at Giridih)	1st year	-	03
12.	**Junior & Senior Research Fellows in different disciplines** (Offered at Kolkata, Delhi, Bangalore, Chennai & Hyderabad)		19	147 $
Grand Total			**415**	**606**

***** Four students repeating a year
****** Three students repeating a year
*** One student repeating a year
**** One student in exchange programme
^ Total number including Kolkata and Delhi
# Total number including Kolkata, Delhi and Chennai
$ JRF & SRF at Kolkata

Table 2

Ph. D degree awarded by the Institute in the 49th Convocation held on 09.01.2015

Sl. No.	Name of the Fellow	Title of the Thesis	Subject	University / Institute	Name of the Supervisor(s)
1.	Pulak Purkait, M. Tech. (Computer Science) (Indian Statistical Institute)	Super Resolution Image Reconstruction Based on Efficient Priors	Computer Science	ISI	Prof. Bhabotosh Chanda, ECSU, ISI, Kolkata
2.	Malay Bhattacharyya, Master of Elec. & Tele-Com. Engg. (Jadavpur University)	Mining Co-Expression Networks: Applications to MicroRNA Regulation and Disease Analysis	Computer Science	ISI	Prof. Sanghamitra Bandyopdhyay, MIU, ISI, Kolkata
3.	Ranajit Das, M. Sc. (Physics) (University of Calcutta)	Some Issues in Gene Regulation and Evaluation.	Computer Science	ISI	Prof. Sushmita Mitra, MIU, ISI, Kolkata
4.	Samiran Bag, M. Tech. (Computer Science) (Indian Statistical Institute)	Application of Combinatorial Structures in Wireless Communication	Computer Science	ISI	Prof. Bimal Roy, ASU, ISI, Kolkata
5.	Sumit Kumar Pandey, M. Tech. (Computer Science) (Indian Statistical Institute)	Generic Constructions of Different Cryptographic Primitives over Various Public Key Paradigms	Computer Science	ISI	Prof. Rana Barua, SMU, ISI, Kolkata
6.	Arunabha Majumdar, M. Sc. (Statistics) (IIT, Kanpur)	Some Statistical Issues Pertaining to Genome-wide Association Studies	Statistics	ISI	Prof. Saurabh Ghosh, HGU, ISI, Kolkata
7.	Buddhananda Banerjee, M. Sc. (Statistics and Informatics) (IIT, Kharagpur)	Inference Based on Surrogate Endpoints in Clinical Trials with Binary Responses	Statistics	ISI	Prof. Atanu Biswas, ASU, ISI, Kolkata
8.	Anirvan Chakraborty, Master of Statistics (Indian Statistical Institute)	Nonparametric methods for data in infinite dimensional spaces	Statistics	ISI	Prof. Probal Chaudhuri, SMU, ISI, Kolkata

9.	Sumesh K, M. Sc. (Mathematics) (University of Calicut)	Bures Distance For Completely Positive Maps And CP-H-Extendable Maps Between Hilbert C*-Modules	Mathematics	ISI	Prof. B.V. Rajarama Bhat, SMU, ISI, Bangalore
10.	Ambily A A, M. Phil.(Mathematics) (Cochin University of Science & Technology)	K-Theory of Quadratic Modules: A Study of Roy's Elementary Orthogonal Group	Mathematics	ISI	Prof. B. Sury, SMU, ISI, Bangalore
11.	Anirban Bose, M. Sc. (Mathematics) (University of Calcutta)	Some Conjugacy Problems in Algebraic Groups	Mathematics	ISI	Prof. M. Thakur, SMU, ISI, New Delhi
12.	Priyanka Grover, M. Sc. (Mathematics) (University of Delhi)	Some Problems in Differential and Subdifferential Calculus of Matrices	Mathematics	ISI	Prof. R. Bhatia, SMU, ISI, New Delhi
13.	Md. Ali Zinna, Master of Mathematics (Indian Statistical Institute)	Euler class groups of polynomial and subintegral extensions of a Noetherian ring	Mathematics	ISI	Prof. Mrinal Kanti Das, SMU, ISI, Kolkata
14.	Qaiser Jahan, M. Sc. (Mathematics) (University of Allahabad)	Wavelet analysis on local fields of positive characteristics	Mathematics	ISI	Prof. Biswaranjan Behera, SMU, ISI, Kolkata
15.	Priya Brata Dutta, M. Sc. (Economics) (University of Calcutta)	Skilled-Unskilled Wage Inequality: Economic Theory and Policy	Quantitative Economics	ISI	Prof. Manas Ranjan Gupta, ERU, ISI, Kolkata
16.	Debasmita Basu, M. Sc. (Economics) (University of Calcutta)	Agricultural Trade and Protectionism	Quantitative Economics	ISI	Prof. Abhirup Sarkar, ERU, ISI, Kolkata
17.	Anup Pramanik, M. S. (Quantitative Economics) (Indian Statistical Institute)	Essays on incentive compatibility on restricted domains	Quantitative Economics	ISI	Prof. Arunava Sen, EPU, ISI, Delhi
18.	Eshita Gupta, M.A. (Economics) (Delhi School of Economics)	Three Essays on Impact of Global-Warming in India	Quantitative Economics	ISI	Prof. E. Somanathan, EPU, ISI, Delhi

Teaching and Training

19.	Srikanta Kundu, M. Sc. (Economics) (University of Burdwan)	Modelling Stock Returns in 'Volatility-in-Mean' Framework under Up and Down Market Movements: A Multi-Country Study	Quantitative Economics	ISI	Prof. Nityananda Sarkar, ERU, ISI, Kolkata

Table 3

Research Fellows who have been awarded Ph. D degree by Academic Bodies other than ISI during 2014 for work done in the ISI

Sl. No.	Name of the Fellow	Title of the Thesis	University	Name of the Supervisor (s)
1.	Sushmita Paul	Rough Sets for Analysis of Coding and Non-Coding RNA Expression Data	University of Calcutta	Dr. Pradipta Maji, MIU, ISI, Kolkata
2.	Vinit Kumar	A Model for Enrichment of Library Online Services using Semantic and Social Web Technologies	University of Calcutta	Dr. Devika P. Madalli, DRTC, ISI, Bangalore
3.	Anjan Dutta	Inexact Subgraph Matching Applied to Symbol Spotting in Graphical Documents	Universitat Autonoma de Barcelona, Spain	Dr. Josep Llados Canet, Deptartamento de Ciencia de la Computacion, Universitat Autonoma de Barcelona, Spain and Prof. Umapada Pal, CVPRU, ISI, Kolkata
4.	Anupam Sarkar	Mechanisation in Contem-porary Indian Agriculture: Nature of Ownership and Use	University of Calcutta	Prof. V.K. Ramachandran, EAU, ISI, Bangalore
5.	Ashoke Sarkar	Study on Some Challenging Issues in Implementing Lean Six Sigma	Jadavpur University	Dr. Arup Ranjan Mukhopadhyay, SQC & OR Unit, ISI, Kolkata and Prof. Sadhan K. Ghosh, Mechanical Engineering Department, Jadavpur University, Kolkata
6.	Partha Pratim Mohanta	On Structural Segmentation of Video Stream for Content Based Summarization	Jadavpur University	Dr. Sanjoy Kumar Saha, Department of Computer Science & Engineering , Jadavpur University,

				Kolkata and Prof. Bhabotosh Chanda, ECSU, ISI, Kolkata
7.	Asmita Bhattacharyya	Gender & Work in Information Technology Sector: A Sociological Study of Women Work Force	Jadavpur University	Dr. Bhola Nath Ghosh, SRU, ISI, Kolkata and Prof. Pradip Kumar Bose, Centre for Studies in Social Sciences, Kolkata
8.	Rituparna Basak	Role of Career Stages, Self-efficacy and School Environment on Job Satisfaction of School Teachers	University of Calcutta	Prof. Anjali Ghosh, Psychology Research Unit, ISI, Kolkata
9.	Mouli Das	Certain Optimization Tasks in Biochemical Pathways	University of Calcutta	Prof. Rajat K. De, MIU, ISI, Kolkata
10.	Sruti Gan Chaudhuri	Distributed Algorithms for Swarm Robots	Jadavpur University	Prof. Krishnendu Mukhopadhyaya, ACMU, ISI, Kolkata
11.	Goutam K Audhya	Channel Assignment for Multimedia Signals in Cellular Mobile Networks.	Jadavpur University	Prof. Bhabani P Sinha, ACMU, ISI, Kolkata
12.	Sudip Roy	Design Automation Algorithms for Sample Preparation on a Digital Microfluidic Lab-on-a-Chip	Indian Institute of Technology, Kharagpur	Prof. Bhargab B Bhattacharya, ACMU, ISI, Kolkata and Prof. Partha P Chakrabarty, IIT, Kharagpur
13.	Sudip Samanta	Phytoplankton-zooplankton interaction in the presence of fish kairomone-model based study	University of Calcutta	Prof. Joydev Chattopadhyay, AERU, ISI, Kolkata
14.	Shouvik Mitra	Carbon dots and zinc oxide nanostructures: Synthesis, fabrication, biological and biomedical applications	Jadavpur University	Prof. Arunava Goswami, AERU, ISI, Kolkata
15.	Sk. Sarif Hassan	Studies on Fractal Formation and its Morphological Analysis with some novel Applications	Utkal University	Prof. P. Pal Choudhury, ASU, ISI, Kolkata and Prof. B. K. Nayak, Department of Mathematics, Utkal University
16.	Sriparna Ganguly	Some Contributions To The Molecular Genetics Of Primary Congenital Glaucoma	University of Calcutta	Prof. Partha Pratim Majumdar, HGU, ISI, Kolkata

Teaching and Training

17.	Moumita Maity	Mental Health Profiles among the Elderly: Effects of Sociodemographic Factors and Area of Residence	University of Calcutta	Prof. Barun Mukhopadhyay, BAU, ISI, Kolkata
18.	Debjit Dutta	Supersymmetry Approach to some Problem in Quantum Mechanics and Related Topics	University of Calcutta	Prof. Pinaki Roy, PAMU, ISI, Kolkata
19.	Swapan Rana	Geometric Quantum Discord	University of Calcutta	Dr. Preeti Parashar, PAMU, ISI, Kolkata
20.	Badri Narayan Subudhi	On Detection and Tracking of Moving Objects in Video Scenes	Jadavpur University	Prof. Ashish Ghosh, MIU, ISI, Kolkata
21.	Soumi Sengupta	Ligand design and virtual screening using metaheuristic algorithms: Applications to Mycobacterium tuberculosis	Jadavpur University	Prof. Sanghamitra Bandyopadhyay, MIU, ISI, Kolkata
22.	Debarka Sengupta	Graph and Rank Based Algorithms for Inferring microRNA-Disease Association	Jadavpur University	Prof. Sanghamitra Bandyopadhyay, MIU, ISI, Kolkata
23.	Navonil De Sarkar	Molecular Genetics of Oral cancer: with special reference to miRNA and mRNA expressions and addressing some technical limitations of PCR	University of Calcutta	Prof. Bidyut Roy, HGU, ISI, Kolkata
24.	Kaushik Kundu	Physicochemical Studies of Single and Mixed Surfactants Microemulsions/Reverse Micelles based on Hydrocarbon and Biocompatible Oils	Jadavpur University	Prof. Bidyut K. Paul, GSU, ISI, Kolkata

Number of candidates who were awarded degrees in the 49th Convocation of the Institute held on 9th January, 2015

Degree /Diploma	Number of candidates
Doctor of Philosophy (Ph.D.)	19
Master of Technology (M. Tech.) in Computer Science	15
Master of Technology (M. Tech.) in Quality, Reliability and Operations Research	14
Master of Statistics (M. Stat.)	59
Master of Mathematics (M. Math.)	06
Master of Science (M.S.) in Quantitative Economics	34
Master of Science (M.S.) in Library and Information Science	05
Bachelor of Statistics (Honours) [B.Stat. (Hons.)]	28
Bachelor of Mathematics (Honours) [B.Math. (Hons.)]	21
Bachelor of Mathematics (B.Math.)	02
Post-Graduate Diploma in Statistical Methods with Applications	03
Total	206

International Statistical Education Centre (ISEC)
Annual Report 2014-2015

The International Statistical Education Centre (ISEC) was founded in 1950 at the initiative of Professor P.C. Mahalanobis. The Centre opened at Kolkata through an agreement between the International Statistical Institute and the Indian Statistical Institute (ISI). At present, the Centre is run by the Indian Statistical Institute under the auspices of the Government of India. The Centre functions under a joint Board of Directors. In its history of more than 60 years, the Board of Directors of ISEC has had only two chairmen. Prof. P.C. Mahalanobis was the Chairman since the inception of the Centre in 1950 until his death in 1972. Since then, Professor C.R. Rao has been the Chairman of the Board.

The Centre aims to provide training in theoretical and applied statistics at various levels to selected participants from countries of the Middle East, South and South-East Asia, the Far-East and the commonwealth countries of Africa. The primary training programme is a 10-month regular course in Statistics leading to a Statistical Training Diploma. In addition, special course on different topics of varying duration are also organized.

The commencement date of the 68th Term ISEC Regular Course (2014-2015) was August 4, 2014. There were14 trainees from 9 different countries, namely (1) Nigeria, (2) Gambia,(3) Mongolia,(4) Tanzania, (5) Myanmar, (6) Niger, (7) Togo, (8) Ghana,(9) Afghanistan. Fourteen trainees were supported by fellowships of the ITEC/SCAAP of Government of India. They will be awarded Statistical Training Diploma in a Convocation, scheduled to be held May 29, 2015. Prof. S.P. Mukherjee, Centenary Professor of the University of Calcutta will be delivering the convocation address.

The ISEC offers regularly some short term special courses on different topics of Statistics. A two week special course on Statistical Research Methods, covering data analysis and report writing, has been offered to seven Afghan officials from the National Statistical Office of the country in the period March 2 to 13, 2015 at the ISEC.

The ISEC in its totality has shifted now to the first floor in a new building, named C.D. Deshmukh Bhavan, at 202, B.T. Road, Kolkata 700108, having four class rooms, one computer laboratory, one library and number of rooms for the Member-Secretary, the Programme Coordinator and the faculty members with all modern amenities including scope for interactive presentations. It has now its independent logo indicating Indian objective of making learning an area of international cooperation. Professor Bimal Kumar Roy, Director, ISI, has taken special interest in enhancing the international image of the ISEC courses and the infrastructure. The trainees are provided with computer facilities and internet connections in the Computer Laboratory and in the ISEC hostel. They have also access to the books at the ISI library. Teachers at the headquarter of the Indian Statistical Institute and officers of the Government of India are participating in teaching the Regular Course during this year. Till now, nearly 1600 trainees from about 82 countries have received the Statistical Training Diploma.

2. RESEARCH AND OTHER SCIENTIFIC ACTIVITIES

The major thrust of the Institute is on research in various disciplines comprising Theoretical and Applied Statistics, Mathematics, Computer Sciences, Biological Sciences, Economics and other Social Sciences, Physics and Earth Sciences, Statistical Quality Control and Operations Research, and Library and Information Sciences. Scientists of the Institute carry out independent research in their own basic discipline and also undertake interdisciplinary research in collaboration with other units within the Institute and also with outside organizations. The Institute also takes up various internally and externally funded projects in diverse fields on challenging live problems of national and international importance. As a part of research activities, scientists of the Institute are involved in consultancy work as well. This section gives a brief account of the principal areas of work over the past year of the scientific divisions of the Institute, namely, the Divisions of:

Theoretical Statistics and Mathematics

Applied Statistics

Computer and Communication Sciences

Physics and Earth Sciences

Biological Sciences

Social Sciences

Statistical Quality Control and Operations Research

Library, Documentation and Information Sciences

In addition, there are reports from the 'Center for Soft Computing Research: A National Facility,' the 'Computer and Statistical Services Centre' and the newly formed 'R.C. Bose Centre for Cryptology and Security'.

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Research in Probability

A work with on finite-diagonal large dimensional Hankel-type matrices was completed. A paper `Convergence of a class of Hankel-type matrices' was prepared where spectral properties of finite diagonal matrices of Hankel type, have been studied, using the method of joint convergence of random matrices in free probability setup. Also a nice interplay between limiting spectral distributions of full-diagonal large dimensional random matrices and finite-diagonal large dimensional non-random Hankel-type matrices have been investigated. A series of lectures, given by Professor Arup Bose, on Free Probability Theory has been attended. A book on Probability Theory is being prepared.

Sreela Gangopadhyay, Arup Bose and T.K. Chandra (ISRU)

Research in Algebra

A G_a-action of rank three has been constructed on the affine four-space over the field of complex numbers for which the Grothendieck group K_0 of the ring of invariants is infinitely generated. The

action provides an infinite family of non-isomorphic projective modules over its ring of invariants which are counterexamples to a question of Miyanishi.However two major results have also been discovered, on the ring of invariants of any rank three G_a-action on the affine 4-space over any field of characteristic zero, which support the spirit of Miyanishi's question. First, the K-theoretic groups G_0 and G_1 of such a ring of invariants is the same as that of the ambient affine space. Second, if the ring of invariants is regular, then it must be a polynomial ring and, in particular, the projective modules over this ring must be free giving an affirmative solution to Miyanishi's question under the additional hypotheses.

S.M. Bhatwadekar, Neena Gupta and Swapnil Lokhande

Two 4-dimensional seminormal domains A and B have been constructed which are finitely generated over the field of complex numbers (or real numbers) such that A[X,Y] is isomorphic to B[X,Y] but A[X] is not isomorphic to B[X].

T. Asanuma and Neena Gupta

The problem of embedding of quadratic planes in the affine three space is being investigated

S.M. Bhatwadekar and Neena Gupta

A family of counterexamples is constructed to Hilbert's fourteenth problem in dimension five by describing locally nilpotent derivations on the polynomial ring in five variables over a field of characteristic zero whose kernels are not finitely generated.

Swapnil A. Lokhande

Research in number theory

Questions regarding distribution of Fourier coefficients of cusp forms in arithmetic progressions and gaps between nonzero Fourier coefficients of cusp forms were investigated.

Satadal Ganguly

Research in Statistics

Non-parametric statistics, Rates of convergence in Central Limit Theorem (CLT), Law of iterated logarithms (LIL) and Characterization theorems. Growth curve model, Applications of Statistics to Industrial quality control, Physics, Sociology, Agriculture, Education and other natural sciences.

Ratan Dasgupta

A Mean-Reverting Stochastic Model for the Political Business Cycle

In this work we look at the PBC problem through the lens of uncertainty. The feedback control used by us is the famous NKPC with stochasticity and wage rigidities. The basic intuition of the classical model is qualitatively carried forward in our set up but uncertainty also plays an important role in determining the optimal trajectory of the voter support function. The internal variability of the system acts as a base shifter for the support function in the risk neutral case. The role of uncertainty is even more prominent in the risk averse case where all the shape parameters are directly dependent on variability. Thus, in this case variability controls both the rates of change as well as the base shift parameters. To gain more insight we have also studied the model when the coefficients are time invariant and created numerical profiles.

Gopal K. Basak, Mrinal K. Ghosh and Diganta Mukherjee (SOSU)

Adaptive MCMC for general target and proposal distribution through diffusion approximation

Earlier we have worked on the case when the target and the proposal distribution both are standard Normal. We have used moment matching (or the matching of mgfs) to recover the target distribution. Therefore it inherently assumed that the target distribution was light tailed. In many situations the standard Normal is the choice as a proposal, since generating samples from it is easy (for example,

using the Box Muller technique). Also in the proof of the diffusion approximation it requires the existence of the first two moments of the proposal. A natural question is how the results can be extended for general target and proposal distributions. We try to address these issues here. We classify the target densities depending their existence of m.g.f.s or moments and give criteria that correspond to the existence of the m.g.f of the target density in the whole of R or in a neighbourhood of zero. We further classify the remaining densities with no m.g.f.s with all moments finite or only a few moments finite. We show that the limiting distribution of the diffusion corresponding to the AMCMC also share the same property. We further show that the diffusion approximation method cannot be used for simulation when the standard Cauchy is the target or density with a finitely moments is the target. We then obtain the diffusion approximation for light tailed proposals. We also explain why heavy tail choices (such as the Cauchy distribution) as the proposal distribution will not work. Specifically, we investigate what goes wrong when we look at the localized infinitesimal drift and diffusion coefficient when the proposal distribution is Cauchy. Work is continuing for further development.

Gopal K. Basak and Arunangshu Biswas

The dynamics of foreign capital inflow and financial crisis

In this work we model foreign capital inflow in a multi-period framework from the developed to the developing countries. The market for foreign loan together with the foreign exchange market simultaneously determines interest rate in the international loan market and the exchange rate. We also derive the conditions for existence of meaningful equilibrium solutions. Because of non- linearity of the functions we adopt a numerical solution method. A number of comparative dynamic analyses explore the impact of parameters of the model on the endogenous variables. The model is then used to explain the possibility of financial crisis originating either in the developed country or in the developing country. The explanation of crisis in this structure is based on trade theoretic terms in a dynamic term of trade framework rather than in terms of informational imperfections. Work is continuing.

Gopal K. Basak, Pranab K. Das and Allena Rohit

Research in Noncommutative Geometry and Quantum Groups

Some new quantum isometry groups are computed.

Debashish Goswami and Arnab Mandal

The nonexistence of genuine quantum isometry groups of classical connected compact Riemannioan manifold has been established.

Debashish Goswami and S. Joardar

Stat-Math Unit, Delhi

A New Approach to Pólya Urn Schemes and Its Infinite Color Generalization

In an earlier work, we introduced a new generalization of *balanced Pólya urn schemes* for infinite, but countably many colors for the class of replacement matrices arising out of bounded increment random walks. In this work, we further extends the study of the infinite color balanced Pólya urn models for more general classes of replacement matrices. The major contribution of the work is to embed the distribution of a randomly selected color into the associated Markov chain sampled at random times. We call this embedding a *representation of the urn.* In this work, we use this representation as the key tool to study the asymptotic properties of various urn schemes with both finite and infinite colors.

Antar Bandyopadhyay and Debleena Thacker

Research Activities

De-Preferential Attachment Random Graphs

In this work we consider a growing random graph sequence where a new vertex is less likely to join to an existing vertex with high degree. In contrast to the well studied *preferential attachment random graphs*, we call such a sequence a *de-preferential attachment random graph model*. We consider two types of models, namely, *inverse de-preferential* and *linear de-preferential*. For the case when each new vertex comes with exactly one half-edge we show that the degree of a fixed vertex is asymptotically of the order $\sqrt{(\log n)}$, for the inverse de- preferential case and of the order (log n) for the linear case, where n is the number of vertices of the graph. These show that compared to preferential attachment, the degree of a fixed vertex grows to infinity at a much slower rate for these models. We also show that in both cases limiting degree distributions have exponential tails, as opposed to power law distribution for the preferential attachment model.

Antar Bandyopadhyay and Subhabrata Sen

A Negatively Reinforced Urn Models

We consider urn models with finitely many colors, where the selection probability is proportional to the total number of balls of other colors, namely negatively reinforced urn processes. We show that the limiting configuration of the urn with any replacement matrix is same as the limiting configuration of the classical urn with a new irreducible replacement matrix. In particular, we obtain uniform limit, if and only if, uniform distribution is the unique stationary distribution of the underline Markov chain. We also obtain the limit of the vector of color count statistics and give the central limit theorem for the configuration and for the color count statistics of the de-preferential urn process.

Antar Bandyopadhyay and Gursharn Kaur

Work was continued on relation between graphs and matrices. In joint work S. Sivasubramanian, the determinant and the inverse of the squared distance matrix of a tree were studied.

R.B. Bapat and S. Sivasubramanian

Posiive definite matrices and positive definite functions

These and the related class of conditionally negative definite matrices and functions are important in harmonic analysis, probability, distance geometry and physics. We continued our study, obtaining new examples and methods. These are important also in the context of "structured matrices".

R. Bhatia and T. Jain

Positive linear maps and eigenvalue variation

Unified proofs of several inequalities giving bounds for the spreads of eigenvalue of Hermitian matrices were obtained using a single idea: estimates for the variance of positive linear maps on C^*-algebras.

R. Bhatia

The first ``Indo-Russian Joint Conference in Statistics & Probability '' was organised at ISI, Delhi from 15 - 18 January 2015. More than 40 researchers from India and Russia participated in the conference. There were 21 lectures - 10 of them by Russians - during the conference. This was funded by NBHM, ISI and CMI.

Abhay G. Bhatt, Rajeeva L. Karandikar, Ildar Ibragimov and Yakov Nikitin

Primary focus of work is on high dimensional inference and study of likelihood based methods using empirical process theory

a. Large sample theory for Lasso type estimators when $p\gg n$. This is joint work with S. N. Lahiri (NCSU, USA). This extends the existing results, which deal with finite p.

b. Pseudo-likelihood based inference using Empirical Process methods: a pseudo likelihood based estimator is studied in a logistic regression set up with partially misclassified responses. Empirical process based tools are used to study the asymptotic behaviour of this estimator, which has non-standard asymptotics due to the presence of a nuisance parameter. Similar methods have been widely used in applications (medicine, biology, envirionment science), but no theoretical validity exists.

Arindam Chatterjee, T. Bandyopadhyay and S. Adhya

c. Estimation in large surveys in presence of many covariates. This is a model based approach and involves the use of Adaptive Lasso estimator in the survey sampling setup.

Arindam Chatterjee and S. Adhya

d. Continuation of earlier work on empirical likelihood based inference in high dimensional estimating equations.

Arindam Chatterjee and P. Bertail

Work continued on (i) U-statistics for associated Random Variables; (ii) Inference based on quantiles; (iii) Deconvolution problem in competing risks.

Isha Dewan

Worked on the irreducibility of polynomials, particularly Hermite-Laguerre polynomials and interesting results generalizing an earlier result of Schur. Worked on perfect powers and products of terms of recurrence sequences and Binary recurrence sequences. Worked on problems related to binary digits of numbers.

Shanta Laishram

Worked on exponential diophantine equations involving products of terms of Pells and Pell-Lucas sequences Proved explicit results on the perfect powers involving products of terms of recurrence sequences.

Shanta Laishram, J. Bravo, S. Guzman and P. Das

Proved results on some diophantine involving Fibonacci sequence which is being published in Fibonacci Q.

Shanta Laishram and F. Luca

Proved explicit results on the irreducibility of Hermite-Laguerre polynomails extending earlier results for arithmetic progressions.

Shanta Laishram and T.N. Shorey

Proved results on irreducibility of generalized Hermite polynomials, thereby a generalizing a result of Schur.

Shanta Laishram, S. Nair and T.N. Shorey

Gave a complete result on the Galois groups of generalized Laguerre polynomials by extending a result of Saradha and Shorey.

Shanta Laishram

Embeddings of rank-2 tori in algebraic groups

This project is concerned with finding conditions under which certain rank-2 rational tori admit embeddings in exceptional algebraic groups. We investigated the cases of groups of type G_2 and F_4 and also the case of classical groups of type A_2. The conditions were obtained via certain mod-2 cohomological invariants associated to these groups and in terms of an invariant attached to

unitary tori of rank-2. It was shown that these groups are generated by the rank-2 rational tori they contain and explicit numbers of such tori required were computed.

Neha Hooda and Maneesh Thakur

An invariant for homogeneous spaces of compact quantum groups

The central notion in Connes' formulation of non commutative geometry is that of a spectral triple. Given a homogeneous space of a compact quantum group, restricting our attention to all spectral triples that are `well behaved' with respect to the group action, we construct a certain dimensional invariant. In particular, taking the (quantum) group itself as the homogeneous space, this gives an invariant for a compact quantum group. Computations of this invariant in several cases, including all type A quantum groups, are given.

Arup Kumar Pal and Partha Sarathi Chakraborty

On quantum quaternion spheres

For the quantum symplectic group $SP_q(2n)$, we describe the C^*-algebra of continuous functions on the quotient space $SP_q(2n)/SP_q(2n-2)$ as a universal C^*-algebra given by a finite set of generators and relations. The proof involves a careful analysis of the relations, and use of the branching rules for representations of the symplectic group due to Zhelobenko. We then exhibit a set of generators of the K-groups of this C^*-algebra in terms of generators of the C^*-algebra.

Bipul Saurabh

Stat-Math Unit, Bangalore

Brownian motion on Real trees, Harnack Inequality and Dense Graph limits

Siva Athreya

Various families of homomorphisms, such as regular, symmetric, t-ternary homomorphisms of C^*-algebras are studied and connected with structure theory of completely bounded maps. This is a joint work with Nirupama Mallick and Sumesh K., and is a work in progress.

B. V. Rajarama Bhat

Research work is going on in local polynomial convexity of finite union of Lagrangian submanifolds in $\mathbf{C}^2$. This is joint work with Kyler Siegel. Work continued in Polynomial convexity of graphs of certain classes of cubics in $\mathbf{C}^2$.

Sushil Gorai

Euler classes

It has been proved that when $k \neq 2, 4, 8$, the Euler class of any vector bundle over $\sum^k \mathbf{RP}^m$ is zero if the rank of the bundle is not $m + k$, provided that $m \neq 3$ when $k = 6$. If $k = 2, 4, 8$, it is shown that the Euler class of any vector bundle over $\sum^k \mathbf{RP}^m$ is zero whenever the rank of the bundle is not $kr + k$, provided that $m \neq 6, 7$ when $k = 2$, where r is the largest integer such that $kr \leq m$.

Aniruddha Naolekar and Ajay Singh Thakur

Operator Theory

(1) Boundary representations and essentially normal quotient modules: A Beurling type quotient module of the Hardy module $H^2(D^n)$ is never essentially normal when $n > 2$. A list of results concerning boundary representations of a class of quotient modules have been obtained. Joint work with Bata Krishna Das and Sushil Gorai.

(2) Inner functions and submodules of Hardy module: Beurling-Lax-Halmos theorem: A connection between a class of submodules of $H^2(D^n)$ and a class of one variable operator-valued inner functions has been obtained.

(3) Characterizations of symmetrized polydisc: A list of concrete characterizations of elements of symmetrized polydisc in n-variables has been obtained.

(4) Operator positivity and analytic model: An explicit model theory has been developed for the class of hypercontractions operators and beyond. Related results have been obtained in several variables.

(5) Rank of Rudin submodules: An explicit rank formula for a Rudin type submodule in 2 variables has been obtained (answering an open question by raised by Douglas and Yang).

(6) Generating vectors of quotient module: An explicit rank formula for Rudin type quotient module in several variables has been obtained. This is a generalization (and fix an error) of 2 variables result.

Jaydeb Sarkar

Certain p-adic Lie groups are shown to be of type R if their adjoints are of type R. In a joint work with (Sharan Gopal-postdoc) periodic points are identified for toral and certain solenoidal systems.

C.R.E. Raja

In the context of a multidimensional insurance model described through Skorokhod problem, a refined notion of ruin was introduced, leading to a dual multidimensional storage type process. Using this, partial results concerning duality for multidimensional ruin problem were obtained.

S. Ramasubramanian

Research continued in the area of Geometry of Banach spaces A study of almost isometric and extremely strict Ideals has been initiated and several stability properties obtained. Using von Neumann's selection theorem, partial solution to the problem of best co approximation in spaces of Bochner integrable functions was obtained.

T.S.S.R.K. Rao

Worked on the normality problem for Roy's elementary group and on comparison questions with the Eichler-Dickson-Siegel group. Proved results on the class groups of cyclic extensions of prime degree p over number fields containing p-th roots of unity; obtained several explicit results for $p = 5$.

B. Sury

Limit theorems for random complexes

In a joint project with R.J.Adler (Technion) and G. Thoppe (TIFR, Mumbai), we considered simple Markovian dynamics on edges of the classical Erdos-Renyi random graphs. We show that the normalized process of the Betti numbers of the corresponding flag complex converges in distribution to the Ornstein-Uhlenbeck process. As a consequence of our proof technique, we also obtain similar weak convergence for the normalized processes of face counts and Euler-Poincare characteristic. In an ongoing project with B. Blaszczyszyn (ENS-INRIA, Paris) and J. Yukich (Lehigh University, USA), we are investigating normal convergence of geometric functionals of general point processes under a weak asymptotic independence condition known as clustering. Illustrative of specific applications, this general result is useful to obtain central limit theorem for U-statistics of zeros of Gaussian entire functions or intrinsic volumes of the Boolean model on determinantal point processes.

D. Yogeshwaran

Stat-Math Unit, Chennai

One parameter family of univalent biharmonic Mappings

The article provides conditions under which one can construct sense-preserving and univalent biharmonic mappings that arise from analytic functions which are not necessarily univalent in the unit disk $|z|<1$. Several theorems under different weaker hypothesis in each case are provided, leading to an affirmative answer to the radius problem posed by Y. Abu Muhanna in 2008.

A.Y. Muhanna, S.V. Bharanedhar and S. Ponnusamy

External problems on the class of convex functions of order – ½

Lawrence Zalcman's conjecture states that if $f(z)=z+\sum_{n=2}^{\infty} a_n z^n$ belongs to the class S of analytic and univalent functions in the unit disk $|z|<1$, then $|a^2_n - a^2_{2n-1}|\leq(n-1)^2$, for each $n\geq 2$, with equality only for the Koebe function $k(z)=z/(1-z)^2$ and its rotations. This conjecture remains open although it has been verified only for a few geometric subclasses of S. We solve this problem for a family of functions (convex in some direction) from S which involvesthe first and second derivatives of f. Few other related basic results and remarks about the Hayman index of functions in this family are also presented.

A.Y. Muhanna, L. Li and S. Ponnusamy

Uniform close-to-convexity radius of sections of functions in the close-to-convex family

For a family of functions f analytic in the unit disk $|z|<1$ satisfying certain condition involving the first and second derivatives of f, it has shown that 1/3 is the uniform sharp bound for the radius of univalence of every section of each function in this family. This solves a recent conjecture of Ponnusamy, Swadesh and Yanagihara.

S.V. Bharanedhar and S. Ponnusamy

Coefficient conditions for harmonic univalent mappings and hypergeometric mappings

We determine coefficient criteria for a normalized harmonic function defined in the unit disk $|z|<1$ to be close-to-convex and fully starlike, respectively. Using these coefficient conditions, different classes of harmonic close-to-convex (resp. fully starlike) functions involving Gaussian hypergeometric functions are presented. In addition, a convolution characterization for a class of univalent harmonic functions discussed recently by Mocanu, and later by Bshouty and Lyzzaik in 2010, are also obtained.Our approach provides numerous examples of harmonic polynomials that are close-to-convex and starlike, respectively.

S.V. Bharanedhar and S. Ponnusamy

Coefficient estimates, Landau's theorem and Lipschitz-type spaces on planar harmonic mappings

Properties such as coefficient estimates and Landau's Theorem for some classes of locally univalent harmonic mappings and properties of some Lipschitz-type spaces for locally univalent and multivalent harmonic mappings are investigated.

Sh. Chen, S. Ponnusmy and A. Rasila

Polyharmonic mappings and J. C. C. Nitsche type inequalities

J.C.C. Nitsche type inequality for polyharmonic mappings between rounded annuli on the Euclidean space $\mathbf{R}^d$ is considered. The case of radial biharmonic mappings between annuli on the complex plane and the corresponding inequality is studied in detail.

D. Kalaj and S. Ponnusamy

Radius of close-to-convexity of harmonic functions

Investigation on the family S^0_H of all normalized complex-valued harmonic functions $f = h+\overline{g}$ univalent and sense-preserving in the unit disk $|z|< 1$ is well-known although a number of open problems including the analog of Biberbach conjecture remains open even for the second Taylor coefficients of the analytic part h. If $K = H + \overline{G} \in S^0_H$ denotes the harmonic Koebe function whose dilation is $\omega(z) = z$, then $K(z)$ is extremal for many extremal problems. However a well-known conjecture is that if a_n, b_n, A_n, B_n denote the Taylor coefficients of h, g, H, G and $f = h+\overline{g} \in S^0_H$, then the conjecture states that $|a_n| \le A_n$, $|b_n| \le B_n$ and $||a_n|-b_n|| \le A_n - B_n$ for $n \ge 1$. If this is true then the family $\mathcal{F}$ contains the family S^0_H, where

$$\mathcal{F}=\{f = h + \overline{g} \in \text{harmonic} : |a_n| \le A_n \text{ and } |b_n| \le B_n \text{ for n} \ge 1\}.$$

We show that the radius of univalence of the family $\mathcal{F}$ is 0.112903… We also show that this number is also the radius of the fully starlikeness of $\mathcal{F}$. Analogous results are proved for a family which contains the class of harmonic convex functions. We obtain the new coefficient estimate for bounded harmonic mappings and use this result to improve thebound for Bloch-Landau constant for bounded harmonic mappings.

D. Kalaj, S. Ponnusamy and M. Vuorinen

Freely quasiconformal maps and distance ratio metric

Suppose that E and E' denote real Banach spaces with dimension at least 2 and that $D \subset E$ and $D' \subset E'$ are domains. We establish, in terms of the j_D metric, a necessary and sufficient condition for the homeomorphism $f: E \to E'$ to be freely φ-quasiconformal mappings Moreover, in terms of the j_D metric, a sufficient condition for the homeomorphism $f: D \to D'$ *to* be freely φ-quasiconformal mappings is also given. Also, it is shown that this condition is not necessary.

Y. Li, S. Ponnusamy and M. Vuorinen

Univalence of quotient of analytic functions

We discuss the radius of univalence of F defined by $F(z) = z^2/ f(z)$, whenever f belongs to certain families of the class of univalent functions in the unit disk $|z|<1$. These results sharpen the earlier known results.

M. Obradovic and S. Ponnusamy

Starlikeness of sections of univalent functions

For the class S of all normalized analytic and univalent functions in the unit disk $|z|<1$, we determine condition so that each section (partial sum) $s_n(f,z)$ of $f \in S$ is starlike in the disk $|z|<r_n$. In particular, the range of $s_n(f,z)$ under $|z| \le 1/2$ is a starlike domain for $n \ge 47$.

M. Obradovic and S. Ponnusamy

Radius problems associated with pre-Schwarzian and Schwarzian derivatives

Some of important univalence criteria for a non-constant meromorphic function $f(z)$ on the unit disk $|z|<1$ involve its pre-Schwarzian or Schwarzian derivative. We consider an appropriate norm for the pre-Schwarzian derivative, and discuss the problem of finding the largest possible $r \in (0, 1)$ for which the pre-Schwarzian norm of the dilation $r^{-1}f(rz)$ is not greater than a prescribed number for normalized univalent functions $f(z)$ in the unit disk. Similar results concerning the Schwarzian derivative are also obtained.

S. Ponnusamy, S.K. Sahoo and T. Sugawa

Univalent harmonic mappings convex in one direction

New criterion for a harmonic function to be convex in one direction is presented. Also, we discuss the class of harmonic functions starlike in one direction in the unit disk $|z|<1$ and obtain a method to

construct univalent harmonic functions convex in one direction. Although the converse of classical Alexander's theorem for harmonic functions was proved to be false, we obtain a version of converse of it under a suitable additional condition.

S. Ponnusamy and A. SairamKaliraj

On the problem of L. Gromova and A. Vasil'ev on integral means and Yamashita's conjecture forspirallike functions

We consider some integral means problem for certain classes of univalent analytic functions, in particular for the class of the starlike functions of order β and for the class of α-spirallike functions of order β. Our investigation settles one of the open problems of Gromova and Vasil'ev in 2002. In addition, we solve another problem concerning area maximum property of α-spirallike functions of order β in the setting of Yamashita and hence, we find the solution to Yamashita's conjecture in 1990 for certain Dirichlet-finite functions in a general form. This conjecture was an open problem since 1990.

S. Ponnusamy and K.-J Wirths

Bounds for Jaeger integrals

Lower and upper bounds are deduced for some Jaeger integrals which involve the Bessel functions of the first and second kind. The upper bounds contain some elementary functions as well as incomplete gamma functions, while the lower bounds are expressed also in terms of incomplete gamma functions and are deduced via some known inequalities for Bessel functions of the first and second kinds.

A. Baricz, T. Pogany, S. Ponnusamy and T. Rudas

Lengths, areas and Lipschitz-type spaces of planar harmonic mappings

We obtain bounds for length and area distortions of harmonic *K*-quasiconformal mappings, and investigate properties of certain Lipschitz-type spaces on harmonic mappings.

Sh. Chen, S. Ponnusamy and A. Rasila

On characterizations of Bloch-type, Hardy-type and Lipschitz-type spaces

At first we establish a Bloch-type growth theorem for generalized Bloch-type spaces and discuss relationships between Dirichlet-type spaces and Hardy-type spaces on certain classes of complex-valued functions. Then we present some applications to non-homogeneous Yukawa PDEs. We also consider some properties of the Lipschitz-type spaces on certain classes of complex-valued functions and study a class of composition operators on these spaces.

Sh. Chen, S. Ponnusamy and A. Rasila

Stable geometric properties of pluriharmonic and biholomorphic mappings, and Landau-Bloch's theorem

Certain properties such as geometric univalence criteria on pluriharmonic mappings, and Landau-Bloch theorem are investigated for a class of pluriharmonic mappings.

Sh. Chen, S. Ponnusamy and X. Wang

Convolutions of harmonic mappings convex in one direction

One of the difficult problems is to obtain an useful analog of Polya-Schoenberg conjecture for univalent harmonic mappings. Let f_1 be a fixed univalent and sense-preserving harmonic mapping which is convex in the real direction but is not necessarily starlike in the unit disk $|z|<1$. The convolution of f_1 with other harmonic mappings, eg.half-plane mappings, is not necessarily univalent in $|z|<1$. However, under suitable restriction on the dilatation of *f*, we show that the convolutions of f_1 with certain slanted half-plane harmonic mappings *f* are necessarily convex in a direction. In addition, we consider a fixed

harmonic mapping f_0 and $f=h+\overline{g}$ with the dilatation $\omega(z)=az^n$, where f is in the class of asymmetric vertical strip mappings. We find the relationship between a and n such that f_0*f is a sense-preserving univalent harmonic mappingand is convex in some direction. These results are generalizations of some recent results of Dorff et al. The contents of this paper enhance interest in univalent harmonic mappings, especially when much is not known on the harmonic convolution.

L. Li and S. Ponnusamy

Disk of univalence of the ratio of two analytic functions

We determine the radius of univalency of $F(z)=zf(z)/g(z)$, where f and g are chosen appropriately from certain subclass of the class of univalent functions. The method used is different from the one used earlier and the present results improve the earlier known results.

M. Obradovic and S. Ponnusamy

Integral means and Dirichletintegral for analytic functions

For normalized analytic functions f in the unit disk, the estimate of the integral means

$$L_1(r, f):= \frac{r^2}{2\pi}\int_{-\pi}^{\pi}\frac{d\theta}{|f(re^{\theta})|^2}$$

is important in certain problems in fluid dynamics, especially when the functions $f(z)$ are non-vanishing in the punctured unit disk $0<|z|<1$. We consider the problem of finding the extremal function f which maximizes the integral means $L_1(r, f)$. In addition, for certain class F of analytic functions, we solve the extremal problem for the Yamashita functional

$$A(r) = \max_{f\in F} \Delta\left(r, \quad \frac{z}{f(z)}\right) \text{for } 0 < r \le 1.$$

M. Obradovic, S. Ponnusamy and K.-J Wirths

Classification of univalent harmonic mappings on the unit disk with half-integer coefficients

We determine the class of all normalized sense-preserving univalent harmonic mappings f on the unit disk with half-integer coefficients for the analytic and co-analytic parts of f. It is surprising to see that there are only twenty seven functions out of which only six functions in this class are not conformal. This settles the recent conjecture of the authors. We also prove a general result which leads to a new conjecture.

S. Ponnusamy and J. Qiao

Bounds for invariant distances on pseudoconvex Levi corank one domains and applications

Invariant distances which decrease under holomorphic mappings were studied elaborately, in a joint work with P. Mahajan and K. Verma, on finite type smoothly bounded pseudoconvex domains in C^n, the Levi form of whose boundary have corank atmost one. Such domains will be referred to as Levi corank one domain for brevity. The class of Levi corank one domains forms the next best class to deal with, after strongly pseudoconvex domains which has been fairly exhaustively studied. Bounds for invariant distances such as those of Kobayashi, Caratheodory and Bergman were obtained in our joint paper and were put to use in the same paper to an analysis of the balls with respect to the integrated Kobayashi distance, for instance. Stability of such balls with respect to scaling was established and used to make deductions about the asymptotic behavior of the Fridman's invariant function on Levi corank one domainsand also to derive uniform `ball box' estimates for balls in the Kobayashi distance on such domains. Further, these bounds were applied to analyze the boundary behaviour of Kobayashi isometries from such domains.

G.P. Balakumar and P. Mahajan

Applied Statistics Division

The Applied Statistics Division came into being in September 1996 through the rechristening of the Applied Statistics, Surveys and Computing Division, which consisted then of the *Computer Science Unit* and the *Biometry Unit*. The Computer Science Unit was renamed as *Applied Statistics Unit* while the *Biometry Unit* was transferred to the Biological Sciences Division. Till 2005-06, the Applied Statistics Division consisted only of the *Applied Statistics Unit*. During the years 2006-07, 2011-12 and 2012-13, three new units, namely, the *Bayesian and Interdisciplinary Research Unit*, the *Sampling and Official Statistics Unit* and *Applied and Official Statistics Unit* were created within this Division, the latter being a part of the Tezpur Centre of the Institute. The *Sampling and Official Statistics Unit* was transferred to the Social Sciences Division in 2012-2013 and the *Applied Statistics Unit, Chennai* came into being during the same year. The *Bayesian and Interdisciplinary Research Unit* was renamed as *Interdisciplinary Statistical Research Unit* in 2014. The following are the research and other activities of the Applied Statistics Division during the year.

Applied Statistics Unit, Kolkata

Scientists of the Applied Statistics Unit (ASU) are involved in various teaching, training, research and development activities. This unit regularly conducts teaching/training programmes like North-east Workshops, winter/summer schools, workshops and Probationers' Training for Indian Statistical Service trainees. The members of the faculty conduct research in various areas of statistics, mathematics and computer science, including cryptology, with special emphasis on applications. Some members collaborate with other units of ISI on joint projects and also with scientists from other Universities/Institutes. Currently, there are collaborative on-going projects with the Theoretical Statistics and Mathematics Division, Computer and Communication Sciences Division, SQC & OR Division, and the Biological Sciences Division. Presently, the Unit has 16 faculty members.

Sample Surveys

Randomized response techniques have been studied with reference to quantitative responses variables. The issue of protection to privacy has been studied for both discrete and continuous sensitive variables and measures of privacy protection are to be developed.

Mausumi Bose

Allowing unequal probability sampling of respondents, showed Randomized Response Technique (RRT) may yield more efficient estimators if inverse Bernoullian trials be permitted to record the first trial for which a `match' between the genuine feature and the randomly generated outcome is realized. This needs a substantial revision of the classical RRT's as noted and studied.

Arijit Chaudhuri

Design of Experiments, Combinatorial Methods and their Applications

Application of Frechet derivatives for deriving optimal statistical planning of experiments has been studied. The optimal design problem has been studied under second-order least squares estimation which is known to outperform ordinary least squares estimation when the error distribution is asymmetric. A general approximate theory has been developed while the error distribution form is not assumed. Necessary and sufficient conditions have been obtained that a D- or A-optimal design measure must satisfy. Optimal design measures have been studied when the design points are binary. The issue of reducing the support size of the optimal design measure has also been addressed.

Mausumi Bose

Adaptive Designs and Censoring Plans

Research on optimal response-adaptive designs has been carried out under different types of constraints. The role of orthogonal arrays and related combinatorial structures has been explored to

construct partially cover-free families of sets with a view to constructing union distinct families. The problem of optimal allocation of units, with given prognostic variates or covariates, between two treatments has been studied. This work is being generalized for more than two treatments and the method is being extended to solve the Travelling Salesman Problem (TSP). Optimal compound designs in the context of dose-response studies of phase II clinical trials are under study. Some problems related to model selection and parameter estimation for a class of completing models are under study. Some design issues related to optimal hybrid censoring plan have been looked at. Similar problem for choosing optimal progressive censoring plan has also been considered.

Atanu Biswas and Anup Dewanji

Reliability and Survival Analysis

Stress Dependent Strength probability distributions were introduced, characterized and inference problems were studied.

Ashis SenGupta

Standard models for software reliability often do not take into account the fact that debugging may take place periodically, rather than continuously. Based on a model adapted to periodic debugging data, a method for specifying the reliability of a software has been developed. The related design problem of determining the optimum release time of a software has also been considered. A discrete time version of the model, suitable for the situation where a software is tested by test cases, is being investigated.
A testing procedure for the hypothesis of increasing hazard ratio between two populations has been proposed. This test is expected to complement the existing methods of testing proportionality of hazards against monotone hazard ratio. Utilization of recall data poses new challenges in the analysis of age at menarche of adolescent and young adult women. Recall is often imperfect, and the associated censoring is informative. Based on a recent formulation of the problem, methods of nonparametric estimation of the menarchial age distribution, as well as analysis under the relative risk regression model, have been developed.

Anup Dewanji and Debasis Sengupta

Both continuous and discrete time software reliability growth model for the analysis of software testing data with periodic debugging schedule has been considered. An additional objective of this work is to find optimal release time of the software which is being investigated. Similar analysis with heterogeneous software bugs is underway. In describing reliability growth through a sequence of parametric models for successive failure time distribution, a conservative confidence bound for the parameter of interest has been developed with minimum coverage probability. A method has been developed to evaluate reliability of a system under dynamic stress strength scenario. Different identifiability issues for Stress-Strength models are being studied; some work on estimation of model parameters based on specific data configurations are also being considered.

AnupDewanji

Statistical Inference

Motivated by a real-life problem arising from the measurements of bifurcated flow at a river barrage, the issue of calibration, where two additive components of an aggregate quantity are measured with different degrees of fixed and multiplicative distortion has been considered. A careful analysis of the problem leads to a model with minimal assumptions that ensure identifiability of the ratio of the distortion factors, so that the measurements of the two components can be brought to a common scale. A class of consistent estimators of the desired ratio has been provided. The work is expected to facilitate implementation of an impending treaty on the water sharing of an international river.

Debasis Sengupta

Multiple Testing and Minimax Estimation

Multiple hypothesis-testing under dependence has been considered. Several testing procedures have been proposed in this context when the usual *p*-values based on individual tests are dependent. These

procedures have been shown to have desirable properties in terms of overall misclassification rate and have been compared favourably with many existing procedures. A useful admissibility result has also been proved for one of the proposed procedures.

Arijit Chakrabarti and Prasenjit Ghosh

(Near) asymptotic optimality of a multiple hypothesis testing rule based on a general class of normal scale mixture prior has been established. This class of priors includes the important global-local scale mixture prior, namely the Horseshoe prior. An open conjecture has also been shown to hold in this context about (near) optimality of the Generalized Double Pareto prior.

Arijit Chakrabarti, Prasenjit Ghosh, Malay Ghosh and X. Tang

Minimax rate optimal estimation under sparsity using one-group shrinkage priors has been studied.

Arijit Chakrabarti and Prasenjit Ghosh

Bayesian Model Selection

Bayesian variable selection in regression problem using mixtures of g-priors has been studied, with emphasis on finding conditions for different asymptotic oracle properties. A mixture of g-priors for variable selection has been proposed for the case when the number of regressors grows with the sample size.

Tapas Samanta and Minerva Mukhopadhyay

Response-adaptive designs

Research on optimal response-adaptive designs has been carried out under different types of constraints.

Atanu Biswas

Surrogate responses

Comparison of treatments in a clinical trial set-up was done in the presence of surrogate responses. The objective is to use the surrogate responses efficiently to enhance the quality of associated inference.

Atanu Biswas

Discrete-valued time series

Modeling, analysis and coherent forecasting have been done for discrete-valued time series data. In particular both categorical and count data are considered. Zero-inflated count data has also been considered for this purpose. Some Bayesian methods are under investigation.

Atanu Biswas

Directional Statistics

Some inferential and design issues have been addressed for a two-treatment clinical trial set up where the responses are circular data. The methodologies have been derived with reference to an eye-related data set.

Atanu Biswas

Probability Distributions on Smooth Manifolds, namely, HyperTorus, HyperSphere, HyperDisc and HyperCylinder were constructed and applied to real-life data on Astrostatistics and Earthquake Occurrences; Multivariate Cylindrical and Toroidal Regression with Applications to Gene Expression Data were constructed.

Ashis SenGupta

Bayesian Inference

Matching priors were constructed for several circular distributions in the context of their mean directions.

Ashis SenGupta

Distribution Theory

A New Family of Possibly Asymmetric Bimodal t-Distribution with applications to Modeling Wind Energy was derived; Mixed Mixture Models were also studied with respect to their Construction, Inference and Applications to Infant Mortality Data in Survival Analysis.

Ashis SenGupta

A New Group Sequential Design for Both Early Acceptance and Early Rejection was constructed.

Ashis SenGupta

Financial Statistics

Models for high volatility multivariate financial data and related inference were studied.

Ashis SenGupta

Cryptology

Research was conducted in the areas of pairing based encryption primitives; symmetric key broadcast encryption; algorithms for the discrete logarithm problem; statistical aspects of multiple linear cryptanalysis; modes of operations of block and stream ciphers.

Palash Sarkar

Bi-affine and Quadratic equations for S-Boxes Based on Power Mappings have been obtained. Research has been done on Cryptographically significant MDS matrices.

Kishan C. Gupta

Two new Authenticated Encryption (AE) have been proposed. Several other existing AE have been analyzed. Symmetric Key Domain Extension: Flaw in a very important result which has been used for several years in symmetric key cryptography has been found. It has also been shown that apparently weaker notion MAC (message authentication code) is actually equivalent to a stronger notion PRF (pseudorandom function). A very popular domain extension EME (encrypt-mix-encrypt) has also been characterized. Research on the following areas has also been carried out: Generic Construction of functional encryption; Generic construction of signcryption; Hardware implementation of newly proposed AE and universal hash functions which are very important components of AE.

Mridul Nandi

Mathematical Genomics

Utilizing the concept of structural biology an effort has been initiated towards understanding the driving force for recognition of DXCA exclusively by PPCA among its homologs (PPCB, PPCC, PPCD and PPCE) which is further rationalized by mathematical modelling. The problem of degeneracy of codon table has been addressed from a mathematical point of view. An attempt has been made to determine the mathematical basis of “iron-protein classification” with the help of on-the-shelf classification of Boolean functions as well as some mathematical parameters. Some study has been done to mathematically characterize amino acids and their chemical properties from a given codon with minimum time and space complexity. It has been found that significant conclusions can be drawn about the side chain structures of amino acids with the help of “impact”, a mathematical parameter. Future research interest is to understand mathematically the computational logic behind the formation of tertiary structure of a protein.

Pabitra Pal Choudhury

Spatio-Temporal Health Statistics

Geostatistical Methods have been applied for spatio-temporal mapping of new incidence of Tuberculosis, in the North 24 Parganas District of West Bengal. Reported cases of Smear positive patients initiated on treatment for each quarter during the period 2008 to 2011 have been considered as study variables.

Kasturi Basu

Interdisciplinary Statistical Research Unit, Kolkata

(Formerly, Bayesian and Interdisciplinary Research Unit)

The Bayesian and Interdisciplinary Research Unit, which had been created in 2006, was renamed as Interdisciplinary Statistical Research Unit in 2014. Scientists of the unit are involved in different kinds of research, training and development activities. Some members collaborate with scientists of other units of ISI on joint projects and also with scientists from other Universities/Institutions. The major research interests of its faculty include Pattern Recognition, Image Processing, Machine Learning, Survey Sampling, Minimum Distance Inference, Robust Inference, Multivariate Analysis, Biostatistics, Sample Survey Methodology, Analysis and Combinatorial aspects of Design of Experiments, Bayesian Statistics and Computation, Probabilistic and Mathematical Inequalities, Clinical Trials, Asymptotic Statistical Theory, Limit Theorems in Statistics and Probability, and so on. A brief account of the current research contributions and studies is given below.

Content-based Image Retrieval

Having formulated the Content-based Image retrieval (CBIR) problem with relevance feedback as a classification-like problem, efficient retrieval algorithms had earlier been developed by combining conventional and statistical classification techniques (such as discriminant analysis, CART and Support Vector Machines) which yielded significant improvement in retrieval performance. Subsequently, investigations were made to study the robustness of these approaches with respect to rotation and noise. Also, performance of the proposed algorithms with standard MPEG-7 features as well as with alternative similarity measures like the earth-mover's distance is also being investigated.

Amita Pal and Smarajit Bose

Probability and Asymptotic Theory

Some work was done on extensions of the strong law of large numbers of Kolmogorov, and of Bernstein's theorem. Extensions of de La Valley Poussin's theorem were also obtained.

Tapas Kumar Chandra

A Semiparametric Bayesian approach for analyzing the longitudinal outcomes from multiple related groups

In this work, the focus was to develop appropriate Bayesian models to handle the possible similarity among the model parameters form various (known) groups which are related in some sense. Dirichlet process mixtures of normal priors are typically used for such modeling, but modified matrix stick breaking priors were used in this work. The method was applied on data from one-year follow-up of nutrition education for hyper-cholesterolemic children with three different treatments where the children are from different age-groups.

Kiranmoy Das, Prince Afriyie and Lauren Spirko

Bayesian non-parametric model for the state estimation of wireless sensor networks

In this work, the goal was to appropriately model the information exchange among different sensor nodes with a predefined sensor network. Sensors were clustered based on the Euclidean distances

and then stick-breaking priors were considered which can dynamically capture the amount of information being shared among different clusters by computing the appropriate posterior probabilities.

Kiranmoy Das and Aditi Chatterjee

On joint modelling of the longitudinal traits and time to event

A flexible approach for jointly modeling the observed longitudinal traits and time to the event of interest has been proposed. Sure independence screening based on distance correlation and Bayesian Lasso were used for variable selection and then Cox proportional hazard model was used for event time data. The method was applied on genetic data for soybean plants and significant genes controlling the first flowering time through biomass of soybean plants.

Kiranmoy Das

Variance of a Homogeneous Linear Unbiased Estimator (HLUE) of the Population Total of a Sensitive Quantitative Character

Warner (1965) pioneered the Randomized Response Technique (RRT) to collect information on a sensitive qualitative character. Following Adhikary (2013), an exact expression has been obtained for the variance of a homogeneous linear unbiased estimator (HLUE) of the population total of sensitive quantitative character that cannot be disclosed to a third person by its very nature. An attempt has also been made to derive an unbiased estimator of the variance of the estimator. This procedure has been illustrated with the Horvitz-Thompson (1952) estimator, the Hansen-Hurwitz (1943) estimator based on PPSWR and also an improved version of it obtained by Rao-Blackwellisation as considered by Adhikary (2009), Des Raj's (1956) ordered estimator and Murthy's (1957) unordered estimator, both based on PPSWOR, ratio estimator based on Lahiri (1951), Midzuno (1952) and Sen's (1953) sampling scheme, Rao, Hartley and Cochran's(1962) estimator based on their sampling scheme and the Hartley-Ross (1954) unbiased ratio-type estimator based on SRSWOR, considering in each case the form of the estimator suitable for the randomized response survey.

Arun Kumar Adhikary

Optimal Definition of Hypotheses in Bernoulli Adaptive Sequential Testing Problem

For two competitive treatments performance of two optimal criteria, power of testing and proportion of application of less effective treatment show to be different for different definition of same testing problem leading to different test functions and limiting allocation proportions. Better functions to define test hypotheses have been searched in this regard with a study of their performance.

Subir Kumar Bhandari

A Bayesian Semiparametric Approach to Learning about Gene-Gene Interactions in Case-Control Studies

Gene-gene interactions are often regarded as playing significant roles in influencing variabilities of complex traits. Although much research has been devoted in this area, till date, a comprehensive statistical model that adequately addresses the highly dependent structures associated with the interactions between the genes, multiple loci of every gene, various and unknown number of sub-populations that the subjects arise from, seem to be lacking. In this work, a novel Bayesian semiparametric approach that is capable of addressing all sources of uncertainties has been proposed and developed. Then, by formulating novel, and suitable Bayesian tests of hypotheses an attempt has been made to single out the roles of the genes, individually, and in interaction with the other genes, in case-control studies. Computationally, a novel and very efficient parallel processing algorithm based on TMCMC has been developed. Application of this model and methodologies to data sets simulated from an existing, relevant population genetics model associated with case-control study, revealed quite encouraging performance.

Durba Bhattacharya and Sourabh Bhattacharya

Bayesian Semiparametric Approach to Learning about Gene-Gene and Gene-Environment Interactions in Case-Control Studies

Present day bio-medical research is pointing towards the fact that almost all diseases are manifestations of the complex interactions of genetic susceptibility factors and modifiable environmental conditions. It is therefore of utmost importance to understand the roles of genes and environment behind causing complex diseases. In this work, the gene-gene interaction model of Bhattacharya and Bhattacharya (2015) has been extended to take into account environmental variables which may be responsible for mutation and/or influencing gene-gene interaction without changing the genetic structure. The associated model and methodologies of hypotheses-testing are far more complex than those of Bhattacharya and Bhattacharya (2015), and the associated computations are much more demanding. Combining TMCMC with parallel computing ideas, it has been possible to construct an efficient parallel algorithm in this regard. Five simulation studies have been conducted with data drawn from a relevant population genetics model; the results are once again, highly encouraging.

Durba Bhattacharya and Sourabh Bhattacharya

On Asymptotics Related to Classical Inference in Stochastic Differential Equations with Random Effects

Delattre et al. (2013) considered *n* independent stochastic differential equations (SDEs) where, in each case the drift term is associated with a random effect, the distribution of which depends upon unknown parameters. Assuming the independent and identical (i.i.d.) situation, independent proofs have been provided of the consistency and asymptotic normality of the maximum likelihood estimators (MLEs) of the hyper-parameters of their random effects parameters. As an alternative route to proving consistency and asymptotic normality in the SDE set-up involving random effects, the regularity conditions required by existing relevant theorems have been verified. Much more importantly, the independent, but non-identical set-up associated with the random effects based SDE framework has been considered, and asymptotic results associated with the MLEs have been proved.

Trisha Maitra and Sourabh Bhattacharya

Asymptotic Theory of Bayes Factor in Stochastic Differential Equations with Random Effects

Research on model selection in the context of stochastic differential equations (SDEs) is almost non-existent in the literature. In particular, when a system of SDEs is considered, as in random effects models, the problem of model selection has not been hitherto investigated. In this work, a system of SDEs for modelling random effects has been considered, and the question of model selection using Bayes factors has been addressed. Specifically, the asymptotic theory of Bayes factors has been developed when the observed processes associated with the systems of SDE's are independently and identically distributed, as well as when they are independently but not identically distributed.

Trisha Maitra and Sourabh Bhattacharya

On Convergence of Bayes Factor in Stochastic Differential Equations with Random Effects as Number of Individuals and Time Domain Increase Indefinitely

The problem of model selection in the context of a system of stochastic differential equations (SDEs) has not been touched upon in the literature. Indeed, properties of Bayes factors have not been studied even in single SDE based model comparison problems. In this work, an asymptotic theory of Bayes factors is first developed when two SDEs are compared, assuming the time domain increases. Using this an asymptotic theory of Bayes factors is developed when two systems of SDE's are compared in a random effects modelling framework, assuming that the number of equations in each system, as well as the time domain, increase indefinitely. This asymptotic theory covers situations when the observed processes associated with the systems of SDEs are independently and identically distributed, as well as when they are independently but not identically distributed.

Trisha Maitra and Sourabh Bhattacharya

On the Misuse of the Variance Test in Meteorological Studies

The erroneous assumption “for all distributions for which the theoretical variance can be computed independently from parameters estimated by any method different from the method of moments” has been used in the case of fitting the gamma distribution to a rainfall data by Mooley (1973) which was followed by several researchers. In this work, it is shown that the asymptotic distribution of the test statistic is generally not even comparable to any central chi-square distribution. A method for checking the validity of the asymptotic distribution for a class of distributions has also been described.

Arnab Hazra, Sourabh Bhattacharya, Sabyasachi Bhattacharya (AERU) and Pabitra Banik (AERU)

A Bayesian statistical model for Nakshatra-wise rainfall of eastern plateau region of India

Statistical modelling of rainfall data has been a major area of research for climatologists and agrometeorologists for a long time. Currently, most of the climate-related statistical researchers prefer Bayesian methods as compared to likelihood-based frequentist methods. Bayesian methods are more flexible and simple. Somehow, very few or almost none of the climate researches applied Bayesian methods on climate data sets. In this work, a preliminary idea of the Bayesian paradigm is introduced and illustrated. The rain-fed agricultural operations are entirely season (rainfall) dependent. In the eastern plateau region, agricultural operations, particularly rice sowing or transplanting, depend on the appearance of Nakshatras in the sky. A zero-inflated exponential distribution has been fit; using preliminary Bayesian methods to calculate the posterior probability distributions of the parameters as well as the posterior predictive distribution to forecast short-period rainfall on different Nakshatra periods at Giridih, India.

Arnab Hazra, Sourabh Bhattacharya and Pabitra Banik (AERU)

Bayesian Asymptotics in Stochastic Differential Equations with Random Effects

Delattre et al. (2013) investigated asymptotic properties of the maximum likelihood estimator of the population parameters of the random effects associated with *n* independent stochastic differential equations (SDEs) assuming that the SDEs are independent and identically distributed (i.i.d.). In this work, the Bayesian approach to learning about the population parameters has been considered, and consistency and asymptotic normality of the corresponding posterior distribution has been proved in the i.i.d. set-up as well as when the SDE’s are independent but non-identical.

Trisha Maitra and Sourabh Bhattacharya

Robust Speaker Identification

The conventional GMM-MFCC based speaker identification algorithms fails miserably for noisy speech recordings. This algorithm can be viewed as a comparison between the estimated densities of the training and test utterances based on the Kullback-Liebler divergence. Algorithms based on robust statistical procedures involving other divergence measures are being developed. Initial results are promising. Combining another set of features called PLPC with MFCC further improved the results.

Smarajit Bose, Ayanendranath Basu and Amita Pal

Robust Tests of Hypotheses based on the Density Power Divergence

Tests of general statistical hypotheses based on the density power divergence are under consideration. These tests appear to produce very strong and robust performance under data contamination while retaining a high degree of efficiency.

Ayanendranath Basu, Abhijit Mandal, Nirian Martina, Leandro Pardo and Abhik Ghosh

Research Activities

A Minimum Distance Weighted Likelihood Method of Estimation

In a major breakthrough, minimum distance methods (like those based on the Hellinger distance) are also modified so that they can be viewed as weighted likelihood procedures. The resulting techniques acquire the advantages of both methods.

Arun Kumar Kuchibhotla and Ayanendranath Basu

Development of New Classes of Divergences for Statistical Inference

The development of new classes of divergences in the spirit of the density power divergence is under consideration. The corresponding minimum distance/minimum divergence estimators have many desirable properties.

Abhik Ghosh, Arun Kumar Kuchibhotla, Avijit Maji and Ayanendranath Basu

Weighted likelihood estimation

Many new properties of robust weighted likelihood estimators are under study.

Adhidev Biswas and Ayanendranath Basu

Optimal Blocked Main Effects Plans with Unequal Block Sizes

Optimality aspects of a main-effects plan used to study m two-level factors using n runs, partitioned into b blocks, the i^{th} block having size k_i where $\sum_{i=1}^{b} k_i = n$ has been investigated. For n *odd*, D- and E-optimal designs are characterized and Hadamard matrices and Kronecker product are used to construct these optimal designs.

Ganesh Dutta and Rita SahaRay

Critical sets in Sudoku and Orthogonal Sudoku

A certain type of Sudoku puzzle consists of a 6×6 grid with six blocks, each of which is 2×3 and must contain each symbol exactly once. A study has been undertaken to identify critical sets in such a Sudoku square which has a specific circulant pattern. The idea has been generalised to a $2n\times2n$ Sudoku with blocks of size $2\times n$ and a critical set of size n^2 has been proposed identifying the trades in the combinatorial structure. Using Galois Field, orthogonal mates for a 8×8 Sudoku having blocked pattern and the usual 9×9 Sudoku are constructed. The investigation on the combined critical set for such an orthogonal pair of Sudokus is under way.

Morgan, H. Ilene and Rita SahaRay

Applied Statistics Unit, Chennai

High Dimensional Statistical problems in Finance

Three main problems were investigated: (i) Covariance matrix estimation of high-dimensional time series (ii) high dimensionality effects on the efficient frontier (iii) Selection of high performing assets from a large collection. The first problem was addressed using rotational random shuffling and its performance is assessed in Linear Processes as in Davis et al (2014). The advantage of this method is that the resamples retain most of the time series structure but do away with cross correlation. In the second problem, the performance of Markowitz portfolio was investigated and the bias correction suggested by El Karouii (2010) for parameter estimation and risk evaluation is investigated in three markets and further modifications were studied. The third problem was studied using recent Bayesian multiple testing procedures. In the process, new theoretical results concerning multiple testing in the regression set-up are derived.

Rituparna Sen

Functional data analysis of HARMA series with covariates

Function-valued time series with covariates were considered, and estimation and forecasting were studied, with particular application to yield curves.

Rituparna Sen

A simple non-parametric test against renewal increasing mean residual life class

When a device is experiencing random number of shocks governed by a homogeneous Poisson process, the concept of renewal increasing mean residual life is very much useful to study the properties of age replacement model. In this work, a simple non-parametric test has been proposed for testing exponentiality against renewal increasing mean residual life class. The exact null distribution of the test statistic has been studied, and critical values for different sample sizes have subsequently been computed. The test statistic was shown to be asymptotically normal and consistent against the alternatives. The Pitman's asymptotic efficacy value shows that the proposed test performs well. Some numerical results have been presented to demonstrate the performance of the testing method and the test procedure has been illustrated using a real data.

S.K. Kattumannil

A Unified approach to estimation of Gini index and its variant

The Gini index and its variant are widely used as a measure of income inequality. Finding reliable estimators of these measures and studying their asymptotic properties has been an important area of research in the last two decades. In this study, a simple unique method has been proposed for finding the estimators of different income inequality measures. Asymptotic properties of these estimators can Be established in an identical way. Several research problems related to the estimation of Gini index and allied concepts have been brought into a uniform framework.

The asymptotic distribution obtained for Gini covariance has far-reaching consequence due to its potential application in non-linear time series analysis.

S.K. Kattumannil

Applied and Official Statistics Unit, North-East Centre, Tezpur

Reliability

Deterioration modeling using Gamma process and estimation of failure distribution has been investigated.

S.M. Bendre

Utilization of water treatment plant sludge as useful material for agriculture by vermi-technology

Water treatment plant sludge (WTPS) is a complex hazardous waste as it harbors high nutrients and toxic heavy metals. Efficacy of *Metaphireposthuma* was tested to degrade and stabilize this waste. Improvement in soil quality and low accumulation of heavy metal in soil under vermistabilized WTPS treatments was noteworthy. *Metaphireposthuma*could be utilized as a successful candidate for bioprocessing toxic WTPS materials.

Satya Sundar Bhattacharya and Pradip Bhattacharyya

Spatial variation of black tea quality of North-East India

The spatial distribution of theaflavin and thearubigin fractions and their impact on black tea quality were investigated using multivariate and geostatistical techniques. The variations in total theaflavins,

total thearubigins and their fractions were the main causes of variations in CTC black tea quality of the North East India.

Lakshmi Bhuyan and Santanu Sabhapandit and Pradip Bhattacharyya

Bioconversion of different organic waste materials into microbially enriched vermicompost

Study was conducted to see the effect of inoculation of different beneficial microorganisms on chemical and biochemical properties of vermicompost prepared from different organic wastes. The best quality compost was prepared where the organic wastes were treated with all the microorganisms together followed by vermicomposting.

Pabitra Banik (AERU) and Pradip Bhattacharyya

Longitudinal Data Analysis

Understanding relationship between certain health outcomes (e.g. depression) and psychosocial work characteristics (e.g. psychological work demands) using statistical techniques such as structural equation models, mediation models and marginal structural models on longitudinal data.

Holendro Singh Chungkham

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit, Kolkata

The research activities of the Advanced Computing and Microelectronics Unit (ACMU) comprise theoretical and applied research in the areas of high -performance computing, pervasive and mobile computing, wireless and sensor networks, VLSI design tools and electronic design automation, logic synthesis and testing, error correction and fault-tolerance, physical design of microchips, embedded systems, microfluidic lab-on-a-chip, system-on-a-chip, low-power architectures, discrete and computational geometry, algorithms and data structures, computational biology, hardware for image processing, nano-technology and giga-scale integration techniques, hardware and software validation. During the period 2014-2015, the faculty members of the unit were engaged in the following internally-funded research projects:

- Logic Synthesis for Quantum Computing (QCS): 2014 -17
- Localizability Testing for Wireless Sensor Networks (LTWSN): 2014 – 17
- Massive Data Algorithms (Massive-Data): 2014 – 16
- Voronoi Game (Voronoi-Game): 2014 – 17
- Algorithmic and Architectural Design Issues of Microfluidic Nano-Biochips for Bioassay Execution (MICROBE): 2012 – 15
- Distributed Computation in Pervasive Computing Environment (DCPC): 2012 – 15
- Extending the Scope of Formal Verification with Assertion Mining from Simulation Traces (ASMT): 2012 – 15
- Power and Bandwidth Management in Wireless Networks – Phase II (PoBaMa-II): 2013 – 15
- The QoS Improvement through Internetworking of WLAN and UMTS Networks (HbridUMTS-WLAN): 2013 – 16
- Visibility with Diffuse Reflections: Bounds and Algorithms (Visibility DifRef): 2013 - 2016

A brief report on each of these projects is presented below:

Logic Synthesis for Quantum Computing (QCS)

Theoretical computer scientists have established that for certain class of problems including ones related to cryptography, quantum algorithms have super-polynomial speed-up over their classical

counterparts. However, designing quantum computers to execute these algorithms is a major challenge as these systems are far more error-prone than classical computers of today. In this project, considering the constraints of quantum logic circuits which are markedly different form classical one, we have designed the following:

a placement and routing algorithms to realize the benchmark blocks for most quantum algorithms, with fault tolerance and error-correction apart from binary quantum logic, synthesis methodologies to reduce the cost of circuit to realize ternary and quaternary quantum logic benchmarks. Both of these efficient algorithms have obtained notable reduction of cost compared to the very few existing methods.

Susmita Sur-Kolay

Algorithmic and Architectural Design Issues of Microfluidic Nano-Biochips for Bioassay Execution (MICROBE)

Microfluidic labs-on-chip (LoC) have brought a complete paradigm shift in the automation of biochemistry using a low-cost tiny device. They are capable of implementing several biochemical laboratory assays or protocols that are useful in pathology, point-of-care diagnosis, drug design and delivery, DNA analysis, toxicity grading, and in defense applications.

During the execution of this research project (2012-2015), we have studied various CAD problems related to digital microfluidic biochips, particularly focusing on algorithmic microfluidics. These problems include sample preparation, architectural layout design of chips, and fault detection.

Sample preparation, which includes dilution and mixing of bio-fluids in a certain ratio, is a fundamental step needed in almost all bio-protocols . Sample preparation plays a pivotal role in biochemical laboratory protocols, e.g., in polymerase chain reaction (PCR), and in other applications of biomedical engineering and life sciences. Design of architectural layout of a biochip is needed for optimizing the performance of protocols when implemented on a chip. Finally, correctness checking and fault detection procedures are needed to ensure correct functionality of the chip and the protocols mapped therein.

We have studied the above-mentioned three *problem*s in detail, and reported new results and algorithms that have been published in archival journals and conferences. A number of patents have also been filed on the basis of this investigation. Our work includes (i) studies in generalized sample preparation with digital microfluidics, (ii) optimization of waste and reactant usage during on-chip sample preparation, (iii) design of droplet streaming engines, (iv) design of new LoC architectures, and (v) studies in fault-tolerance, and automated checking of the correctness of a biochemical assay implemented on a chip.

Bhargab B. Bhattacharya

Distributed Computation in Pervasive Computing Environment (DCPC)

Pervasive communication systems such as smart phones, sensor networks, tablets, vehicular networks etc. may be deployed in a variety of network connectivity conditions ranging from mostly well-connected environments such as cellular networks to most poorly connected environments such as wireless sensor networks (WSN). For WSN, considering both coverage and load-balancing criteria, we propose a novel node deployment technique maintaining minimum traffic in the network as well as minimum load on individual nodes that finally enhances the network lifetime significantly. An average case probabilistic analysis is done to establish a theoretical lower bound on the number of nodes to be deployed to ensure nearly load balanced coverage. Next, for the proposed node distribution, a simple distributed heuristic algorithm is developed for load-balanced data gathering with minimum possible load on each node. Analysis and simulation studies show that the proposed model ensures nearly load balanced coverage using significantly less number of nodes compared to the earlier works, generating

minimum traffic in the network, and most importantly, with minimum possible load on each node that finally enhances the network lifetime manifold.

Nabanita Das

secarT noitalumiS morf gniniM noitressA htiw noitacifireV lamroF fo epocs eht gnidnetxE (TMSA)

The objective of this work is to investigate the possibility of mining assertions automatically from execution traces obtained by pre-silicon system simulation. The mined assertions in turn allows the designer to understand better the system under test, verify its correctness, and manage possible evolutional changes. In particular, this work has the following motivations:

- Expanding the scop0e of ABV within the validation process by developing mechanisms for mining the high-level design intent from recurring temporal patterns as seen in the execution traces obtained by pre-silicon simulation.
- Investigating the role of specification mining in formal verification and failure diagnosis.

In the last year, we have come up with a parallel invariant miner that is able to generate invariants by processing multiple simulation traces in parallel. This enables faster assertion mining and reasoning in the verification process. A new confidence measure has been proposed for combining the invariants generated from distributed traces. We have shown the efficacy of our method on real world design traces from Opencores. We are currently working on building a complete prototype to be hosted on our website.

Ansuman Banerjee

Power and Bandwidth Management in Wireless Networks

In low power wireless networks, e.g. mobile and sensor networks, one of the major concerns is the energy-efficient communication so that battery power can be saved as much as possible. Also, with a limited amount of available bandwidth, allocation of channels to ever-increasing number of cellular mobile users for multimedia communication is a challenging research problem. Another related recent problem is the judicious allocation of channels to the uncoordinated wireless 802.11 hotspots, in order to optimize the performance of the network and fairness to all clients connected to the access points in respect of channel sharing. Accordingly, the following problems in this project have been taken up:

1) *D*evelopment of cost-effective techniques for energy-efficient communication inlow power wireless networks (particularly dealing with the physical layer and the MAC layer), 2) development of efficient algorithms for channel assignment in multimedia cellular mobile networks as wells as in uncoordinated wireless 802.11 hotspots, 3) development of efficient and novel routing protocols for multi-hop communication through cognitive radio ad-hoc networks for highly mobile nodes, maintaining the QoS and enhance the security of the multimedia signal and 4) energy efficient multimedia communication in Wireless Communication networks.

We have developed a multi-path routing algorithm in a CRN for multimedia communication, based on an extension of the idea of SDM as given for single-hop communication, even when a contiguous band of required width is not available for some or one of the hops in the route. Each data packet of the multimedia signal will be split into several sub-packets each of which needs much smaller bandwidth than the original packet, and these sub-packets will be sent through all these routes to be eventually received by the destination node with the desired QoS. We have also proposed an energy-efficient routing algorithm based on a Quint Fibonacci Number System (QFNS) encoding of message and the concept of silent communication of the dominant symbol. This technique provides significant amount of both transmitter and receiver energy savings. We have also proposed a novel near optimal algorithm for channel allocation in cellular mobile networks for multimedia communication. A fast channel allocation algorithm has been proposed for multimedia Communication in cellular networks. A new steganographic technique has been proposed for sending secrete massage over wireless networks.

Bhabani P. Sinha

The QoS Improvement through Internetworking of WLAN and UMTS networks

With increasing popularity of WLAN and emerging real time applications, seamless mobility has become one of the primary concerns. Hence the choice of a proper handoff algorithm is of utmost importance. Previous work suggests that WLAN usage efficiency can act as a good metric to measure the performance of a handoff algorithm. The usage efficiency is defined as the ratio of WLAN is actually used to that of WLAN may be usable. We argue that both the load on the APs and soft handover have a significant impact on the usage efficiency. *We have developed* an analytical framework to measure the usage efficiency under both load condition and soft handover. Our *proposed a*pproach is based on finding the circular region centered around an AP within which the requested data rate can be satisfied. The usage efficiency is then computed based on finding the union of all such circular regions. The channel assignment problem in mobile networks can be modeled as a temporal graph coloring problem where a temporal graph represents a sequence of graphlets generated over a regular interval of time. The cost of coloring a graphlet is defined as a function of number of colors used in the current graphlet and the number of color changes from the previous graphlet. A differential coloring technique is proposed which first finds the minimum number of vertices that requires recoloring and then recolor them. A prediction based and a random coloring based approach are then proposed to reduce the cost. In prediction based approach, we predict a graph which is a supergraph of the graph representing the union of current and next k graphlets and then color it. Whereas, in random coloring we color the graphlets individually. We have shown that both approaches perform better than an existing SNAP algorithm.

Sasthi C. Ghosh

emaG ionoroV

The Voronoi game is a competitive facility location problem given a user space, two players, P1 and P2, sequentially place a set of point facilities. These facilities partition the user space into a set of regions, such that all users within a region are served by a particular facility. The Objective of each player is to maximize the total service zone of all its facilities. Recently Bandyapadhyay, Banik, Das and Sarkar studied the one round discrete Voronoi game for *G*raphs.

Sandip Das

Low Memory Algorithms

Facility location problems: We proposed an O((n+M(n))log4n) time and O(1) extra space algorithm for the minimum enclosing circle problem in R2 where the input points are given in a random-access read-only array. Here M(n) is the time complexity of computing the median of a set of n elements in the constant work-space model, which is slightly superlinear in n. This answers an open question posed by Asano et al. [2011] positively. We also considered several facility location problems on tree network. Here we proposed linear time algorithms for the centroid and weighted median problems in the constant work-space model where the input tree is given in a read-only memory. Next, we show that for both weighted 1-center and weighted 2-center on a tree network can be computed in O((n+M(n))log2n) time in the constant-work-space model. Finally, we demonstrate an O(M(n)(n+M(n))log4n) time algorithm for the minmax regret 1-center in the tree network. All our algorithms are simple and deterministic. Interestingly, most of our algorithms use prune-and-search. Naturally, we develop a novel idea to implement prune-and-search in the constant-work-space model. We believe that this can be applied to other problems which admit solutions by prune-and search paradigm. For example, we can apply the technique to solve two and three dimensional linear programming in O((n+M(n))polylog n) time time in this model. Center-point problem: We proposed a O(M(n2) log2n) time algorithm for computing a center-point for a set of n points in R2 in the constant work-space model, where the input points are given in a random-access read-only array. We also present the applications of this algorithm for computing the k-hull and Tukey depth of a point set in R2. Rectilinear shortest path: We study the rectilinear path problem in the presence of disjoint axis parallel rectangular obstacles in the in-place and read-only setup. In the read-only setup the shortest path between a pair of points among a set of n axis-parallel rectangular obstacles in R2 can be computed in

O(n2/s + n log s+ Ms(n) log n) time, where Ms(n) is the time complexity for computing the median of n elements in read-only setup using O(s) extra-space. For the query version of the problem, we need to preprocess the input rectangles in an in-place manner such that an axis-parallel path between an arbitrary pair of query points can be reported efficiently. For rectangular obstacles, our preprocessing needs O(n log n) time and the query can be answered in O(n3/4+ □) time where links (bends) in the path. For unit square obstacle, we show that □□ is O(log n) reported in O(log n) time.

Subhas C. Nandy

V htiw ytilibisiD esuffiR :snoitcelfeB dna sdnuoAsmhtirogl

Let s be a source point and t be a destination point inside an n-vertex simple polygon P. Euclidean shortest paths and minimum-link paths between s and t inside P have been well studied. Both these kinds of paths are simple and piecewise-convex. Similar paths in the context of diffuse or specular reflections have not been studied. However, computing optimal paths in the context of diffuse or specular reflections does not seem to be an easy task. A path from a light source s to t inside P is called a diffuse reflection path if the turning points of the path lie in the interiors of the boundary edges of P. A diffuse reflection path is said to be optimal if it has the minimum number of turning points amongst all diffuse reflection paths between s and t. The minimum diffuse reflection path may not be simple. The problem of computing the minimum diffuse reflection path in low degree polynomial time has remained open. In our quest for understanding the geometric structure of the minimum diffuse reflection paths vis-a-vis shortest paths and minimum link paths, we define a new kind of diffuse reflection path called a constrained diffuse reflection path where (i) the path is simple, (ii) it intersects only the eaves of the Euclidean shortest path between s and t, and (iii) it intersects each eave exactly once. For computing a minimum constrained diffuse reflection path from s to t, we present an O(n(n+ x)) time algorithm, where x = Θ(n^2) in the worst case. Here, x depends on the shape of the polygon. We also establish some properties relating minimum constrained diffuse reflection paths and minimum diffuse reflection paths. Constrained diffuse reflection paths introduced in this paper provide new geometric insights into the hitherto unknown structures and shapes of optimal reflection paths. Our algorithm demonstrates how properties like convexity, simplicity, complete visibility, etc., can be combined in computing and understanding diffuse reflection paths that are optimal or close to optimal. Apart from this, we have also explored path homotopies in diffuse reflection path and approximation algorithms for diffuse reflection path.

Arijit Bishnu

Computer Vision and Pattern Recognition Unit, Kolkata

Pair-Copula Based Mixture Models and their Application in Clustering

Finite mixtures are often used to perform model based clustering of multivariate data sets. In real life applications, such data may exhibit complex nonlinear form of dependence among the variables. Also, the individual variables (margins) may follow distributions from different families. Most of the existing mixture models are unable to accommodate these two aspects of the data. A finite mixture model has been developed that involves a pair-copula based construction of a multivariate distribution. Such a model de-couples the margins and the dependence structures. Hence, the margins can be modelled using distributions from different families. Again, many possible dependence structures can also be considered using different copulas. The resulting mixture model (called DVMM) is capable of capturing a broad family of distributions including non-Gaussian models. DVMM has been studied here in the context of clustering of multivariate data. An expectation maximization procedure has been designed for estimating the mixture parameters. Extensive experiments have been performed on a number of well-known data sets. The performance of DVMM has been found to be quite satisfactory.

Anandarup Roy and Swapan Kr. Parui

Clustering of Circular-linear Data for Colour Image Segmentation

Most of the existing mixture models are designed for linear data. However, real life applications may involve multivariate data having both circular and linear variables. For example, in the LCH (Lightness, Chroma, Hue) colour space, L and C are linear variables while H is linear. A mixture model based algorithm has been developed where L and C are assumed to follow a Gaussian distributions while H is assumed to follow a wrapped Gaussian distribution. Here the LCH values of a pixel in a colour image is assumed to be generated from a finite mixture of joint distributions of L, C and H. The parameters of this mixture is estimated using Expectation Maximization algorithm. Clustering is done after the mixture parameters are obtained, based on maximum a posteriori probability. The resulting colour image segmentation algorithm has been tested on the Berkeley segmentation data set. Four metrics, namely, PRI, GCE, VoI and BDE, have been used for comparison. The algorithm developed by us outperforms five existing mixture model based colour image segmentation algorithms in terms of all these metrics excepting GCE.

Anandarup Roy and Swapan. Kr. Parui

Automatic Query Expansion in Information Retrieval

Automatic query expansion (AQE) is a useful technique for enhancing the effectiveness of information retrieval systems. A novel AQE algorithm has been developed that first adopts a systematic incremental approach to selection of feedback documents from the top retrieved set and then selects the expansion terms aggregating the scores from each feedback set. Also, a term selection measure and a number of weighting schemes based on easily computable features have been devised. A set of experiments with a large number of standard test collections shows that the proposed incremental blind feedback algorithm outperforms a number of state of the art query expansion methods with remarkable significance and consistency.

Jiaul H. Paik, Dipasree Pal and Swapan Kr. Parui

Fusion of Runs in Information Retrieval

It is established that a weighted linear combination of different runs can produce better results than the unweighted combination in Information Retrieval. Many techniques have been used to determine the linear combination weights. A Genetic Algorithm based approach has been developed for this purpose. Since the combination weights form a constrained space, it is mapped to an unconstrained space on which the GA operates. GA is used to learn the optimum fusion weights using the relevance assessments of the top retrieved documents only. The proposed method has been tested on the runs submitted in TREC. The proposed weight learning scheme produces significant improvements over the best candidate run, CombSUM, CombMNZ, Z-Score, linear combination method with performance level, performance level square weighting scheme, multiple linear regression-based weight learning scheme, mixture model result merging scheme, LambdaMerge, ClustFuseCombSUM and ClustFuseCombMNZ. Furthermore, the proposed method can identify and remove the redundant runs.

Kripabandhu Ghosh, Swapan Kr. Parui and Prasenjit Majumder

Improving Information Retrieval Performance on OCRed Text

OCR errors hurt retrieval performance to a great extent. Research has been done on error modeling for correction of OCR errors. However, most of the existing systems use language dependent resources or training texts for studying the nature of errors. However, not much research has been reported on improving retrieval performance from erroneous text where no training data is available. We developed a new algorithm for identifying OCR error variants on the basis of both string similarity and context information. These variants are then used for query expansion which significantly improves the retrieval performance from the erroneous corpus. Our algorithm does not use any training data or any language specific resources like thesaurus. We have tested our algorithm on erroneous Bengali and Hindi FIRE collections. The proposed approach achieved statistically significant

improvements over the state-of-the-art baselines. We also show that it is possible to automatically detect some OCR error patterns.

Kripabandhu Ghosh, Anirban Chakraborty, Swapan Kr. Parui and Prasenjit Majumder

Development of an Annotated Database of Online Handwriting Samples

Recently developed database of unconstrained online handwritten Bangla word database has been further enhances during the present year. All of its samples are attached with its (Unicode) ground truth and transliteration. A large part of these samples have been semi-automatically annotated at sub-stroke level. Another database of online unconstrained handwriting samples of continuous Bangla texts has been developed. These have been segmented at word level and attached with their ground truth. Annotation of these samples at sub-stroke level is underway. Also, a secondary database of segmented online handwritten characters of 127 classes has been developed from the word samples of the above databases.

Soumik Bhattacharya, Durjoy Sen Maitra, Anirban Chakraborty and Ujjwal Bhattacharya

Study of a Novel Machine Learning Approach to Detection of Core Regions of Online Handwriting Samples

Detection of core region of unconstrained handwritten words of any script, particularly Indian scripts that have a large number of characters, is an important step towards their automatic recognition. Efficient preprocessing operations such as height normalization, slant estimation etc. may be designed based on such core region. A majority of the characters of Indian scripts have their main parts belonging to such core regions that is bounded above by a headline and bounded below by an imaginary base line. Only a few of these characters or their parts appear either above or below the core region. A novel method for detection of such core regions of an online handwritten word sample of Bangla, a major Indian script, has been developed. The proposed method consists of a smoothing operation followed by segmentation of a stroke into substrokes at the initial stage. Certain novel positional features for such substrokes have been designed based on which a multilayer perceptron (MLP) based classification scheme has been designed to determine the position of both the headline and the baseline of a handwritten word sample. The approach has been tested successfully on a large database of online unconstrained handwriting Bangla word samples.

Sudarshan Baral, Soumik Bhattacharya, Anirban Chakraborty, Ujjwal Bhattacharya and Swapan Kr. Parui

Study of a Novel Strategy for Stroke level User Adaptation towards Stroke Order Free Online Handwriting Recognition

A novel lightweight user-adaptive and stroke order free approach to online Bangla handwriting recognition has been developed. The approach is based on prior identification of the set of possible strokes of different shapes used in writing the characters of the underlying alphabet. In this approach a small number of prototypes of each stroke shape is used along with certain weighted DTW distance based nearest neighbour classifier to recognize the strokes in an input character. Individual characters are identified using a look-up table (LUT) each row of which corresponds to one character composed of a distinct set of stroke shapes. This LUT is formed using the representative sample set of the underlying character set. If a stroke does not find a close match in the training set or if the set of strokes for an input character does not find a corresponding entry in the LUT, user adaptation takes place using a modified Learning Vector Quantization (LVQ) method.

Debarshi Dutta, Aruni Roy Chowdhury and Ujjwal Bhattacharya

Study of Combination of Different Features Encoding Complementary Shape Characteristics for Offline Handwriting Recognition

In offline handwriting recognition tasks, often features are computed from contour representation of the input image sample. A basic reason of its popularity is that this representation can preserve many useful shape information and is robust against occlusion. However, its sensitivity to noise and non-rigid deformations is a well-known fact. On the other hand, medial axis or skeletal shape representation based features are capable of encoding the basic shape information of the interior of a word image although they lack the boundary information. However, an important aspect of skeleton based features is that they can cope up with non-rigid transformations. Indeed, contour and skeleton provide complementary shape information. In the literature, although these two shape representations had been considered in isolation for handwriting recognition but no such recognition study could be found in which these two had been used in combination. In the present study, existing Gradient, Structural and Concavity (GSC) features have been computed from both contour and skeletal representations of offline word images and their concatenation has been fed to a Support Vector Machine for recognition. Simulation results of the proposed approach on a database of handwritten Devanagari words show improvement in recognition accuracy compared to the same obtained on the basis of any one of them only.

Bikash Shaw and Ujjwal Bhattacharya

A Data Driven Strategy for Obtaining the Weights of Multiple SVMs towards Their Combination

Designed a novel data driven strategy for combining multiple SVM classifiers each being trained with a distinct feature vector. The SVM classifiers in the ensemble are ranked based on their increasing order of average performance on a validation sample set. The outputs of the SVM classifiers are combined based on a weighted average strategy which uses the above ranks of the underlying SVMs to determine the respective weights. In this study, four sets of different feature vectors representing online handwritten words are selected. Simple concatenation of these feature vectors does not help much in improving the recognition accuracy compared to the best performing feature vector among the four. This is possibly due to the fact that a larger dimension of the feature vector needs a much larger training set. In this study, distinct SVM classifiers with different feature vectors are trained and combine their outputs at the final stage. This combination approach for multiple SVMs has been simulated on a limited vocabulary recognition problem of unconstrained mixed cursive online handwritten Bangla words. Obtained recognition accuracy improved the existing result on the same database.

Avinaba Srimany, Souvik Dutta Chowdhuri and Ujjwal Bhattacharya

Binarization of Degraded Document Image

Binarization is a crucial preprocessing step of a majority of document analysis tasks. There are many old archived documents in degraded condition containing various background patterns and noise or affected by smear, smug, variation in brightness, change in original colour of the material etc. Scanned image of such a document is usually difficult to binarize properly and existing approaches often fail to provide a workable binarized image. The characteristics of document image degradations have usually two different natures one of which is global and the other is local. A robust binarization approach suitable for such degraded document images has been developed where the label of a pixel in the binarized image is decided at two successive stages. In the pre-processing stage, the input image is blurred using a Gaussian filter. A global threshold value is first computed based on the Canny edge representation of the pre-processed image and each pixel with gray value greater than the above threshold is labelled as a background pixel. In the second stage, a local threshold is obtained for each non-labelled pixel by analyzing the pixel gray values in a small neighbourhood of it. These local threshold values classify the non-labelled pixels into background or foreground pixels. Finally, a set of simple post processing operations helps to remove a few small noise components. Simulation of this binarization approach on a benchmark database of sample document images provided successful results.

Barun Biswas, Ujjwal Bhattacharya and Bidyut B. Chaudhuri

Research Activities

Text Extraction from Video Lectures

Automatic recognition of handwritten texts in video lectures has important applications. Recognition of texts from such a video frame requires prior detection of the region of texts in the frame. A novel scheme based on Scale Invariant Feature Transform (SIFT) descriptor and multilayer perceptron (MLP) has been designed for this purpose. These descriptors are located on a regular grid of 5 pixels following the usual practice and considered a uniform patch size of 60 × 60 pixels as its support on the basis of an empirical study. This SIFT descriptor at each location (grid point) is fed as a 128-dimensional input feature vector to a Multilayer Perceptron (MLP) network which gives response for each grid point as either text or non-text. Depending on certain aggregate response at each pixel text regions in the input video frame are localized. Next, K-means clustering is employed to detect the text components present in the localized region of the video frame. Finally, some simple rules are applied to decide certain possible detected text components as noise. Encouraging simulation results of this approach have been obtained on a database of online video lectures downloaded from the WWW.

Purnendu Banerjee, Ujjwal Bhattacharya and Bidyut B. Chaudhuri

Handwritten Text-Line Segmentation from Manuscript image

Segmentation of individual text lines from offline handwritten documents of Indian scripts are rarely found in the existing literature. Certain peculiarities of handwritten documents of these scripts such as widespread occurrences of ascenders and descenders or some of its characters appearing only as an ascender or as a descender often cause unique difficulties to this segmentation task. Touching of several characters or cursive words over a number of successive text lines is a common phenomenon in similar unconstrained handwritten documents. A novel but efficient approach for text line segmentation of handwritten Bangla documents has recently been developed where initially, the input document image is first smudged to blur-out white spaces between words, while preserving gaps between consecutive lines. An initial segmentation is obtained by shredding the image based on the white most pixels in between consecutive smudged lines. Next, multi-line connected components are separated by finding the most probable point of separation in the thinned version of such a component. This segmentation strategy while simulated on ICDAR 2013 Handwriting Segmentation Contest dataset of Bangla provided acceptable results.

Koustav Mullick, Sudipto Banerjee and Ujjwal Bhattacharya

Document Analysis

The aim of text frame classification technique is to label a video frame as text or non-text, before text detection and recognition. It is an essential step prior to text detection because text detection methods assume the input to be a text frame. Consequently, when a non-text frame is subjected to text detection, the precision of the text detection method decreases due to false positives. We have proposed a new text frame classification approach based on the component linearity. The method, at first, obtains probable text clusters from the gradient values of the RGB images of an input video frame. The Sobel edges corresponding to the text cluster are then extracted and are used for further processing. Next, the method proposes to eliminate false text components before undertaking a linearity check where the linearity of the text components is determined using centroids of the text components in a piece-wise manner. If the components in a frame satisfy the defined linearity condition, then the frame is considered as a text frame, else it is considered as a non-text frame. The method is tested on standard text and non-text datasets of different orientations to demonstrate that the proposed method is independent of orientation. Also, a comparative study with the existing method shows that the proposed method is better than existing methods in terms of classification rate and processing time.

Umapada Pal, Nabin Sharma, Palaiahnakote Shivakumara,
Michael Blumenstein and Chew Lim Tan

The date is a key piece of information, which can be used in various robotic applications such as date-wise document indexing/retrieval. We have proposed a system for automatic date field extraction from

multi-lingual (English, Devnagari and Bangla scripts) handwritten documents. In order to design the system, first the script of the document is identified, and based on the identified script, word components of each text line are classified into month and non-month classes using word-level feature extraction and classification. Next, non-month words are segmented into individual components and labeled into one of text, digit, punctuation or contraction categories. Subsequently, the date patterns are searched using the labeled components. Both numeric and semi-numeric regular expressions have been used for date part extraction. Dynamic Time Warping (DTW) and profile feature-based approaches are used for classification of month/non-month words. Other date components such as numerals and punctuation marks are recognized using a gradient-based feature and Support Vector Machine (SVM) classifier. The experiments are performed on English, Devnagari and Bangla document datasets and the encouraging results obtained from the system indicate the effectiveness of the proposed system.

Umapada Pal, Ranju Mandal, Partha Pratim Roy and Michael Blumenstein

Recognition of offline musical symbols can aid in automatic retrieval of a particular piece of musical notation from a digital repository. Though some work on on-line Musical symbol notations exists, little work has been done on off-line recognition of the symbols. A system for offline isolated musical symbol recognition is proposed. Efficacy of a texture analysis based feature extraction method is compared with a structural shape descriptor based feature extraction method coupled with a Support Vector Machine (SVM) classifier. Later three different kinds of feature selection techniques were also analyzed to gauge the contribution of each feature in the overall classification process. The proposed system exhibited encouraging results in a five-fold cross validation experimental framework. On 3795 music symbols we achieved 97.5% accuracy while using chain-code histogram feature along with a SVM classifier.

Umapada Pal, Sukalpa Chanda, Debleena Das and Fumitaka Kimura

A novel approach for offline Bangla handwritten word recognition by Hidden Markov Model (HMM) is proposed. Due to the presence of complex features such as headline, vowels, modifiers, etc., character segmentation in Bangla script is not easy. Also, the position of vowels and compound characters make the segmentation task of words into characters very complex. To take care of this problem we propose a method considering a zone wise break up of words. In particular, the word image is segmented into 3 zones, upper, middle and lower, respectively. The components in middle zone are modeled using HMM. By this zone segmentation approach we reduce the number of distinct component classes compared to total number of classes in Bangla character set. Once the middle zone portion is recognized, HMM based forced alignment is applied in this zone to mark the boundaries of individual components. The segmentation paths are extended later to other zones. Next, the residue components, if any, in upper and lower zones in their respective boundary are combined to achieve the final word level recognition.

Umapada Pal, Partha Pratim Roy, Prasenjit Dey, Sangheeta Roy and Fumitaka Kimura

Script identification

is an important area in handwriting document image analysis field. The script identification at word level on documents written in multiple scripts is an open challenge for the scientific community and a real concern in countries with multiple official languages, e.g. the country like India. Such documents usually contain two scripts. A word or even character level script identification is sometimes required in the document. We have proposed a system towards handwritten script identification.

Umapada Pal, Miguel A. Ferrer, Aythami Morales and Nayara Rodrígue

Biometrics

An efficient and adaptive biometric sclera recognition and verification system is proposed. Sclera segmentation was performed by Fuzzy C-means clustering. Since the sclera vessels are not prominent, in order to make them clearly visible image enhancement was required. Adaptive histogram

equalization, followed by a bank of Discrete Meyer Wavelet was used to enhance the sclera vessel patterns. Feature extraction was performed by, Dense Local Directional Pattern (D-LDP). D-LDP patch descriptors of each training image are used to form a bag of features; further Spatial Pyramid Matching was used to produce the final training model. Support Vector Machines (SVMs) are used for classification. The UBIRIS version 1 dataset was used here for experimentation of the proposed system. To investigate regarding sclera patterns adaptively with respect to change in environmental condition, population, data accruing technique and time span, two different sessions of the mention dataset are utilized. The images in two sessions are different in acquiring technique, representation, number of individual and they were captured in a gap of two weeks. An encouraging Equal Error Rate (EER) of 3.95% was achieved in the above mention investigation.

Abhijit Das, Umapada Pal, Miguel Ángel Ferrer Ballester and Michael Blumenstein

South Asian Face database

This project aims to create a standardized face database for various South Asian ethnicities and then make face recognition and other psychophysical assays out of them for research and screening purposes. Specifically, studies will be done among ethnic groups of Darjeeling-Sikkim area and North-East. Furthermore, the databases will be publicly available for use in research.

Garga Chatterjee and Avik Singha

Effect of Internet of brain structure

Navigating the internet involves various brain processes. This project is looking at the effect of internet usage by naive subjects on the structure of their brains, especially certain areas of the cerebral cortex. Brain plasticity is a well documented phenomenon but the response of a previously unexposed brain to internet navigation is unknown.

Garga Chatterjee, Priyanka Chakravarty, Ryota Kanai and Himadri Datta

Studying the phenomenon of disgust with reference to genetic contribution using twins

The feeling of disgust is a human phenomenon mediated by the brain. Some evidence from animal studies suggest that there might be genetic contribution to the the phenomenon of disgust. This study aims to look at human variation in disgust using a adapted questionnaire and will look at the genetic contribution to disgust variation by comparing sets of monozygotic twins and dizygotic twins. For the purpose of testing, a Twin database will be made, which will be used. Most testing will happen online.

Garga Chatterjee, Dhairyya Singh, Sumitava Ghosh and Shubhrakanti Naha

The cognitive architecture of face-processing – understanding the separation of information streams

Faces contain various kinds of information like identity, age, gender, expression, attractiveness, etc. These information streams from the same image source (face) can be serial or parallel. This study will create face databases and then use those databses for psychophysical experiments with monozygotic twins, dizygotic twins and controls to understand the cognitive architecture of these information streams.

Garga Chatterjee and Neloy Chakraborty

Human face and body skin tone and their relationship with various biological and social parameters

Human skin variation has often been associated with various biological and social factors. In this study, certain social and biological information will be collected from human subjects – these will act as independent variables. The face and body skin tone will be assayed objectively through colorimeter, in

controlled environment. The study aims to see whether tone variations are predictably correlated with any of the independent variables.

Garga Chatterjee and Neloy Chakraborty

Unsupervised Keyphrase Extraction

Given a long text, a set of *keyphrases* (representative phrases with one or more words) can act as a useful summary of the text. The summary can be used for interesting visualization, tagging, classification and other similar tasks. Since prior training is hard and tends to be very domain specific, unsupervised keyphrase extraction is an important problem in text analysis. Previous works on keypharse extraction include few approaches which are based on word graph construction and applying the PageRank algorithm on such graphs to determine important words in a text. In all of the previous works, the word graphs were unweighted and thus the word – word associations captured in the graphs were symmetric. In our ongoing project, we are investigating whether the quality of extracted keyphrases improve when the word graph constructed as a directed graph with different parts of speech such as nouns, adjectives and verbs are dealt with differently in determining the direction and weight of the edges of the graph. Our initial experiments show that the keyphrases extracted using such directed graphs are better representatives of the text when used for text classification. More thorough evaluation using gold standard keyphrases and user study is ongoing.

Debapriyo Majumdar, Mayur Chhabra and Enakshi Mukhopadhyay

Point of view detection from news articles

Clustering of news articles by topic is a well-studied problem and is effectively used in consumer portals such as Google news and several other applications, including mobile apps. Such a clustering of articles shows a huge number of results for trending topics, highlighting one or two representative articles. However, in reality there are several points of views expressed by many authors on current affairs. It is impractical for readers to read through several hundred articles for each topic to get all or most of the different points of views. In our ongoing project starting in late 2014, we are aiming to detect and present the different point of views expressed in a cluster of articles. We are extracting named entities (such as persons, authors of articles), which would be the sources and targets of points of views expressed in the articles, and extracting the statements made by them. Then we are performing sentiment analysis on the statements and constructing a statement graph with persons being nodes and edges representing statements. The sentiments and the content of the statements determine the direction and the edges of the graph. We are currently investigating the structure of the graphs formed this way to come up with an algorithm for segregating the different and representative points of views.

Debapriyo Majumdar and Tanmoy Patra

Image and Video Quality Assessment

Objective image quality assessment is an important area of research which is of use for quality of service determination, image restoration etc. Algorithms have been proposed for reduced reference and no reference approaches for image quality assessment which does not require the original undegraded image for this measurement. The approaches also identify the cause and amount of degradation – noise, blurring or compression which are the major sources of image quality loss. The issue of tamper detection has been addressed by developing a pre-processing algorithm. The processed image contains necessary information for detecting any tampering and also correcting the tampered regions of the image. Results have been found to be superior to existing techniques.

S.Palit, Dipabali Sarkar and Ankan Bhattacharya

Computational Linguistics for Indic Languages

Several new algorithms have been designed for natural language processing for Indic languages (IL). A new method has been implemented for performance analysis of text chunking. For Indic language

machine translation (MT) an off-the-shelf statistical machine translation tool has been configured and its performance is analyzed for ILMT (from several Indic languages to Hindi translation). This system was participated in ICON 2014 NLP Tool Contest and achieved the fourth best position. A Novel algorithm for named entity recognition (NER) has been designed and evaluated for several Indic languages. The method makes use of Wikipedia and Web information mash up techniques. Recently introduced word embedding technique has been studied and used for solving NER and lemmatization problem in Bengali and Hindi. The BenLem (a system for lemmatizer for Bnegali) has been further improved and a Trie-based method is incorporated. The system has been extended to develop IndiLem (a system for Indic language lemmatizer) and evaluated for Hindi. Computational aspects have been studied for drop detection in Bengali and analyzing one expressions. Honorificity of Bengali proper nouns play important role in pronominal anaphora resolution in Bengali. This aspect has been studied and a maximum entropy based model has been designed for capturing honorificity information.

Utpal Garain, Arjun Das, Abhisek Chakrabarty, Apurbalal Senapati, Suchismita Maiti, Arnab Dhar and Sankar De

Event extraction from technical literature on Cancer Genetics

In biomedical domain the present research requires improved access to the ever-increasing amount of scientific literature. This research employs learning based pattern classification technique to extract events from biological literature. Although various approaches to extract events have been explored, none is suitable for designing a practical system of event extraction. Extracting events more precisely is still an ongoing process. In this paper, new features that seem to be relevant for the given task are investigated. Two syntactic patterns namely phrase structure and dependency structure are explored to produce improved results with respect to the Cancer Genetics Data provided in the BioNLP'13 Shared Task. A stacked model based on conditional probability scores are also considered as features. The patterns and the probability scores along with some other linguistic features are fed to SVMs to train it for the task of bio-event extraction from natural language articles. The results are compared with the performance of the best extraction system in Cancer Genetics Task.

Utpal Garain, Debajyoti Sinha and Sanghamitra Bandyopadhyay

Language Identification from Handwritten Documents

A novel approach is designed for identification of language from handwritten documents. The approach is based on script identification followed by character recognition. BLSTM-CTC based handwriting recognizers have been used and the OCR output is fed to a statistical language identifier for detecting the language of the input handwritten document. Documents in two scripts (Latin and Bengali) and four languages (English, French, Bengali and Assamese) are considered for evaluating the method. Several alternative frameworks have been explored; effects of handwriting recognition and text length on language detection have been studied. It is observed that with some empirical restrictions it is very much possible to achieve more that 80% language detection accuracy and based on the current research practical systems can be designed.

Utpal Garain, Luc Mioulet, Clement Chatelain, Philippine Barlas and Thierry Paquet

A Recurrent Neural Net based Bengali Handwriting Recognizer

A pioneering method has been designed for developing a recurrent neural net based connectionist system for unconstrained Bengali offline handwriting recognition. The major challenge in configuring such classification system for a complex script like Bengali is to effectively define the character classes. A novel way of defining character classes is introduced in order to make the recognition problem suitable for using a recurrent model. Indeed, it has to deal with more than nine hundred character classes for which the occurrence probability is much skewed in the language. An off-the-shelf BLSTM-CTC recognizer is used. A new open-source dataset is developed for unconstrained Bengali offline handwriting recognition. The dataset contains 2338 handwritten text lines consisting of about 21,000 words. Experiment shows that with the new definition of character classes the BLSTM-

CTC framework provides an impressive performance for unconstrained Bengali offline handwriting recognition. The character level recognition accuracy is 75.40% without doing any post-processing on the BLSTM-CTC output. Among the 24.60% character level errors, the substitution, deletion and insertion errors are 18.91%, 4.69% and 0.98%, respectively.

Utpal Garain, B. B. Chaudhuri, Luc Mioulet, Clement Chatelain and Thierry Paquet

Searching into OCR'd Comic Collection

This paper investigates a novel technique for word searching in an OCR'd collection. Instead of attempting OCR error correction, query expansion method is followed. OCR errors are analyzed and the analysis result is used as feedback for expanding a query. Predictions are made on how a query word may appear in the OCR'd documents. The predicted words are formed by corrupting the clean query word as per the nature of OCR errors. Later, these predicted words are also searched into the collection along with the error-free clean word. Two different models namely, single error model (SEM) and multiple error model (MEM), are used for query expansion. Experiments are conducted on the comic collection known as eBDtheque. Evaluation shows that when a list of eighteen (18) query words is searched in the OCR'd collection consisting of 3; 537 text documents, simple string matching method is 47% accurate in locating the intended query words in OCR'd collection. However, after query expansion this accuracy is improved by a significant margin. SEM improves the accuracy to 55:6% whereas MEM further improves to 57%. The statistical significance test shows that this 21% profit (47% to 57%) in searching words in the OCR'd collection is statistically significant.

Utpal Garain, Arjun Das, Christophe Rigaud, Jean-Christophe Burie and Jean-Marc Ogier

Automatic Text-to-Diagram Conversion based technique for designing a Novel Teaching Aid for the Blind People

Diagram describing texts are integral part of science and engineering subjects including geometry, physics, engineering drawing, etc. In order to understand such text, one tries to draw or perceive the underlying diagram. For perception of the blind students such diagrams need to be drawn in some non-visual accessible form like tactile graphics. Technologies for producing tactile graphics are available but they are too expensive to be afforded by the blind students or schools in developing countries like India. Therefore, science education for the blind students is severely compromised. This research achieves a novel solution to this problem. A tool for drawing geometry diagrams on the low-cost traditional Braille text printer is reported here. This tool is then integrated with a previously developed text-to-diagram conversion system. Using the integrated system, a blind student can input a geometry word problem and perceive the underlying diagram on a Braille printout. The technology has been evaluated at a Blind school. The enthusiasm and the interest shown by the subjects in using the system strongly attest its viability as a novel teaching/learning tool for the blind students. An impact analysis for the proposed technology shows the effectiveness of the proposed tool for teaching geometry to the blind students.

Utpal Garain, Anirban Mukherjee and Arindam Biswas

Computational Forensics

In the domain of computational forensics two different areas have been explored. One work is on authentication of paper of a printed security document. Paper pulps play a crucial role in characterizing a paper material. These pulps are visible in the UV scanned image of the document. The pulp identification is done by borrowing ideas from rice grain detection method. Shape and color features are extracted from the identified pulps. Paper pulps coming from fake documents are significantly different from those of genuine documents in their shapes and colors. Using the shape and color features, a multilayer back propagation neural network is used to discriminate paper pulps as genuine or fake. The method is tested with Indian banknote samples and experiment shows that consideration of paper pulps is one of the crucial tests for authenticating paper money. The second work presents a new inverse half toning method for reconstructing low resolution line halftone images. This

reconstruction is done in order to authenticate an image in question. The reconstructed image is compared with its original image in terms of standard image quality metrics such as peak signal to noise ratio (PSNR) and structural similarity index measure (SSIM). A comparative study shows that the new method outperforms many existing inverse halftone techniques while dealing with line halftone images.

Utpal Garain, Biswajit Halder, Ankush Roy and David Doermann

Dataset for Evaluating Online Handwritten Mathematical Expressions

The shared task, Competition on Handwritten Mathematical Expression Recognition (CROHME), is continued in collaboration with labs in France and USA. CROHME-IV was organized with the Int. Conf. on Frontiers in Handwriting Recognition (ICFHR) 2014 in Greece and eight teams from academia and industry took part. For the fourth CROHME, the training dataset was expanded to contain 8836 expressions (matrices are included now) and a new test set containing 986 expressions was developed. Several new tools were developed for evaluating performance at the level of strokes as well as expressions and symbols. Data and tools used for the competition have been be made publicly available through IAPR TC-11 site.

Utpal Garain, Harold Mouchere, Christian Viard-Gaudin and Richard Zanibbi

Database for Automatic Identification of Singer

An automatic singer identification based on both audio segmentation and separation is being studied. To perform the experiments, a database is constructed that consists of songs from 50 singers. The genre is Tagore's song in Bengali. The number of male and female singers is considered with an equal distribution (i.e. 25 each). The age distribution of the singers is randomly selected. Two non-native singers have been considered (one male and one female). Six songs per singer have been taken in the database. So, in total 300 songs are taken in this work. The unique songs considered in this experiment are 112. All the songs initially are downloaded from the internet in different available formats. Later, during the experiments, they are down sampled to 16 KHz and saved in a wav format to reduce the data storage and processing requirements. Even at the lower sampling rate, most vocal energy falls well below the Nyquist rate (half the sampling-rate) and is preserved for the analysis. The training and development datasets consist of three songs per singer and remaining three songs per singer (total 150 songs) are part of the test dataset.

Utpal Garain and Rupayan Chakrabarty

Electronics and Communication Sciences Unit, Kolkata

Video Processing

Video data is used to recognize human activity based on facet model features. The method gives very good results on regular or routine activities like running, walking, jogging, handwaving, etc. This is also applied on Indian classical dance data to recognize different dance styles or schools like Odissi, Bharathanatyam, etc. Sometimes important objects in a scene are obscured by other undesired objects. A image or video inpainting algorithm is developed to solve this problem and predict the desired part of the scene behind the undesired objects. This inpainting method makes use of higher order SVD for predicting the target patch, which produces much more robust and reliable output. Another important application of video processing is copy detection. A useful algorithm for this purpose along with an efficient algorithm for shot detection, which is an inevitable step of the former, are developed.

Image Processing and Analysis

Work on super resolution (SR) technique i.e., producing high resolution image from low resolution ones to overcome hardware limitations is being carried on. A novel SR algorithm for single frame

image reconstruction is developed based on fuzzy rule-based system. This single-frame exemplar based approach produces results which are much better than that of state-of-the-art methods. An important and wide-spread application of image analysis technique is analyzing document image. Novel algorithms (i) for correcting slope and slant of handwritten text, (ii) for binarization of land maps are developed and tested on indigenously developed database.

B. Chanda

Recognition of Emotions from Face Images

We present a novel framework for recognition of facial expressions from a given face image. The framework is based on the assumption that expression information lies in the subspace orthogonal to the subspace representing expression-neutral faces. For deriving the principal subspace of the face images showing no expression, PCA is used as a tool. Then we derive a method to find the orthogonal complement (OC) of the subspace defined by the principal components. It is shown that the OC of the principal subspace better represents the expressions as compared to the principal subspace in PCA analysis. We have done extensive experiments to validate the recognition capability of the proposed OC space. Two well known publicly available facial expression databases are used for the experiments. We also compare the expression discrimination capability of the OC subspace with some well known features for expression representation. The proposed framework exhibits higher (9.66% on an average) recognition capability as compared to the present state-of-the-art works.

Mitosis Detection in Microscopic Histopathologial Cell Images

Histological grading of cancer not only gives an estimate of the patients' prognosis but also helps to develop individual treatment plans. Mitosis count in histological slides plays a crucial role in the grading of invasive breast cancer. Pathologists perform this grading by manual examination of a few thousand images for each case. Clearly, finding the mitotic figures from these images is a tedious job and also prone to observer variability. We propose a fast and accurate approach for automatic mitosis detection from histological images. We employ area morphological scale space for cell detection. The scale space is constructed in a novel manner by restricting the scales with maximization of relative entropy between the cells and background. This results in precise cell detection. The random forest classifier is applied on the detected cells to classify them in mitotic and non-mitotic category. Experiments show at least 12 percent improvement in F1 score on more than 450 histopathological images at x40 magnification

D.P. Mukherjee

Nonmonotonic Reasoning Using Disposition: An Approach to Construct Consistent Belief Set

Nonmonotonic reasoning using modified version of First Order Logic is already established. Several proof-theoretic approaches proposed by McDermott & Doyle, Moore, Reiter and McCarthy are already established for generating fixed points. T. Przymusinski examined the close connection between logic programming and nonmonotonic reasoning. As a declarative semantics for general programs he proposed Perfect Model semantics and proved its equivalence to all the major formalisations of nonmonotonic reasoning in artificial intelligence (AI). Stable model semantics and well founded semantics were developed as an extension of perfect model semantics. We propose a different approach to nonmonotonic reasoning using disposition, which not only represents the nonmonotonicity of common sense reasoning but also takes into account the fuzziness of real world environment. In our approach we handle dispositions in an explicit manner. Thus our theory includes First Order Logic as well as Dispositions. At the time of handling Dispositions we simultaneously consider the usual world and the exceptional world. Our experience says that the essential source of nonmonotonicity in reasoning is the conflict of the information of the exception world with that of the usual world stated in terms of dispositions. Thus, the said conflict may invalidate any inferences drawn from the existing theory and demands a new conclusion. Due to the lack of information in the exception world apparently the very nature of nonmonotonicity in reasoning may be suppressed; but more the exception world is informed more the possibility of nonmonotonicity in reasoning may increase

provided such conflicts occur. Hence generation of a consistent belief set from the given theory including disposition arises. Once a consistent belief set is generated, then the question of belief revision arises if the said conflict occurs. Then the consistent belief set must be updated. We use a different approach for the construction of consistent belief set for a nonmonotonic theory including dispositions. The inclusion of dispositions and the corresponding exceptions leads to the absence of a least model. Not only that the set of clauses becomes nonmonotonic with respect to the natural closure operator, because of which the existence of a least fixpoint is not ensured. We solve the problem by compartmentalising the nonmonotonic theory into *piecewise-monotonic* partitions and work on each of these compartments separately. Then based on this partition we construct a unique consistent belief set. We develop a resolution type theorem proving to establish the effectiveness of the nonmonotonic reasoning with dispositions and also verify the soundness and completeness of the nonmonotonic reasoning with disposition. We also compare the performance of our approach with the approaches of nonmonotonic reasoning as stated above and demonstrate the difference. We further show the advantage of our approach in terms of handling fuzzy concept using disposition.

Kumar S. Ray

Fuzzy Sets

We have analyzed the minimal set of axioms that overlap indices between fuzzy sets must fulfil. We have also presented a method to build overlap indices using overlap functions and then have carried on a theoretical study about the continuity, the invariance and some general properties of such indices. We have presented a generalization of the inference algorithm for interpolative fuzzy systems using overlap indices. Finally we have proposed an algorithm for choosing, among a set of overlap indices, the best one for a given problem.

Evolutionary Computing

Many diversity metrics have been proposed for off-line diversity measurement of the whole population in multi-objective optimizations. Usually these methods require the knowledge of the exact Pareto optimal front or the ideal vector. Thus, there is no direct approach to use the diversity metrics in an online manner. We have proposed an online diversity metric inspired by the geometrical interpretation of convergence and diversity. This method is able to measure the diversity loss caused by any individual in the population. We have demonstrated the effectiveness of the proposed metric on the well-known multi-objective evolutionary algorithm with decomposition using several benchmark problems. For a c-class problem, we have developed an integrated algorithm for simultaneous feature selection and designing of diverse classifiers using a steady state multi-objective genetic programming. Our method evolves c sets of genetic programs to create c ensembles. During mutation operation, our method exploits the fitness as well as unfitness of features, which dynamically change with generations with a view to using a set of highly relevant features with low redundancy. The effectiveness and superiority of our scheme are demonstrated on a large number of high dimensional problems with diverse number of classes (from 2 to 44) and number of features varying from 2000 to 49151.

Bioinformatics

Determination of how genes interact among themselves with respect to certain disease is an important problem. We have first identified the issues with the existing information theoretic methods for finding synergistic networks and then redefined the measure of synergy. This new definition is then applied on datasets containing gene expression values of both diseased and non-diseased samples to identify pairs of genes, which are seemingly unable to discriminate between diseased and non-diseased samples individually but can do so jointly when we take their synergistic property into account. We have also proposed a very simple yet effective technique for computation of conditional entropy at a very low cost. Finally, using gene enrichment analysis, we have discussed the biological relevance of the synergy networks identified by the proposed method.

Nikhil Ranjan Pal

Secured Query Processing for Semantic Web Applications

Continuing the excavation to the access control model of semantic data, the current research focus has been extended from a single-user entity to a user-group mapping. Significantly, with the introduction of User-Group hierarchy along with object hierarchy has increased the degree of complexity. Furthermore, the digital library metadata access control model has been evolved from an individual user's facility towards the users' group based authorization systems. However, this improvement has inevitably increased the administrative and maintenance flexibility over the previous model. The underline structure of digital library includes poly-hierarchy and represented by the DAG rather than the tree. This assumption has raised the importance of Separation of Duties (SOD) and conflict resolution mechanism. Nonetheless, the policy rules have been developed for handling the conflict resolutions and the safety property. Further, the model has been extended from the single graph to multiple graphs. Due to unavailability of the large linked data set, a simulation data for multi-graph has been prepared by utilizing “Stanford Large Network Dataset Collection” (4,847,571 nodes and 68,993,773 edges). Also, XACML 2.0 based policy repository has been set up for replying authorization queries. Further, an Ontology repository based on Virtuous (Open source repository) has been set up. Algorithms have been developed for ontology based to update model for individual user.

Pinakpani Pal

Video Scene Segmentation and Classification

Video scene segmentation and classification are two fundamental tasks to design an intelligent multimedia retrieval and browsing system. Representation of the video as a group of semantic units ensures efficient indexing and retrieval. We have developed scene detection methods using shot level key-frames following two approaches: one method splits the key-frame sequence into scenes, while the other, by merging the key-frames to form the scenes. Both the methods rely on the observation that shots appear in a quasi-periodic pattern in a scene. The methods are tested on benchmark datasets. Present research activity includes the analysis of scene contents to identify their categories such as comedy, horror, action, dialogue, sports, commercial, etc.

Partha Pratim Mohanta

Design of Online Atmospheric Pattern Detection System

Indigenously designed two SODAR systems were fabricated and tested along with structure recognition software. These are installed at ISI, Kolkata, one is at backside of transport unit and the other one is on the roof of the library building. Both the system captured atmospheric boundary layer thermal structures up to a height of 1 Km. In order to generate supporting ground truth data for the SODAR system, we also designed and fabricated automatic weather station.

Monitoring of air Quality

Two air sampler machines (PM10 and PM 2.5) are installed at ISI, Giridih and other two air sampler machines (PM10 and PM 2.5) are also installed at ISI, Kolkata for data collection of Suspended Particulate Matters (SPM) and the experiment is being continuing. Samples were collected on pre-heated (450℃) filter papers for 8 hour. The filter papers were weighed before and after the sampling/experiment in order to determine the air mass (µg m-3) of the PM10 and PM2.5 collected. These collected samples were stored under dry condition at -20℃ till analysis. Water soluble ionic components (WSIC) of PM10 and PM 2.5 were being analyzed using Ion Chromatograph and Organic Carbon (OC) as well as Elemental Carbon EC analysis has been carried out by OC/EC carbon analyzer at the National Physical Laboratory (NPL), New Delhi. We have analyzed OC, EC and WSIC data at NPL, New Delhi and developed models for estimation of OC and EC from WSIC of particulates along with meteorological data.

Srimanta Pal

Research Activities

Evolutionary Computing and Swarm Intelligence

Efficient variants of the Differential Evolution algorithm have been derived to provide elegant solutions of dynamic single and multi-objective optimization problems, where the nature of the functional landscape changes with time. Inter-agent communication, search dynamics and the chaotic dynamical characteristics of certain simulated swarms have been investigated both analytically and experimentally to gain better insight into the coordinated swarm control observed in nature. Some of the devised optimization algorithms have also been applied to solve some challenging signal estimation problems. Many real world optimization scenarios demand identification of all possible optimal solutions on the run. We have developed very efficient niching algorithms in the framework of the Differential Evolution algorithm. We are using the neighbourhood based mutation models to avoid basin to basin transfer in the evolutionary process. Our algorithm can detect all the local and global optima of several benchmark and practically multi-modal functions efficiently.

S. Das

Imbalanced Data Machine Learning

In real world the datasets are very often imbalanced in the sense that the representations from different classes are not approximately equal and at least one class is under-represented relative to others. Such datasets arise quite often from applications including (but not limited to) fraud/intrusion detection, medical diagnosis/monitoring, bioinformatics, text categorization etc. The problem of imbalanced data is often associated with asymmetric costs of misclassifying elements of different classes. Our research focuses on devising suitable variants of the support vector (maximum margin) classifiers and boosting algorithms for providing acceptable solutions to imbalanced data classification problems without using severe computational overheads.

S. Das

Machine Intelligence Unit, Kolkata

Evolutionary Computation

Critical surveys of multiobjective optimization based data mining and clustering approaches have been carried out. Further, a new algorithm for differential evolution based many objective optimizer has been developed that takes into account the conflict among the objectives to determine a smaller subset of the objective to work with. This algorithm operates recursively in phases, where in the first phase works on the full set of objectives while the second phase works on the smaller conflicting subset that is recomputed in every iteration. Results show a significant improvement in performance of the proposed method over several state-of-the-art techniques.

S. Bandyopadhyay

Computational Systems Biology

We have developed a methodology for identifying the interactions among the genes in terms of dependencies (named as gene–gene interaction) that have altered quite significantly from normal stage to diseased stage with respect to their expression patterns. This idea leads to predict the disease mediating genes along with their altered interactions. The methodology involves measuring information content of individual genes using fuzzy entropy, conditional fuzzy entropy of a gene on another, dependencies (interactions) of a pair of genes in both normal and diseased states, detecting the dependencies being deviated from normal to carcinogenic state and finally identifying the influential genes from altered dependencies. Thus the gene–gene interactions for normal state and diseased state are represented separately by the gene dependency networks (GDN). The altered interactions among the genes have been represented using a network, called altered gene dependency network (AGDN), in which each node represents a gene and a directed edge signifies altered dependency between a pair of nodes (genes). The methodology has been demonstrated on

five gene expression data sets dealing with human lung cancer, colon cancer, sarcoma, breast cancer and leukemia. The results have been appropriately validated, in terms of gene–gene interactions, using biochemical pathways, t-test, p-value, NCBI database and earlier investigations in terms of gene regulation. We have also used sensitivity to validate the results. For a comparative study, we have used some existing association rule mining algorithms and frequent pattern mining algorithms like Fuzzy Cluster-Based Association Rules, Apriori, T-Apriori in terms of gene–gene interactions. In addition, we have implemented Significance Analysis of Microarray, Signal-to-Noise Ratio, Neighborhood analysis, Bayesian regularization and frequent pattern mining algorithms for a comparison with AGDN in terms of ability to identify the important genes mediating the cancers.

R.K. De

Pattern Recognition

Performance of clustering algorithms is largely dependent on selected similarity measure. Efficiency in handling outliers is a major contributor to the success of a similarity measure. Better the ability of similarity measure in measuring similarity between genes in the presence of outliers, better will be the performance of the clustering algorithm in forming biologically relevant groups of genes. We have introduced the concept of Relative Sample Outlier (RSO), and formulated new similarity, called Weighted Sample Similarity (WSS). WSS has been incorporated in Euclidean distance and Pearson correlation coefficient and then used in various clustering and biclustering algorithms to group different gene expression profiles. The results suggest that WSS improves performance, in terms of finding biologically relevant groups of genes, of all the considered clustering algorithms.

R K. De

A dense subgraph finding approach has been developed for the unsupervised feature selection problem in a graph theoretic framework, with individual features constituting the vertex set and inter-feature mutual information denoting the edge weights. Feature selection is performed in a two-phase approach where the densest subgraph is first obtained using an approximation algorithm so that the features are maximally non-redundant among each other. In the second stage, feature clustering around the non-redundant features is performed to produce the reduced feature set. The proposed approach is found to be competitive with several state of art unsupervised feature selection algorithms.

S. Bandyopadhyay

Simultaneous Feature Selection and Extraction

Dimensionality reduction of a data set by selecting or extracting relevant and nonredundant features is an essential preprocessing step used for pattern recognition, data mining, machine learning, and multimedia indexing. Prior to analysis of the data set, preprocessing the data to obtain a smaller set of representative features and retaining the optimal salient characteristics of the data not only decrease the processing time but also lead to more compactness of the models learned and better generalization. In this regard, a novel dimensionality reduction method has been proposed that simultaneously selects and extracts features using the concept of feature significance. The method is based on maximizing both relevance and significance of the reduced feature set, whereby redundancy therein is removed. The method is generic in nature in the sense that both supervised and unsupervised feature evaluation indices can be used for simultaneously feature selection and extraction. The effectiveness of the proposed method, along with a comparison with existing feature selection and extraction methods, has been demonstrated on a set of real life data sets.

P. Maji

Text Mining

A new similarity measure between documents in a corpus, named extensive similarity, has been defined. Its utility in classification as well as clustering problems has been successfully demonstrated. A tweak on K-Nearest neighbor decision rule (denoted by TKNN) is introduced which partially solves the problem of choosing the value of K for K-NN rule. Its utility in general classification problems has

been successfully demonstrated. In text mining domain too, categorization of documents using extensive similarity with the help of TKNN has been attempted. It is found that this new classification scheme outperformed all the other categorization algorithms in text mining.

C.A. Murthy

Medical Imaging

An algorithm for predicting the binding sites of miRNAs in their target mRNAs has been developed in a multiple instance learning framework. This not only serves the purpose of predicting which miRNAs target which mRNAs, but also the locations in the target mRNA where the miRNA binds. In a separate study, new miRNAs expression signatures have been computationally identified in order to predict subtypes of breast cancer. Influence of miRNA in insulin signaling pathway and insulin resistance in type 2 diabetes has been surveyed in another work. In the area of drug design, a new tubercular maltosyl transferase protein target, GlgE, has been modeled. Its binding sites have been studied. Some potential ligands have been identified through pharmacophore based virtual screening and molecular dynamics simulation.

S. Bandhyopadyay

A semiautomatic region growing volumetric segmentation algorithm, implemented in the free and publicly available 3D-Slicer platform, was investigated in terms of its robustness for quantitative imaging feature extraction. Fifty-six 3D-radiomic features, quantifying phenotypic differences based on tumor intensity, shape and texture, were extracted from the computed tomography images of twenty lung cancer patients. These radiomic features were derived from the 3D-tumor volumes defined by three independent observers twice using 3D-Slicer, and compared to manual slice-by-slice delineations of five independent physicians in terms of intra-class correlation coefficient and feature range. Radiomic features extracted from 3D-Slicer segmentations had significantly higher reproducibility compared to the features extracted from the manual segmentations. Furthermore, we found that features extracted from 3D-Slicer segmentations were more robust, as the range was significantly smaller across observers, and overlapping with the feature ranges extracted from manual contouring. Our results show that 3D-Slicer segmented tumor volumes provide a better alternative to the manual delineation for feature quantification, as they yield more reproducible imaging descriptors. Therefore, 3D-Slicer can be employed for quantitative image feature extraction and image data mining research in large patient cohorts.

S. Mitra

Remotely Sensed Image Analysis

A novel spatio-contextual fuzzy clustering algorithm for unsupervised change detection from multispectral and multitemporal remote sensing images is developed. The proposed technique uses fuzzy Gibbs Markov Random Field (GMRF) to model the spatial gray level attributes of the multispectral difference image. The change detection problem is solved using the maximum a posteriori probability (MAP) estimation principle. The MAP estimator of the fuzzy GMRF modeled difference image is found to be exponential in nature. Hence we adhered to the variable neighborhood searching (VNS) based global convergence criterion for iterative estimation of the fuzzy GMRF parameters. Experiments are carried out on different multispectral and multitemporal remote sensing images. Results confirm the effectiveness of the proposed technique. The computational time taken by the proposed technique is comparable with that of the HTNN scheme.

A. Ghosh

Object Tracking

In this work, an object tracking method using a rule mining/ induction technique is presented. Initially, a rule based classification algorithm is employed to classify the target frame into object and background. A sequential covering algorithm is used in order to extract the rules from the candidate frame.

Extracted rules are then used for classifying the test samples obtained from the search region of the target frame. Classified test samples form the classification map which is used for calculating the new centroid to locate the object in the target frame. Temporal coherence (between frames) is maintained by updating the rule set during the rule extraction phase. Efficiency of the proposed method is established both qualitatively and quantitatively by comparing it with some of the state-of-the-art algorithms.

A. Ghosh

Counting and Characterizing Red Blood Cells

An automated method for counting red blood cells present in a blood sample has been proposed. The proposed method addresses the problems of holes present in blood cells and overlapping characteristics of the red blood cells. The procedure is quite simple and straightforward, which utilizes mathematical morphological operations of erosion and dilation for performing different steps. It first thresholds a gray scale image to obtain the binary image using the Otsu thresholding method, and then, performs the hole filling process on the red blood cells if they have holes. Then, the process moves on to the job of counting the red blood cells. For this, each red blood cell is extracted and its shape analysis is performed to decide whether it is circular, non-circular, overlapping or just partially present in the sample. If a cell is only partially present in the image, then it is discarded. In case of overlapping, the number of cells in the overlapped area is determined. Several experimental results have been presented to establish the effectiveness of the method. One of the important findings is that the proposed method gives accurate count of red blood cells of the blood sample, and classifies each cell into one of the four categories mentioned above.

P. Maji

Skull Stripping Algorithm for Brain MRI

The skull stripping method is an important area of study in brain image processing applications. It acts as preliminary step in numerous medical applications as it increases speed and accuracy of diagnosis in manifold. It removes non-cerebral tissues like skull, scalp, and dura from brain images. In this regard, a simple skull stripping algorithm, termed as S3, has been proposed, which is based on brain anatomy and image intensity characteristics. The proposed S3 method is unsupervised and knowledge based. It uses adaptive intensity thresholding followed by morphological operations, for increased robustness, on brain magnetic resonance (MR) images. The threshold value is adaptively calculated based on the knowledge of intensity distribution in brain MR images. Experimental results, both qualitative and quantitative, have been reported on a set of synthetic and real brain MR T1-weighted images. The performance of the proposed S3 algorithm has been compared with that of several popular methods using standard validity indices.

P. Maji

Bioinformatics

Possibilistic Biclustering Algorithm

One of the important tools for analyzing gene expression data is biclustering method. It focuses on finding a subset of genes and a subset of experimental conditions that together exhibit coherent behavior. Since biological processes are not independent of each other, many genes may participate in multiple different processes. In this regard, a novel possibilistic biclustering algorithm has been proposed to find highly overlapping biclusters of larger volume with mean squared residue lower than a predefined threshold. It judiciously incorporates the concept of possibilistic clustering algorithm into biclustering framework. The integration enables efficient selection of highly overlapping coherent biclusters with mean squared residue lower than a given threshold. The detailed formulation of the proposed possibilistic biclustering algorithm, along with a mathematical analysis on the convergence property, has been presented. Some quantitative indices have been introduced for evaluating the

quality of generated biclusters. The effectiveness of the algorithm, along with a comparison with other algorithms, has been demonstrated on yeast gene expression data set.

P. Maji

Identification of Co-Expressed microRNAs

The microRNAs or miRNAs are short, endogenous RNAs having ability to regulate mRNA expression at the post-transcriptional level. Various studies have revealed that miRNAs tend to cluster on chromosomes. The members of a cluster that are at close proximity on chromosome are highly likely to be processed as co-transcribed units. Therefore, a large proportion of miRNAs are co-expressed. Expression profiling of miRNAs generates a huge volume of data. Complicated networks of miRNA-mRNA interaction increase the challenges of comprehending and interpreting the resulting mass of data. In this regard, a clustering algorithm has been proposed in order to extract meaningful information from miRNA expression data. It judiciously integrates the merits of rough sets, fuzzy sets, c-means algorithm, and normalized range-normalized city block distance to discover co-expressed miRNA clusters. While the membership functions of fuzzy sets enable efficient handling of overlapping partitions in noisy environment, the concept of lower and upper approximations of rough sets deals with uncertainty, vagueness, and incompleteness in cluster definition. The city block distance has been used to compute the membership functions of fuzzy sets and to find initial partition of a data set, and thereby helps to handle minute differences between two miRNA expression profiles. The effectiveness of the proposed approach, along with a comparison with other related methods, has been demonstrated on several miRNA expression data sets using different cluster validity indices. Moreover, the gene ontology has been used to analyze the functional consistency and biological significance of generated miRNA clusters.

P. Maji

Machine Vision and Perception

Psychophysics attempts to connect the material and the mental, the objective with the subjective. This requires quantification of humansensations and perceptions with respect to external stimuli. Our work attempts to solve some of the experimental as well as theoretical aspects of visual perception in general and brightness perception in particular especially with reference to brightness contradictions. Brightness contradictions occur in a type of visual illusions in which various surfaces of perfectly equal luminance have different apparent brightness. It so seems that, what apparent brightness those surfaces will have, depends on the nature of the rest of the field of view. Moreover there are two basic and contrary types of brightness illusions. These are the brightness-contrast and brightness-assimilation types. In the brightness-contrast type, the apparent brightness of a region changes in the opposite direction to the brightness of its surrounding regions. This increases the apparent contrast of the region with respect to its surroundings. Examples of this include the Simultaneous Brightness Contrast (SBC) illusion, the Mach Band illusions, the Sine and Square Grating Illusion etc. On the other hand in the brightness-assimilation type ofillusions, the apparent brightness changes in the same direction as itssurroundings. This reduces the apparent contrast of the region with respect to its surroundings. Examples of this include the White effect, the ShiftedWhite illusion and the Checkerboard illusion. Why does our brain decide toshow us brightness illusions of such opposing nature and how does it decideupon what type of illusion to show, is still unknown. It is even possible to move smoothly from one type of illusion to the other, thus also changing the apparent brightness of the test regions. Howe's stimulus is one such type of smooth transition in which the White effect can be smoothly converted to SBC. Traditionally some of these illusions have been explained using a spatial filtering function applied on the input stimulus. Such models have been supported by the experimental observation of lateral inhibition in the retina of the eye and the LGN. Lateral inhibition is the Difference of Gaussian (DoG) model. The opposing naturesof brightness illusion types have not yet been explained simultaneously byany single spatial filtering algorithm, though there have a few such attempts like the Oriented DoG model. Our current attempt is to arrive at aunified model for brightness perception with the help of a combination of isotropic DoGs only.

K. Ghosh

Noncoding RNAs

Noncoding RNAs (ncRNAs) are functional RNAs in the cell. Although they do not code for proteins, revealing their functions are necessary for understanding many biological processes like gene expression regulation, gene silencing, transcription, replication, processing, chromosome stability etc. There are different types of ncRNAs such as transfer RNA (tRNA), ribosomal RNA (rRNA) and micro RNA (miRNA) whose functions can be predicted from environmental genetic materials, called metagenomes. Metagenomics is a rapidly growing field of research that can provide new directions in finding novel ncRNAs, annotating existing ones and possibilities for other biological discoveries. In this regard, the application and importance of dynamic programming, probabilistic models, artificial neural networks (ANN), genetic algorithms (GAs) and simulated annealing (SA) to analyze and interpret metagenomics data for predicting novel noncoding RNAs have been investigated.

S.S. Ray

Documentation, Research and Training Centre, Bangalore

The main areas of research in which the DRTC Faculty were engaged during the period are furnished below.

Knowledge Organization

The focus of Knowledge Organization has transformed substantially in the last one decade as a direct consequence of the emergence of digital resources, digital libraries and the World Wide Web. Knowledge organization, today, has to meet the twin objectives of facilitating organization of information resources for effective retrieval while at the same time look at ways and means of effective tagging of the huge volume of digital resources to support retrieval at acceptable levels of precision.

Devika P. Madalli

Faceted Approach for Domain Ontology Development

The research focuses on developing a systematic, comprehensive and formal methodology for domain ontology construction. The goal is to build a general process flow independent of any specific domain. Towards this we have already come out with preliminary result, a process flow called YAMO, Yet Another Methodology for Ontology Development. The soul of this process flow is the well known Analytico-Synthetic approach introduced by S.R. Ranganathan. We are currently working on its further refinements based upon the results that we have found through its applications in developing ontologies. We are also working on methodology for developing core ontology for domains. We have refined the YAMO approach; have tested the approach by applying it in building domain ontologies; result has been published in a peer reviewed journal; YAMO is further extended and defined YAMO+ approach, an approach for constructing core ontology.

Biswanath Dutta and Devika P. Madalli

Linguistic Phenomenon and Knowledge Organization

The research focuses on finding the various linguistic phenomena (e.g., complementary polysemy, contrastive polysemy, metonymy, metaphor) that are present in WordNet, a large scale lexical database highly used for the Natural Language Processing (NLP) tasks. Besides resolving the linguistic phenomena issues, we are also working on adding semantics into it by making structural changes applying the knowledge organization techniques. The goal is to make WordNet a truly useful resource for NLP tasks, for instance, word sense disambiguation, relationship extraction, annotation, abstract construction, question answering. Sense enumeration in WordNet is one of the main reasons behind the problem of high polysemous nature of WordNet. The sense enumeration refers to misconstruction those results in wrong assignment of a synset to a term. In this work, we have proposed a novel approach to discover and solve the problem of sense enumerations in compound

noun polysemy in WordNet. The proposed solution has reduced the number of sense enumerations in WordNet and thus high polysemous nature without affecting its efficiency as a lexical resource for natural language processing.

Biswanath Dutta

Digital Libraries and Semantic Web

Research is carried out in faceted ontologies in social and media research. Study of Wordnet for semantic compatibility as part of EU funded FET Living Knowledge Project, was under taken. The main objective of the project is to develop ontologies using faceted approach, in order to provide folksonomies which should facilitate visualizations to the end-user. DRTC is actively pursuing research in web ontologies using RDF (Resource Description Framework), OWL (Web Ontology Language) and SKOS (Simple Knowledge Organization system). The ultimate goal is to develop context based search mechanisms combined with inference engines. Domain based ontologies in LK format are being built.

Devika P. Madalli

Agriculture data interoperabilitoy and Open data Repositories

DRTC has been working in the area of agricultural representation and standards. With the emergence of Big Data and focus on issues in exploiting Big Data sets, DRTC has set out to work on “Agricultural Data Interoperability”. Another related area of work is in Open Data Repositories. With more and more open data being published, the questions of how to harness, organize and build useful applications on data have risen. Open Data repositories is the next big stop in data management processes, standards and architectures. DRTC is working on the ‘PROMIS” data infrastructure and developing into a model for open data repositories. Dr. Devika Madalli is working with international experts in this area as the chair of the Interest group in Agriculture data at the Research data Alliance. Also the work in Open Data repositories is taken forward by Profs. Prasad and Madalli in collaboration with the G8+05 countries scientific representatives in exploring Open Data Infrastructures.

A.R.D. Prasad and Devika P. Madalli

Graph Database and Query optimization

In Semantic Web, Resource Description Framework (RDF), a directed label graph, is a data model that plays an important role for modelling and storing network of data. RDF data has experienced accelerated growth in recent years. The massive growth of RDF data throws challenges in terms of data management and query processing time. In this work we mainly focus on query processing and optimization. We have proposed a hypergraph based data management system and SPARQL query optimization technique. We have used the concept of hypergraph which is a generalization of the graph where the edges connect more than two vertices. We have proposed some algorithms for storing RDF data as hypergraph. We have compared the performance of our algorithms with 3 other systems, namely, Rdf-3x, Apache-Jena and AllegroGraph, based on SP2Bench, a SPARQL performance benchmark dataset and SPARQL queries.

Biswanath Dutta

Development Universal Knowledge Core

DRTC has a long history in its contribution to Knowledge Modeling and management for systems in libraries. The principled approach of analytico synthetic classification is now applied to semantic web especially to developing faceted ontologies. The work in the past few years has lead to an international team working towards development the Universal Knowledge Core (UKC). We have made some theoretical contributions and also have added new concepts to UKC. We have modelled entity *recipe*. Also, some translation work has been carried out. We have translated the following domain and eTypes from English to Hindi: Space domain, person, organization and location eTypes.

Devika P. Madalli and Biswanath Dutta

Multilingual data in Indian languages for Universal Decimal Classification

Coordination and supervision of translation and mapping of concepts for Universal Decimal Classification in Indian languages such as Hindi, Kannada, Tamil, Telugu, Marathi and Punjabi is being pursued. Presently work on Urdu is ongoing. Work commenced on Oriya.

Devika P. Madalli

Library and Information Technology

In the recent past, several technology applications to library and information work have been demonstrated. As a part of this kind of research, a LiveCD called Liblivecd has been released. It is preconfigured with DSpace digital library software + Koha, Library Management Software + PKP Harvester (which collects metadata from various digital/institutional repositories to provide a single stop search engine) + dbwiz, a federated search engine which facilitate searches across e-journals and online databases. The Liblivecd is hosted on http://sourceforge.net/projects/liblivecd. The updated version has been provided at the same site. Updated LiveCD version 1.5.

A.R.D. Prasad.

Big Data

As more and more data is available on the Internet organising retrieving and handling big data has become essential for scientific research and e-governance. DRTC is working on implementation of tools for big data including Hortonworks, Cloudera, which include a cluster of tools like Hadoop, Hive, Pig, Zookeepr etc. DRTC is exploring the possibilities of developing models using home grown Analytico Synthetic Approach to Graph Database.

A.R.D. Prasad.

Institutional repositories and Open Access to Information

In the 1990's a movement was started to enhance public access to scholarly journal articles through pre-print servers. In these servers, authors would deposit pre-prints of articles. It thus provided readers worldwide with a quick access to research outputs. These types of servers began as informal vehicles for the dissemination of preliminary research and literature. However, the last decade witnessed the rapid evolution of such resources into increasingly important media for dissemination of research results in certain fields. Broadly known as "Open Access to Information". In keeping with International and national importance of the area of Open Access to Information at DRTC the following contributions were made:

1. Comparative study of open source tools for digital repositories
2. Study the Feasibility of designing and developing an appropriate prototype Institutional Repository (IRs) model using open source software easily implementable in all the universities in India.
3. Study the adequacy of existing standards in this regard especially for scholarly material in Indian languages and scripts.
4. Design an end user interface for browsing, navigating through and searching the Institutional Repository.

Dr. Devika P Madalli is consultant to UNESCO for drafting guidelines and policies for open data and data repositories.

A.R.D. Prasad Devika P. Madalli

Ontology Supported Information Systems

The exponential growth of information on the web far exceeds the capacity of present day information retrieval systems and search engines, making information integration on the web difficult. In order to overcome this, semantic web technologies were proposed by the World Wide Web Consortium (W3C)

to achieve a higher degree of automation and precision in information retrieval systems. Semantic web, with its promise to deliver machine understanding to the traditional web, has attracted a significant amount of research from academia as well as from industries. Semantic web is an extension of the current web in which data can be shared and reused across the internet. RDF and ontology are two essential components of the semantic web architecture which support a common framework for data storage and representation of data semantics, respectively. Ontologies being the backbone of semantic web applications; it is more relevant to study various approaches in their application, usage, and integration into web services. In this article, an effort has been made to review the research work being undertaken in the area of design and development of ontology supported information systems. . So, the semantic web concepts came into picture. Information is an important resource in the management is very different from traditional Library management. Mostly, it involves management of change, time and electronic sources, along with traditional collection management aspects.

M. Krishnamurthy.

Systems Science and Informatics Unit, Bangalore

Broad areas of research carried out by the faculty members at Systems Science and Informatics Unit (SSIU) fall under the category ‘Computing in Science and Engineering'. SSIU deals with multidisciplinary research. Nature, Society, and Science consist of numerous phenomena and processes, the behaviors of which traverse various phases ranging from very *simple* to highly *strange*. Current faculty members of SSIU are dealing with some of such phenomena and processes from certain (but different) domains—such as terrestrial systems, urban and environmental systems, brain function, sociological systems etc—via computationally rigorous approaches and also via informatics. Efficient way of understanding the dynamical behavior of many complex systems of nature, society and science is possible through data acquired at multiple spatial and temporal scales. Earlier, several toy models were developed via classical mathematics to explain several possible phases in dynamical behaviors of complex systems. With the advent of computers with powerful graphics facilities, about three decades ago the interplay between numeric (generated via classical equations explaining the behaviors of dynamical systems) and graphics are shown. That progress provided initial impetus to visualize the systems’ spatial and/or temporal behaviors that exhibit simple to complex patterns on graphical screens. Since last two decades, we have been seeing significant breakthroughs in data acquisition procedures with precision. Retrieving relevant information from such precisely acquired spatial-temporal data of varied types about a specific complex system is a basic prerequisite to understand the spatial-temporal behavior of a system. The varied but coherent phases involve in developing cogent domain-specific models include information retrieval from the source data, information analysis, information reasoning, and simulation and modeling. These essential components that faculty members deal with at SSIU are basic ingredients of informatics, the science and engineering of information. They are pursuing vigorous research programs in Spatial Informatics, Computational Neuroscience, and Computational Intelligence. These areas of research are presently being carried out in three broad research groups: Spatial Informatics Research Group (SIRG), Computational Neuroscience Research Group (CNRG), and Quantitative Geomorphology Research Group (QGRG).

S. Daya Sagar, Kaushik Majumdar and Saroj Meher

Graph Morphology Based Image Segmentation Algorithms

One of the powerful morphology-based image segmentation algorithms is a watershed algorithm. A major shortcoming with this algorithm is over-segmentation. Since recent past, this over-segmentation challenge is well addressed via application of connected operator theory. However, of late, handling of image segmentation problem through graph-morphology based watershed received wide attention. This graph-morphology based approaches aimed at image segmentation problems have been re-visited, and understood the importance of further emphasis to generalize the power watersheds involving watershed-like algorithms, graph-cuts, random-walker, shortest-paths as components. The

main objectives identified to address the topic on generalization of power watersheds include (i) to characterize the conditions for which these algorithms are superior over the existing algorithms, and (ii) to employ these algorithms as a fast and effective alternative to the energy minimization algorithms that currently pervade the wide variety of applications in computer vision.

Sravan Danda and B.S. Daya Sagar

Development of mathematical morphology-based algorithms for generation of contiguous cartograms from point-data and, for modelling the spatiotemporal behaviour of varied phenomena via cartograms

Models developed via analytical means limit our understanding as it is hard to visualize the spatiotemporal behavior. However, modelling the spatiotemporal behavior of a phenomenon via proper visualization across spatial and temporal scales enhances our understanding. In conventional Geographical Information Science (GISci), development of models to visualize the spatiotemporal behavior is strictly by using choropleth raster maps. This modeling approach has various limitations as we employ some indicators such as color, shade, hatching, label to represent the strength of a variable. But it is proposed to develop variable-specific cartogram, in which the strength of the variable reflects in terms of area occupied by the unit. Employing such variable-specific cartograms of varied related phenomena is more appropriate to develop models to understand the spatiotemporal behavior of a phenomenon, as well as to understand the spatial relations between the cartograms of varied phenomena. The main objectives of this study include: (i) to develop efficient mathematical morphology-based algorithms to generate variable-specific cartograms that preserve global, topological and local shapes with minimum area-errors, (ii) to develop cartogram-based models to characterize spatio-temporal behavior of time-varying geographic phenomena of varied types, and (iii) to show the spatial relationships among the varied types of geographic variables that are visualized in the forms of cartograms and to the demonstrate the potential of cartograms-based relationships.

B.S. Daya Sagar and Raghvendra Sharma

Morphing of Grayscale DEMs via Morphological Interpolations

We compute morphological medians hierarchically between the spatial fields (e.g. Digital Elevation Models) represented with similar sizes via grayscale morphology-based interpolations. These hierarchically generated sequential morphological medians facilitate construction of morphing-like sequence between the source and target spatial fields to visualize the spatiotemporal changes that have occurred between discrete time-intervals or episodic intervals. Two DEMs of similar sizes but belonging to two different regions are considered as source and target spatial fields further to (i) demonstrate morphology-based algorithm to generate all possible sequential morphological medians, and (ii) create morphing depicting source-DEM transforming into target-DEM. Application of morphological interpolation to DEM morphing is shown for the first time.

B.S. Daya Sagar and Lim Sin Liang

Ranks for Pairs of Spatial Fields via Metric based on Grayscale Morphological Distances

Based on a set of morphological distances computed between the grayscale images (spatial fields) of similar size specifications, ratios of selected morphological distances, and the ratios of areas of infima and suprema of grayscale images, a new metric to quantify the degree of similarity between the grayscale images is proposed. We demonstrate the whole approach on (i) synthetic spatial fields (ii) a set of 12 similar-sized grayscale images representing cloud-top temperatures of a specific region for 12 different time-instants, and (iii) four spatial elevation fields to rank possible pairs of images.

B.S. Daya Sagar and Lim Sin Liang

Automatic Orientation-Based Classification of Geophysical Basins Hierarchically Decomposed from Digital Elevation Models via Directional Granulometries

Geophysical basins of various orders were decomposed hierarchically from Digital Elevation Models (DEMs) of nine major river basins. Their' general orientations were automatically detected by computing certain parameters required for granulometric analysis. This automatic approach to detect the orientations of basins is now extended to the subbasins and sub-subbasins hierarchically decomposed from major basins. The main aim of this exercise is to find out potential relationships between the orientations of the major basin and the subasins decomposed from major basin.

B.S. Daya Sagar and S. Ashok Vardhan

Variable-Specific Classification of Zones, Pairs of Zones, and Clusters of a Spatial System via Modified Gravity Model

Hierarchical structures include spatial system (e.g. continent), clusters of a spatial system (e.g. countries of a continent), zones of a cluster (e.g. states of a country), and so on. Variable-specific classification of the zones $\left(X_i\right)$ of a cluster of zones $\left(X\right)$ within a spatial system is the main focus of this paper. Variable-specific (e.g. GDP, population, trade, resources, economic activity etc) classification of zones is done by computing the levels of interaction between the *i*th and *j*th zones. Based on a heuristic argument, we proposed a modified gravity model for the computations of levels of interaction between the zones. This argument is based on the following two facts: (i) the level of interaction between the zones X_i and X_j, with masses mX_i and mX_j is direction-dependent, and (ii) the level of interactions between the zones X_i and X_j, with masses mX_i and mX_j, situated at strategically insignificant locations would be much different (lesser) from that of the zones X_i and X_j with similar masses mX_i and mX_j but situated at strategically highly significant locations. With the support of this argument, we provide a modified gravity model by incorporating the $dX_{ij} \neq dX_{ji}$, and the product of location significance indexes $\left(\varphi X_i \varphi X_j\right)$ of the corresponding zones. This modified gravity model yields level of interaction between the two zones that satisfies $FX_{ij} \neq FX_{ji}$. We demonstrate this modified gravity model on the 28 states of India, whereby the areal extents of each state is considered as a parameter mass. The levels of interactions are shown for all possible pairs of states.

B.S. Daya Sagar

Neural Information Processing

Working on neural information processing under a DBT funded project and an ISI funded project. In both the projects human depth EEG signals are being studied. For the time being only epileptic seizures are being studied with the help of various nonlinear combinations of differential operators in order to understand the seizure onset and offset dynamics. Also patterns in digitized signals are being studied for a possible coding scheme in order to algebraically encode the seizure patterns in the depth EEG signals.

Kaushik Kumar Majumdar

Granular Neural Networks for Pattern Classification

The objective of this study is to develop a new concept of granular neural networks and establish a solid framework as to the underlying ideas of information granules and their role in the construction of neural networks. Our intent is also to analyze how the level of granularity of the available data may impact the learning in the networks as well as influence their resulting performance. The present work

discusses an idea of granular computing regarded as a development environment of neural networks and leading to the emergence of a new class of granular neural networks. Such networks are viewed as new computing architectures that are focused on processing information granules rather than being geared towards plain numeric processing as usually encountered in most neural networks. The considered information granules are represented as assembles that may be formalized in the setting of set theory, fuzzy sets, rough sets or specified within a probabilistic environment. We will discuss several main approaches to the design of information granules. A number of fundamental issues will be tackled including specificity of information granules vis-a-vis learning complexity in the neural networks along with their generalization features. We also provide with a list of architectures of granular neural networks and elaborate on the associated training (learning) scenarios.

Saroj K. Meher and D. Arun Kumar

Computer Science Unit, Chennai

On Acyclic Edge-Coloring of Complete Bipartite Graphs

An acyclic edge-coloring of a graph is a proper edge-coloring without bichromatic cycles. The acyclic chromatic index of a graph G, denoted by $a'(G)$, is the least integer k such that G admits an acyclic edge-coloring using k colors. Let $\Delta=\Delta(G)$ denote the maximum degree of a vertex in a graph G. A complete bipartite graph with n vertices on each side is denoted by $K_{n,n}$. In this work, we show that $a'(K_{n,n})=n+2=\Delta+2$ for $n = p^2$ or $2p-1$, where p is an odd prime.

Ayineedi Venkateswarlu, Santanu Sarkar and A. Sai Mali

Partial Key Exposure Attack on CRT-RSA

In Eurocrypt 2005, Ernst et al. proposed an attack on RSA allowing to recover the secret key when the most or least significant bits of the decryption exponent d are known. In Indocrypt 2011, Sarkar generalized this by considering the number of unexposed blocks in the decryption exponent is more than one. In this work, for the first time, we study this situation for CRT-RSA. Further, we consider the case when random bits of one decryption exponent are exposed in this model. These results have implications in side channel attacks.

Santanu Sarkar and Ayineedi Venkateswarlu

Revisiting Roos Bias in RC4 Key Scheduling Algorithm

RC4 is one of the most popular stream cipher with wide industrial applications, it has received serious attention in cryptology literature in the last two decades. In 1995, Roos pointed out that the elements $S_N[y]$ of the permutation S_N after the Key Scheduling Algorithm for the first few values of y are biased to certain combinations of secret key bytes. In this work, we present a detailed analysis of Roos Bias. We provide a more accurate formula for the correlation probabilities.

Santanu Sarkar and Ayineedi Venkateswarlu

On the Construction of Recursive MDS Matrices

MDS matrices allow to build optimal linear diffusion layers in the design of block ciphers and hash functions. There has been a lot of study in designing efficient MDS matrices suitable for software and/or hardware implementations. In particular recursive MDS matrices are considered for resource constrained environments. Such matrices can be computed as a power of simple companion matrices. In this work, we give a characterization of recusive MDS matrices. We also analyse and establish the potential cases that yield recursive MDS matices from BCH codes. As a conseqeunce we are able to provide formula for the number of such recursive MDS matrices. We then look a general method for the construction of recursive MDS matrices. The ideas can be usedo explore various other new/known techniques which can be fitted directly like BCH codes and Gabadulin codes.

Kishan Chand Gupta, Sumit Kumar Pandey and Ayineedi Venkateswarlu

Preference change via deliberation

Situations akin to public deliberation leading to preference changes are modelled. A set of agents is considered, each endowed with a preference relation over a set of objects and a reliability relation over the involved agents. Different ways in which the public announcement of the current individual preferences can influence the agentsfuture preferences are studied. Special emphasis is given to ways in which the repetitive public announcement of the individual preferences leads to unanimity on preferences.

S. Ghosh and Fernando R. Velazquez-Quesada

Forward Induction Behavior in Dynamic Games

We conducted an experiment where participants played a perfect-information game against a computer. It turned out that in the aggregate, participants were likely to respond in a way which is optimal with respect to their best-rationalization extensive form rationalizability conjecture - namely the conjecture that the computer is after a larger prize than the one it has foregone, even when this necessarily meant that the computer has attributed future irrationality to the participant when the computer made the first move in the game. Thus, it appeared that participants applied forward induction. However, there exist alternative explanations for the choices of most participants; for example, choices could be based on the extent of risk aversion that participants attributed to the computer in the remainder of the game, rather than to the sunk outside option that the computer has already foregone at the beginning of the game. For this reason, the results of the experiment do not yet provide conclusive evidence for Forward Induction reasoning on the part of the participants.

S. Ghosh, Aviad Heifetz and Rineke Verbrugge

Cognitive studies of strategic reasoning

This work develops a typology of players based on their strategic reasoning in turn-based games. Classifications have been done based on latent class analysis and according to different orders of theory of mind, and exploratory validations have been provided for the resulting classifications. Finally, interaction of the typologies described by these classifications is discussed towards achieving a common perspective of typologies of players originating from various aspects of strategic thinking.

S. Ghosh, Tamoghna Halder, Khyati Sharma and Rineke Vebrugge

Variations in Vertex Coloring

Vertex colorings and edge colorings are the basic graph colorings and have a long history starting with the four color problem. Recent publications show that vertex coloring problems still receive maximum attention. They occupy a central place in the complexity theory of algorithms and arise naturally in many real world problems like storage problem, register allocation and time table scheduling. Several variations of vertex colorings have been introduced and studied in the literature. A graph G is said to be *equitably k-colorable* if the vertex set $V(G)$ can be partitioned into k non-empty independent sets $V_1, V_2, ..., V_k$ such that $| |V_i| - |V_j| | \leq 1$ for every i and j. The smallest integer k for which G is equitably k-colorable is called the *equitable chromatic number* of G, and is denoted by $\chi_e(G)$. A conjecture of Meyer in 1980 states that if G is a connected graph different from K_n and C_{2n+1} $(n \geq 1)$, then $\chi_e(G) \leq \Delta(G)$. We have verified this conjecture for some classes of graphs which are defined by forbidden induced subgraphs.

T. Karthick

Weighted Independent Sets in Graph Classes

Graph decompositions play a crucial role in structural graph theory and in designing efficient graph algorithms. Among them, clique separator decomposition (a decomposition tree of the graph whose

leaves have no clique separator (so-called atoms)) used by Tarjan for solving various optimization problems recently received much attention. The Maximum Weight Independent Set (MWIS) problem on graphs with vertex weights asks for a set of pairwise nonadjacent vertices of maximum total weight. MWIS is well known to be NP-complete, and hard to approximate. We focused on MWIS problem in certain graph classes that are defined by forbidden induced subgraphs. The complexity of the MWIS problem for H-free graphs, where $H \in \{P_6, S_{1,1,3}, S_{1,2,2}\}$ is unknown. We have shown that the MWIS problem can be solved in polynomial time for some subclasses of H-free graphs, where $H \in \{P_6, S_{1,1,3}, S_{1,2,2}\}$ by deriving the atomic structure of these classes of graphs. These results extend some known results in the literature.

T. Karthick and F. Maffray

Weighted Efficient Domination in Graph Classes

In a graph G, an efficient dominating set is a subset D of vertices such that D is an independent set and each vertex outside D has exactly one neighbor in D. The Minimum Weight Efficient Dominating Set (Min-WED) problem asks for an efficient dominating set of total minimum weight in a given vertex-weighted graph; the Maximum Weight Efficient Dominating Set (Max-WED) problem is defined similarly. The Min-WED/Max-WED is known to be NP-complete for P_7-free graphs, and is known to be polynomial time solvable for P_5-free graphs. However, the computational complexity of the Min-WED/Max-WED is unknown for P_6-free graphs. We showed that Min-WED/Max-WED can be solved in polynomial time in some subclasses of P_6-free graphs.

T. Karthick

Strong chromatic index of chordless graphs

A strong edge colouring of a graph is an assignment of colours to the edges of the graph such that for every colour, the vertices belonging to the set of edges that are given that colour induce a matching in the graph. The strong chromatic index of a graph is the minimum number of colours required in any strong edge colouring of the graph. A graph in which every cycle is a chordless cycle is called a chordless graph. It was shown that for any d that for any that for any chordless graph, the strong chromatic index is at most 3Δ, where Δ is the maximum degree of the graph. This improved the previously known upper bound of 8Δ – 6. There exists an infinite family of graphs whose strong chromatic index is 3Δ – 2, and therefore this bound is almost tight.

C. Mathew Francis and Manu Basavaraju

Forbidden structure characterization for circular-arc graphs

A circular-arc graph is the intersection graph of arcs of a circle. It is a well-studied graph model with numerous natural applications. Even though this class of graphs had been intensely studied since their introduction in the 1960s, a forbidden structure characterizationfor these graphs, i.e., some structural property that is necessary and sufficient for a graph to possess so as to be not circular-arc, had proved elusive. This project has resulted in the discovery of the first such forbidden structure characterization of circular-arc graphs. Also discovered were other kinds of hitherto unknown forbidden structures in circular-arc graphs, which even though not sufficient to characterize this class of graphs, unifies characterizations of various known chordal subclasses of circular-arc graphs found in the literature.

C. Mathew Francis, Pavol Hell and JurajStacho

Side Channel Cryptanalysis of Streebog

Streebog is the cryptographic hash function standard of theRussian Federation. It comprises two hash functions corresponding totwo digest sizes, 256 bits and 512 bits. This paper presents side channel attacks that use processor flag information to obtain preimages on the512-bit version. The best of our attacks requires $O(2^{513 - len})$ time forguaranteed success, where *len*is the length of the string padded to themessage. We also construct other attacks, each of which has a complexityof $O(2^{511})$ and a success probability that is either 2/3 or 1 depending on*len*and the state of the carry flag.

Gautham Sekar

Research Activities

Cryptanalysis of RC4

RC4 is arguably the most popular stream cipher. It is used in protocols such as the TLS andWEP.Our research has exposed what we believe are hitherto undiscovered weaknesses in the cipher's key schedule.

Gautham Sekar and Deepak Sharma

Computational Physics

Amplitude-phase locking investigation of granular superconductivity

We developed a theoretical method to couple the investigation of how the amplitude and phase of the superconducting order parameter has an interplay which ultimately determines the fate of the superconductor as disorder strength. This is the first time a method has been developed to self-consistently couple the phase and the amplitude of the order parameter which works equally well from weak to strong coupling. This research has been ongoing and close to publication.

Sanjeev Kumar and Prabuddha Chakraborty,

Strong coupling expansion of interacting electrons in the presence of spin-orbit coupling

A strong coupling expansion of interacting electrons in the presence of spin-coupling coupling was formulated with an eye to the application on the newly discovered topological insulator materials. This is a continuing project.

Krishnendu Sengupta and Prabuddha Chakraborty

The Sign Problem in quantum Monte carlo simulations of strongly correlated quantum systems

A novel method of solving the sign problem was discovered based on generalized Kramers' degeneracy.

Prabuddha Chakraborty

Mott-Anderson transition in spin-resolved disordered systems

Quantum Monte Carlo simulations were undertaken in spin-resolved disordered systems to investigate the role of interactions in various transitions in disordered systems.

Shashi Kunwar, Prabuddha Chakraborty and Rajesh Narayanan

Physics and Earth Sciences Division

Geological Studies Unit, Kolkata

A Study of Neogene and Quaternary successions of eastern Himalayan foreland basin

The sedimentology and detrital thermochronology of the Siwalik sediments along Kameng River section (Arunachal) has been studied. Isotopic studies reveal that Higher Himalayan terrains fed the foreland drainage system during 13-7 Ma and 3-0 Ma time while the major drainage that fed the foreland deposits during 7-3 Ma ago came from the Tibetan terrain. Examination of small Quaternary alluvial fans in the foreland indicate that the formation of the fans and their incision was controlled by climatic events at >30 Ka and 18-24 ka. In the catchment area of the Tista River millennial-scale erosion rate and million-year-scale exhumation rate is being evaluated through cosmogenic, fission track and OSL dating methods. This age data is likely to provide more precise chronologic framework for the modern foreland sedimentation and their controlling factors.

T. Chakraborty

Community structure and ecology of the Mesozoic non-marine tetrapods of the Gondwana basins of peninsular India

This work mainly focuses on the community structure and diversity of the Mesozoic terrestrial vertebrates of the Gondwana basins of Peninsular India. Substantial work has been done on the comparison and correlation of the Triassic non marine tetrapod communities of the world and that of peninsular India. Indian Triassic non-marine vertebrates are found to be Pangean in distribution. These have many key faunal elements of the Triassic but are less diverse than some other Triassic non-marine fauna of the world. Triassic non marine amphibians are noted to show high diversity and low disparity during Early Triassic and comparatively low diversity and high disparity during Late Triassic. New Middle Triassic archosaur taxa including a unique horned taxon, collected from central India, has been studied for the first time. The Jurassic communities on the other hand had different sauropod dinosaurs and sphenosuchians among others. The effects of Permian –Triassic and Carnian – Norian (both Late Triassic) biotic extinctions are noted in the non-marine vertebrate fauna of India.

D.P. Sengupta and S. Bandyopadhyay

Fault zone, fractals and crustal deformation in Eastern Himalaya

It has been shown from recent structural mapping that unlike Darjeeling-Sikkim- Himalaya, tectonic exhumation of Bomdila granite gneiss over the Gondwana strata occur along the Main Boundary Fault (Bomdila thrust) in SW Arunachal Pradesh (around Itanagar); even though deformation is semibrittle in the MBF zone, large displacement is facilitated by smear of weak/quasiplastic carbonaceous shale in the fault core, derived from the footwall Gondwana rocks. In the frontal part of the orogenic wedge in Arunachal Eastern Himalaya, tectonic shortening in Siwalik and Gondwana strata is accommodated by folds and faults at various scales.

Dilip Saha, Abhijit Patra and Amlan Banerjee

Geochemistry and tectonic setting of Prakasam Alkaline Province granitoids

Two distinct tectonic setting of granitic rocks have been established using geochemical discrimination based on relative REE abundance. Podile syenite/alkali feldspar granite has affinity with continental rift related felsic magmatism while Kanigiri granite and satellite bodies intrusive into Kanigiri ophiolite melange represent volcanic arc related magmatism. Though the bulk chemistry is similar to some A-type granite, the modal mineralogy of these two-mica granites and high-temperature crystal plastic deformation microstructures together with highly flattened enclaves favour syn- to late tectonic (post-collisional) emplacement of the second group of granites.

Dilip Saha and **Arnab Sain**

Morphometric properties of the trans-Himalayan river catchments: clues towards a relative chronology of orogen-wide drainage integration

The crustal deformation and concomitant erosion by surface processes related to the evolution of the Himalayan mountain belt have profoundly influenced a number of earth system processes. An attempt was made to understand the history of erosion with the help of morphometric characters of the catchment basins of the trans-Himalayan rivers, produced by long-term erosion of the Himalayan landscape. The shape of 18 such rivers cannot be explained only by head ward enlargement of drainage networks on a topographic slope. Moreover, the smaller drainage components (watersheds) occurring within individual catchments were found to be systematically organized with respect to the first order physiographic features of the Himalayas, formed at different periods of geological time. Thus, the morphology of the trans-Himalayan catchment basins represents an integration of a number of processes (i.e., head ward drainage enlargement, capture of pre-existing drainage, and diversion of drainage in response to crustal deformation) at successive stages of Himalayan mountain growth.

P. Ghosh, S. Sinha and A. Misra

New detrital zircon geology, isotopic provenance and geochemistry of the Ongole Domain protoliths constrain India in Columbia

Major populations of Palaeoproterozoic detrital zircon grains (ca. 2460, 2320, 2260, 2200–2100, 2080–2010, 1980–1920, 1850 and 1750 Ma), and minor Archaean grains (ca. 2850, 2740, 2600 and 2550 Ma) have been shown to dominate the detrital zircon patterns obtained from the Ongole domain metasedimentary rocks, Southern Eastern Ghats, India. Combined U–Pb ages and Lu–Hf zircon isotopic data suggest that the sedimentary protoliths were not sourced from the adjacent Dharwar Craton. Instead they were likely derived from East Antarctica, possibly the same source as parts of Proterozoic Australia. Magmatism occurred episodically between 1.64 and 1.57 Ga in the Ongole Domain, forming felsic orthopyroxene-bearing, isotopically evolved granitoidsyielding εHf values between −2 and −12. Metamorphism resulted in the partial to complete resetting of detrital zircon grains, as well as the growth of new metamorphic zircon at 1.67 and 1.63 Ga. The Ongole Domain has been interpreted to represent part of an exotic terrane, tectonically transferred to proto-India in the late Palaeoproterozoic as part of a linear accretionary orogenic belt possibly incorporating south-west Baltica and south-eastern Laurentia.

B. Henderson, A.S. Collins, J. Payne, C. Forbes and Dilip Saha

Numerical models of fluid flow in Cuddapah basin: Implications for mineralization

An effort has been made to understand plumbing mechanisms of the hydrothermal flow responsible for ore mineralization in the Cuddapah basin, India. This was done using transient numerical fluid, heat and mass flow models.

Amlan Banerjee

Sedimentology of the Triassic and Jurassic sedimentary deposits of the P.G. Valley Gondwana Basin

The transition from the Triassic to the Jurassic period was a time of significant global changes in continental configurations, sea level, and paleobiological systems. In India, the succession comprising the Maleri, Dharmaram and Kota Formations of the Pranhita-Godavari Gondwana basin represents more than a kilometer thick sedimentary rock record of this important time interval. A detailed field-based sedimentological investigation has revealed the evidences for a gradual change in depositional environment from Late Triassic to Middle Jurassic. The sheet-flood dominated, muddy, ephemeral river system of Late Triassic evolved into a siliciclastic lake shoreline environment in late Late Triassic-Early Jurassic time and finally into an extensive intracratonic, carbonate depositing freshwater lake environment in the Middle Jurassic. These new findings contrast significantly with the views of the earlier workers and would help to better constrain the environment conditions for the archaic vertebrate community of that time, known from their fossil remains.

P. Ghosh, S.N. Sarkar, S. Dasgupta and S. Goswami

Stratigraphic analysis of the Cuddapah, Bhima and Kaladgi successions: implications for Palaeoproterozoic to Neoproterozoic lithospheric dynamics of southern India

An integrated study of the stratigraphy and deformation pattern of the Purana basins of the Dharwar cratons, namely the Kaladgi the Bhima and the Cuddapah basins is in progress. All these basins overlie granite-greenstone terrain (consisting of granite-gneisses, pegmatites, banded ironstones, jaspilites, and metavolcanics) of the Dharwar craton. The Kaladgi succession unconformably overlies the basement, is folded, and shows low grade metamorphism. Cuddapah, Bhima and Badami on the other hand is undeformed or with local deformation near the vicinity of faults and generally unmetamorphosed. The basins include multiple unconformity-bound sequences; a basal immature siliciclastic succession deposited in cratonic rifts to carbonate-shale successions in passive margin settings. Detailed analysis of sedimentary attributes of unconformity–bound sequences indicates that a successive fining-upwards motif of deposition at a scale of more than a kilometer, observed in all the basins, was the direct sedimentary response to eustatic sea-level fluctuations leading to variable

changes in accommodation space that were controlled by lithospheric dynamics. Physical and chemical aspects of carbonate depositional systems and their potential in predicting climatic changes on regional scale are in progress.

S. Patranabis Deb

Study of gastropod diversity from the Indian fossil record (Mesozoic-Caenozoic) with special emphasis on phylogenetic systematics, evolutionary trends and palaeoecological interactions

A new dataset, involving 31,929 gastropod specimen, from the latest Maastrichtian Infratrappean bed in Rajahmundry, southern India have been examined to quantify naticid drilling predations. These specimens belonged to 40 species of 20 families, thus representing a spectacular gastropod diversity that was not known until recently from this region. Although drilling frequencies showed fluctuating patterns, most of the previous studies argued that naticid drilling predation was less intense during the Cretaceous and the modern values were achieved since the Palaeocene. It appeared from the present study that drilling frequency was significantly higher from all previous Cretaceous values. Predators were prey selective and there was poor correlation between relative abundance and drilling frequency of prey taxa. It has been concluded that naticid drilling-induced escalation was already established during the Cretaceous and the present find extends the paleobiogeography of naticid predation (which was previously reported from the western world) up to India.

S.S. Das

Tectonostratigraphic evolution of the Nellore schist belt (NSB)

Several longitudinal tracts of deformed Palaeoproterozoic to Mesoproterozoic volcanosedimentary successions: the Vinjamuru Group, the Kandra ophiolite complex (KOC), the Kanigiri ophiolitic melange (KOM) and the Udaigiri Group, arranged tentatively in relative order of younging, have been established from new geochemical and geological data from the NSB occurring along the eastern margin of the Eastern Dharwar craton. A transpressional tectonic contact zone has been shown to separate the NSB from the high-grade Eastern Ghats belt. Thrust-transported oceanic crust remnants occur in the 1.9 Ga KOC, 1.34 Ga KOM, and the Vinjamuru Group, which show multiple deformation, amphibolite facies metamorphism and granitic intrusions. Subduction-related ocean closures outboard and east of the Dharwar Craton, are evidenced by the KOC and KOM.

Dilip Saha, Arnab Sain, Parijat Nand, Rajat Mazumder and Rajib Kar

Physics and Applied Mathematics Unit, Kolkata

PHYSICS

Astro Optics

In the framework of the MRN type of models for the interstellar dust (contained in galaxies like the Milky Way, Small Magellanic Clouds, Large Magellanic Clouds) analytic formulae were developed by us,for obtaining the extinction spectra profiles corresponding to the dust components–Graphite (parallel and perpendicular), Silicate (large) and the Polycyclic Aromatic Hydrocarbons. During this year, another component, viz. the Ultra-small Solicate grains' extinction behavior has been studied to construct analytic formulas for generating the extinction spectra profiles for Ultra-small Silicates as well. This work, added to the earlier lot (analytic formulas for extinction spectra of Graphite, Silicate and PAHs) comprise a very useful analytic platform for researchers working in the area of model building for interstellar dust of various galaxies through the corresponding Color (extinction) spectra profile resulting from astronomical observations and measurements. However, it was seen that all the dust components show significant absorption in the Ultra-Violet and Far Ultra-Violet regions of their extinction spectra. This led us to consider yet another analytic study of the emission behaviour of these dust components and find out formulas for generating the emission spectra profiles of the galactic dusts. With this, our research goal to prepare a complete analytic platform for construction of

galactic interstellar dust models through study of the corresponding observed color (extinction) spectra data will come to a fruitful and useful end. At present this work is in the very initial phase and it is hoped to be completed in the coming year.

Ashim Kr. Roy, R.Gupta, S.K. Sharma and P. Ranadive

Cosmology of the Early Universe

A new class of models of Higgs inflation has been introduced using the superconformal approach to supergravity by modifying the Kaehler geometry. Using such a mechanism, a Kaehler potential has been constructed followed by various types of models characterized by a superconformal symmetry breaking parameter χ. Depending on the numerical values of χ all of the proposed models have been classified into three categories. Models with minimal coupling are identified by $\chi = \pm 2$ branch which are made up of shift symmetry preserving flat directions. Various other models have also been proposed by introducing a non-minimal coupling of the inflaton field to gravity described by $\chi = 2$ branch. All these models have then been employed to study the inflationary paradigm by estimating the major cosmological observables and confronted them with recent observational data from WMAP9 along with other complementary data sets, as well as independently with PLANCK.

Supratik Pal, Sayantan Choudhury and Trina Chakraborty

Dark Energy and Constraints from Data

Plausible dark energy models have been constrained using both CMB and non-CMB observations. To this end two distinct approaches have been followed: (i) one with three existing equations of state covering a wide class of dark energy models, (ii) another with a new two-parameter generalization for dark energy equation of state covering almost all thawing class of models. This leads to a robust and generic constraint on dark energy models. In both the approaches, clear indications of phantom behavior for dark energy at some point of its evolution have been observed. It was also observed that the present data cannot distinguish between different thawing dark energy equations of state but the best fit variation of the equation of state does reflect some characteristic feature which can be employed to distinguish them from one another. From both observational and theoretical points of view, the analyses open up some questions like how the apparent tension between CMB and non-CMB constraints can be resolved, whether new parametrization of dark energy equation of state is required, how phantom behavior can be realized in a proper field theoretic framework, if there are other tools that can distinguish among different dark energy models using present or future data etc; which needs to be addressed further.

Supratik Pal, Dhiraj Kumar Hazra, Subhabrata Majumdar, Sudhakar Panda, Anjan Ananda Sen, Debabrata Adak and Debasish Majumdar

Mesoscopic Physics and Nanoelectronics

In the present research program, some of the important open issues regarding circular currents, electron transfer, spin selectivity and magnetic field effects in different mesoscopic systems such as an organic molecule, a cluster of molecules, magnetic systems, quantum rings, quantum wires to name a few have been addressed. A new approach has been put forward, based on Green's function formalism, to evaluate precisely persistent charge and spin currents in an isolated AB ring subjected to Rashba and Dresselhaus spin-orbit interactions, together with voltage driven circular currents in a molecular wire with multiple substructures addressing effects of spin-orbit interactions, molecular twist, and other inelastic processes in these phenomena. Utilizing the phenomena of voltage driven circular currents, the possibility of regulating local magnetic field in a quantum ring associated with circular current has been addressed and eventually the possibility of designing spin-based quantum devices has been explored. Finally, the robust effect of curvature on spin polarization has also been reported in a three-terminal bridge system where the bridging material is subjected to Rashba spin-orbit interaction.

Santanu K. Maiti, S.N. Karmakar, P. Dutta, S. Sil and M. Dey

Quantum Information Theory

Quantum steering, first discovered by Schrodinger in 1935, has recently been formalized. There are many inequalities involving quantum operators whose violation implies steering. But recently there had been a new result which suggests some inequality involving statistics whose violation implies steering. Interestingly like Bell's inequality, in this case also the degree of impossibility of joint measurement derives the optimum value of the expression that appeared in this inequality.The preparation contextuality has been established for all mixed states in quantum mechanics. The operational meaning of the preparation contextuality is not very obvious. It has been shown that the degree of preparation contextuality can be revealed by the degree of success of winning the multiplexing oblivious game. The Schmidt number of a quantum state is a very important feature. But entanglement measure alone does not determine the Schmidt number except in very few extreme cases. Recently, using a modified form of Hardy's non-locality, Schmidt number witness has been suggested which can decide whether the Schmidt number is above two or not. The result has been extended to device independent witness. To establish LOCC indistinguishability of d or less than d number of (non-factorizable) maximally entangled state in d×d (≥4) system is a notoriously difficult problem. Four maximally entangled states in 4×4 that are indistinguishable by one way LOCC and by two way LOCC with projective measurement were provided. Recently four states in 4×4 were also found that could be shown to be LOCC indistinguishable.

Guruprasad Kar, R. Rahaman, S. Ghosh, S. Bandyopadhyay, A. Majumdar, Arup Roy, Som Sankar Bhattacharya, Amit Mukherjee and Manik Banik

A compound quantum mechanical system allows correlations of a more complex nature as compared to its classical counterpart, such as entanglement, Bell non locality and discord. Characterization, quantification and applications of these correlations have been pursued vigorously over the last two decades. However, a single quantum system, apparently with no correlations also differs from a classical system. The figure of merit is attributed to coherence i.e. superposition. Despite the immense success and richness of quantum theory, it is only very recently that a foundation for resource theory of coherence has been proposed. Various measures of coherence have been studied and some other features like quantification are being investigated.

Preeti Parashar

Quantum Mechanics

Dirac oscillator in the presence of a magnetic field in Snyder and Anti Snyder space has been studied and the corresponding chirality phase transition has been examined in details. The discontinuity in the spectrum of the same system in the presence of a parallel electric field has also been examined. Exact solutions of Nonlinear Schroedinger equation with PT symmetric potentials and general power law nonlinearity have been obtained and linear stability of such solutions has been analyzed.

Pinaki Roy, D. Nath and O. Panella

Methods have been given for constructing Darboux pairs of pseudoscalar and scalar Dirac potentials that are associated with exceptional orthogonal polynomials and for the construction of time dependent potentials that admit solutions in terms of exceptional orthogonal polynomials. In the framework of N-fold super-symmetry, it has been shown that any two-step shape invariant system possesses, in addition to 2-fold super-symmetry, second order parasuper-symmetry. Several new two-step shapes invariant potentials have been obtained some of which are conditionally shape invariant.

Barnana Roy, A. Schulze-Halberg and T.Tanaka

Quantum Field Theory

The AdS-CFT correspondence has been extended to cases where the space has a non-commutative geometry. Restricted case of only electric field has been studied. It is now being extended to include

magnetic fields. Conformal invariance of mutually interacting particles satisfying a Snyder form of non-commutative geometry has been studied. Symmetries and dynamics of interacting fluid models are analyzed in a Hamiltonian framework.

Subir Ghosh

Theoretical Condensed Matter Physics

Spintronics without magnetism, an emerging field of condensed matter physics is based on the ability to manipulate spins in semiconductors through the spin-orbit interaction. It has been shown how the induced spin-orbit interaction can be generated either from the non-inertial effect or from the effect of cosmic string. Vital role of the induced spin orbit interaction and the associated gauge fields in the arena of spin transport have been discussed. To this end, some important parameters in the theory of spin transport such as spin current, spin Hall conductivity, out of plane spin polarization, spin relaxation time and spin electric fields have been computed. Furthermore, it has been shown that non-uniform exchange field in spin chiral configuration of ferromagnetic grapheme can lead to the generation of anti -damping spin orbit torque. Besides, proposal of the spin filter configuration has been displayed for the electron vortex beams carrying orbital angular momentum and propagating through a time dependent magnetic field.

Banasri Basu, Debashree Chowdhury and P. Bandyopadhyay

APPLIED MATHEMATICS

Mixed-synchronization in counter-rotating oscillators

Sometimes counter-rotation may be obtained by replacing any state variables of a system by same state variable with negative sign. But these techniques are not general and it is system dependent. In this type of coupled counter rotating oscillators there is an uncertainty to get mixed-synchronization (MS). A method has been proposed to create a counter rotation of a system by changing the one or two pair of conjugate elements (if exist) of the linear matrix of the dynamical systems. Using a simple diffusive coupling, mixed synchronization has been derived between two counter-rotating oscillators. Mixed synchronization scenario has been numerically simulated using two chaotic oscillators, Sprott and Pikovsky-Rabinovich model. Noise-induced mixed-synchronization has also been elaborated using Pikovsky-Rabinovich model. Experimental evidence of the extended work has been shown using electronic circuits. Good qualitative agreement has been obtained between the numerical and experimental results.

Dibakar Ghosh, S.K. Bhowmick and B.K. Bera

Nonlinear dynamics of classical counterpart of quantum system

The chaotic dynamics of certain damped and forced versions of classical counterpart of generalized quantum nonlinear oscillator endowed with position dependent mass has been studied. Various bifurcations such as symmetry breaking, period doubling, inverse period doubling, interior and boundary crises have been observed. Sensitivity of the mass parameter to the chaotic dynamics of the system has been demonstrated by the appearance of completely different route to chaos for positive and negative values of the mass parameter. Fractal boundaries have been observed in the chaos plots.

Dibakar Ghosh and Barnana Roy

FLUVIAL MECHANICS LABORATORY

Simulation of Hawking effect in analogue (fluid) gravity model

Data collection has been started for analysis of the experiment concerning (white hole analogue) horizon formation in a flume where waves are being imposed on an opposing flow. The effects of horizon on bed profiles have also been studied.

Subir Ghosh, Debasmita Chatterjee, Pralay Das and B.S. Mazumder

Secondary flow in open channel

The effect of Secondary flow in a straight rectangular open channel has been studied experimentally. The bed roughness was created using crushed stone. 3-D velocity was measured using a Vectrino (Acoustic Doppler Velocimeter). Experiments were conducted for flows with different aspect ratios. The experimental data may also be used to study the dip phenomenon in open channel.

Sankar Sarkar

Turbulence in Gravel-Bed Stream with Protruding Larger Gravels

A series of experiments were performed in the Flume Lab to study the turbulence characteristics in flow over a gravel-bed with protruding larger gravels that resembles to a flow over fully submerged gravel-cascades found in nature. The subject turbulence occupies the central portion of applied hydrodynamics. The most significant characteristic of turbulence is its randomness and intermittency, which makes a deterministic approach potentially infeasible. Turbulent flow over gravel-bed streams is common in nature. This study focused on the turbulence characteristics in flow over a gravel-bed with protruding larger gravels. The local flow characteristics and their double-averaging (DA) parameters were discussed with the help of contour-plots and DA methodology. Different turbulent parameters like Double-Averaged velocity, Reynolds shear and normal stresses, turbulent length scales, turbulent kinetic energy (TKE), TKE fluxes, TKE budget, turbulent bursting and anisotropy have been studied in details.

Sankar Sarkar and S. Dey

Biological Sciences Division

Agricultural and Ecological Research Unit, Kolkata

The Unit has been pursuing both internally and externally funded research projects on diverse areas such as practices for sustainable agriculture with regard to rice and other field crops;the use of nano-biotechnology in targeting crop pests, ecological aspects like the role of allelopathy in structuring aquatic ecosystems, characterization of SSR markers in some mangrovesfor their effective conservation; as well as mathematical and statistical modeling on predation and co-operative recovery mechanisms among many other connected issues. A brief account of the some of the Unit's research activities are listed below:

Evaluation of different sources and levels of phosphorus on field crops in Eastern India

Phosphatic fertilizers are gaining interest of the researchers, at present. Studies are undertaken to evaluate the effect of different levels of water and/or citrate soluble phosphorus on crop productivity and soil health in eastern plateau area. The results indicated that the application of 80 kg per hectare of water soluble phosphorus has a significant effect on grain yield of rice and dehusked cob yield of baby corn as well. The groundnut crop has also been tested on the different levels and sources of phosphetic fertilizers, and the results indicate the similar trend as in rice and baby corn.

P. Banik, S. Bhattacharya, P.K. Ghosal, D. Das, S.D.Yadav and R.C. Sharma

Site Specific Nutrient Management (SSNM) System for Submerged Rice in the Eastern Plateau Region of India

Work is being done in the Agricultural Experimental Farm of ISI at Giridih, Jharkhand, under the Chotanagpur plateau in India,on site specific nutrient management - the (SSNM approach), on submerged rice. Due to the adverse climate, water resource and soil condition prevalent in the region,

it is poorly suited to agriculture and the crop productivity is very low. Recommendation for field specific fertilizer rate will be made for submerged rice after taking into account the indigenous soil nutrient supplies and crop response based on experimental evidence.

P.K. Ghosal, P. Banik, S. Bhattacharya, I.Mukhopadhyay, T. K. Sasmal, C. Medda, K. Bhattacharya and S.Ghosh

An investigation on antimicrobial potential of chebulicmyrobalan (Fruit of *Terminaliachebula* Retz.) against methicillin-resistant, *Staphylococcus aureus*

The aim of this study is to contribute to the development of safe and potent antimicrobial agents from *Terminaliachebula* fruits effective against infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA). To achieve this goal, we have studied the antibacterial potential of different solvent extracts of *T. chebula* fruits againat MRSA. It was observed that acetone extract of *T. chebula* fruits which was found to have strong antibacterial activity against MRSA in our previous study, also demonstrated promising anti-inflammatory and antioxidant activities. Besides, in acute oral toxicity study no gross behavioural changes of acetone extract was observed in mice upto 1000 mg/kg, p.o. dose and 24h LD_{50} value was found to be > 2000 mg/kg, p.o. in mice.Bioassay-guided fractionation of acetone extract following solvent-solvent partitioning, silica gel 60, sephadex LH-20 column chromatography as well as TLC analysis revealed the presence of two bioactive compounds having R_f values 0.44 and 0.92 respectively. These promising findings warrant further studies for the development of safe and effective antimicrobial agents from *T. chebula* fruits effective against the diseases caused by methicillin-resistant *Staphylococcus aureus*.

R.R. Chattopadhyay, A. Bag and S. Gupta

Competition or facilitation between two invasive plants

Impact of invasive species is known to severely impact native plant biodiversity and we have found it to be true for two species which are making its presence felt in this region. However, an increase in the number of occurring invasive species, at a particular site, has been observed from our field studies and we find that there exits limited knowledge of the effect of multiple co-existing invaders on communities and ecosystems. In order to understand interactions among exotic species, field studies as well as greenhouse experiments have been set up.Under greenhouse conditions, the two plants were grown,at constant density,as monocultures as well as mixed-cultures. Preliminary results suggest that *M. micrantha*was probably unaffected by the presence of *A. philoxeroides* and was a better competitor among the two invasive plants.

A. Dewanji, S. Bhattacharya, P. K. Ghosal, C. Medda, A. Chatterjee, A.K. Banerjee and S Chatterjee

Determination of Functional response under selective predation through experimentation and modeling

The paradox of enrichment (PoE) proposed by Rosenzweig (1971) is still a fundamental problem in ecology. Most of the solutions have been proposed at an individual species level of organization and solutions at community level are lacking. Knowledge of how learning and memory modify behavioral responses to species is a key factor in making a crucial link between species and community levels. PoE resolution via these two organizational levels can be interpreted as a microscopic- and macroscopic-level solution. Fractional derivatives provide an excellent tool for describing this memory and the hereditary properties of various materials and processes. The derivatives can be physically interpreted via two time scales that are considered simultaneously: the ideal, equably flowing homogeneous local time, and the cosmic (inhomogeneous) non-local time. Several mechanisms and theories have been proposed to resolve the PoE problem, but a universally accepted theory is still lacking because most studies have focused on local effects and ignored non-local effects, which capture memory. Here we formulate the fractional counterpart of the Rosenzweig model and analyze the stability behavior of a system. We conclude that there is a threshold for the memory effect

parameter beyond which the Rosenzweig model is stable and may be used as a potential agent to resolve PoE from a new perspective via fractional differential equations.

J. Chattopadhyay, S. Bhattacharya, S. Rana ana J. Pal.

Cooperative Recovery Mechanism: A Safeguard for Minimizing Extinction Risk

Last year we concentrated on Cooperative Recovery modeling on species and observed that sometimes it can be interpreted as Allee effect a common ecological phenomenon as it was first described in the 1930s by its namesake, Warder Clyde Allee. So this year, we concentrated on Allee effect on different species based on GPDD database and its extinction probability/rate. We propose a deterministic model for a population subject to a strong Allee effect and undertake a model based study on commercially valuable herring fish population. We analyze the time series of two herring populations from the Icelandic and Canadian regions from the Global Population Dynamics Database with GPDD Id 1765, 1759. The parameters for the proposed models are estimated using Nonlinear Least Squares and Grid Search procedures. Confidence intervals for the parameters are computed using both Nonlinear Least Squares and regression bootstrap estimates. In the stochastic counterpart of the model we consider demographic noise to estimate different extinction measures viz. probability of extinction and expected time to extinction. The data histogram of population size is well approximated through the quasi-stationary distributions of the proposed stochastic model. The hypothesis of the presence of a strong Allee effect is prominent in both of the herring populations. The presence of a strong Allee effect in these two populations makes them more vulnerable to extinction. External perturbation or uncontrolled harvesting may drive the populations below the Allee threshold where the probability of extinction is high. We suggest that, our analysis can have a huge impact on understanding extinction patterns and enable us to identify demographic threats and guide decision making in conservation management. In addition, a similar analysis can be used in understanding the conservation status for other species. Growth of living organisms is a fundamental biological process. It depicts the physiological development of the species related to the environment. Mathematical development of growth curve models has a long history since its birth. We propose a mathematical model to describe the evolution of relative growth rate as a function of time based on a real life experiment on a major Indian Carp *Cirrhinusmrigala*. We establish that the proposed model is able to describe the fish growth dynamics more accurately for our experimental data than some existing models e.g. logistic, Gompertz, exponential. Approximate expressions of the points of inflection and the time of achieving the maximum relative growth rate are derived. We study, in detail, the existence of a nonlinear least squares estimator of the model parameters and their consistency properties. Test-statistics is developed to study the equality of points of inflection and equality of the amount of time necessary to achieve the maximum relative growth rate for a species at two different locations. Using the theory of variance stabilizing transformations, we propose a new test statistic to test the effect of the decay parameter for the proposed growth law. The testing procedure is found to be more sensitive in comparison with the test based on nonlinear least squares estimates. Our proposed model provides a general framework to model growth in other disciplines as well.

S.Bhattacharya, J.Chattopadhyay, A.R.Bhowmick, B.Saha and Joydeep Pal

A study on yield performance of Sweet Sorghum (*Sorghum bicolor*L.) in West Bengal

Sweet Sorghum (*Sorghum bicolor* (L.)Moench) is a multipurpose crop, which store sugar in its stem. It can produce grain from its ear head and the stem can produce sugary juice, which can be fermented to produce ethanol for energy purpose. Sorghum planting is more advantageous than sugarcane and sugar beet, because it needs less water, produces maximum sugar per hectare and has short growing period. The sweet sorghum stems, containing high concentrations of sugar and it is the most important product for use as a raw material for the production of Ethanol. Sweet sorghum has not been studied enough in West Bengal State and it has not been cultivated commercially on a large scale. Due to necessity needed for knowing appropriate agronomic practices and cultivar in different agro-climatic and different soil condition of state of West Bengal, India, this research was designed. The objectives of the proposed studies are located at different district of West Bengal according to their different soil type. This year (2014-15) cultivar “Madhura” is selected out of many varieties. The proposed locations

were at Basirhat of North 24-Pgs., Nimpith of South 24-Pgs. Sriniketan of Birbhum and Panskura of East Midnapore district. Total treatment combinations were 32. Fertilizer Nitrogen (N) 4 level (N1) 0 Kg (N2) 40 Kg (N3) 80 Kg and (N4) 120 Kg/ha: Phosphorous (P) 2 level (P1) 0 Kg and (P2) 60 Kg/ha: Potassium (K) 4 level (K1) 0 Kg (K2) 30 Kg (K3) 60 Kg and (K4) 90 Kg/ha. (N4 x P2 x K4 = 32). Fertilizer Sources were Urea (N 46%) as N, Single Super Phosphate (P 16%) as P and Muriate of Potash (K 60%) as K. All fertilizers were applied as basal dose accept Nitrogen. ½ N applied as basal and another ½ applied as top dressing at 30 days after sowing. These 32 treatment combinations replicated thrice with Randomised Block Design (RBD) for all experimental sites. Each plot size was 8 sqm. (4m x 2m) and total number of plots were 96. Various yield data such as Green biomass Yield (t/ha), Grain Yield (Kg/ha), Sugar Concentration (%) and Sugar Yield (t/ha) were collected every 20 days interval starting from 80 days after sowing and up to 140 days after sowing. It has been observed from the experiment that the green biomass Yield (t/ha) was highest 64.42 t/ha given by treatment N120P60K60 kg/ha. 1152.58 kg/ha grain yield was given by the treatment N120P60K90 kg/ha and from the same treatment combination 9.14 % of sugar concentration was observed. Whereas, sugar yield of 3.44 t/ha was given by the treatment N80P60K90 kg/ha. All the data placed here at 140 days after sowing harvest only.

S. Barik

Generation of SSR marker in some mangroves of Sundarbans, India

Worth of mangrove vegetation along the shorelines and estuaries in tropic and sub-tropic World has been acknowledged much. With enduringruin and destruction of such advantageous vegetation, it is an immerging obligatory to explore the fundamental genetic evidences for outliningoperative conservation strategies. Moreover, the genetic factors that shaped the present-day mangrove populations are important for understanding their response to climate change.. Hence, the authentication of diversity at the genomic level of some mangrove species, particularly those who are in extreme existence, would be the direction towards restoration policy. Microsatellite markers, (simple sequence repeats or SSR) are short tandem repeats of mono- to tetra-nucleotide repeats, which are assumed to be randomly distributed in the nuclear genome. Such SSRs are relatively abundant and have high mutational rates in comparison to other markers and useful in population studies. They are highly polymorphic because of their frequent variation in the number of tandem repeats and are inherited as co-dominant markers which could be easily detected with polymerase chain reaction (PCR). The conserved flanking regions can also be used as useful molecular markers for related genomes. An enormous advantage for SSR is that the exact designation of alleles (their length) to a known locus allows standardizing information between laboratories thereby making fully integrative worldwide.

S. Das and N.Dasgupta

Allelopathy in an Aquatic and Neighbouring Ecosystems and the role of allelochemicals in community structure

Allelopathy in aquatic environments can influence the competition between different photoautotrophs for resources and change the succession of species. Field observations and laboratory experiments indicate that allelopathy occurs in all aquatic habitats and that all primary producing organisms are capable of producing and releasing active allelopathic compounds. Our studies have been done on *Vallisneriaspiralis* and *Lemna minor* in aquatic ecosystems and on *Ecliptaalba* and *Piperomiapellucida* from neighbouring ecosystems. The individual and interactive impacts of the plants on the ecosystems were also considered. *Vallisneriaspiralis* Linn. (family Hydrocharitaceae), is a submerged perennial plant with high invasiveness and exerts beneficial effect on the biodiversity on the entire aquatic ecosystem by inhibiting the growth of blue green algae thereby improving the physio-chemical properties of the water. Root exudates of *Vallisneriaspiralis* imparts an antagnostic effect on the growth of *Lemna minor* and determine the community structure and dynamics of the populations within the aquatic ecosystem. Ecliptaalba (L.) Hassk (Asteraceae) is a branched herbaceous plant known for its curative properties against various tropical and sub-tropical diseases. The extensive growth of the plant in moist areas of diverse topology indicates its invasiveness and signifies its intense allelopathic

activity. Root exudates of *Ecliptaalba* exhibited strong antimicrobial and strong allelopathic effects on germination and seedling growth of rice. *Peperomiapellucida* L. HBK.belonging (Family Piperaceae) is widely distributed in the tropical and subtropical regions and is occasionally cultivated and naturalized as weed. A new phenol glycoside isolated from the root exudates of *Peperomiapellucida* using chromatographic techniques and the structure was confirmed on the basis of spectral data (mass spectroscopy, 1H and 13C NMR). In vitro allelopathic activities of the compound were studied on rice wheat and gram bioassay techniques. These interactions between the aquatic and terrestrial environment play an important role in structure and dynamics of aquatic communities.

S.Mandal Biswas

Biological Anthropology Unit, Kolkata

Identification of susceptibility genes associated with Type 2 Diabetes Mellitus in the population of Andhra Pradesh, India

This project on T2DM has been initiated with the overall aim of understanding the patterns of genetic association with T2DM as well as the role of gene-gene and gene-environment interactions in the manifestation of this disease in the population of Hyderabad. Given that the population of this region was not genetically explored hitherto it is necessary to assess the role of different candidate genes in the etiology of T2DM in Andhra Pradesh. Based on the available literature, we focused on the most studied and widely replicated 15 Single Nucleotide Polymorphisms (SNPs) of the 9 prominent genes that were known to have implications in the pathophysiology of T2DM and genotyped on SEQUENOM platform. A total sample of 1379 subjects (758 T2DM cases and 621 controls) were enrolled for the study from Hyderabad city in India which is considered as the “Diabetic Capital of India”. We could replicate the significant association of SNPs of TCF7L2 (rs7930146, rs11196205, rs12255372), CDKAL1 (rs7754840, rs7756992) CDKN2A/B (rs10811661), IRS-1 (rs1801278) and CAPN10 (rs3792267) with T2DM in the population of Hyderabad which is consistent with the results earlier observed among the Caucasian/western populations. Our findings also suggest significant Gene-Gene and Gene-Environment interactions in the etiology of T2DM in this high risk population of Hyderabad. Overall, among the nine genes studied, TCF7L2 and CDKAL1 emerged as the most prominent T2DM susceptible genes in this high risk population. Based on this work a couple of papers were published in international peer-reviewed journals and one of our research scholar submitted her Ph.D thesis to Andhra University.

B.M. Reddy

Identification of Susceptible Genetic Variants Associated with Coronary Heart Disease in the Population of Andhra Pradesh, India

Given the increasing prevalence of coronary heart disease in India due to their characteristic dyslipidemic phenotype and the insufficient number of associated genetic polymorphisms studied hitherto, we intend to study the association pattern of polymorphisms in/near the cholesterol transport system regulating gene cluster region at 11q23.3 chromosomal region and a prioritized set of Genome Wide Association Studies identified SNPs specific to 9p21.3, 1p13.3, 1p32.3, 3q22.3, 6q25.1, 6q25.3 and 10q11.21 loci using high throughput genotyping platforms like Fluidigm/Illumina/Sequenom. A comprehensive and critical literature review on the subject has been done. Based on this, a review paper has been published in journal of post graduate medicine. Collaborations with clinicians (Cardiologists) have been worked out and about 485 CHD cases and 530 Controls have been recruited in the study (collected blood samples, background information). DNA isolation, quality check and quantification of the collected samples have been accomplished. SNP genotyping is in progress.

B.M. Reddy

Health of the Stone Quarry Workers of Birbhum district, West Bengal

The aim of the project is to (1) see the health status of the stone quarry workers and (2) to investigate the health hazards linked with the stone quarry work. In the present study, four groups of workers have been selected – (1) working in the quarries and residing within the crusher area (2) not working in the

crusher but residing within the crusher area (3) working in the quarries but residing far away from crusher area and (4) working and residing far away from the crusher area.

Subrata K. Ray

Body weight and body shape concerns and related behaviors among Indian urban adolescent girls

In order to assess the association of body weight and body shape concerns and related behaviors with actual weight status among urban adolescent girls, a cross-sectional study was done, in twin cities of Kolkata and Howrah, West Bengal, India. Self-administered questionnaires were used to collect socio-demographic and other information. Weight and height of each girl were measured to assess actual weight status. A total of 1223 adolescent girls aged 14-19 years were selected from nine schools of Kolkata and Howrah in West Bengal. The study revealed, many overweight girls perceived themselves as overweight and engaged in weight reducing activities. However, several normal weight girls also perceived them as overweight and attempted to lose weight. Unhealthy eating practices to reduce weight were followed by both overweight and normal weight girls and even by a few underweight girls. Multivariate binary logistic regression showed significant association between actual weight status and use of unhealthy weight loss measures. The likelihood of adopting unhealthy eating practices was significantly higher among overweight than normal weight girls.

Susmita Mukhopadhyay

Human Genetics Unit, Kolkata

The Unit has been pursuing research projects, both internally and externally funded. During the year under review, scientists of this unit published 22papers in various scientific journals. They have also been participating in teaching activities in the Institute and other Institutions. Brief accounts of research activities are provided below:

Genomic and Epigentics Studies on Common Diseases in Indian Populations

The focus of these studies is to understand the genomic and environmental contributions to common diseases in India.

Genomic Studies on Oral Cancer

Comparative evaluation of miRNA expression in oral submucous fibrosis (OSF) and squamous cell carcinoma (OSCC)

Keeping in mind the vital role that miRNAs play in the modulation of gene expression leading to carcinogenesis, the present study was conducted in OSF and OSCC patients and healthy individuals with a view to assess the malignant potentiality of OSF. Biopsy specimens taken from clinically normal, OSF and oral cancer tissues were evaluated for expression of seven miRNAs. Expressions of three miRNAs have been found to be significantly deregulated in both OSF and OSCC samples in relation to healthy samples. Then through an elaborate search of target genes of these miRNAs, an attempt has been made to find out the biological significance of these miRNAs in the pathological process of malignant transformation of OSF. Two miRNAs i.e. hsa-mir-204 and hsa-miR-31 and their target genes have finally emerged as promising biomolecules with a strong potential to be designated as prognostic markers in relation to malignant transformation of OSF.

B. Roy and E.Chattopadhyay

Genetics of Birt-Hogg-Dubé syndrome

Familial spontaneous pneumothorax is one of the phenotypes of Birt-Hogg-Dubé syndrome (BHDS), an autosomal dominant condition associated with folliculin (FLCN). We investigated clinical and genetic data of an Indian family having two patients suffering from spontaneous pneumothorax in

absence of skin lesions or renal tumors. HRCT scan of patient's lung revealed paracardiac cysts and DNA sequencing of all 14 exons of FLCN from patients showed presence of heterozygous "C allele" deletion in the poly-cytosine (poly-C) tract of exon 11 leading to truncated folliculin. This mutation was also observed in 4 asymptomatic members of the family.Our results confirmed presence of deletion mutation in poly-C tract of FLCN in members of BHDS family. This is first report of genetic insight in a BHDS family from India but in-depth studies with a larger sample set are necessary to understand mechanism of familial pneumothorax.

B.Roy, A.Ray and S.Kundu

Epigenetic studies on Oral Cancer

Since 1980s, when first the reduction of methylation was observed in primary cancer tissues compared to the normal tissues, role of DNA methylation in cancer has been studied extensively. In cancers, global hypomethylation occurs at gene bodies, transposable elements and repetitive sequences, and hypermethylation occurs at promoters, which leads to aberrant transcription initiation and genome instability. DNA hypomethylation contribute to the development of cancer by activating the transposable elements, generating the chromosomal instability and loss of imprinting. We determined differential methylation of many CpG Island associated gene promoters in oral pre-malignant disorder and OSCC patients. These differential methylation at the gene promoters are shown to be correlated with the OSCC progression. To explore the possibility of these epigenetic marks to be used as biomarker, these differentially methylated regions will be validated in the easily accessible saliva of OSCC patients. We are also determining the miRNA signature in different classes of OSCC patients and different OPMD patients. The aberrantly methylated regions and mis-regulated miRNAs will then be detected in the cell free DNA and RNA among OSCC and OPMD patients from eastern India. These aberrantly methylated regions and miRNA signatures could be used as biomarkers to better understand the etiology, prognosis and might explain their functional implications in OSCC and OPMD development.

R.Chatterjee, B.Basu and J.Chakraborty

Genetic and epigenetic studies on Psoriasis

Psoriasis is a recurrent chronic inflammatory disorder of the skin. A varied prevalence is observed across the populations throughout the world, but the severity, course and phenotypic appearance of the disease is mostly common. It is suggested to be an autoimmune disease and the exact trigger of the disease is not completely known. We are studying the genetic predisposition that might be involved in the disease pathogenesis of psoriasis. Several genetic predispositions in psoriasis pathogenesis are indicated, in some cases environmental as well as gender and age related factors have also been found to be associated. We observed a significant association of HLA-Cw6 allele mainly in the Type I psoriasis patients; however HLA-Cw6 association for the Type II patients is comparatively low. LCE gene cluster was previously shown to be associated with the generalized plaque type psoriasis, but in psoriasis patients of India, we do not observe any association of previously reported four polymorphisms at the LCE gene cluster. However, a functional variant at the LCE3D gene showed significant association for HLA-Cw6 positive patients only. Recently, imbalances in epigenetic networks are also explored to be causative elements in psoriasis pathogenesis. DNA methylation analysis of ID4 and WIF1 promoters from the tissues of involved and uninvolved skin in few CpG island associated promoters identified differential methylation suggesting the involvement of DNA methylation in psoriasis pathogenesis.

R.Chatterjee, A. Chandra and A.Lahiri

Genetics and Functional Genomics of Pancreatic Cancer

Genome-wide analysis of DNA methylation profile in pancreatic adenocarcinoma

It is the best-studied epigenetic modification that governs transcriptional regulation and silencing.We will explore DNA methylation landscapes in pancreatic cancer isolated from PANC patients and normal

pancreas from same individuals. We have collected blood and tissue samples from 60 patients of pancreatic cancer and 15 chronic pancreatitis.

N. Sikdar

Identification and Characterization of Somatic Mutations in Gall Bladder Cancer in Indian Population

We have isolated DNA and RNA from respected tissues (Tumor-Normal form each patient) and blood by QIAGEN (All prep, DNeasey) methods.From our collected sample set, 8 pancreatic ductal adenocarcinoma patient samples pairs (tumor DNA and blood DNA), i.e. total 16 samples have sequenced (targeted exome sequencing) for 400 genes which includes K-RAS, TP53, EGFR, CDKN2A/p16, INK4A, SMAD4/DPC4 genes by Next Generation Sequencing method. The analysis of variant calling is ongoing.

Statistical Genomics

The focus of these studies is to critically analyze existing statistical methodologies and to develop new methodologies for human genetics, especially for gene-mapping and genotype-environment interactions.

Statistical Methods for Analysis of Complex Traits

The focus of these studies is to analyze critically existing statistical methodologies and to develop new methodologies for human genetics, especially for gene-mapping and genotype-environment interactions.

Statistical Methods for Analysis of Complex Traits

Some novel statistical methods have been developed for association analyses of complex genetic traits. These include:

(a) A clustering approach of mapping rare genetic variants using mutual association between variant sites.
(b) Allelic level tests for mapping multivariate phenotypes.
(c) Transmission Disequilibrium tests for quantitative traits using sibshipdataand transmission information from both parents.
(d) Developing a method for association mapping of count phenotypes using a generalized Poisson regression model.
(e) Developing asymptotic distribution kernel based statistic for multilocus genetic association using longitudinal phenotype data
(f) Developing KBAT type statistic for family data to study multilocus genetic association
(g) Developing a test for gene-gene interaction and SNP-SNP interaction for case-control data
(h) A new clustering method for clustering mixed type data arising in medical diagnosis
(i)Methodological development on integrating SNP data and eQTL data in genetic association study

Analyses were performed on:
(a) Type 2 diabetes and related quantitative precursors.
(b) Major psychoses phenotypes including bipolar disorder and schizophrenia
(c) Quantitative precursors such as homocysteine levels, Vitamin B12 levels for coronary artery disease.

Social Sciences Division

Economic Research Unit, Kolkata

This year the scientific workers of the Unit are extensively involved in research, teaching, training, consultancy and academic administration. The research is carried out both at individual and collaborative/interdisciplinary levels. These include theoretical as well as empirical research in economics and econometrics.

The topics of different dimensions of researches in the unit are as follows:

Vulnerability Orderings, Polarization for an Ordinal Dimension of Human Well-being, Polarization and Conflict, Multidimensional Indicators; Spatial and Temporal Price Index Numbers, Purchasing Power Parity, Budget Share Distribution, Demand Analysis; Intra House Models; Inflation and Inflation Uncertainty, Asymmetric Mean Reversion and Cross-Country Volatility Dependence in Returns, Asymmetry in the Extracted Housing Wealth Effects on Consumption in the USA and the UK, Convergence in Food Grains Production in Indian States using Panel Models, New Estimators for Models with Multicollinearity and Autocorrelation, and their Comparisons; R&D and Patent; Experimental Economics, with Focus on Communication, Information Reception and Information Transmission; General Equilibrium Theory, Game Theory; Diversity Index; Informal Household Water Market and Determinants of Price; Measurements of Poverty and Gender Bias, Poverty Eradication Programmes in India, Variation of Adult Heights and Weights in India; Modification of Chow Test; Factors Associated with Age at Menarche; Panel Data Models, Financial Time Series Models; Growth Theory, Development Economics; Trade, Tariff and Employment; Game Theory, Industrial Organization, Mechanism Design under Incomplete Information, Social Choice Theory; Game Theory, Mechanism Design, Algebraic Graph Theory, Social Choice Theory, Probability Theory (Percolation, Random Matrix), Number Theory, Epistemic Game Theory; Inequality and Conflict; Regulation of Non-Governmental Organizations; Group Conflict; Linguistic Justice; Economic Development, International Trade, Political Economy; Open Economy Macroeconomics; Spousal Violence Against Working Women in India, Marital Status: a Significant Determinant of Women Empowerment in India, Quality of life of Indian Women; Impact of MGNREGA on Livelihood of Rural Poor in India: A Study Based on National Sample Survey Data.

The details of the applied and theoretical researches in Economic Research Unit are given below:

Vulnerability Orderings

Satya R. Chakravarty and Nachiketa Chattopadhyay (SOSU)

Polarization for an Ordinal Dimension of Human Well-being

Satya R. Chakravarty and Bhargav Maharaj

Polarization and Conflict

Satya R. Chakravarty

Multidimensional Indicators

Satya R. Chakravarty and Maria Ana Lugo

Political Economy

This study looks at the possible link between Democracy and Globalization. The argument is that in less developed countries democracy does not perform up to its full potential because of the existence

of large informal sectors. In the informal sector, agents have a patron-clientele relationship with political parties. This relationship in turn reduces the incentive of the ruling party to put in the right amount of effort. Globalization, by creating new opportunities for the skilled, reduces the size of the informal sector and improves the quality of democracy.

Abhirup Sarkar

Tariff that Exports Unemployment

This note points toward an important omission in the literature of trade with increasing returns to scale and equilibrium unemployment in shirking type models. The general consensus appears to be that free trade via proliferation of varieties is likely to increase real wage and thus by relaxing the no-shirking constraint should increase employment. What has escaped the imagination of many, is that in presence of transport cost, the home market effect which makes firms gravitate towards the protected market can result in the contrary, wherein less free trade (in this case a tariff) is shown to increase (decrease) employment in the tariff imposing country (the trading counterpart).

Brati Sankar Chakrabarti

Spatial Variation and Temporal Movement in Prices: The Dynamic Household Regional Product Dummy Model

This study provides a comprehensive framework that allows both spatial variation and temporal movement in prices. The proposed model is based on twin extensions of the household version of the 'country product model' (CPD) by allowing for a dynamic stochastic specification and interdependence of spatial prices of geographically adjacent regions. Tests of temporal stability of the estimated spatial prices and of their regional independence are proposed and applied in this paper. The paper shows that the introduction of an AR (1) error process improves the efficiency of the estimates of the urban-rural and temporal price indices. The Indian application points to a rich potential for using the proposed framework in cross country comparisons such as the ICP exercises.

Manisha Chakrabarty, Amita Majumder and Ranjan Ray

Estimates of Spatial Prices in India and their Sensitivity to Alternative Estimation Methods and Choice of Items

This paper provides Indian evidence on sub-national PPPs that point to considerable spatial price heterogeneity within the country. This paper shows that the CPD model, proposed in the cross country context, can be adapted to the household context to estimate spatial prices in the intra country context. The proposed CPD based model is shown to be formally equivalent to certain well known fixed weight price indices under certain parametric configurations. The empirical contribution includes a systematic comparison between the spatial price indices from alternative models, namely the CPD and utility based models, and the result that the utility based methods point to a much greater extent of spatial price heterogeneity than is suggested by the CPD type models. The results also record the sensitivity of the spatial price indices to the choice of items in the utility based approach. The pair wise comparison of estimates suggests that item selection may be more important than model selection in its impact on the spatial price estimates, though the latter is important as well. The study provides estimates of rural urban differentials in spatial price indices that suggest some interesting differences between the constituent states.

Amita Majumder and Ranjan Ray

Preferences, Spatial Prices and Inequality

This study examines the effect of prices on inequality in the heterogeneous country context of rural India during the period of economic reforms and beyond (1999/2000 – 2009/2010). It proposes a

framework for calculating “exact” price indices, based on the recent “Exact Affine Stone Index” (EASI) demand system, and shows its usefulness by calculating spatial prices and regionally varying temporal prices that allow for both differences in preferences between states and over time. The study finds that the nature of inflation has been regressive during the first half (1999/2000 – 2004/2005) and progressive during the second half (2004/5- 2009/2010) and the effects of temporal price inflation and spatial prices on inequality are qualitatively different. The study of the behaviour of inequality as a country develops and experiences high growth rates is important, given that rising inequality may lead to increasing marginalisation even while the poverty rates may have declined.

Manisha Chakrabarty, Amita Majumder and Ranjan Ray

Occupational Segregation and Wage Differential between Males and Females in India

Earning differential between males and females has been the subject of many empirical studies all over the world. This study provides evidence on the relative importance of intra and inter-occupational earnings differentials between males and females using the 68th round (2009-10) employment-unemployment unit level data collected by National Sample Survey Organisation (NSSO). A multinomial logit model is used to describe the occupational attainment. The wage equations for the males and females are estimated separately accounting for the selection bias. The gross earnings difference has been decomposed into between and within-occupation components. The study reveals interesting facts regarding gender wage differentials and corroborates the findings of other studies on gender based wage differentials.

Nilanjana Chakraborty and Amita Majumder

Variation of Adult Heights and Weights in India: State and Zone wise Analysis

In India, gender inequality in nutrition, from infancy to adulthood, is a common phenomenon. Women never reach their full growth potential due to nutritional deficiency. Height and weight reflects nutritional deficiency. The main objective of this study is to see the variation of adult height, weight and BMI along with gender differences in the states of India. This study is based on the National Family Health Survey, 3rd round (NFHS-3) conducted by International Institute of Population Sciences (IIPS), during the period of 2005 to 2006. The conclusions are: Socio-cultural differences including differences in economic pattern may be the leading causes in the variation of height weight distribution in the states of India. In this context, level of living and education need to be given proper attention because these two seem to be the most influential factors in improving the health and nutritional status as reflected through height, weight and BMI.

S. Som (SRU), P. Roy**,** Manoranjan Pal and P. Bharati (BAU**)**

A Modified Chow Test Approach towards Testing Differences in the Engel Elasticities

This paper finds the Engel Curves for food separately for rural and urban India and finds the differences in the coefficients using a test which is an improved version of Chow Test enabling component wise comparisons. The proportional change of expenditure spent on food per one percent change in the per capita total expenditure is found by this method to be decreasing for both rural and urban India establishing Engel’s law for food. The decrease in the values of these proportional changes is found to be highly statistically significant. The statistical testing of differences would otherwise be difficult. It is also statistically tested that the household size decreases as per capita expenditure increases.

J. Saha and Manoranjan Pal

Factors Associated with Age at Menarche of Secondary School Girls in Rajshahi City, Bangladesh

Early onset of menarche is a risk factor for breast cancer on the other hand delayed menarche affects the reproductive function. The aim of the present study is to investigate the effects of anthropometric

measures and parents' socio-demographic factors on age at menarche among secondary school girls in Rajshahi City, Bangladesh. The results suggest that heavier girls and girls coming from rich family are more likely to attain menarche earlier than their counterparts.

Md. Golam Hossain, Mst. Selina Khatun, Md. Rafiqul Islam, Md. Nazrul Islam Mondal, P. Bharati (BAU) and Manoranjan Pal

Women Autonomy, Nutritional and Immunization Status of their Children

This paper examines the impact of women's autonomy on their children's nutritional and immunization status. The main objectives of the paper are to see the women's decision making power in different socio-economic conditions and how far different levels of decision making power influence their children's nutritional health and immunization status. The study reveals that the welfare of children depends on the consciousness and awareness of the mother. Awareness is directly related with the mothers white colored job and this job is dependent on women's higher education. Welfare of children can be taken as an indicator of autonomy of mothers because autonomy of mothers has the highest effect on nutritional and immunization status of children.

Susmita Bharati (SRU), Manoranjan Pal and P. Bharati (BAU)

Informal Household Water Market and Determinants of Price: Evidence from an Indian Hill City

Pricing of water in the hill cities in India is different from that of plain lands, because water is a scarce resource in most of the hill cities. The supply of water by the municipalities is inadequate. This paper tries to examine the pricing of household water use in Shillong urban area, India and the impact of various factors including income, house rent, seasonal scarcity of water, capacity of municipal supply, household size on the price-quantity determination. The result of three stage least squares reveals significant positive impacts of income, scarcity of water on the demand price while significantly negative impacts of quantity purchased, extent of municipal supply, house rent paid on the demand price. But the household size does not have any significant impact on the demand price though large household is expected to require more water. The supply of water on the other hand is not significantly affected by price, extent of municipal supply and deficiency though the coefficients are in the expected line.

Manoranjan Pal and Utpal Kumar De

A Modified Diversity Index and its Application to Crop Diversity in Assam, India

A new measure of diversification index is proposed taking the correlation structures of the shares into consideration. This index is a generalization of the Herfindahl-Hirschman Index (HHI) proposed in the context of concentration in industries. When this index is applied in the crop production along with other related data in Assam, India, it is seen that many of the interrelations are changed from that of found by HHI. The analysis helps us to plan for improvement of crop patterns in a region prudently.

P. Bharati (BAU), Utpal Kumar De and Manoranjan Pal

Temporal Trend of Anemia among Reproductive-Aged Women in India

Anemia is one of the major leading nutritional deficiencies in India, and the most vulnerable groups are preschool and adolescent children and pregnant and lactating women. The main objective of the study is to determine the temporal trend of anemia among reproductive-aged women of age 15-49 years. Anemia was most prevalent in the east zone for both the periods. The changes at the all India level were not much, but the north-east zone improved very well, whereas the south zone deteriorated drastically. The occurrence of severely anemic women in India varied between 1% and 2%. The highest prevalence rates were observed among women who were 15 to 24 years of age, illiterate, from non-Christian scheduled tribes (STs), unmarried, and whose standard of living was low. Rates of anemia have increased over time except in the case of Buddhists, Parsees, Jains, and the STs. From the viewpoint of this study, illiteracy and low standard of living may be the main causes of anemia

among women in India. It is also necessary to take appropriate steps to curb anemia in women in their early adulthood.

Susmita Bharati (SRU), Manoranjan Pal, Suparna Som and P. Bharati (BAU**)**

Socioeconomic Determinants of Iron-Deficiency Anemia among Children Aged 6 to 59 Months in India

The extent of anemia and its socioeconomic determinants among the preschool children (6- 59 months old) in India have been studied in this article. Relevant data are taken from the third round of the National Family Health Survey. The initial analysis reveals some interesting features. The most affected children are in the age-group of 6 to 23 months. Beyond this age a decreasing trend is observed up to the age of 48 to 59 months. The highest and the lowest prevalence of anemia have been found to be in the central and the northeast zones, respectively. The vulnerable groups are the children of illiterate parents and those belonging to the poor families in the rural areas. Categorical logistic regression also confirms that status of literacy and wealth of parents have strong negative association with the status of anemia of the children.

Susmita Bharati (SRU)**,** Manoranjan Pal, Suman Chakrabarty and P. Bharati (BAU**)**

Predictions of Voting Patterns

In a setup of a given set of political parties in a region it is possible to build up a Markov chain model, which enables us to predict the results of the subsequent election. We assume that the result of the latest election depends only on the previous election. The transition probabilities can be interpreted as the coefficients of a set of regression lines, where the number of votes obtained by each party in the latest election is regressed on the number of votes obtained by the parties in the previous election. This demands the coefficients to be non-negative. The problem is that the transition probabilities are not known here and need to be estimated from data. The above model is applied to predict the results of the next election of West Bengal using the results of the latest two elections. Assessment of the prospect of Bharatiya Janata Party (BJP) in West Bengal gives mixed result.

Manoranjan Pal

Poverty Eradication Programmes in India: Actions Taken and Impacts Made

Many development programmes have been taken by the Government of India and some of them are running quite successfully. The studies so far made on these programmes show that the rural infrastructures have been improved substantially. But these programmes failed to improve the poverty situation to that extent. The main reason is that the most of the programmes have transient effect on the eradication of poverty. India is having one of the highest economic growth rates in the world and still 36% of the world's poor are living in India. The Human Development Index (HDI) for India is 0.519 and is ranked 119 according to Human Development Report in 2010. In addition to reviewing critically the successes and failures of these programmes taken by Government of India, this paper gives a historical profile of the poverty and inequality situations in India without referring to any causal relationships of the poverty levels with the actions taken.

Manoranjan Pal**,** B.N. Ghosh (SRU) and P. Bharati (BAU**)**

Strategic Outsourcing with Technology Transfer under Price Competition

A model is constructed to show that outsourcing of a crucial input can occur even though it can be produced in-house at a lower cost. There are two firms producing differentiated goods and competing in prices, and only one of them possesses input production technology which is superior to that of an independent input supplier. It is shown that if the degree of product differentiation is small or the technological gap between two input producing firms is small, strategic outsourcing will occur. Technology transfer in the form of patent sale will act as a commitment that the firm will outsource. While the outsourcing firm gains, consumers' welfare as well as social welfare goes down.

Interestingly, sometimes rival firm's profit might increase. The paper brings into focus some competition policy concerns.

Tarun Kabiraj and Uday Bhanu Sinha

Incomplete Information and R&D Organization

This paper studies the choice of cooperative versus non-cooperative R&D under incomplete information about the innovation size of the rival. It is assumed that the R&D outcome is stochastic and continuously distributed with a given mean and a constant variance. We show that the incentive for cooperative research is smaller the larger is the variance of the R&D outcome, irrespective of the nature of the product market competition (Cournot versus Bertrand).

Srobonti Chattopadhyay and Tarun Kabiraj

Strategy-proofness and Pareto-efficiency in Quasi-linear Exchange Economies

A long-standing question on the structure of strategyproof and Pareto-efficient social choice functions (SCFs) in classical exchange economies (Hurwicz (1972)) is revisited in this paper. Using techniques developed by Myerson in the context of auction design, it is shown that in a specific quasi-linear domain, every efficient and strategy-proof SCF satisfying non-bossiness and a mild continuity property, is dictatorial. The result holds for an arbitrary number of agents but the two-person version does not require either the non-bossiness or continuity assumptions. It also follows that the dictatorship conclusion holds on any superset of this domain. A result using the minimum consumption guarantee result (in the spirit of Serizawa and Weymark (2003)) is also provided.

Manipushpak Mitra, Mridu Prabal Goswami and Arunava Sen (EPU, Delhi)

Egalitarian Equivalence and Strategy-proofness in the Queueing Problem

The implication of egalitarian equivalence, queue efficiency and strategyproofness in the context of queueing problems is investigated. The complete class of mechanisms satisfying the three requirements is characterized. Though there is no mechanism in this class satisfying budget balance, feasible mechanisms exist. It is also shown that it is impossible to find a mechanism satisfying queue efficiency, egalitarian equivalence and a stronger notion of strategyproofness called weak group strategyproofness. In addition, it is shown that generically there is no mechanism satisfying two normative notions, egalitarian equivalence and no-envy, together.

Manipushpak Mitra, Youngsub Chun and Suresh Mutuswami

Subgroup-additivity in the Queueing Problem

The notion of 'subgroup additivity' is defined and is used as the main axiom to investigate its implications for the queueing problem. The axiom of subgroup additivity requires that a rule assigns the same expected 'relative' utility to each agent whether an agent's expected relative utility is calculated from the problem involving all agents or from its sub-problems with a smaller number of agents. Five important rules in the queueing problem are characterized, they are: the minimal transfer rule, the maximal transfer rule, the symmetrically balanced VCG rule, the pivotal rule and the reward based pivotal rule. Given some basic axioms and subgroup additivity, the characterization results can be obtained by additionally imposing either strategic axioms (like weaker versions of strategyproofness) or equity axioms (adjusted versions of egalitarian equivalence). Each strategic axiom can be replaced by an appropriate equity axiom for the characterization of all five rules.

Manipushpak Mitra and Youngsub Chun

Asymmetry in the Extracted Wealth Effects on Consumption

This study investigates the asymmetric effect of extracted housing wealth on consumption under the consumption-smoothing and financial motivation of households for two most developed economies

viz., the USA and UK. By applying the methodology of two-regime threshold cointegration in vector error correction model developed by Hansen and Seo (2002), it has been found that the motivation behind withdrawing equity depends on the threshold variable of return differential between mortgage and saving.

Nityananda Sarkar and Mahamitra Das

Convergence of Foodgrains Productivity and Foodgrains Production across Indian States: A Panel Data Approach

This study attempts to understand the regional convergence- both in terms of sigma and beta convergences - of (i) per capita foodgrains production across the major foodgrains producing states of India over the period 1991 to 2011 and (ii) foodgrains productivity of major crops in major states of India, by applying the conventional methods and also the modern panel data approach for convergence hypothesis including the tests based on dynamic panel models of first differenced GMM and system GMM. While in case of foodgrains production, beta convergence has been found, the results for productivity are somewhat mixed.

Nityananda Sarkar and Debabrarta Mukhopadhyay

The returns and Volatility Interdependences in Up and Down Markets

Transmission of price and volatility spillovers across stock markets of different groups/blocks of countries is quite common. These spillovers are likely to depend on market conditions. In this study, analysis of the behaviour of returns and volatility spillovers in two different market conditions - up and down - have been done for a group of two developed economies and four important emerging economies. A VAR-MGARCH -in -mean-type model has been used for this purpose. In case of MGARCH, the dynamic conditional correlation (DCC) approach has been used. Based on computations done , it is found that there is significant and asymmetric effect of returns and volatility of one market on another in both up an down markets , but the sign of the effect varies over pairs of countries concerned and also of market conditions group of G7 and EURO countries.

Nityananda Sarkar and Srikanta Kundu

The Effect of Inflation on Inflation Uncertainty in the G7 Group - A double Threshold GARCH Model

The impact of inflation on inflation uncertainty in a modelling framework where both the conditional mean and conditional variance of inflation are regime specific is being studied here, and the GARCH model for inflation uncertainty has been extended by including a lagged inflation term in each regime. Applying this model to the G7 countries with monthly data from 1970 till 2013, it is found that the impact of inflation on inflation uncertainty differs over the regimes in most of the G7 countries. The findings, in general, provide empirical support to the well-known Friedman-Ball hypothesis of positive impact of inflation on inflation uncertainty.

Nityananda Sarkar and Kushal Banik Chowdhury

Various Issues in Panel Data Models with Cross Sectional Dependence

Samarjit Das

Discrete-valued Time Series

Modeling, analysis and coherent forecasting are done for discrete-valued time series data. In particular both categorical and count data are considered. Zero-inflated count data is also considered for this purpose.

Samarjit Das

Psychological Ownership, Group Affiliation, and Other-Regarding Behavior: Some Evidence from Dictator Games

It is found that dictator giving is higher in group environments, where the dictator and recipient share a common group affiliation, and the funds are group-owned, than in the benchmark individual environment, where the dictator and recipient do not share a group affiliation, and the funds are owned by the dictator. A move to the group from the individual environment involves two distinct shifts. One, a shift in affiliation, where the dictator gives to a group member, rather than just a randomly matched partner, in both cases out of his own fund. Two, a shift in ownership, where the dictator gives out of group-owned rather than personal funds, in either case to a group-member. We implement these two shifts through linguistic framing of instructions, and find that while affiliation effects are absent, ownership effects are present, though not decisively.

Priyadarshi Banerjee and Sujoy Chakravarty

Contracting Outcomes with Communication and Learning

We show that allowing simple communication can enhance tendencies for optimal choices and increase efficiency in a multi task, incomplete contracting, and principal agent setting. The communication protocol, by asking principals to communicate requests to the agent regarding non-contractible choices, promotes greater deliberation and faster learning, and thereby results in superior outcomes. The benefits accrue mainly due to changes in the choices of principals, who issue communication, rather than agents. Coordination is promoted, and learning subdued, when the communication protocol permits promises and ex post payments, in addition to allowing a request. This protocol also increases efficiency, with the efficiency gains equal across the protocols. However, a reduction in the degree of incompleteness in contracting yields larger efficiency gains than induced by any communication protocol.

Priyadarshi Banerjee and P.Srikant

Macroeconomics of India Recent Experience

Development of a suitable macro model is under way for explaining India's recent macroeconomic performance. The endeavour is worthwhile for the following reasons. India entered into a high-growth phase unprecedented in India's recorded history during 2003-04 – 2010-11. However, since 2011-12, India entered into a recession. It is absolutely important to know why India's growth rate shot up to such a high level and why it could not be sustained after 2010-11. It is also important to assess the policies adopted by the Govt. of India so far to tackle the situation. The objective of the current research is to accomplish these goals.

Chandana Ghosh

Impact of MGNREGA on Livelihood of Rural Poor in India: A Study Based on National Sample Survey Data

Using difference-indifference frame work, an evaluation study has been made on the MGNREGA on livelihood of the rural poor in terms of its impact on food, non-food and average monthly per capita expenditure. An alternative methodology has been developed to handle the problem of identifying target households utilizing large sample survey data from a secondary source, like NSSO, and novelty of the work lies in developing this alternative methodology. The study found that households who did not take MGNREGA jobs are well-off compared to the beneficiary households in terms of the study variables mentioned above. The time trend showed the overall growth impact as being stronger than the true effect of the program.

Saswati Das

Linguistic Research Unit, Kolkata

During the period (from April 2014 to March 2015) the *Linguistic Research Unit* of the Institute is continuing with its programs of research in the area of *Cognitive Linguistics, Corpus Linguistics, Computational Linguistics, Language Technology, Sociolinguistics, Field Linguistics* and *Descriptive Linguistics*.

Substantivist Lexicological Study of Bangla

A substantivist study of conceptual networks on the basis of *Whole Word Morphology* is in progress. Earlier work has demonstrated a connection between this inquiry and the linguistics of lexico-phrasal difficulty. The work now being done is part of a long-term exercise in the domain of conceptual structure studies with reference to the lexicon. The purpose is to develop empirical base for a corpus-based electronic lexicon for Bangla. A corpus-based electronic lexicon is an indispensable resource for research and application in Language Technology (LT) and Natural Language Processing (NLP). This type of resource is of use in machine translation, information extraction, word-sense disambiguation, semantic net, ontology, etc. Also, it has direct academic relevance in electronic dictionary and thesaurus development, language teaching (first and second language), discourse analysis, lexical semantics, and language cognition. The Electronic Lexicon envisaged in this research will be the first work of its kind for Bengali, and the enterprise may be extended to other Indian languages if corpora are available. The utility of the work is further enhanced by two specific features. First, the proposed Lexicon is of the Differentiated type in the sense of Dasgupta, Misra and Datta (2002). In a Differentiated Lexicon, the asymmetry between peripheral and kernel items drives intra-lexical glossing, and the artificial metalanguage Esperanto serves as the glossing mediator, on cognitive-scientific grounds provided in Dasgupta (2006). Second, the proposed Lexicon not only uses frequency within the corpus to determine the kernel-periphery boundary but also provides specific frequency data for each lexeme. This will be the first electronic lexicon for Bengali.

Probal Dasgupta

Interlexical Study of Asamiya in a Substantivist Framework

The purpose of this project is to develop the empirical base for electronic lexical resources for Asamiya. Electronic lexical resources are an essential presupposition for other sectors in research within the domains of Language Technology (LT) and Natural Language Processing (NLP). This type of resource is of use in machine translation, information extraction, word-sense disambiguation, semantic net, ontology, etc. Also, it has direct academic relevance in electronic dictionary and thesaurus development, language teaching (first and second language), discourse analysis, lexical semantics, and language cognition. The proposed lexical resources will set a precedent for Asamiya, and the enterprise may be extended to other Northeastern Indian languages for which background descriptive material is available on a similar scale. The utility of the project is further enhanced by the fact that it extends the advances in interlexical understanding attained in the context of earlier research on Asamiya, Boro and Bengali.

Probal Dasgupta

Sociolinguistics

The unit has taken up studies in linguistic (lexical and syntactic) difficulties in cognition of language in different discourse frames. The sociolinguistic dimension of linguistic difficulty has been studied within single languages, in relation to the mapping between the full conceptualization system and its basic level kernel, and across languages in the Indian context. Here the important target of study has been the place of English in the sociolinguistic fabric of India.

Probal Dasgupta

Corpus Based English Language Teaching (C-BELT) System

LRU is working towards developing a generic model for Corpus-Based English Language Teaching (C-BELT) for the Bengali speakers. It has been observed that the idea of teaching English language to learners with direct reference to English Language Corpora (ELC) is a more useful strategy, as data and information obtained from modern ELC provide authenticity and reliability towards the process of teaching English as a second language to the learners. We propose to access and utilize the English Language Corpora directly in classroom situation with information obtained from corpora through utilization of corpus processing techniques, such as, concordance, lemmatization, POS tagging, morphological processing, bilingual lexical databases, etc. for teaching English to the Indian learners. We also propose to encourage Indian learners to extract relevant linguistic data, examples, and information from the English Language Corpora to increase their knowledge in the language as well as enhance their communicative competence and communication skill in English in various interactional environments. Furthermore, we envisage English Language Corpora as an authentic source of data and linguistic information, which may be directly utilized for developing ELT text books, bilingual dictionaries, dictionary of idioms, phrases and proverbs, graded vocabulary, and primary and advanced grammar books for the Indian learners. We are planning to generate a lexical database of basic and graded vocabulary of English from the English Language Corpora to be used in the development of a C-BELT system for the Indian learners.

Niladri Sekhar Dash

Domain-Specific Parallel Translation Corpora from Hindi to Bengali

We are developing a Hind-Bengali parallel translation corpus keeping Hindi as the source language and Bengali as the target language. The second phase of the project (ILCI-2) has so far produced 35,000 Hindi-Bengali parallel sentences covering two domains of information sharing: Agriculture and Entertainment. Each sentence has an average length of sixteen (16) or more words in the target language output. The most vital feature of this bilingual parallel sentence database is that parallelism between the two languages (Hindi and Bengali) is maintained and preserved at both semantic and syntactic level (i.e., structural and thematic parallelism) – making the translation corpus an indispensable resource for cross-lingual information retrieval, bilingual lexical database generation, bilingual dictionary compilation, bilingual wordnet development, word sense disambiguation, domain-specific lexical database generation, translational equivalent extraction, core grammar development, machine translation, language teaching and cross-cultural research. The second phase (ILCI-2) has started in April 2012 and is scheduled to end in September 2015.

Niladri Sekhar Dash

Bengali Web Corpus (a Multidisciplinary Monolingual Bengali Corpus with Web Texts)

As an important component of Indian Languages Corpora Initiative (ILCI-2) project, we are developing a multidisciplinary and multidirectional monolingual Bengali corpus (Bengali Web Corpus) with text data retrieved from internet, digital portals, and web pages. At present it contains more than 30,000 sentences obtained in equal proportion from the domains of games and sports, tourism, economics, art & culture, entertainment, literature, and politics &public administration. We have tried to address the methods and strategies that we applied for this purpose; the issues that have cropped up in the act of generating the whole corpus database; and the major problems that we faced at the time of creating the corpus. Fishing language data from the web and harvesting the Bengali web corpus may be treated as a milestone in the history of Bengali corpus development, which holds tremendous potentials for opening up new avenues for web crawling and language corpus building in the wider spectrum of language technology, and applied linguistics. An on-line version of the corpus will contribute towards building an interface where language users will be allowed to navigate through the web-enabled corpus to address their linguistic needs. Along the side of corpora generated from printed texts, the corpus produced from web texts may be used in natural language processing, linguistic resource development, cross-lingual communication, globalization of linguistic profiles and language resources,

digital lexical database, computational lexicography, language planning and E-governance. Here lies the theoretical relevance, empirical pertinence, and functional importance of this work which seeks to propose a makeshift guideline for the new generation of corpus developers in Indian languages.

Niladri Sekhar Dash

POS Tagging of Bengali Words in the Bengali Corpus

We have developed a well-planned and hierarchical POS tagset for the Bengali text called the “BIS Bengali Tagset” (for the Bureau of Indian Standard) as a benchmark standard to be used in POS tagging of Bengali text of all types. We have used this POS tagset to develop a POS tagged corpus of 50,000 Bengali sentences relating to health and tourism domains as well as 10 thousand sentences from the Bengali web corpus. An important bi-product of this work is the generation of POS tagged digital lexical database for Bengali which is now being used to compile digital Bengali dictionaries, thesauruses and wordnet. The database can also be used in some other NLP works such as information retrieval, grammar development, machine learning, language teaching, word sense disambiguation, lemmatization, morphological analysis, and in mainstream and applied linguistics. The POS tagset as well as the POS tagged Bengali corpus is available at the TDIL Data Centre, Govt. of India homepage.

Niladri Sekhar Dash

Digital WordNet for Bengali

We have developed a WordNet for Bengali that stands parallel to other wordnets developed for other Indian languages, e.g., Hindi, Sanskrit, Marathi, Konkani, Urdu, Oriya, Gujarati, Kashmiri, Tamil, Telugu, and Malayalam, etc. We have adopted an intricate interface of lexical structure made of synsets (i.e., set of synonyms) where semantic relations of words, in which synsets act as sets of synonyms to refer to similar or near similar concepts, are linked up with one another in implicit dichotomies of semantic relations like hypernymy and hyponymy (is-a relation), meronymy and holonymy (part-of relations), and troponymy (manner-of relations), etc. expressible through their conceptual linkages in the wordnet. In the act of Bengali wordnet creation, the central focus is concentrated not on the words but on the concepts the word(s) are capable of denoting. Based on the idea of covering a large number of senses within a generic frame, we have used the Expansion Approach, since our primary goal is to link up the Bengali synsets with the synsets of other geographically, genealogically and typologically related Indian languages along with English wordnet. So far we have completed 36,000 synsets and are on the process of creating more than 1000 Language Specific Synset (LSS) that are meant to represent the uniqueness of Bengali life, living, language, people, and culture in the WordNet.

Niladri Sekhar Dash

SHELL System for Teaching English to Bengali Learners

Think of a situation when English is being reintroduced in Bengali after a gap of nearly 20 years at the primary level. At the crucial stage of reintroduction of English at primary level in West Bengal it is noted that there is neither suitable textbooks, nor good ELT resources, nor trained teachers who can make this mission successful. That means there is no academic support of any kind that can be accesses and utilized for fruitful execution of ELT courses in the state. Keeping this state of affairs and the target learners in mind we have proposed a strategy for developing ELT textbooks in such a way that the target learners are able to learn English, at least at the initial stage of learning, at their own ways through direct utilization and assistance of their mother tongue. Since there no one to help them learn English, the learners will help themselves in this process of learning. Therefore, we call this strategy as the Self Help English Language Learning (SHELL) system. This new strategy is adopted in an experimental basis for developing text books and learning materials for the new generation of Bengali learners who are being exposed to English for the first time in life at the primary level. Let it be assumed that the target learners, for which this method is being proposed, have acquired some kind of

linguistic efficiency in their mother tongue, and are now sent to primary schools to learn English as a second language. It has been also assumed that these students receive no academic help or tutorial support from their parents in the act of learning English, since these students are mostly first generation learners. What they can expect is a kind of passive help or guidance from their teachers only at school hours. At present, we have completed the task for developing resource that can guide Bengali children to learn orthographic forms, pronunciations, and usage variations of the English vowels and consonants with direct use of their mother tongue – Bengali. Now we are trying to develop the GUI for the application purpose.

Niladri Sekhar Dash

Field Linguistic Survey at Linguistic Field Surveys in Jharkhand

We have conducted Linguistic Field Surveys at four villages in the district of Ranchi, Hazaribagh, and Ramgarh in the state of Jharkhand among the native Khortha speakers for the purpose of elicitation of samples of spoken data in the form of lexical list, sentence list, and free discourse speech along with some recordings of local songs, lullabies, riddles, death songs, birth songs, marriage songs and other socio-cultural events and narrations thereof. The primary purposes of this survey are to digitally record and document the linguistic details of the language and its speech community for its preservation and promotion. The utilization of the Khortha speech database may be realized in understanding the general as well as special linguistic features and phenomena of the language, recording its separate linguistic identity with regard to the standard variety and other sister varieties; developing general and special lexicon of Khortha; writing descriptive grammars; producing texts and study materials; compiling dictionaries and thesauruses; and producing information for standardization of Khortha. The Khortha speech corpus is now available for other branches of social science like anthropolinguistics, ethnolinguistics, sociology, demography, history, sociolinguistics, psycholinguistics, ecolinguistics, culture studies, etc.

Niladri Sekhar Dash

Bengali Pronunciation Dictionary in Electronic Form

The objective of this project is to develop a Bengali pronunciation dictionary in electronic and printed form with the lexical database obtained from a corpus of modern Bengali texts. It will become an indispensable resource for research and application in applied linguistics, lexicography, speech technology, language technology, and language processing. Till date, we have collected a lexical database of 60,000 words from a printed Bengali dictionary and from a large lexical database of the modern Bengali text corpus. The wordlist includes all Tatsama, Tadbhava, Deshi, and foreign words of different forms and part-of-speech. These words are being used in the pronunciation dictionary in their lemmatized and alphabetically sorted form. To avoid linguistic controversies, the spelling of the words is fixed following the proposal of the *Pashchimbanga Bangla Akademi, Kolkata*. Each word is being transliterated in Indic Roman tagged with diacritics for all types of end users. Accepted pronunciation of *Standard Colloquial Bengali* (SCB) is adopted for the words, and this is presented in standard Bengali script for those people who know Bengali script but do not know IPA; as well as in IPA for those people who know IPA but do not know Bengali script, particularly the learners of Bengali at various universities and institutes in Europe, USA, and other countries. The meaning for each word is given for sense disambiguation and pronunciation determination, which is particularly useful for those homographic and homophonous homonyms (words having similar orthographic forms or pronunciation but different meanings). The audio output of pronunciation of the words will be available in sentence-free and sentence-bound contexts. At present, pronunciation details of the vowel-initiated words are complete. We are working on the remaining words included in the dictionary. The work of project will continue for next three years.

Niladri Sekhar Dash

Population Studies Unit, Kolkata

Gender Inequality in Health Care Status of Indian Children

The study aims to investigate the gender inequality in health care services (preventive and curative care) among children aged 0-6 years in Indian states. It is observed that female children are more likely to be discriminated in the matter of health care services. Attempt are being made to study gender disparity in health care status of children by important socio-economic and demographic characteristics, namely, education level of women, caste, religion, wealth status of household, female autonomy, number of living children etc. using National Family Health Survey (NFHS 2, 1998-99 data) and (NFHS 3, 2005-06 data), a sample survey conducted by International Institute for Population Sciences (IIPS), Mumbai, India.

Subhash Barman

Gender Disparity in Nutritional Status of Children in India

This study attempts to examine the gender disparity in nutritional status of children aged 0-6 years in India. Female children who suffer from malnutrition are more likely to face discriminating attitude in the household. To find out the gender disparity in nutritional status among children, a set of socio-economic and demographic variables have been applied using National Family Health Survey, NFHS 2 data (1988-99) and NFHS 3 data (2005-06), a sample survey conducted by the International Institute for Population Sciences(IIPS), Mumbai, India.

Subhash Barman

Co-relates of Fertility Preference among Currently Married Women in Indian States

The objective of this study is to explore the fertility preference among currently married women aged 15-49 years using National Family Health Survey (NFHS 3, 2005-06) data, a sample survey conducted by International Institute for Population Sciences, Mumbai, India. Attempt is made to estimate the fertility preference by some socio-economic and demographic characteristics, namely, female autonomy of the women, number of living children, sex composition of children, incidence of child death, education level of the women, wealth status of household, exposure to media, caste and religion of the head of the household.

Subhash Barman

Developmental Challenges and Associated Demographic and Socioeconomic Factors within the Children of Purulia District, West Bengal

Childhood disability is mostly a consequence of developmental delay and challenge. Much of the disability burden can be reduced if the developmental delays are detected early and Early Intervention is initiated, thereby averting a permanent disability. If the major contributing factors to developmental delays are identified and treated on regular basis, the burden of developmental challenges and ultimate child disability could be largely reduced in India. Unfortunately, till lately, little emphasis had been laid on the medico-social aspects of underlying aetiology of these conditions, of which very scanty data is available. The task of the present study is to conduct a household survey among the developmentally challenged children to understand contextual factors, particularly on the demographic and socioeconomic factors representing the background of a child's life and living along with parental characteristics (age, gender, ethnic, education, household wealth, health, etc.). The final objective is to utilize the collected data to explore associations between existing developmental delays in children's activities and participation in life situations, and their contextual factors. The household survey has conducted in the 9 blocks of Purulia district among the identified developmentally challenged children having locomotor, hearing, speech, cognitive or social problems. Preliminary observations show that, motor delay, tone abnormality, cerebral palsy and speech delay are more common within the children having developmental delay. Among the high risk children for the study 30 percent found having the

problem of developmental delay. The probable causes for the problem are low birth weight, malnutrition, twin baby, preterm birth (less than 37 weeks) etc.

Partha De

Under-Nutrition in Children under five years in Purulia District of West Bengal

Under-nutrition is the single largest contributor to child mortality. It is well documented that prevalence of under-nutrition among children in India is amongst the highest in the world. Not only the hunger caused by the poverty is the only determinant of malnutrition, other factors like availability of MCH services, feeding practices, quality of water, hygiene and sanitation, women status, birth weight etc are also crucial determinants of under-nutrition in children in India. The aim of the study is to assess the nutritional status by the standard indices like underweight, stunting and wasting. Bivariate and multivariate analysis has performed to determine the differentials of under-nutrition in below five years' children by explanatory variables.

Partha De

The reasons for dropout of mentally retarded children from therapeutic intervention

The early intervention is the best way to improve the condition of special children those who suffer from various physical and mental problems. Either the parents or guided by the doctor these children are brought to the developmental clinic for therapy to consult with a developmental pediatrician, developmental psychologist or pediatric neurologist. But it is frequently observed that before their proper improvement or achievement many of the children drop out from therapeutic treatment and follow up. Present study deals with the problem to find out the reason behind the dropout of such children from therapeutic treatment. The study was conducted in a developmental clinic in North Kolkata of West Bengal. The present study aims at detection of causes of dropout among mentally retarded (MR) children those who were receiving treatment and services from the developmental clinic. From the study it is evident that the cost and distance are the major two issues in case of dropout from therapeutic intervention. Significant portion of parents does not believe in this type of therapeutic intervention and others does not like to recognize the problems faced by their children and thinks the problem will be eliminated in the due course.

Partha De

Psychology Research Unit, Kolkata

Cognitive Processing through PASS model and its role in determining Academic Performance of School Students of North – Eastern India

The objective of the project is to find out the role of planning, attention, simultaneous and successive processes of Cognitive functioning in determining academic performance of primary school students. The study will also try to find out the effectiveness of the reading enhancement training programme and thereby its effect on academic performance of low achievers. In this connection three states of North- East India namely, Tripura, Mizoram and Assam were selected and 234 data were collected from 10 schools through SRSWOR. From these states, low achiever group from two schools of West Tripura district were selected for conducting the intervention program of PREP under Cognitive Assessment System. The findings of the study indicate positive effect of Pass processes on academic achievement. Results also revealed that low achiever group benefited from the PREP training.

Anjali Ghosh and Manjusha Adak

Development of Information processing test through Successive Learning

The objective of the study is to develop a test of information processing through successive learning. The test has two parts: sentence repetition and word series. Sentences Repetition test containing

meaningful sentences both in English (containing 14 items) and in Bengali (containing 22 items) were prepared based on the Class IV Syllabus of Tripura Board. The students are required to repeat each sentence exactly as it was presented. In Word series, a series of Bengali Word given in increasing length from 2 to 10 were prepared. Special feature of this test was that the students' participation in formation of word series had been into account. Students were asked to suggest names of flowers /fruits /sports /sweets /animals /birds /dresses /etc. and thereby a collection of 18-20 such words were complied and these were arranged suitably for preparing the successive information processing test under Word series. The span of the increased from two to ten. The Word series test requires the students to repeat words in the same order as read by the test examiner. Reliability and validity of the tests are being developed.

Anjali Ghosh and Manjusha Adak

Development and Validation of a Cognitive measure for Juvenile Delinquent in the Indian Context

The aim of the study is'' Development and Validation of a Cognitive measure for Juvenile Delinquent" in the Indian Context. Test items were developed for this purpose under three domains, namely attention, language processing and behavioural inhibition. A pilot study is being conducted on 30 official delinquent juveniles and 30 matched non-delinquent juveniles. Final study would be conducted on 100 official delinquent juveniles and 200 matched non – delinquents juveniles. The data would be collected from the state of West Bengal.

Tanushree Moitra and Anjali Ghosh

Differential validity of computer programming abilities

Objectives of the study were to examine differences in correlations between computer Programming abilities and academic achievement across sub groups. Data were collected from 2083 students. Initial analysis shows differential coefficients across different subgroups like gender, cast and religion. No differences were found in grades. Both academic achievement and computer programming abilities were significantly correlated with socio-economic conditions.

D. Dutta Roy and Parama Gupta

Visuo-spatial Reasoning abilities among adolescent high school students

Visuospatial reasoning is the ability to construct and hold information spatially and manipulate the relations among events so as to reason out a valid and consistent inference based on the given information. Aim of the study was to examine extent of relations between visuospatial reasoning abilities and mathematics achievement of the high school students. Data were collected from 148 high school students (Boys=56; Girls=92; Mean age=13 years) by administering paper-pencil tests assessing the four visuospatial reasoning abilities. Results reveal that the visuospatial reasoning abilities are positively and moderately correlated with mathematics achievement in a significant manner.

D. Dutta Roy and Sumona Datta

Cognitive Self-Efficacy in Schizophrenia

Patients with schizophrenia have marked deficits in cognitive and social functioning. It is assumed that symptom severity can be reduced with the change in cognitive self-efficacy level. Cognitive self-efficacy Questionnaire (CSEQ) was administered to 150 patients diagnosed with schizophrenia according to ICD-10 were taken from the Department of Psychiatry of different Post-Graduate hospitals of Kolkata. Positive and Negative Symptoms Scale for Schizophrenia (PANSS), Schizophrenia Research Foundation, India-Social Functioning Index (SCARF-SFI) and cognitive test battery consists of Trail making, Stroop Test, Digit span test and Verbal fluency tests were also administered. To compare cognitive functions, 50 matched normal controls were taken after screening with General health questionnaire-12 (GHQ-12) and Mini mental status examination (MMSE). Results

revealed that the Cognitive self-efficacy is multi-dimensional composed of three dimensions: Contextual self-regulation, Efficacy &Flexibility and Inter & Intra-personal coping. Cognitive functions of schizophrenia group found to impair as compared to normal control group. Further meditational path analysis revealed that cognitive self-efficacy plays a mediating role between both cognitive function-social functioning and cognitive function- symptom severity relationship.

D. Dutta Roy and Shivani Santosh

Innovative Self-efficacy of school teachers

The innovative self-efficacy is one's own capability to perform innovative task effectively to attain certain desired goals. Objectives of the study are (a) to develop a scale for assessing innovative self-efficacy of school teachers, and (b) to find out whether school climate or the innovative self-efficacy factors are important for innovation in teaching. One 25-item Likert type rating scale was constructed to assess five domains of Innovative Self-efficacy and it was administered to 300 (male=96 and female=104) secondary school teachers of both private and government schools. Principal component Analysis (PCA) was done. Innovative work behaviour scale (Janssen, 2000) and School Climate Perception (Johnson, Stevens and Zvoch, 2007) were also administered. Principal component analysis extracted two factors accounting for 60.7% of total variances. Linear regression analysis results showed innovative self efficacy is a strong predictor of innovative work behavior than school climate factors.

D. Dutta Roy and Anurupa Kundu

Reliability of self-care efficacy in diabetes

Incidence of diabetes is on the rise. Management of optimal level of blood glucose is dependent on performing essential self-care behaviours. It is necessary to assess patient's confidence in their ability to perform these behaviours. There is a contribution of a tool that assesses self-care efficacy of the patients. Objective of the study was to ascertain the psychometric properties of the 44-item 5 point Likert type rating scale with an established diabetes self-efficacy tool (PDSMS), self-care activities and glycemic control as measured through glycosylated haemoglobin (HbA_1C). 200 diabetes patients were surveyed. Cronbach's alpha coefficient for the overall scale was 0.87 suggesting good reliability with respect to internal consistency. Results also showed that self-care efficacy was significantly related to domains of personality, diabetes self-care activity and measure of glycemic control, glycosylated haemoglobin (HbA_1C).

D. Dutta Roy and Sravanti Adhikari

Parenting style and academic achievement of the school students

The aim of the study was to develop a parenting style questionnaire because parents have the main responsibility for socializing their children and they cannot avoid having an impact on their children's personality, character and overall academic achievement. Exploratory research has been done. In the first stage of the project separate questionnaires have been prepared and four factors have been selected for consideration in the preparation of questionnaires namely Authoritative, Authoritarian , Permissive and Neglectful. For the final stage, the aim was to Investigate the relation between different parenting styles and academic achievement. For this purpose, the data have been collected from the students of the sampled school in urban and rural area of two districts in West Bengal and their parents. At the same time academic achievement marks of the students have been collected. Results revealed that the Authoritative Parenting Style have significant positive correlation with students' Academic Achievement whereas other three parenting styles viz., Authoritarian, and Neglectful have negative correlation with academic achievement.

Rumki Gupta and Jayeta Dhara

Self- esteem and Coping strategies in University students

The objective of the present study is to assess self-esteem and coping capability of University students. Data collections have been done from 150 students of Education Department of University

of Calcutta and State University, Barasat. We have seen that there is no significant difference between male and female student regarding self–esteem. But there is a positive gender difference between self-efficacy and coping strategies. Literature also suggests that boys are usually more problem oriented, using more direct actions to solve their problems. But girls use more strategies related to wishful thinking than males.

Himani Bhattacharya

Determinants of fertilizer purchase decision

In Agricultural marketing, analysis of purchasing behavior is important for segmenting the market. This study investigates the factors farmers consider to purchase fertilizer and how their socio-economic condition affects purchase decision. Data were collected from 200 farmers of Birbhum district through 30-item structured schedule. It is noted that farmers gave maximum priority on quality of fertilizer, landscape and type of crops they cultivate. Least preferred determinant was price.

D. Dutta Roy and Kausik Choudhury

Medical Healthcare Insurance Need

Objective of this project was to explore the relative importance of the need of the 'Medical HealthCare Insurance'. Data were collected from 107 insurers and non-insurers with Questionnaire. Results identified most important needs are Risk Aversion (76.96%), Family Health Security (69.16%), Protection Against Healthcare Expenses (63.55%), Pharmaceutical Cost (60.75%) and Tax Benefit (57.01%).

D. Dutta Roy and Sourav Maitra

Sampling and Official Statistics Unit, Kolkata

Agent Intermediate Lending;

Distributive Impacts of Loans to Finance Smallholder Agriculture;

Market Structure and Middleman Margins in Potato Markets in West Bengal: Evidence from Trader Surveys

Pushkar Maitra, Dilip Mookherjee, Sujata Virasia, Alberto Motta and Sandip Mitra

Assessing the Relative Importance of Information and Credit Constraints: An Empirical Study of Agricultural Sales

Pushkar Maitra, Dilip Mookherjee, Alberto Motta and Sandip Mitra

A Study on Arsenic Contamination

Ayanendranath Basu, Partha Ghosh and Sandip Mitra

Strategic Litigation---- A study on sales tax in West Bengal

Sugata Marjit and Sandip Mitra

Data Link Initiative

Sharon Buteau and Sandip Mitra

Estimating the size of homogeneous population via Bayesian method under a complex dual-record system

Kiranmoy Chatterjee and Diganta Mukherjee

Politics of Violence: Identity, Isolation and Strategy in Insurgency Areas of India

Abhinandan Sinha and Diganta Mukherjee

Capturing variation in ageing of population in selected states in India

Population ageing is taking place with varying rates in different states in India. The pattern of ageing varies from one state to the other. The study attempts to capture quantitatively the patterns of ageing in selected advanced, moderately advanced and less advanced states by using census data over the period 1961 to 2011. The states considered are Tamil Nadu, Maharashtra, Gujarat, West Bengal, Andhra Pradesh, Madhya Pradesh, Rajasthan, Bihar and Uttar Pradesh. By making use of selected indices, the study attempts to measure the extent of ageing and establishes how demographic dividend is associated with the advancement of the states.

Prasanta Pathak

Chance of labour absorption in workforce by age, sex, education and residential area over different districts in West Bengal, India

Based on Census data of 1981, 1991 and 2001, the study attempts to estimate the temporal changes in the chances of labour absorption in workforce in different states in West Bengal. It also finds out how the chances vary with age, sex, level of education and residential area. Based on an elaborate statistical analysis, the districts have been categorized in terms effective chance of getting absorbed in the workforce.

Prasanta Pathak

Protection of privacy in generating randomized response by inverse mechanism

Protection of privacy is to be importantly considered while estimating the sensitive population proportion or population mean by randomized response technique. It has been observed by many researchers that protection of privacy behaves in the reverse way of the efficiency of an estimator. In the present study of estimating sensitive population proportion using randomized response by inverse mechanism the behaviour of privacy protection is being studied under unequal probability sampling of respondents.

Kajal Dihidar

Determination of robust optimum plot size and shape - a model based approach

This study considers the problem of determination of optimum plot size in field experiments which is an aspect in the general subject area titled “Design of Experiments” identified in the second decade of the last century (twentieth century). The importance of this problem stems from the fact that Fisherian classical analysis of variance technique assumes independence of observations when applied to real life data from designed experiments. But it is not an usual phenomenon that the data obtained from field experiments are often found to be spatially correlated. For such data, the spatial heterogeneity can be discovered by using the variogram technique. The present study explores the effect of different plot sizes and shapes in discovering the point attaining the minimum radius of curvature beyond which the variogram assumes stationary values with further increase in displacements. The investigation is done in case of the most commonly employed models incorporating correlation structure which are assumed to represent real-life data situations.

Satyabrata Pal, Gautam Mandal and Kajal Dihidar

On the comparison of some randomized response techniques under unequal probability sampling and super population modeling

In this study the problem of estimation of sensitive population proportions using several pioneered randomized response techniques are considered under unequal probability sampling. Under a super-

population model approach Horvitz Thompson's strategy and Murthy's strategy are compared for this problem.

Kajal Dihidar

Estimating sensitive population proportion by generating randomized response following direct and inverse hypergeometric distribution

Estimation of sensitive population proportion is considered in this study by generating randomized responses with direct and negative hypergeometric distribution. We consider sampling of respondents by general sampling schemes having the positive inclusion probabilities for single and paired population units. Essential theoretical derivation for unbiased estimator, variance and variance estimators are presented in this study. Two approaches are compared here with a numerical illustration.

Kajal Dihidar

Measuring Outsourced Manufacturing Process in India – Relevance in National Accounts Compilation

The study attempts to measure the prevalence of and changes in outsourcing activities in different manufacturing activities, in terms of their shares in total number of units, workforce and contribution to domestic product. The paper examines certain issues of relevance in the context of compilation of national accounts. It demonstrates possible presence of under-coverage, misclassification and reporting bias that are likely to affect the estimates of domestic product.

Mrinal Bhaumik and Aloke Kar

Sociological Research Unit, Kolkata

Gender and Labour: A Study of Coffee Industry of Karnataka

In the labour intensive coffee plantation industry of Karnataka, women constitute more than 55% of its workers. Secondly, women's presence in the coffee manufacturing industry other than plantation is nearly 30% that comprises non-manual work. The total number of permanent and casual labour that works on these lands is estimated at 5.35 lakhs. This estimate made by the Coffee Board does not include the contribution of family labour, which is significant. However, an institution such as UPASI (United Planters Association of South India) estimates that the total labour force that toils to produce India's coffee is 10 lakhs. The main features of coffee industry is that their structural concentration in terms of their size. The bulk production in coffee (60 per cent) comes from the small holdings (0-2 hectare; 42.2% of total 3.8 lakh hectares area under coffee cultivation) and the share of women labour is 55% of the total workforce which is highest among plantation industry (Govt. of India, 2009) while 30% of women workers are concentrated in the coffee manufacturing sector. There are variations in the forms of production; from large-scale factories to home-based services. Since factories themselves are not monolithic in terms of employment practices and production methods, the study attempts to compare women's experiences in different sectors of the coffee industry. It explores how gender relationships are experienced and perceived both in the family and at work. For example, recruitment practices for all these different types of workers may reflect the many different ways in which the said industry draws upon embedded social divisions in its recruitment policies, channelling workers of different genders and ethnic groups into specific occupations. This study anticipates how gender hierarchies, which have been firmly established by society, are extended and maintained in the industry.

Molly Chattopadhyay

Contextualizing Intergenerational Mobility of Women 'Techies' of Kolkata

Women's education and employment provide the basic f framework for their emancipation and scope

for social mobility. The study discusses education and occupational status of mothers with those of their daughters to understand aspects of social mobility. The observations are recorded during face-to-face interview with the professionals working in software industry in Kolkata. Data were collected using a predesigned questionnaire. The objectives and subjective indices of intergenerational mobility in terms of education and occupational status of mother's with that of respondents is highlighted here. The study concludes by showing positive trend of mobility among the professionals in terms of access to educational and career opportunities unlike that of mothers'. The change is well supported by shift in societal attitude that has outgrown from societal conservatism.

Bhola Nath Ghosh and Asmita Bhattacharya

Causes of HIV/AIDS in underdeveloped Countries: A critical Review

AIDS, is relatively a new disease, was first recognized in 1981. This paper reviews how cultural beliefs and customs amongst different societies and other socio-economic factors play important roles in the spread of HIV/AIDS in the societies especially in backward economies of Africa. Many of these beliefs and customs are enshrined within the institution of marriage and the family. Outside the family and the marriage setting, many other predisposing factors have also been at the centre stage of spreading out HIV/AIDS and notable among them include peer pressure amongst individuals, migrations especially of prostitutes and economic limitations. The study suggests that there is need for the government, Nongovernmental organization and civil society organizations such as different religious bodies to come out and engage themselves in mitigating this dangers associated with certain social and cultural aspects of life.

Bhola Nath Ghosh

Development of Tribal Women in Rural Jharkhand

Development is a multidimensional phenomenon. Several attempts have been made to define and prepare a composite index, which captures not only economic but also social, cultural, environmental, psychological, political and philosophical aspects. The primary objective of this paper is to understand the level of development achieved by women in Jharkhand in the beginning of 21st century in the eyes of millennium development goal. For understanding it, we shall try to consider a number of socio-economic variables for estimating the level of women empowerment in the rural set up. A gender empowerment measure (GEM) is constructed according to the UNDP guideline in respect of opportunities for the women. Three key areas are being considered – political participation, economic participation and decision making power and control over economic resources for the said purpose. But considering the extreme rural setting in Jharkhand, we have relaxed the criteria little bit and taken the close substitutes of the variables on which the measure is constructed by the UNDP.

Bhola Nath Ghosh

The Health problems of ageing in India: some theoretical issues

In 2000, approximately 10% of the world's people were 60 years old or older. According to the United Nations Medium Variant population projection, falling fertility and mortality rates will cause this figure to rise to over 20% by 2050. This means that 400 million older people will be living in the developed countries – and over one and a half billion in the less-developed world! Clearly, the interests of the elderly, including their health concerns, are poised to take on greater prominence in coming years.

Bhola Nath Ghosh

Changing Matrilinity of the Khasi Society of Meghalaya

In Meghalaya, the majority of the people actively follow a matrilineal society. The Khasis, the jaintias and Garos practise matriliny with some variation. But, with the development of socio-economic conditions and influence of other social groups every society goes through a change over time. The Khasi society is one of the tribes living in Meghalaya state in northeast India. This tribe draws much attention of the sociologists, because this tribe practices matrilineal system characterized in terms of

marriage, inheritance and residential status after marriage. The Khasi society also is not an exception. The Khasi people came with the contact of British in pre-independent India along with other people from the plain areas and later on with several groups because of the resettlement in these hill areas. Though there is no much amalgamation of different group even after sixty-five years of independence. Thus, here we are interested to understand the present situation of matrilinity in Khasi community, as the Khasi matriliny is in the transition phase and its future is still not properly defined.

Bhola Nath Ghosh

Empowerment of Tribal Women in India: A Brief Review on Actions Taken and Goals Achieved

Goal 3 of Millennium Development Goals (MDGs) is to promote gender equality and empower women. Gender equality cannot be achieved without empowering women, because it is the women who usually do not have the control of resources and decision making powers especially in developing countries like India. To ensure the rights and social life of women, government has formed the National Commission for Women in 1990 and provided reservation of seats in local bodies of Panchayats by the 73rd and 74th amendments (1992-93) to the Constitution of India. In spite of all these efforts, the progress is not very satisfactory. We find women's work participation, that is, participation in work involving production of goods and services for the market, to be low. Over time, the proportion of women agricultural labourers in total workers has increased and for women agricultural labourers, who are growing in both absolute and relative terms, the major issues of concern are the abysmally low level of wages for tasks that women perform and the insecurity of employment and the lack of adequate days of employment. **T**he present study briefly discusses the role of Government towards promoting the empowerment of women and the historical facts revealing the situation of women over the past few decades.

Bhola Nath Ghosh Manoranjan Pal (ERU) and Premananda Bharati (BAU)

Women in Natural Resource Collection: Experience from Rural Jharkhand in India

Women particularly those living in rural areas are very close to the natural environment. Poor families are mostly dependent on nature for their survival activities viz grazing of cattle (pastoral activities), collection of water for drinking and cooking purposes and collection of fuel wood for cooking purposes. The aforementioned natural resource collection activities are considered to be inferior, less remunerative and suitable for the women or young kids to perform. Thus, they are found to be more close to the nature than men and this very close relationship makes them perfect managers of an eco-system. The involvement of women in such activities is also found to be more in the tribal dominated societies. This study tries to examine to what extent women in rural Jharkhand are involved in such natural resource collection and management activities. Also, we tried to unearth various economic and cultural reasons and their impact on the involvement of women in such activities across various social and economic groups. The analysis of primary data collected from the rural areas of tribal dominated Jharkhand reveals that income, occupational and status of the families have significant inverse link with the involvement of women and also of girl child at the cost of their educational prospects. Religious and cultural beliefs also enter in the determination of extent of involvement of women and children in the rural society. It is also an indication of the low empowerment level of the rural women in the study area.

Bhola Nath Ghosh and Utpal Kumar De

Existing Status of Milk Co-operatives in India: The case study of West Bengal

This study reviews the existing status of milk marketing and dairy co-operatives in India. It is found that the dairy co-operatives play a vital role in alleviating rural poverty by augmenting rural milk production and marketing.

Bhola Nath Ghosh, Kamalaksha Das and Ranjit Karmakar

NREGA on Women in West Bengal

The National Rural Employment Guarantee Act (NREGA) has special provisions to ensure full participation of rural women and perhaps, this Act has succeeded in bringing large numbers of women into paid work, many of them are the first time. NREGA has made female workers more self sufficient and it is expected that the living standard of rural poor women would be brought up. It is observed that participation of women during the execution of the scheme in different Gram Panchayats has been very high. The objective of the study is an attempt to examine the performance and drawbacks of NREGA of that Gram Panchayats in West Bengal and to analysis the impact of NREGA on the empowerment of women. This paper also tries to explore the socio-economic condition changes of women and also discusses the barriers of women's participation. It is observed that NREGA work has brought about the improvement in the lives of many people especially, poor women, marginal peasants and agricultural workers who are solely dependent on agriculture produce. NREGA has brought in an opportunity for supplementary earnings to the poor villagers who are mostly BPL (Below poverty line) families in West Bengal.

Bhola Nath Ghosh and Sarmistha Roy

Status of Muslim Women: A Case Study of North 24 Parganas of West Bengal

Education is the oxygen of the human beings in the contemporary technology-driven world of knowledge and economy. Low level of literacy and education impede national growth and violation human rights as well as the rights of religious community. The Muslim women tend to suffer not only the problem attached to gender, but also the impoverished minority status of the Muslim community as well as they are also the cultural minority. Muslim women are at double disadvantage with low educational status and community pressure. Their lives, movements in public places are under constant scrutiny and control. The present study examines the reciprocal relationship between literacy and socio-economic determinants as consequences of the low level of socio-economic development of the Muslim Community in West Bengal and attempts to analyse the Muslim women empowerment of the three selected villages of District North 24-Parganas. The study concludes with the suggestions to enhance Muslims literacy, which is an ultimate solution to reduce existing group disparities in socio-economic development in West Bengal.

Bhola Nath Ghosh and Notan Bhusan Kar

Atmospheric Fine and Coarse Mode Aerosols at Different Environments of India and the Bay of Bengal during Winter-2014: Implications of a Coordinated Campaign

In this study, we present mass concentrations of particulate matter [$PM_{2.5}$, PM_{10} size fractions and total suspended particulates (TSP)] measured simultaneously over land stations (Kullu, Patiala, Delhi, Ajmer, Agra, Lucknow, Varanasi, Giridih, Kolkata, Darjeeling, Jorhat, Itanagar, Imphal, Bhubaneswar, and Kadapa), mostly distributed across the Indo-Gangetic plain (IGP) of India as well as in the marine atmosphere over Bay of Bengal (BoB) in the period from 20 January to 3 February, 2014. The main objective of this study was to quantify the continental outflow of particulates ($PM_{2.5}$, PM_{10} and TSP) from IGP and associated regions into the BoB along with low level north-east wind flow during winter monsoon period. This research study provides a glimpse of the aerosol loading over the IGP region.

Anil K. Choudhuri et all

SNA approach for survival strategy of rural poor: A case study from Jharkhand and Bengal

In course of daily life of rural poor, situations often arise when a need is faced by a household which it has to fulfill immediately even by taking help from others and thus they gradually build up social networks among themselves. These social networks work at household level and play an important role as a kind of strategy for survival of the rural poor. In Jharkhand, with the system of Panchayati Raj initiated in very recent (in 2010) as well as almost absence of peasant mobilization, Total Literacy Campaign or organized women's movement, major portion of the people having dependence upon the market forces have, no doubt, extended their livelihoods to various distant urban-industrial job

markets. Unlike in Jharkhand, in West Bengal, socio-economic and political / organizational changes have been taken place. Redistribution of land through land reforms, increase of wage rate and rise of Gram Panchayat have been as a source for the rural poor in West Bengal. Under the circumstances, the present paper intends to apply SNA approach for studying survival strategy of the rural poor in Jharkhand and West Bengal.

Anil K. Choudhuri and Rabindranath Jana

Land Alienation, Dispossession and Displacement: A Reappraisal of Constitutional Safeguards and Tribal Rights

This is a retrospective introspection of land issues and reappraisal of Constitutional safeguards and tribal rights in India. The research activities also provide insights about historic discrimination and dispossession of the poor and indigenous tribal communities; discussion on various issues like land alienation, displacement and tribal movements; and also pinpoints new hopes emerged in the backdrop of the Forest Rights Act, 2006.

Hari Charan Behera

Land Reforms and Record Management in Tribal Areas: Pertaining Issues and Prospects

It is an attempt to understand the socioeconomic and policy dimensions of land reforms and record management in the tribal regions. Further, there is an effort to delineate the issues in land records management and new initiatives undertaken to overcome the constraints in the tribal regions. The researchers also explore the scope for further improvement and discuss the future prospects in land records management in tribal areas in India.

Hari Charan Behera and A.P. Singh

Current Trends in Land Records Management

There is a discussion about contemporary governance initiatives in the country through institutional reforms by adopting new policies and technology. The research theme includes various issues in the land records management, and also focuses India's position in an international perspective. It provides background about India's e-governance measures in land records management such as strengthening revenue administration and updating of land records (SRA and ULR), and computerization of land records (CLR) and also encompasses discussion about more contemporary reform initiatives through the National Land Records Modernization Programmes.

A.A.A. Faizi and Hari Charan Behera

Identifying Existing Capacities to Execute the National Land Records Modernisation Programme in West Bengal: An Appraisal

The study had been undertaken in West Bengal based on the following specific objectives.
(1) To understand features of Bhuchitra software and hardware components and their implications in land record management (2) To appraise the progress made in land record computerization that includes computerization of textual data, digitization of cadastral maps (mauza map and plot maps), online mutation, etc. (3) To appraise the progress achieved in infrastructure development such as Computer Centre, Kiosk setup, modern record room and data centres, NLRMP Cell, etc. (4) To examine the status of service delivery such as Record of Rights, mauza maps, plot map and online mutation in the state (5) To understand capacity building measures/initiatives in modern cadastral survey (6) To identify the gaps and needs in technology intervention, infrastructure development, capacity building and service delivery under NLRMP.

Hari Charan Behera and A.A.A. Faizi

Variation of Adult Heights and Weights in India: State & Zone wise Analysis

In India, gender inequality in nutrition, from infancy to adulthood, is a common phenomenon. Women never reach their full growth potential due to nutritional deficiency. Height and weight reflects nutritional

deficiency. Knowledge of inter-state variations in adult height and weight can help us to explain the differences due to socio-cultural and economic factors like poverty, illiteracy, cultural barriers, concentration of multiple ethnicity, physical geography etc. The study shows a clear positive relation of height with the economic level reflected through wealth index. Education level also has strong positive effect on height. The intensity of mean height, weight and BMI for adult females varies more than that of males but the variation pattern is similar for both males and females. Socio-cultural differences including differences in economic pattern may be the leading causes in the variation of height weight distribution in the states of India. In this context, level of living and education need to be given proper attention because these two seem to be the most influential factors in improving the health and nutritional status as reflected through height, weight and BMI.

S. Shome, P Roy (BAU), M. Pal (ERU) and P Bharati (BAU)

Women's intra-household decision making power in Jharkhand state, India

This study is carried out in order to see the factors associated with women's intra-household decision making power in a newly formed state, Jharkhand where most of the women are not only suppressed and dominated by their male counterparts but also are the bottom of educational level. A comparison is done to see the exact position of the women in Jharkhand state with respect to India. The study also argues whether women decision making power is related with their educational level, employment, income and other socioeconomic variables. It is found that the relationship between independent characteristics and their ability to influence decision within household depend on the nature of decision under consideration. The result shows a significant association of marital duration and family pattern irrespective of all decisions in Jharkhand state as well as in India, indicating the indirect effect of seniority in marital life. The significant relation of education or earning position with that of intra-household decision is only seen in India and not in Jharkhand, signifying the lack of awareness or low status of the women in the family.

Suparna Shome

Height, weight and BMI of the teenagers: A Comparative Study of Jharkhand, Bihar, West Bengal and Orissa

This paper compares the height, weight and BMI of the 15-19 groups of male and female of four eastern region states of India namely Jharkhand, Bihar, West Bengal and Orissa. It is well recognized that height and weight are interrelated. These are also related with socioeconomic variables. But, does the relation remain same over all teen ager's (15-19 years) height and weight groups in different eastern region states? The objective of this paper is to find the effect of the socio-economic variables on heights and weights for different groups of persons formed according to the different levels of heights and weights and to see whether there are gender differences in the variation of heights and weights in the four eastern region states. Descriptive studies show a clear positive relation of height and weight with the economic level. In case of BMI, it is the age group which seems to be the most influential factor. The notable feature is that percentages of short height in all the four eastern region states are higher in comparison to India (29.5%) in case of male. For underweight, the percentage of West Bengal only is lower than national average. The result is similar in case of short height for the females also and for underweight all eastern region state's female shows higher percentage than national average.

S. Shome, P Srimani, A. De Bose and P. Bharati (BAU)

Women autonomy and its influence on motherhood care

Women's empowerment or autonomy is a part of sociological or anthropological concepts, which recognizes that individuals are strongly influenced by social collectivities that are integrated by common ideological or normative systems. These systems make some norms and rules about many fundamental principles of social life. India shows a diversification in the normative pattern which creates differences in the position of the women in the family or society in different regions of the country. Choices of ones decision-making are very much influenced by these normative systems to

which there social collectivity subscribes. The study is trying to make a common platform to understand women autonomy and links it to another critical area of motherhood care as safe motherhood encompasses a series of practices, protocols, service delivery guidelines etc, therefore a number of autonomy related factors are linked to uptake maternal health services.

Suparna Shome

Performance of Old Adults under Special Adult Literacy Programme of Tripura

Literacy is now considered as a component of development index of any country. It acts as a torch in any age group of people. Besides, it is one of the key weapons of any nation. It is acceptable to not only adult people of age group 15-50 years but also is inevitable for old adults of 51 years & above. In the present paper, it has been attempted to analyze the performance level of an achievement test on reading, writing and arithmetic done by old adults of Tripura across few socio-economic variables. The multi-stage stratified simple random sampling technique (SRSWOR) has been adopted for the study. The analysis shows that moderate performance level has been achieved. The findings of the study are useful to the policy-makers for eradication of illiteracy among old adults of a country.

Tirthankar Ghosh, Himani Bhattacharya (PRU), Rabindranath Jana and Anjali Ghosh (PRU)

Panchayat Raj and Human Development in India with Special reference to Dalits

In India, various development programmes under the Panchayat Raj system have been launched at different time points for people's well-being. But different studies on human development undertaken in Indian context have shown that peoples' felt-need at the grass-root level have, by and large, remained neglected in course of planning for the country as a whole. It, therefore, becomes necessary to study the process of development through panchayat raj in terms of combining their felt-need and the views of programme planning authorities as well as to minimize the gap between them, not merely studying in terms of allocation of financial and material resources. The gap occurs at two levels: conceptualization, that is, formulation as well as implementation. The latter can be remedied by devising an appropriate system of evaluation and monitoring. The former needs serious consideration by the social scientists. A modest objective of the proposed paper is to make an endeavour to contribute in this direction. Further more, being most downtrodden socio-economically as well as since the SC, ST and OBC communities constitute the bulk of the lower rung of the rural population in India; the paper intends to focus upon them in particular. Besides, whether these communities differ from the mainstream response to developmental inputs supplied by the different programmes through Panchayat Raj as well as their utilization will also be considered as hypothesis of this paper. It may also be added that the incidence of poverty in India has not reduced satisfactorily, especially the rate of reduction in poverty is less in case of the people belonging to 'dalits' as SCs, STs, and OBCs of rural India (National Human Development Report, 2001). With this backdrop, the main focus of our study is to identify different socio-economic, socio-cultural and socio-political factors affecting proper utilization of different developmental inputs given through panchayat raj system by SCs, STs, and OBCs in rural area of Easterm India.

Tirthankar Ghosh and Kamalaksha Das

Temporal Trend of Anaemia among Reproductive-Aged Women in India

Anemia is one of the major leading nutritional deficiencies in India. The most vulnerable groups are preschool & adolescent children and pregnant & lactating women. The main objective of the study is to determine the temporal trend of anemia among reproductive-aged women of age 15-49 years. The study uses data from second and third rounds of the National Family Health Surveys (NFHS-2, 1998-1999, and NFHS-3, 2005-2006), conducted by the International Institute for Population Sciences. The striking feature is that the changes in anaemia in all India level are more or less same over time, but there is variation in zone-wise distribution. The occurrence of severely anaemic women in India varied between 1% and 2%. The highest prevalence rates are observed among women who were 15 to 24 years of age, illiterate, from non-Christian scheduled tribes (STs), unmarried, and whose standard of living is low. Rates of anemia have increased over time except in the case of Buddhists, Parsees,

Jains, and the STs. From the viewpoint of our study, it can be said that illiteracy and low standard of living may be the main causes of anemia among women in India. It is also necessary to take appropriate steps to curb anemia in women in their early adult.

Susmita Bharati, Manoranjan Pal (ERU), Suparna Som and Premananda Bharati (BAU)

Domestic violence against women in Jharkhand

A large number of persons in India are victims of domestic violence. Usually it occurs more to women than men. The main objective of this study is to measure the percentage of women who are victimized in various types of domestic violence in Jharkhand and its comparison in respect of all India level. For this study, the data have been culled from NFHS-3 data of Jharkhand state and the sample size is 853 reproductive aged (15-49 years) married women. Background characteristics such as place of residence, women's and their husband's educational status, women's occupational status and wealth index of the family are linked to domestic violence to find the relationship with domestic violence. The major finding of this study is that occurrence of domestic violence is more in Jharkhand in comparison to India. The incidences of domestic violence are found to be very low among the higher educated women and richest families. It is also interesting to know that, among the professionals or service holding women, the percentage of occurrence of physical violence is very high compared to other occupational categories of women and this result is statistically significant.

Susmita Bharati

Labour market discrimination in India

It is well known that labour is the key source of our livelihood and labour market is the platform where we could sell of it to fulfil our need. But the alleviation of hunger cannot entirely supported by one's own attributes like education, sex, age, skill, experience, locality or what so ever. It also depends on the prejudices and likings of the buyers. That segmented the labour market by excluding a large section of people from all types of jobs. The issue of labour market discrimination has received less attention with the main stream of labour studies. In India along with gender disparity the discrimination associated with caste, class, religion, ethnicity etc prevails in the labour market. The distribution of workers is highly skewed along religious lines. Though many affirmative actions had been undertaken from the Government level, SC and ST communities are far away to achieve the satisfactory level of status in terms of employment. Nonetheless, the gender ratio of SC, ST and OBC is higher than the females of general castes in all-occupational subgroups, especially in agriculture, which indicates that the female representation in comparison to male is greater among the socially backward classes. Of course, in Professional Technical class, the GR of general categories have parity with them. In mining, there is a remarkable hike in female share from ST group (0.19 to 0.54 from 1999 to 2005).

Sonali Chakraborty and Molly Chattopadhyay

Unpaid Family Labour in Handloom Sector in West Bengal

Along with labour market segmentation, unemployment, wage differentials, labour force participation the unpaid family labour is also an important issue in the labour market and has received less attention. Women's participation in labour force are overwhelmingly concentrated in household-based manufacturing, where they often serve as unpaid family worker, such as dairying, fisheries, small animal husbandry, handlooms, handicrafts, sericulture etc. Handloom industry is the largest cottage industry in West Bengal and it provides employments in a large number next to agriculture though their income is included in the aggregate income of the family they are not paid individually. It is attempted to explore the full extent of the share contributed by the unpaid family helper to the total income of the family, time spent on that of labour and age-sex specific distribution of them.

Sonali Chakraborty

Comparative Study on Gender Segmentation in Organized and Unorganized Manufacturing Sector of India

This study proposes to compare the quality of female labour force participation, gender segregation, influence of female share in wage rate and employment structure in organized and unorganized manufacturing sector of India. The analysis has been done based on Annual Survey of Industries (2005-06) that covers registered enterprises and National Sample Survey that (2007-08 & 2011-12) covers unorganized manufacturing sector. Measures like occupational gender segregation, simple regression and some basic statistics has been carried out in this context at all India level. The results point out that the segregation of workforce is mainly observed among own account manufacturing of unorganized sector. It is found that females are concentrated in part time jobs in unorganized sector which are home based small enterprises. The share is found mainly in food processing, textile, wearing apparel, tobacco and in basic chemicals from among other manufacturing segments. The devaluation of female has been significant as we see that wage received by the female workers. Despite all initiatives taken from Government side, the share of female labour has declined.

Sonali Chakraborty and Molly Chattopadhyay

Survival Strategy of elderly headed households of rural West Bengal: An SNA approach

In our day to day life, situations often arise when a need is faced by a household which it has to fulfil immediately even by taking help from others and thus they gradually build up social networks among themselves. These social networks work at household level and play an important role as a kind of strategy for survival of the rural people. Several gerontologists have studied on both involuntary and voluntary ties of elderly people from the point of well-being of their mental and physical health. In West Bengal, socio-economic and political / organizational changes have been taken place. Redistribution of land through land reforms, increase of wage rate and effective functions of Gram Panchayat have been as a source for the rural people in West Bengal. Under the circumstances, the present study intends to apply SNA approach for studying survival strategy of elderly (≥ 50 yrs.) headed households in rural West Bengal. The findings of the study will be useful to policy-makers for understanding importance of elderly heads of the rural households in social networks needed for survival strategy.

Rabindranath Jana, Rangasamy Maruthakutti and Anil Kumar Choudhuri

Application of Social Network Analysis in Livelihood System Study

Social Network Analysis (SNA) has received growing attention among diverse academic fields for studying 'social relations' among individuals and institutions. Unfortunately, its application has remained limited in the study of livelihood systems of rural poor. Complexity in rural livelihoods has increased sharply in the face of increased pressure on natural resources and rapid shift in farm-based to non-farm based employments. This poses great challenge to successful livelihood intervention in rural areas. On one hand, rural development/extension needs to cater to diverse information and service need of the rural people; on other hand, rural institutions need to deliver livelihood-sustaining services more efficiently, which often need institutional restructuring at multiple levels. To achieve these challenges, a strong innovative analytical tool is required for understanding the complexity of rural livelihoods and the associated role of rural institutions. SNA provides excellent scope to analyse such complex systems and interactions among their components. This article proposes an outline of using SNA in livelihood system analysis.

Sanchayeeta Misra, Rupak Goswami, Debabrata Basu and Rabindranath Jana

Data Gap in Gender Statistics: Women in Mining Industry

The purpose of this project is to evaluate gender gap in official statistics relating to the number of miners and their wages in India. The compilation of mining statistics assumes importance, considering the pivotal role of the mining sector in Indian economy, both for research and policy-making. There are different agencies that are collecting and disseminating data on mining sector, but there also exists gap in the data between different agencies, particularly in respect of male-female distribution of labour.

Research Activities

Data on number of miners in India is collected by Annual Survey of Industries, Director General of Mines Safety, and Indian Bureau of Mines based on returns submitted by the mining companies (both public and private). On the other hand, based on household data, number of miners is also available from population censuses and National Sample Survey Organisation's (NSSO) employment-unemployment surveys. Amongst these agencies, Indian Bureau of Mines does not provide male female distribution of miners. The scope of the study is to evaluate official statistics on mining covering all over India from 1991 to 2011.

Molly Chattopadhyay

Gender Issues and Empowerment of Women in rural West Bengal

Main objectives of the project are:
(A) To find the status of empowerment in the context of economic, social, education and health in some districts of West Bengal (See Appendix 2 for a list of indicators of empowerment).
(B) To assess the benefit accrued to women through the different developmental programmes taken by the Government India towards empowerment of women (see Appendix 1 for a list of some of the major development programmes for women and for gender equality)

Bhola Nath Ghosh

Dynamics of Land use Pattern in North Chotanagpur Plateau: A Micro-level study

The present study covers 3 villages from two different blocks in Giridih district in Jharkhand. In this research project, the main objectives are (a) to examine the current status of land holdings and land use practices in the study villages; (b) to identify the network of culture, social mobility and land use pattern; (c) to examine both external and internal interventions in land use dynamics; (d) to study landuse pattern and its implications for agrarian social structure; and (e) to find out in what extent the land use practices have affected rural livelihood.

Hari Charan Behera

A micro level study of Television (TV) watching and childhood obesity in Kolkata city of West Bengal, India

Childhood obesity and TV watching are very sensitive issues. Childhood obesity is an emerging problem throughout the world as well as in India, especially in urban areas. Factors contributing to childhood obesity, recently media consumption like TV watching has been detected as the indirect factor to increase the obesity among children because due to TV watching, as no movement occurs, children's metabolic rate reduces which contributes more weight gain. Another factor which causes more obesity among TV addicted children may be changing food habit due to influence of TV Advertisement (Ad).. So it is necessary to estimate the overall prevalence of overweight and obesity among urban children to see the difference of impact of socio-economy and TV watching on childhood obesity and how far the food habit is changing with TV advertisement.

Susmita Bharati

Migration, Social Networks and their impact on rural household of Jharkhand

It has been observed in various studies that migration has brought both positive and negative impacts on the socio-economic conditions in the village scenario. In one hand, migration helps (i) to increase the standard of living of the migrants, (ii) to generate the possibility of investments and savings, and (iii) to slacken the power grasped by the upper-caste land-owners. On the other hand, (i) the income from migration may not be sufficient to balance the excessive expenditure in market products newly adopted through migration, like introducing of catering and decoration in festivals, use of luxurious goods, etc.; (ii) at peak period of cultivation, there is a shortage of labour due to out-migration and, as a result, it creates negative labour impact on production; and (iii) migration contributes to increase in the incidence and spread of different contagious diseases. There are broadly two kinds of migration, like permanent and temporal. The present study will cover seasonal and other temporal out-migration from the rural

Jharkhand. In the context of seasonal and other temporal out migration in rural Jharkhand, the research work attempts (a) to investigate how the migratory channel is opened, and how social network and migration are affected by each other; and (b) to study the positive and negative impacts of migration on the households and the pattern of relational ties among them.

Rabindranath Jana

Economics and Planning Unit, Delhi

The Economics and Planning Unit (EPU) faculty has, as in the past, continued to work on the cutting edge of economics research, both in theory, as well as empirical analysis. Research in mechanism design and auction theory, long a strength of the unit, continues. Research on the theoretical aspects of micro-finance has been conducted. The links between education, health, and other public goods and the distribution of income has been investigated theoretically and empirically. Research on the political economy of NREGS is an active area of research. Social capital and collective action in the Himalayas, the link between climate change and labor productivity, agricultural fires and air pollution, and climate change and electricity demand in India are some of the environmental issues in India on which empirical research has been conducted. Empirical research on schooling and labor force participation has been conducted. In macroeconomics, research on the impact of fiscal policy on growth, distribution and macroeconomic stability continues. In growth, research on models of unbalanced growth also continues to be active area of research. Understanding the economics of higher education is also a topical area of research in the unit.

Here is a more detailed breakdown of research interests:

Ongoing research is on electoral competition and corruption, determinants of women's labour supply in India, school subsidy programs, female labor force participation, and supplementary school feeding programs.

Farzana Afridi

Research on areas concerning micro-finance, committee formation in network industries, conflict and terrorism, among others

Prabal Roy Chowdhury

Research on unbalanced growth

Satya P. Das

Growth inequality trade-offs with human capital investments and optimal taxation, unbalanced growth in India, labour Income shares in the course of development, Small open economy (SOE) RBC model with fiscal policy, terms of trade shocks and optimal monetary policy, monetary policy in India.

Chetan Ghate

Research on mechanism design, game theory, and social choice theory

Debasis Mishra

Research on the political economy of NREGS, the impact of NREGS on credit and on migration, research on returns to tertiary education

Abhiroop Mukhopadhyay

Research on Public versus Private Provisioning

Role of Education and Political Participation; Financing Higher Education: Comparing Alternative Policies; Education Financing Policy: Income Contingent Loans and Educational Poverty Traps; Inequality, Neighbourhoods and Welfare of the Poor.

Tridip Ray

Research Activities

Research on economics of risk and insurance, commodity markets, food policy and technology supply in agriculture

Bharat Ramaswami

Research on the design of random mechanisms in voting environments

Arunava Sen

Environmental Economics

It was found that high temperatures have adversely affected labour productivity in manufacturing industries in India. This impact is expected to become more severe with continued warming due to climate change and urban heat islands.

E. Somanathan

Economic Analysis Unit, Bangalore

The Economic Analysis Unit (EAU) is engaged in research on aspects of socio-economic development using quantitative methods. The research includes studies of incomes of small farmers, impact of caste and exclusion on socio-economic variables, labour markets and occupational mobility, rural housing and housing shortages, and nature of agrarian relations and development of capitalism in different regions of the countryside. The internally-funded project examines the underestimation of operated area in the Land and Livestock Holdings of the National Sample Survey Organisation.

Statistical Quality Control and Operations Research Division

The Division comprises of eight SQC & OR Units located at Bangalore, Chennai, Coimbatore, Delhi, Hyderabad, Kolkata, Mumbai and Pune and the Central SQC (CSQC) Office located in the main campus at Baranagore. The CSQC Office functions as the office of the elected Head of the Division and co-ordinates various activities of the Division.

The activities of the division consist of consultancy and training, research with a focus on the applied one, academic teaching including conducting M.Tech. (QROR) programme at Kolkata, M.S. (QMS) programme at Bangalore and Part-Time Certificate Course at Bangalore and Hyderabad. The faculty members of the division also teach in other academic programmes like B.Stat. and M.Stat. Supervision of Ph.D. thesis along with the dissertation and project work by M.Tech. (QROR) and M.Stat. students are another part of the responsibilities discharged by the divisional members.

The activities of the Division under different headings are furnished in the following.

SQC and OR Unit, Kolkata

Different items produced in industries have different types of specifications for its quality parameters. Process capability concepts developed earlier are mostly usable when a characteristic has both sided specifications. However, circular specification or one-sided specifications are not rare. The methodology developed for two-sided specifications for assessing process capability cannot be applied in such cases. We look into such cases and developed new process capability indices and their properties for such cases. Whenever feasible, we found out the threshold values for such indices.

Ashis Kr. Chakraborty

Many items produced in industries needs multiple quality characteristics simultaneously to be met within some given specification limits to be considered to be of good quality. Process capability for

such cases needs multivariate statistical concepts. We develop some new multivariate process capability indices and studied their various statistical properties.

Ashis Kr. Chakraborty

Existence of solutions for various functional equations arising in multistage decision process

The existence of solutions for various functional equations arising in multistage decision process has both theoretical and practical interest. We establish some sufficient conditions ensuring both the existence and the uniqueness of solutions for the class of functional equations arising in dynamic programming. We use Boyd-Wong fixed point theorem to show the solvability of these functional equations.

Arup K. Das

Optimization in aircraft recovery problem and Portfolio optimization

We carry out an extensive survey work on aircraft recovery problem and portfolio optimization problems to classify the problems for finding solutions. We plan to formulate a type of aircraft recovery problem in line with the result developed for the functional equations in multistage decision process.

Arup K. Das

Optimum bandwidth allocation problem

As a result of the growing number of mobile communication systems, there is an increasing need to allocate and re-allocate bandwidth for point-to-point communications. We formulate a general optimization problem in mobile communication systems and suggest a method for its solution.

Arup K. Das

Optimum progressive hybrid censoring schemes using variable neighborhood search (VNS) approach

This work considers determination of optimum progressive hybrid censoring scheme. Cost and variance minimization based optimality criteria are proposed. It is shown that the proposed criteria are scale invariant. A meta-heuristic algorithm based on variable neighborhood search (VNS) approach is proposed for computation of optimum scheme. A-, D- and T-optimum censoring schemes are also proposed.

Ritwik Bhattacharya, Biswabrata Pradhan and Anup Dewanji (ASU)

Inference and optimum life testing plan under progressively type-I interval censoring

This work considers inference for the unknown parameters based on progressive type-I interval censored data. Asymptotic properties of the maximum likelihood estimates are studied. Approximate tolerance intervals are obtained using the maximum likelihood estimates of the model parameters. A cost minimization based optimality criterion is proposed for determination of optimum life testing plan. It is shown that the proposed cost function is scale invariant. Computation of optimum life testing plans under different scenario is in progress.

Sonal Budhiraja and Biswabrata Pradhan

Bayes Estimation for the Block and Basu Bivariate and Multivariate Weibull Distributions

This work considers the Bayesian inference of the unknown parameters of the Block and Basu bivariate Weibull distribution. The Bayes estimators are obtained with respect to the squared error loss function, and the prior distributions allow for prior dependence among the unknown parameters. Prior independence also can be obtained as a special case. If the shape parameter is known, the Bayes estimators of the scale parameters can be obtained explicitly. If the shape parameter is unknown, the

Bayes estimators cannot be obtained in explicit forms. In this case Bayes estimates are computed by using MCMC technique. Finally the results are generalized for the multivariate Weibull distributions.

Biswabrata Pradhan and Debasis Kundu

Estimation of quality adjusted lifetime distribution using copula

This work considers parametric estimation of QAL distribution using the idea of Pradhan and Dewanji (2009, Statistics in Medicine, 28, 2012-2027), when the sojourn times in different health states are dependent. The main idea of this work is to first derive the theoretical distribution of QAL in terms of the joint distribution of sojourn times. The joint distribution is modeld using copula and estimated by the two-step maximum likelihood method. The QAL distribution is then estimated by replacing the joint distribution by its estimate in the expression of QAL distribution. The asymptotic properties of the estimates are studied. The proposed approach allows us to carry out estimation of QAL distribution in a situation when the illness state may not be observable for some individuals.

Biswabrata Pradhan and Debasis Kundu

Tests of non-monotonic stochastic aging notions in reliability theory

Testing of various classes of life distributions has been a subject of investigation for more than four decades. In this study we restrict ourselves to the problem of testing exponentiality against *non-monotonic aging notions.* We model non-monotonic aging using the notions of *bathtub failure rate*, *increasing and then decreasing mean residual life* and *new worse then better than used in expectation* classes. The different tests of exponentiality against these alternatives are discussed in detail.

M.Z. Anis

Weighted Weibull Distribution: Properties and Estimation

We take a closer look at the weighted Weibull distribution. First, we study the structural properties of the probability density function, hazard rate and mean residual lifetime functions of this distribution. We put forward the estimation for the parameters of the weighted Weibull distribution via maximum likelihood estimation technique. We also obtain expected Fisher's information matrix as well as discuss the existence and uniqueness of the maximum likelihood estimates. With regard to Bayesian inference of the unknown parameters, we use importance sampling technique to calculate Bayes estimates and the corresponding highest posterior density intervals. We perform a data analysis for illustrative purposes.

S. Dey, T. Dey and M. Z. Anis

.

On testing exponentiality against NBAFR alternatives

In this paper, we propose an interesting approach for testing exponentiality against NBAFR alternatives. A measure of deviation from exponentiality has been derived on the basis of an inequality which we have proved. A test statistic has been constructed using density estimators and its asymptotic normality established. The consistency of the said test is also proved.

Aditi Pal, M. Mitra and M. Z. Anis

Inference for the component and system lifetime distribution of a *k*-unit parallel system based on system data

In this paper, we consider the inference for the component and system lifetime distribution of a k-unit parallel system with independent components based on system data. The components are assumed to have identical Weibull distribution. We obtain the maximum likelihood estimates of the unknown parameters based on system data. The Fisher information matrix has been derived. We propose β-expectation tolerance interval and β-content γ -level tolerance interval for the life distribution of the

system. Performance of the estimators and tolerance intervals is investigated via simulation study. A simulated dataset is analyzed for illustration.

Biswabrata Pradhan, S. Roy and M. Z. Anis

Tests for exponentiality against NBUE alternatives: a Monte Carlo comparison

Testing of various classes of life distributions has been addressed in the literature for more than 45 years. In this paper, we consider the problem of testing exponentiality (which essentially implies no ageing) against positive ageing which is captured by the fairly large class of new better than used in expectation (NBUE) distributions. These tests of exponentiality against NBUE alternatives are discussed and compared. The empirical size of the tests is obtained by simulations. Power comparisons for different popular alternatives are done using Monte Carlo simulations. These comparisons are made for both small and large sample sizes. The paper concludes with a discussion in which suggestions are made regarding the choices of the test when a particular alternative is suspected.

M.Z. Anis and K. Basu

Assessment of C_{pm} in the presence of measurement errors

With the advent of Taguchi's loss function, the concept of target and sticking to the target to achieve better process performance has become widely accepted. In practice, while estimating process performance, the gauge measurement error is not taken into consideration. In the real world scenario this hardly happens since measurement errors cannot be avoided in most of the manufacturing processes. Ignoring this measurement error while estimating the process capability may often lead to unreliable/wrong decision about the capability of the process under study. Therefore, in this work we apply the method of Generalized Confidence Interval (GCI) to measure the process capability index C_{pm} in presence of measurement errors. In this study, an exhaustive set of simulation has been conducted to assess the performance of the GCI method in terms of expected value of generalized lower confidence limit (L_{pm}) and Coverage Probability (CP). The efficacy of dealing with the measurement error has been found satisfactory in this model. Finally it can be concluded that GCI method seems to be quite satisfactory for measuring process capability when the measurement errors are present; as well as when measurement error is negligible.

M.Z. Anis

Development of framework to assess customer experience

Measurement of customer experience is key to the success of business organizations. However, not much work has been carried out in measuring experience of customers. The existing studies focus primarily on customer satisfaction measured from a transactional perspective. In this study we have looked at the interaction with the customer as a journey. The customer experience was proposed to be measured for telecom service and the experience was looked at from the perspective of interactions right from getting connected to a network, to its usage and finally the accuracy of billing and information that the company provides. On the basis of a carefully designed questionnaire, the different aspects of customer experience were measured and a scale was proposed. At present the proposed scale is being validated.

Amitava Bandyopadhyay

Measuring diversity and its impact on performance of organizations

Large service organizations now impact very large number of people from very different backgrounds. The values and the level of education of the employees are likely to be very different. Teams formed with such diverse members are a reality but its impact on performance is unknown. In this study we have identified three different types of diversity, namely – value, knowledge and identity diversity. A model linking the different types of diversities and the performance has been proposed. A questionnaire has been designed to measure diversity for different teams and attempts are being

made to estimate the impact of diversity on performance. The study is being carried out with TCS. The pilot study has been completed.

Amitava Bandyopadhyay, Ranjan Sett and D.K. Manna

Impact on Noise Quality due to Highway and Infrastructure Development

In this research work, it has been established that both the noisier situation (L_{10}) and the equivalent sound level (L_{eq}) are the by-products of honking of horn. The pertinent corrective measures have been suggested based on the explanatory variables found from the regression analysis. In addition, the extent of noise from a popular Indian automobile (car) has been estimated based on the technical data corresponding to the designed parameters. This demonstrates as to how the noise of a car can be measured at the design stage itself (upstream) in lieu of the prevalent downstream measures.

Arup Ranjan Mukhopadhyay and Tarun Roy

Optimization and Reliability Modeling

The principal pivot transform (PPT) is a fundamental concept introduced by Tucker for developing many theories and algorithms in optimization theory and plays an important role in the study of matrix classes. Some new classes of generalized PPT based matrix classes are introduced. These classes are important from algorithmic point of view. The identification of these PPT based matrix classes motivates the study and further application in matrix theory. A class of functional equations arising in multistage decision processes is considered. The existence of coincidence solutions for this class of system of functional equations is established. Work in the following areas are in progress: – a) Airline crew scheduling problem, and b) coincidence solution of a system of functional equations arising in multistage decision process.

Modified Kolmogorov-Smirnov test is proposed for goodness-of-fit based on hybrid censored data. A new algorithm is proposed to obtain optimum progressive censoring life testing plan. Method of finding optimum reliability acceptance sampling plan is proposed. Determination of optimum optimal release time of software under periodic debugging schedule. Discrete time software reliability 112 modelling with periodic debugging schedule. Survival analysis of recall data in observational study is considered, where both parametric and nonparametric maximum likelihood estimates are obtained.

Biswabrata Pradhan, A. Bandyopahyay, D.K. Manna, A. Gupta, A.K. Das, A. Dewanji, D. Sengupta (ASU, Kolkata), S.K. Neogy (SQC & OR, Delhi); Sudipta Das; Deepmala and Buddhananda Banerjee

SQC and OR Unit, Delhi

Mathematical Programming, Linear Complementarity Problem (LCP) and its generalizations, Optimization problem in graph theory, Matrix Theory (Study of Matrix Classes useful in Complementarity, Optimization and Game Theory), Non-cooperative games, Algorithms for Stochastic Games

S.K. Neogy

Design of Experiments – Static Characteristics, Dynamic Characteristics and Categorical Characteristics in a multi response processes

Rina Chakravorty, Susanta Kumar Gauri and Sankar Chakraborty

Mathematical Programming, Matrix classes in Linear Complementarity Problem, Game theory

Dipti Dubey and S.K. Neogy

SQC and OR Unit, Bangalore

Identifying critical success factors and effectiveness measurement system of Six Sigma initiatives in business processes

Post completion of PhD degree on above research area, further work in being carried out to develop suitable methodologies for various categories of Industries in the areas of Six Sigma Project selection and effectiveness evaluation of completed projects. The Business Process selected at present is Modern Retail Format of Less Shelf Life Products and Perishable Products.

Sanjit Ray

Business Process improvement in Indian Industries through statistical techniques

PhD thesis on above research work was submitted to Mahatma Gandhi University, Kottayam, Kerala and on the basis of recommendation of the Board of Examiners and on satisfactory performance in the PhD viva voce examination, the PhD degree was awarded with effect from 6th December 2014.

E V Gijo

New Area of Projects

Design for Six Sigma for both Product Design and Process Design.

K.K.Chowdhury

Designing and developing a methodology for controlling critical sub processes in software development process

Successfully completed the course works and the literature survey. A methodology has been developed to control the critical sub processes in software development process to achieve quality goals. The methodology is validated with different Information Technology companies. Meanwhile successfully completed the Pre PhD comprehensive viva voce and one more paper published related to research work.

Boby John

SQC and OR Unit, Chennai

Multiple Response Optimization involving one or more categorical response variables from orthogonally designed experimental data

Surajit Pal

SQC and OR Unit, Coimbatore

Benchmarking Yarn Quality from Cotton Quality

Assessment of yarn quality from the quality of raw material is an important yet unexplored area. This requires developing measures for cotton quality and linking these measures with the final yarn quality. As both cotton and yarn are bulk material with substantial variability of quality, maintaining linkage between cotton quality and yarn poses a challenge. In this research, cotton quality was defined and methods were found to conduct experiment to establish the linkage. The study was carried out with SITRA.

A. Rajagopal

Reduction of resolution time of level 1 tickets

Level 1 tickets are the ones that can usually be solved through oral instructions or by making minor changes that do not require changing the code. Examples of such tickets are loss of password, file

getting corrupted etc. The inflow of such tickets is usually large and it is important to solve these in a short span of time. In this research, a methodology was developed to classify the level 1 tickets and provide methodologies to train people such that the resolution time decreases.

A. Rajagopal

SQC and OR Unit, Hyderabad

Areas of research: Linear Complementarity Problem, Decision Support Systems, Six Sigma, DOE, SPC, Text Data Mining, Generalized Gaussian Distributions (GGD)

G.S.R. Murthy, A.L.N. Murthy, G.M. Rao, and S.M. Subhani

SQC and OR Unit, Mumbai

Six Sigma and Lean Six Sigma

Ashok Sarkar

Multivariate Process control

Sagar Sikder

SQC and OR Unit, Pune

Six Sigma- Integration of approaches to synergies growth of an Organisation; Design for Six Sigma; Six Sigma for Academic University and Business Analytic using Data Mining

S. Rath

Library, Documentation and Information Sciences Division

The Library, Documentation and Information Science Division comprises

- Central Library, Kolkata
- ISI Delhi Centre Library, Delhi
- ISI Bangalore Centre Library, Bangalore
- ISI Chennai Centre Library, Chennai
- ISI North-East Centre Library, Tezpur
- Prasanta Chandra Mahalanobis Memorial Museum and Archives, Kolkata

The Division is perhaps the most important central facility of the Institute.

Central Library, Kolkata

The Central Library occupies a unique place in academic and research activities of the Institute. The Central Library moved to its present location in 1978, and it occupies 5 floors (60000sq.ft) of a ten-storied building at Calcutta. The Central Library seeks to:

- Meet the informational, educational, recreational, and cultural interests and needs of the user community by providing timely access to print and non-print resources appropriate to those needs.
- Encourage and facilitate reading, literacy and lifelong learning by supplying resources in a variety of formats designed to interest, inform, and enlighten.

- Protect the public's right to know by providing equal access to information needed for informed and effective daily living, decision making, problem solving and thoughtful participation in civic/community affairs.
- Provide the highest quality service and to organize and display the collection for easy, open access by all.
- Maintain publication exchange programme of the Institute with regional, international, national, and foreign institutions and organizations.
- Continue to function as the Eastern Regional Library of the National Board of Higher Mathematics [NBHM], Department of Atomic Energy, Government of India since 1989.

Over the years, the ISI Central Library has attained the distinction of being one of the richest libraries in India in the areas of mathematics, statistics, economics, theoretical computer science and related areas. To achieve the goals of the Library, following activities were undertaken during the year under report:

Collection Development

The Library maintains an excellent collection of books, journals, reports, rare and special collection, government publications, data-books, theses and other documents/ materials in print and electronic formats. During the year under report, the library accessioned 889 books purchased from ISI budget and 227 books purchased under CPDA grant, while 129 books were received on complimentary basis. Added 28+ book to the project collection. The Library also accessioned more than 2000 bound volumes of journals and subscribed to 550 scholarly journal titles in print. More than 52 journal titles were received as complimentary and 97 titles in exchange with Sankhya. The library received and processed more than 7000 loose issues of journals. It classified and catalogued 2000 new books etc.. It also processed 50 titles on government reports/data-books etc. more. Beside this, the library has added a collection of 100+ books, mainly in English, Bengali and Hindi on literature, humanities, travel, health and recreation in its Statistical Workers' Circulating Library**.** In addition to this, the library has about 32000 reprints.

E-Resources

The library has a good collection of electronic resources on different media and has access to several online journals/databases. During the year under report, the library has added 1 subscription based eBook database containing more than 120000 ebooks, a few CD/DVD on statistical data. The library has provided the online access to about 2500+ full-text journals. It has renewed the online database like MathSciNet, ScienceDirect, and Springer Link through consortia. It has also subscribed to the IEL online of the IEEE/IEE publications, ACM Digital Library and Current Index to Statist ics (CIS) on Web. The library has also subscribed to few statistical data sources available on CDs. Central has added Online Journal Archives: Mathematics and Statistics of Springer-Verlag and Taylor and Francis.

Publications Exchange Programme

The library maintains the publication exchange programme of 'Sankhya - the Indian Journal of Statistics' with 57 national and 23 international institutions/organizations. The 23 international agencies are from various countries of the world such as Bangladesh, Belgium, Brazil, Canada, China, Taiwan, Croatia, Czech Republic, Denmark, France, Hungary, Italy, Japan, Pakistan, Poland, Romania, Russia, Slovakia, Spain, Switzerland, Thailand, UK, and USA. In exchange Library has received 97 titles during the reporting period.

Membership

Membership of the ISI-Library is restricted to persons with post-graduate or equivalent academic qualification, interested in the objectives of the Institute. Faculty members, research scholars, students, research associates, visiting scientists, ISEC trainees, project-linked staff, project assistants,

Research Activities

ISI-employees, outside students and the Institute members are eligible for the membership of the Institute Library. However, they have to apply for the membership of the library and receive a bar-coded Library Card. During this period, library membership was given to 252 persons and 970 readers were given special permission to use the library for a short period.

Services
The ISI-Library, since its inception has been providing a variety of library and information services to its users. The services presently being provided include:

Web-OPAC: Members use this facility to browse and search the database to see the status of a document including their own transactions.

Document Delivery Service: About 100000 books and other documents were issued to the user on loan and reference. Publications from Government of India and other International Organization and data CDs, were issued to users for reference purpose. Provided 2500 pages of reprints and 25000 soft copies from different full text database /journals. It provided email-based reminder services like 7-day advance alert, long overdue notice and check-in information. 15000 books were circulated from the workers' circulating library.

Inter-library loan: 25 Books and journals were borrowed from other libraries, while 93 books and journals were lent to other libraries.

Current Awareness Service: 12 monthly lists of current additions to the library were made available online.

Self-Photocopying Service: The library provided the Self-photocopying service in its periodical section, which was available everyday throughout the library hours. During this period 18000 pages were photocopied from the journals.

Electronic Document Delivery Service: Full-text articles and/or bibliographical data were provided through email from online resources. Besides electronic document delivery, 25000 pages of printouts were also supplied against demand.

Preservation: 12 books were laminated and 273 books were fumigated.

Electronic Document Delivery Service: Full-text articles and/or bibliographical data were provided through email from online resources. Besides electronic document delivery, 25000 pages of printouts were also supplied against demand.

Online Full-Text Access to Journals/ Database: During the period under review, the library has provided services from more than 2500+ online journals and major databases like MathSciNet, Econlit, ScienceDirect, Springer Link, IEL Online (IEEE/IEE Electronic Library), ACM Digital Library, CIS on WEB, OUP journal online consortia: JSTOR (Life science). The online access is available through campus-wide network.

1. Euclid Prime http://www.projecteuclid.org/
   Euclid Prime is a growing collection of high-impact, peer-reviewed titles in theoretical and applied mathematics and statistics hosted by Project Euclid. Euclid Prime also includes complimentary access to archival content of certain journals. The restricted portion of this content (content published in the last 5 years) is only available to current Prime subscribers.

2. Project Muse: Social Sciences Collection http://muse.jhu.edu/browse/social_sciences
   Project MUSE is a unique collaboration between libraries and publishers providing full-text, affordable and user-friendly online access to high quality humanities, arts and social science journals from scholarly publishers.

3. EconLit with Full Text http://search.ebascohost.com
   It is the World's foremost full-text source of references to Economic Literature. This database contains all of the indexing available in EconLit in addition to full text for hundreds of journals including the American Economic Association journals with no embargo (American Economic Review, Journal of Economic Literature, and Journal of Economic Perspectives). This database also contains many non-English full-text journals in economics & finance and volume and issue browsing is available for all full-text journals.

4. IEEE Xplore Digital Library http://ieeexplore.ieee.org/Xplore/home.jsp
   The IEEE Xplore digital library is a powerful resource for discovery and access to scientific and technical content published by the IEEE (Institute of Electrical and Electronics Engineers) and its publishing partners. The content in IEEE Xplore comprises over 160 journals, over 1,200 conference proceedings, more than 3,800 technical standards, over 1,000 eBooks and over 300 educational courses. Approximately 25,000 new documents are added to IEEE Xplore each month.

5. ACM Digital Library http://dl.acm.org/
   The ACM Digital Library (DL) is the most comprehensive collection of full-text articles and bibliographic records in existence today covering the fields of computing and information technology. The full-text database includes the complete collection of ACM's publications, including journals, conference proceedings, magazines, newsletters, and multimedia titles. In addition to the full-text database, the *ACM Digital Library* is heavily integrated with and includes unrestricted access to the Guide to Computing Literature bibliography.

6. EBSCO eBook AcademicSubscription Collection http://search.ebscohost.com
   The EBSCO eBook Academic Subscription Collection offers cross-searchable access to a multidisciplinary library of over 126,000 high quality, unlimited user ebooks from over 450 publishers. New titles are added monthly at no extra charge. Access is via EBSCOhost which offers sophisticated yet intuitive functionality, and a wide range of customisation options, to support the needs of the widest possible range of users. A mobile interface is also available.

Archive

JSTOR http://www.jstor.org
JSTOR is a digital library of academic journals, books, and primary sources. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations.

Secondary Databases:

MathSciNet http://www.ams.org/mathscinet
It is an electronic publication offering access to a carefully maintained and easily searchable database of reviews, abstracts and bibliographic information for much of the mathematical sciences literature. Over 100,000 new items are added each year, most of them classified according to the Mathematics Subject Classification.

Current Index to Statistics https://www.statindex.org/CIS/psqlQuery
The **Current Index to Statistics** is a bibliographic index to publications in statistics, probability, and related fields. The on-line **CIS Extended Database (CIS-ED)** indexes the entire contents of over 160 "core journals", in most cases from 1975 (or first issue if later) to the current end year, and pre-1975 coverage for some, selected articles with statistical content since 1975 from about 1200 additional journals (cumulatively) in related fields, and about 11,000 books in statistics published since 1975.

Research Activities

Numerical Databases:

Indiastat.com http://www.indiastat.com

Indiastat.com is a cluster of 57 sites including India-specific, Sector specific, Region specific and State specific sites rendering its dedicated services to the research fraternity from academic, professional and corporate world with authentic and comprehensive compilation of secondary level socio-economic statistical data about India and its states,Region and Sector on more than 35 variables.

Economic Outlook-CMIE http://economicoutlook.cmie.com

The Economic Outlook provides CMIE's view on where the Indian economy stands and where it is likely headed. This view is derived from a careful and continuous monitoring of all new data releases. New data releases are analysed in real-time in the context of the historical trends and in the context of other current data releases. Economic Outlook therefore provides a comprehensive and integrated view of the Indian economy.

State of India-CMIE http://statesofindia.cmie.com/

States of India is a comprehensive compilation of state-level statistics. The data is sourced from each of the 23 major states and 12 minor states or union territories. The central agencies provide most of the state level data, while district statistics are released by different agencies of the states. CMIE's own monitoring information generates a lot of state-level data. CMIE compiles all of these from different sources and weaves them into one cohesive and seamless offering.

India Premium Database-CEIC Data http://webcdm.ceicdata.com

MACROECONOMIC AND INDUSTRY-SPECIFIC TIME SERIES DATA FOR INDIA. The CEIC India Premium Database is one of CEIC’s standalone BRIIC country databases, delivering a wide range of macroeconomic and industry-specific time series data for India. The database covers over 163,000 time series with historical data from as early as 1951 and offers a wide range of dataset frequencies, from daily to annual. CEIC’s India Premium Database classifies time series into 15 macroeconomic sectors and 13 industrial sectors, enabling both a macro-perspective of the Indian economy and sector-specific analysis for a comprehensive set of industries.

Global 130 Country Database http://webcdm.ceicdata.com

Coverage on 130 countries. This database is unique with respect to having official data from local country sources as well as ley indicators from World Bank and IMF.

Daily Database http://webcdm.ceicdata.com

High frequency data covering interest rates, inflation, deposit rates, exchange rate, swap rates, monetary etc.

Sector Database http://webcdm.ceicdata.com

It is a unique database covering top 10 companies and their financials for Asian and non-Asian countries covering 15 key sectors

Central has added Online Journal Archives: Mathematics and Statistics of Springer-Verlag and Taylor and Francis. EBSCO Academic Book Collection is also available for access.

Plagiarism: Central Library, Indian Statistical Institute is subscribing iThenticate services. iThenticate is plagiarism detection software that is designed to be used by researchers to screen written work for originality. The service allows researchers to easily upload and scan documents, manuscripts, research and other professional works into iThenticate which compares the work against 14 billion web pages and 110 million content items from leading academic publications. Utilization of iThenticate prior to publications is optional, but highly encouraged.

If you want to access it, please send your request to library@isical.ac.in. For instructions, visit http://www.ithenticate.com/products/faqs

Remote access to ISICAL licensed E-Journals & Databases: Faculty members and research scholars of the Institute can now access most of our electronic resources when they are away from the campus/country. In order to avail this facility, one should use his/her isical.ac.in email id as user name. For details, contact library@isical.ac.in

Reprographic & Photographic Service: During the year, it provided photocopies, graphic designs, scanning, color and b/w pages of print outs, color photocopies, piral bindings and lamination services.

Documentation Service: A searchable bibliographic database has been prepared on scientific contributions made by the ISI scientists on all subject fields since 1934. The entries are currently being subjected to editing.

General Enquiry Assistance & Consultation Service: Assistance extended to 251 external visitors including participants of the Winter School, NBHM Nurture Programme, Summer Research School and visiting students of different institutions.

Special Initiatives:

Consortia arrangements: During the reporting year, the Library has further strengthened the consortia initiative to enhance the electronic collection and online access to scholarly resources to cope up with the increasing subscription cost and diminishing budget.

Preservation and conservation: Completed binding of more than 1000 physical volumes of journals. Lamination and de-acidification of 8 rare books of 2000 pages were completed, fumigated 12 books, and photocopied rare and out-of-print books.

Institutional Repository (IR): A prototype of IR of ISI has been created. Currently it covers scientific writings of Professor P.C. Mahalanobis, full-text of 3000+ ISI research papers, full text of all convocation addresses, ISI Annual Report from 1933to 2008 and 300 Ph.D theses.

Digitization: 10 books were digitized. 15886 frames of microfilm/fiche were digitized. These will be made available on the Web after the completion of the work.

Library, Delhi

The Indian Statistical Institute, Delhi Centre, maintains an academic library, which aims to be a leading library in the fields of Economics, Mathematics, Statistics, Operations Research and Statistical Quality Control. The library caters mainly to the needs of bonafide students, scholars and staff of the Institute. However, it is also open for reference to academic and research users of other educational and scientific institutions of the city and its neighboring regions. It is one of the modern library with an extensive collection of books, journals, CDs, reports, government publications and other documents in print and electronic formats. The ISI Delhi Centre library also act as one of the NBHM regional library of northern India and provides information resources to support academic and research activities in the areas of Mathematics, and allied subject ares. Some of the main activities of the library during the period under review were as under:

Collection Development

Books: The library accessioned 315 new books and 647 bound volumes during the year under report from the ISI and NBHM funds. The library also received 73 books as gift from different sources. Thus raising the current library stock both books and bound journals to 50,000 volumes.

Journals: During the period under review 288 journals, both foreign as well as Indian have been renewed. 22 journals on gratis and 10 journals in exchange are being received in the library from various sources.

Online Resources: The library also participated consortia based subscription to electronic resources and provided users more than 800 fulltext electronic journals access including EconLit, SIAM ejournals, Current Index to Statistics, MathSciNet, IAOR, Science@Direct, SpringerLink, J-STOR, Oxford Journals, Taylor & Francis, IEEE, INFORMS, AMS, IMS, Sankhya and many others.

CDs: The library has more than 550 CDs of different reference books and journals including databases.

Exchange Programme

Exchange program established with seven scientific institutions in the regions of China, Korea, Netherlands, Poland, Spain and Vietnam for getting their publications in exchange to our journal 'Sankhya'- Indian Journal of Statistics and "Texts and Readings in Mathematics" (book series).

Library Services

Circulation services: During the period April 1st 2014 to March 31, 2015, total 180 members, availed the lending facilities as permanent members of the library, whereas more than 480 users availed reference facilities of the library. More than 4200 publications have been circulated among the members.

Reprographic services: During the period under review more than 11000 pages have been Xeroxed and made available to users of the library and outsiders. Xerox facilities were also provided to research scholars of neighboring institutes under NBHM programme.

Electronic document delivery service: In addition to Xerox facilities, more than 2500 Full texts articles (PDF files) were provided to the users.

Current awareness service: The following lists were brought out regularly from the library:
a) Monthly list of current periodicals
b) New additions of books

Web-OPAC Facility: The users have been given LibSys Web OPAC access facilitates 24X7 over the Internet.

Web Enable Library Services: The library proving web enables library service to users. The library web site contains information about the library its collection, services, rules, list of electronic journals, Catalogues, databases, telephone directories, and online requisition forms etc. The contents of library web pages are regularly updated to serve the internal and external needs of users.

Union Catalogue of Serials

The Indian Statistical Institute Delhi Centre library has developed this Union Catalogue of Serials database with a view to promote the new improved access to journal holdings among the users. The database stored the serial holdings information of 3 ISI Libraries i.e. Kolkata, Delhi and Bangalore. The tool provides a web based central access point to all print and electronic journal holdings information and can be search under Journal title, Keywords, ISSN, Item types, Alphabetical browse (A-Z) or even Library wise serial holdings.

Library, Bangalore

Indian Statistical Institute Bangalore Centre Library is aiming to be identified as a model library in the Indian academic scenario. The Library is providing many modern library services using internet and they are popularly known as web based information services. ISI Bangalore Centre Library has also initiated interactive applications for in users. The library has developed a very distinguished collection in different knowledge domains such as Mathematics, Statistics, Economics, Quality Management & Operations Research, Library & Information Science, Computation & Artificial Intelligence and so on. Various services are designed to meet the information needs of the faculty members, students, research scholars and visiting scientists. Walk-in users from the other institutions are also permitted to use the library. The following activities were undertaken by the library during the period April 2014 – March 2015.

Collection Development

In order to meet the user needs and maintain the good collection, books were brought at regular intervals in the library from various publishers. Book exhibition was also conducted to buy books. The library purchased 201 Books, Received 65 Books as gift during this period. The library subscribed to 350 Journal titles, 14 journal titles were subscribed from NBHM grants. Additionally library has subscribed to IEL ONLINE, giving access to journal and technical reports published by IEEE. The Library has 39 E-Books from world scientific publishing.

Library Collection

Total no of Books are 29,982 and Bound Volumes are 17,539.

Membership

More than 120 registered users enjoyed the library facilities and the services during the year. In addition, facilities were extended to around 1124 walk-in users during this period.

Current Content Service: Content pages of around 1600 journals have been scanned.

Circulation Service: Around 3800 books and 360 journals were circulated during this period. 400 loose issues of journals were issued to users overnight.

Inter-library Loan Service: Due to good liaison amongst the local libraries, the library has been involving itself in providing inter-library loan service.

Document Delivery Service: Under this service around 600 documents in pdf format were downloaded and supplied to the registered users.

Reprographic Service: During this period 17,976 photo copies were supplied to the library users.

Web based Library Services: The library has devised various services using World Wide Web. They are all accessible at http://www.isibang.ac.in/library. Full text online journals were accessed through this website. The library also provides access to various Abstracting and Indexing services.

Infrastructure

Four New Book racks were bought.

Library Software

We are in the process of installing Windows Server OS for the smooth functioning of Libsys Software.

Library, Chennai

Academic Library for Indian Statistical Institute Chennai Centre (ISIC) was started in 2011 to cater to the information needs, adding to the existing library of SQC & OR unit, at Taramani. This evolving library aims to a vibrant collection in the fields of Statistics, Applied Statistics, Mathematics, Computer Science, Statistical Quality Control and Operation Research making it prototypical in functioning, administration and unique in collection. Various services are provided for an efficient usage of library facilities by the students, faculty members, visiting scientists and research scholars. Researchers from other institutions are offered reference service.

Collection Development

The Library maintains an excellent collection of books, journals, magazines, question papers, multimedia resources etc. During April 2014 – March 2015, 730 books were added raising the collection to 2988 books. Around 14 International online journals and 16 magazines were subscribed.

Technical Processing

Around 1450 books have been classified during the period April 2014 – March 2015. As a part of automation process, around 4800 books from ISI Chennai Centre Library, Taramani and SQC & OR Unit Library, Aminjikarai have been tagged with RFID tags and Anti-theft stickers. Database entries in KOHA Library Automation software were updated in Z39.50 Standard bibliographic format for all the books. Other services like Inter-Library Loan, content service, reprography service and document delivery service are initiated.

Web based library services:
It has remote access to more than 2000 e-journals accessible through ISI Kolkata Library procured under ISI Consortia.

Membership

ISIC library has restricted access to postgraduate students, research scholars, faculty members and visiting scientists totaling to around 30. Institutional Membership has been renewed with Indian Institute of Technology, Madras (IITM) and Institutional Membership has been added with British Council Library. Interlibrary Loan with other ISI Centers and Units were activated.

Library Services:

Lending and document delivery service: Around 320 documents were delivered during the period April 2014 – March 2015, showing the active participation of the users. Automation of library with full setup of RFID is in final stage of completion. Database has been completed for both ISI Chennai Centre Library, Taramani and SQC&OR Unit Library, Aminjikarai totaling to 5000 books. Full automation has been completed and user will be enabled with these automated services in near future. Database for Hostel Library books was also initiated.

Library, Tezpur

ISINE Library has started functioning from July, 2011. The library aims to provide quality service to its users by developing quality documents in the field of Statistics and Mathematics. The library has limited collection in the fields of Computer Science, Soil Science, Geography and Library Science also. The library has automated its service from mid 2013.

Collection Development

In order to cater the requirements of the user the library has processed 639 books in different fields during this 2014-15 session. The ISINE Library has subscribed 18 Indian and foreign journals, 4 Newspapers and 2 magazines in this period.

Budget

The Total budget for this period is 4015000

Membership

The main users of this library are the students, scholars, faculty members and visiting faculties of the institute. Total number of members is 25.

Technical Processing

All the purchased books are technically processed.

Library Services:

Circulation Service: Around 400 books were circulated in this period.

a) **Web Opac:** Library members use this facility to browse and search the database of the library and check the status of documents including their own transactions.
b) **Document Delivery Service:** Around 40 documents in pdf format were downloaded and provided against demand.
c) **Web Based Service:** Library has remote access to e journals from ISI Kolkata general access.

Prasanta Chandra Mahalanobis Memorial Museum and Archives

The Museum and Archives carried out regular up keeping programme for 752 exhibits through 91 panels and a collection of artifacts related to Professor. Mahalanobis displayed in the ground floor, chatal, and Professor's residence along with the pest control programme for the whole building of Amrapali. Among other programmes a new project on 'Arrangement and description of archival collection of P.C. Mahalanobis Memorial Museum & Archives' with three year duration has been initiated from the month of July to continue the development of archival record management system. Under the project over 2,500 photographic documents and above six hundred letters, manuscripts etc. has been identified, sorted and listed.

The work of the proposed new gallery on Rabindranath Tagore and Prasanta Chandra has nearly been completed with two interactive kiosks. One is with facilities for visually impaired persons. Contributed in the exhibition on 'Statistics At Work', inaugurated on 30th June, 2014 organized by Birla Industrial and Technological Museum on the occasion of 'Statistics Day' of India. A customized browser based cross platform software has been developed through agency to develop the reader and researcher area comprising their activities, data sharing policy, cataloguing and integration of xml and parsed PDF files and also to develop extended administrative area for creation of entity like network user and creation/modification of accession register, PDF security and stamp/watermark implementation to showcase the archival metadata with proper retrieval procedure maintaining the standard of existing archival system.

Center for Soft Computing Research: A National Facility, Kolkata

Moving Object Segmentation from Video Images

Feature extraction from compressed video

Automatic analysis of digital video sequences for surveillance requires segmentation of regions of interest (ROI) or foreground from the background scene (i.e., background subtraction) based on motion characteristics present in video. Most related techniques operate in the pixel-domain using a fully decoded/uncompressed information about each pixel. However, most digital video sequences today are stored/transmitted in compressed form such as MPEG-x, H.264, and HEVC, which require a significant decoding overhead prior to the application of pixel-based approaches. In order to reduce computation we propose feature extraction methods utilizing information already available in various coded forms. We have shown our method to be competitive in terms of segmentation performance while maintaining a high processing speed in case of H.264 Baseline Video. High Efficiency Video Coding (HEVC) standard was adopted by the coding community to address the requirement of increased video resolution using parallel processing architectures. Therefore, in our recent development, a new method is presented for feature extraction from video coded using HEV.

B. Dey and M.K. Kundu

Rough Sets in Video Tracking

Moving object detection and tracking from video sequences have been an important task in computer vision. There are several approaches to solve it, e.g.: based on some prior knowledge, based on background estimation. Our aim is developing different methodologies and algorithms demonstrating applications of granular computing and rough sets to unsupervised video tracking. The tasks that are considered include unsupervised video tracking, occlusion/ overlaping handling, and providing quantitative measures for performance evaluation. Rough sets, rough-fuzzy sets, neighborhood rough sets, flow graph are used, among others, as paradigms for dealing with uncertainty. The concepts of 3-D granules, spatio-temporal neighbourhood granules, granular rough rule-base, rough flow graph, neighbourhood rough filter, neighbourhood rough entropy are introduced over videos to make the processing faster and more accurate. The new hybridized tools are proven to be more effective in dealing uncertainties over the existing ones. Gray, Color or R-G-B and R-G-B-D video sequences are used as input data.

D. Chakraborty and S.K. Pal

Remote Sensing Image Analysis

Hyper Spectral Image Processing in Remote Sensing

Hyperspectral sensors acquire a set of images from hundreds of narrow and contiguous bands of electromagnetic spectrum from visible to infrared regions. A hyperspectral imagery can be viewed as an image cube where the first two dimensions indicate the size of the image and the third one specifies the band number of the imagery. The computational complexity and curse of dimensionality are two major difficulties for classification of hyperspectral imagery due to the presence of large number of bands. In such a scenario, dimensionality reduction is an important task of hyperspectral image processing. Band selection and band extraction are two main approaches for dimensionality reduction. Depending on availability of label patterns, band selection and band extraction can be categorized as supervised and unsupervised ones. An unsupervised band elimination method has been proposed which considers both correlation among bands and discriminating capability of each band. This method iteratively eliminates one band from the pair of most correlated neighbouring bands depending on the discriminating capability of the bands. Correlation between neighbouring bands is calculated over partitioned band images. Capacitory Discrimination is used to measure the discrimination capability of a band image. Another method of band selection is proposed. It is basically a three step method. In the first step, characteristics (attributes) of the bands are found out. Next,

redundancy among the bands is removed by clustering. At last, the remaining bands, which are non-redundant among themselves, are ranked according to their discriminating capability. Discriminating capability is calculated by measuring the capacitory discrimination of the bands.

A. Datta and A. Ghosh

Change Detection in Remotely Sensed Images

Change detection is a process of detecting temporal effects of multi-temporal images. This process is used for finding out changes in land covers over time by analyzing remotely sensed images of a geographical area captured at different time instants. Changes can occur due to natural hazards (e.g., disaster, earthquake), urban growth, deforestation etc. Traditionally, two approaches are used for change detection process: supervised and unsupervised. In change detection, collection of labeled patterns is costly and time consuming. Under this circumstance, a few labeled patterns can be collected from experts. Here, applicability of supervised approaches is rare and if unsupervised approaches are used for analysis, then these few labeled information is unutilized. To handle this problem, semi-supervised and active learning approaches can be used to make full utilization of a few labeled patterns along with the abundant unlabeled patterns. Both the learning approaches are attacking the same problem by following different roadways. Under this scenario, purpose of our research work is two-fold: at first new algorithms are developed using artificial neural networks (ANNs) under semi-supervised and active learning mode so that ANNs can utilize a few labeled information along with plenty of unlabeled patterns during learning and then these new methodologies are used for betterment of change detection on multi-temporal and multi-spectral remotely sensed images. In initial phase, some of the semi-supervised clustering algorithms (e.g., COP-KMeans, Seeded-KMeans and Constrained-KMeans) are applied for change detection. Thereafter, modified self-organizing feature map neural network under semi-supervision is used for future improvement of the change detection process. A neural approach has also been developed for improvement of change detection using radial basis function neural network and multilayer perceptron under two different active learning frameworks, namely uncertainty sampling and query-by-committee strategy. Then, some investigation is carried out with the supervised neural networks for change detection. Here, ensemble of multilayer perceptron neural networks (MLP) is used to minimize the effort of the optimal architecture selection for MLP. As already mentioned, the usability of supervised methods is infrequent in change detection due to unavailability of labeled patterns. Hence, an ensemble of semi-supervised classifiers can be utilized instead of using either a single classifier or ensemble of classifiers in pure supervised learning paradigm. A change detection technique is developed by integrating both the semi-supervised and ensemble learning in a single platform. Here, multilayer perceptron, elliptical basis function neural network and fuzzy k-nearest neighbour techniques are used as the base classifiers and ‘maximum combination rule’ is used as a combiner.

A. Ghosh

Image Co-segmentation

Image co-segmentation refers to the simultaneous segmentation of similar regions from two (or more) images. It aims to segment common objects from a collection of images given by the user. A co-segmentation approach addresses the co-segmentation problem from two aspects, i.e., single image segmentation and common objects segmentation. The single image segmentation technique extracts some uniform and homogeneous regions with respect to texture or color properties, and the common objects segmentation is concerned with the segmentation of objects with similar features. Applications of image co-segmentation lies in the following field such as creation of a visual summary from photo collections, image retrieval, extractions of pathologies such as lesions from brain image volumes. Various methods have been applied in the state-of-the-art literature to perform co-segmentation task which includes: MRF based method, interactive method, discriminative clustering method, scale invariant method, etc. Recently, active contour based method has been applied for the co-segmentation of the images and also found to be popular. There are various models of active contour based method; among this dual active contour is the most popular one and is extensively used for image segmentation. An image co-segmentation technique using the dual active contour model is

developed to extract meaningful common objects in different images. This method has an advantage that it can integrate global shape information, thus guides the contour into an appropriate minimum and reduces misclassification of the regions.

S. Bandyopadhyay and A. Ghosh

Granular Computing

The self-organizing maps (SOM), a component of artificial neural networks (ANN), mainly use Gaussian function for defining the neighborhood. However, this neighborhood does not handle the uncertainty arising from overlapping patterns in the data. In this regard, a new granular self-organizing map (GSOM) is developed by integrating the concept of a fuzzy rough set with the self-organizing map (SOM). Here, lower and upper approximations of rough sets are exploited in defining the neighborhood function. The clusters (granules), evolved by GSOM, are presented to a decision table as its decision classes. Based on the decision table, a method of gene selection is developed. Effectiveness of the GSOM is shown in both clustering samples and developing an unsupervised fuzzy rough feature selection (UFRFS) method for gene selection in microarray data.

A. Ganivada, S.S. Ray and S.K. Pal

Network Mining

Fuzzy-Rough Community in Social Networks

Community detection in a social network is a well-known problem that has been studied in computer science since early 2000. The algorithms available in the literature mainly follow two strategies, one, which allows a node to be a part of multiple communities with equal membership, and the second considers a disjoint partition of the whole network where a node belongs to only one community. In this work, we propose a novel community detection algorithm which identifies fuzzy-rough communities where a node can be a part of many groups with different memberships of their association. The algorithm runs on a new framework of social network representation based on fuzzy granular theory. A new index viz. Normalized fuzzy mutual information, to quantify the goodness of detecting communities is used. Experimental results on benchmark data show the superiority of the proposed algorithm compared to other well known methods, particularly when the network contains overlapping communities.

S. Kundu and S.K. Pal

Bio-informatics

micro RNA Analysis

MicroRNAs (miRNA) are one kind of non-coding RNAs which play important role in gene expression and cancer. A novel miRNA selection methodology, called fuzzy mutual information based miRNA selection (FMIMS), is developed which automatically selects the most relevant miRNAs for a particular type of cancer. In FMIMS, miRNAs are initially grouped by using a SVM based algorithm; then the group with highest relevance is determined and the miRNAs in that group are finally ranked and selected according to their redundancy. Fuzzy mutual information measure is used in computing the relevance of a group and the redundancy of miRNAs within it. Superiority of the most relevant group as compared to all others, in deciding normal or cancer, is demonstrated on breast, renal, colorectal, lung, melanoma and prostate cancer data set. The merit of FMIMS as compared to several existing ones is established. While 12 out of 15 selected miRNAs corroborate with those of biological investigations, three of them are possible novel predictions by FMIMS.

J.K. Pal, S.S. Ray and S.K. Pal

Computing With Words (CWW) and Artificial General Intelligence (AGI)

Envisioning the role of CWW in natural language understanding, our study on Z-number based CWW highlighted its capability of subjective semantic-summarization from a sentence; operators and procedures for these mechanisms were formulated as well. This study led to the design of a methodology based on Shannon's and Bayes' theorems for text granulation and extraction of context-sensitive relevant sentences for faster processing. The results of these investigations have now been assimilated into the conceptualization of a cognitive machine-mind framework for natural language comprehension, and extension of the Z-numbers for enhanced subjectivity-encapsulation towards emulation of the 'self' by the framework. Our work is envisioned to support man-machine symbiosis.

R. Banerjee and S.K. Pal

Cognitive Vision

The role of understanding visual perception in image compression as well as copyright protection has now become a challenging domain. Digital watermarking scheme is one important tool for copyright protection technique. A good quality watermarking scheme should have high perceptual transparency, and should also be robust enough against possible attacks. A well-known (Lewis-Barni) Human Visual System (HVS) based watermarking model is fairly successful with respect to the first mentioned criterion, though its effectiveness in color images has not been claimed. Furthermore, it is true that although several watermarking schemes are available in literature for grayscale images, relatively few works have been done in color image watermarking. Here, first of all, the question remains that, which is the optimal color space for color image watermarking and whether this HVS model is applicable for that color space. There are two main contributions of our present work with respect to the above. First, it claims that for color image watermarking, the YCbCr space can be used as the perceptually optimum color space, the Cb component being the optimal color channel here. Second, it also tests the effectiveness of the above-mentioned HVS model in that color space. These have been achieved by using the HVS model to propose a new non-blind (original image and the watermark logo image both are needed for extraction) image adaptive Discrete Wavelet transform and Singular Value Decomposition (DWT-SVD) based color image watermarking scheme in YCbCr color space. The multi-resolution property of DWT and stability of SVD additionally makes the scheme robust against attacks, while the Arnold scrambling, of the watermark, enhances the security in our method. The experimental results support the superiority of our scheme over the existing methods.

K. Ghosh

Computer and Statistical Services Centre, Kolkata

Throughout the Year, the IT infrastructures of the Institute were updated and developed by the CSSC. Delhi, Chennai & Tezpur Centres and Giridhi Unit of the institute were connected with CSSC by 10 mbps Point to Point connection. The Bengaluru Centre of the Institute was connected with Site-to-Site VPN (Virtual Private Network). All the networks of ISI were managed and technically supported by the CSSC. The infrastructure of the institute's servers, softwares (Matlab, ArcGis, R etc), Local Networks (wire and wifi), Networks and Internet securities, IP Telephones, Video conferencing faciliies, e-library and internet facilities (NKN – 1 gbps) were managed by the CSSC. The meetings including Academic Council meetings among the Institute's Centres (Delhi, Bengaluru, Chennai and Tezpur) and Giridhi Unit through Video conferencing facilities were managed by the CSSC. The classes (M.Tech. in Computer Science and PGDSM at ISI Tezpur) through video conferencing facilities were organized by the CSSC throughout the year. The Video conferencing facilities were used through web based (http://www.isical.ac.in/~cssc) booking. The CSSC arranged to provide Laptop and Desktop to the faculties, scientific staffs and research scholars of the Institute. The CSSC also arranged to provide technical support to the institute by computer trainees trained by the CSSC.

R.C. Bose Centre for Cryptology and Security, Kolkata

ID-Based Encryption

An ID-based Authenticated Key Exchange (AKE) protocol with Perfect Forward Secrecy (PFS) (resp. Master Perfect Forward Secrecy-MPFS) ensures that the revealing of static keys of the parties (resp. the master secret key of the private key generator), must not compromise evena single bit of the session keys of the past sessions between the parties. In the current status, to thebest of our knowledge, there is no ID-based eCK secure single round AKE protocol with either PFS orMPFS. We have proposed ID-based eCK secure single round AKE protocols with PFS and MPFSin the random oracle model. Towards achieving this goal, we also construct ID-based eCK secure single round AKE protocols, one without Master Forward Secrecy (MFS) and the remaining one with MFS,almost at the same computational cost as the existing efficient ID-based eCK Secure Single Round AKEprotocols. All of our protocols are secure under the Gap Bilinear Diffie-Hellman (GBDH) problem.

Tapas Pandit, Rana Barua and Somanath Tripathy

Atribute-Based Encryption

We first propose an Attribute-Based Signcryption (ABSC) scheme which is weakexistential unforgeable, IND-CCA2 secure in the adaptive-predicates attack and achieves signer privacy. Secondly, by applying strongly unforgeableone-time signature (OTS), the above scheme is lifted to an ABSC schemeto attain strong existential unforgeability in the adaptive-predicates model. Both the ABSC schemes are constructed on common setup, i.e the public parameters and key are same for both the encryption and signature modules. Our first construction is in the flavour of CtE&S paradigm, except that one extra component that will be computed using both signature components and cipher text components. The second proposed constructionfollows a new paradigm (extension of CtE&S), we call it "Commit thenEncrypt and Sign then Sign" (CtE&StS). The last signature is done usinga strong OTS scheme. Since the non-repudiation is achieved by CtE&Sparadigm, our systems also achieve the same.

Tapas Pandit, Sunit Pandey & Rana Barua

Stream Ciphers

Our recent work on stream cipher reveals new weaknesses of RC4 when used in IEEE WiFi WPA protocol. Motivated by the work of AlFardan et al. (2013), we first prove the interesting sawtooth distribution of the first byte in WPA and the similar nature for the biases in the initial keystream bytes towards zero. As we note, this sawtooth characteristic of these biases surface due to the dependence of the first two bytes of the RC4 key in WPA, both derived from the same byte of the \IV. Our result on the nature of the first keystream byte provides a significantly improved distinguisher for RC4 used in WPA than what had been presented by Sepehrdad et al. (2011-12). Further, we revisit the correlation of initial keystream bytes in WPA to the first three bytes of the RC4 key. As these bytes are known from the IV, one can obtain new as well as significantly improved biases in WPA than the absolute biases exploited earlier by AlFardan et al. or Isobe et al. We notice that the correlations of the keystream bytes with publicly known IV values of WPA potentially strengthen the practical plaintext recovery attack on the protocol.

Goutam Paul, Sourav Sen Gupta, Subhamoy Maitra and Santanu Sarkar (CMI)

Quantum Computing

We study a modified version of CNOT attack as well as asymmetric incoherent attack on recently proposed Fully Device Independent (FDI) Quantum Key Distribution (QKD) protocol [Vazirani&Vidick, 2012] and identify interesting dichotomy between these two attacks on the protocol. The modified CNOT attack provides the full information about the raw key introducing an additional error probability of 1/(6\sqrt{2}) on the remaining bits that are not used as key bits. In the symmetric incoherent attack, Eve can obtain the information about a secret key bit with probability 1/2 + \sqrt {D(1-D)}, where the

noise parameter increases by $D/6$ due to this eavesdropping [D being the bit-error probability in the channel], but the the average error on the rest of the bits, that are not used as key bits, does not change.

Goutam Paul and Arpita Maitra

Steganography

An LSB-based image steganography algorithm hides information in the least significant bits of the pixel intensities of a cover image. But such a method has a very low embedding capacity compared to a multi-bit embedding scheme. The latter is very challenging in the sense that the possibility of a large change in the pixel value of the cover image becomes very high and only a few algorithms based on multi-bit embedding exist in the literature.We improve the multi-bit embedding technique of Park et al. (2005), and achieve higher capacity of embedding (at most 5 bits per pixel) and higher embedding efficiency (at most 5.33) into an image with lower distortion. We compare our performance with existing techniques and support our claim with theoretical and experimental results.

Goutam Paul and Imon Mukherjee

Key Management in Wireless Sensor Networks

We propose a hybrid key management scheme for Hierarchical WSN. In this scheme, the resource constrained sensor nodes use symmtric key cryptographic schemes using polynomials for secure communication. The clusterheads which are more powerful and can communicate using public key cryptographic schemes. We use a onion routiung based scheme for anonymous routing across cluster heads. The computation and communication costs of the proposed hybrid scheme are better than existing results.

Sushmita Ruj and Kouichi Sakurai

Cloud Security

We address two problems, in the first problem, we address access control schemes for cloud computing. We propose a new decentralized access control scheme for secure data storage in clouds that supports anonymous authentication. In the proposed scheme, the cloud verifies the authenticity of the server without knowing the user's identity before storing data. Our scheme also has the added feature of access control in which only valid users are able to decrypt the stored information. The scheme prevents replay attacks and supports creation, modification, and reading data stored in the cloud. We also address user revocation. Moreover, our authentication and access control scheme is decentralized and robust, unlike other access control schemes designed for clouds which are centralized. The communication, computation, and storage overheads are comparable to centralized approaches. In the second problem we provide cloud security services using crowd sourcing.

Security-as-a-service is an emerging area in cloud computing. Traditionally, security approaches are service provider-centric and provider-driven. In this paper, we propose a model for security-as-a-service using “crowdsourcing”. Though crowdsourcing has been used to provide specific security services like browser security, detecting phishing attacks, detecting cybersecurity threats, there has been no work which provides a unified framework to provide different types of security verification. Dispersed computing power of devices is used to perform security verifications. This is done by subscribers in a collaborative way, using their idle resources, in exchange of certain incentives. Our architecture guarantees anonymity of users who request service and the crowd who contribute in verification by using virtualization concepts and virtual machines. Moreover, we propose an approach for managing these security verification jobs, subscribers in a fault tolerant manner. To the best of our knowledge, we are the first to propose a unified security-as-a-service framework using crowdsourcing, thus introducing a new research problem. We discuss a number of applications, challenges and problems of crowdsourcing in security verification. We have written a book chapter on security of cloud data.

Sushmita Ruj, Kouichi Sakurai, Junpei Kawamoto, Hiroaki Anada, Takahashi Nishide, Rohit Verma and Rajat Saxena

Security and Fault Tolerance in Smart Grids and IoT

We model smart grids as complex interdependent networks, and study targeted attacks on smart grids for the first time. A smart grid consists of two complex networks: the power network and the communication network, which are interconnected. Occurrence of failure/attack on one network triggers failure in the other and propagates in cascades across the networks. Such cascading failures can result in disintegration of either of the networks. Earlier works considered only random failures. In practical situations, an attacker is more likely to compromise nodes selectively. We study cascading failures in smart grids, where an attacker selectively compromises the nodes with probabilities proportional to their degrees; high degree nodes are compromised with higher probability. We mathematically analyze the sizes of the giant components of the networks under attack, and compare them with the sizes in random attacks. We show that networks disintegrate faster for targeted attacks compared to random failures. A targeted attack on a small fraction of high degree nodes disintegrates one or both of the networks, whereas, both the networks contain giant components for random attack on the same fraction of nodes.

Sushmita Ruj, Zhen Huang, Amiya Nayak, Arindam Pal and Misuk Huh

3. PROJECTS

Internally Funded Projects

Ongoing Projects

Sl. no.	Name of the project	Principal Investigator(s)	Unit(s) involved
Theoretical Statistics and Mathematics Division			
1.	ISI Lectures on Probability	Antar Bandyopadhyay & Krishanu Maulik	Stat-Math Unit, Delhi & Kolkata
Applied Statistics Division			
1.	Quantitative Understanding of Genes ….. Morphology	P. Pal Chaudhury	ASU, Kolkata
2.	Turing Laboratory1	Palash Sarkar	ASU, Kolkata
3.	Robust Speaker Identification	Smarajit Bose	ISRU
4.	Application of Classification Techniques in Content Based Image Retrieval	Amita Pal	ISRU
5.	An Interdisciplinary Study of the Arsenic Contamination Problem in Bengal Delta	Ayanendranath Basu	ISRU
Computer and Communication Sciences Division			
1.	The QoS improvement through internetworking of WLAN and UMTS networks (Hybrid UMTS-WLAN)	Sasthi C. Ghosh	ACMU
2.	Visibility with diffuse reflections: bounds and algorithms (Visility DifRef)	Arijit Bishnu	ACMU
3.	Voronoi Game	Sandip Das	ACMU
4.	Massive Data Algorithms	Subhas C. Nandy	ACMU
5.	Logic Synthesis for Quantum Computing (QCS)	Susmita Sur-Kolay	ACMU
6.	Localizability Testing for Wireless Sensor Networks (LTWSN)	Krishnendu Mukhopadhyaya	ACMU
7.	Bangla Handwritten text image corpus with Ground-truth	B.B. Chaudhuri	CVPR
8.	Pattern Classification with absent features	B.B. Chaudhuri	CVPR
9.	Script Identification from Handwritten Documents	U. Pal	CVPR
10.	Video Text Understanding	U. Pal	CVPR
11.	Start-up grant : South Asian Face database	G. Chatterjee	CVPR
12.	Unsupervised Facet Generation in Text Search	D. Majumdar	CVPR
13.	User Adaptive Online Handwriting Recognition	U. Bhattacharya	CVPR

Projects

14.	Algorithms for blind quality assessment of images, tamper detection and correction.	S. Palit	CVPR
15.	Biomedical Natural Language Processing	U. Garain	CVPR
16.	Secured Query Processing for Semantic Web Applications	Pinakpani Pal & Aditya Bagchi	ECSU
17.	Biometric System Design using Bio-hashing Approach	B. Chanda	ECSU
18.	Computational Intelligence Approaches for finding Synergy Networks from Gene Expression Date	N.R. Pal	ECSU
19.	Video Scene Segmentation & Classification	Partha Pratim Mohanta	ECSU
20.	Nonmonotonic logic for common sense Reasoning	K.S. Ray	ECSU
21.	Automated Surveillance System using Hidden Markov Model	K.S. Ray	ECSU
22.	Eulerian Magnification of Video of Biomedical Interest	D.P. Mukherjee	ECSU
23.	Development of Nature-Instpired Metaheuristic for large Scale Engineering Optimization in Dynamic Environments	S. Das	ECSU
24.	Design & Implementation of Online Atmospheric Pattern Detection & Global change monitoring System.	N.C. Deb & Srimanta Pal	ECSU
25.	e-Governance System of ISI	D.P. Mukherjee	ECSU
26.	Development of Computational Methods for Analyzing Biochemical Pathways as Integrated Systems	R.K. De	MIU
27.	Integrating CT Images with Gene Expressions using Soft Computing	S. Mitra	MIU
28.	Development of Rough Set Based Approaches for Identification of Co-Expressed miRNAs	P. Maji	MIU
29.	Network Analysis of Biomolecules for Disease Therapeutics	S. Bandyopadhyay	MIU
30.	Improving the Learning Methodologies in Text Mining	C.A. Murthy	MIU
31.	Development of mathematical morphology based ….. via cartograms	B.S. Daya Sagar	SSIU
32.	Binary Code for the Brain	Kaushik Majumdar	SSIU
Physics and Earth Sciences Division			
1.	Stratigraphic analysis of the Cuddapah, Bhima and Kaladgi successions: implications for Palaeoproterozoic to Neoproterozoic lithospheric dynamics of southern India	S. Patranabis-Deb	GSU
2.	Numerical models of Fluid flow in Cuddapah basin: Implication for Mineralization	Amlan Banerjee	GSU
3.	A comprehensive study on vertebrate faunal assemblage of Jurassic Kota Formation, Pranhita-Godavari basin, India	Debarati Mukherjee	GSU

4.	Sedimentology of the Triassic mud-dominant fluvial systems	P. Ghosh	GSU
5.	Fault zones, fractals and crustal deformation in the Eastern Himalaya	Dilip Saha	GSU
6.	Community structure and ecology of the Mesozoic non-marine tetrapods of the Gondwana basins of peninsular India	D.P. Sengupta & S. Bandyopadhyay	GSU
7.	Study of gastropod diversity from the Indian fossil record (Mesozoic-Caenozoic) with special emphasis on phylogenetic systematics, evolutionary trends and palaeoecological interactions	S.S. Das	GSU
8.	A Study of Neogene and Quaternary successions of eastern Himalayan foreland basin	T. Chakraborty	GSU
9.	Precision Cosmology using combined dataset of CMB Lensing and SN1a	Supratik Pal	PAMU
10.	Simulation of Hawking effect in analogue (fluid) gravity model.	Subir Ghosh	PAMU
11.	Spatially-averaged turbulent flow characteristics over a gravel-bed	Sankar Sarkar	PAMU
Biological Sciences Division			
1.	Competition or facilitation between two invasive plants?	A. Dewanji	AERU
2.	Generation of SSR marker in some mangroves from Sunderbans, India	S. Das	AERU
3.	A study on yield performance of Sweet Sorghum crop (*Sorghum bicolor* L.) at different location and fertility levels for maximization of bio-fuel production in West Bengal	S. Barik	AERU
4.	Health of the Stone Quarry Workers of Birbhum district, West Bengal	S. K. Ray	BAU, Kolkata
5.	Identification of Susceptible Genetic Variants Associated with Coronary Heart Disease in the Population of Andhra Pradesh, India.	B. M. Reddy	BAU, Hyderabad
6.	Study of expression of OXPHOS related mitochondrial and nuclear genes from normal, leukoplakia and cancer tissues of oral cavity and importance in progression of disease	B. Roy	HGU
7.	Genetic Mapping of rare variants, multivariate and longitudinal phenotypes	S. Ghosh	HGU
8.	On integrating several data sources in genetic association study	I. Mukhopadhyay	HGU
9.	Role of epigenetics in psoriasis: Identification of DNA methylation biomarker	R. Chattopadhyay	HGU
Social Sciences Division			
1.	Mechanism Design in Internet Economics	Souvik Roy	ERU

Projects

2.	Biaxial Study of Bangla Lexicosyntax	Probal Dasgupta	LRU
3.	Developmental Challenges in Children and Associated Socioeconomic Factors: A Study in the Purulia District of West Bengal.	Partha De	PSU
4.	Direct and Indirect Roles of Socio-Economic, Demographic, Health and Programmatic Factors in the Growth of Population in Giridih, a District in Jharkhand.	Prasanta Pathak	SOSU
5.	Data Gap in Gender Statistics: Women in Mining Industry	Molly Chattopadhyay	SRU
6.	Gender Issues and Empowerment of Women in rural West Bengal	Bhola Nath Ghosh	SRU
7.	Dynamics of Land use Pattern in North Chotanagpur Plateau: A Micro-level study	Hari Charan Behera	SRU
8.	A micro level study of Television (TV) watching and childhood obesity in Kolkata city of West Bengal, India	Susmita Bharati	SRU
9.	Migration, Social Networks and their impact on rural household of Jharkhand	Rabindranath Jana	SRU
10.	Persistence of Dowry in West Bengal	Prabal Roy Chowdhury, Shyamlal Chowdhury (University of Sydney) & Indrani Roy Chowdhury (Jamia Millia Islamia)	EPU
11.	Evaluating the Consumption Effect of Trade Liberalization	Bharat Ramaswami & Sutirtha Bandhopadhyay	EPU
12.	A field experiment on labour productivity in an Indian garment factory	Farzana Afridi, Amrita Dhillon (Kings College) & Vegard Iversen (University of Manchester)	EPU
13.	Women and Work in Rural India	Farzana Afridi, Abhiroop Mukhopadhyay, Kanika Mahajan & Taryn Dinkelman (Dartmouth College)	EPU
14.	The Role of R & D in Firm Transformation	Farzana Afridi, Susan Thomas (IGIDR) & Renuka Sane	EPU
15.	The Quantity – Quality Trade-off in Education Outcomes:Evodemce from the Right to Education Act in India	Abhiroop Mukhopadhyay, Nishith Prakash (University of Connecticut) & Elizabeth	EPU

		Kaletski (University of Connecticut)	
16.	Evaluating Official Statistics on Land and Livestock holdings	V.K. Ramachandran & Madhura Swaminathan	EAU
Statistical Quality Control and Operations Research Division			
1.	Optimization and Reliability Modeling	Biswabrata Pradhan A. Bandyopahyay, D.K. Manna, A. Gupta, A.K. Das, A. Dewanji, D. Sengupta & S.K. Neogy	SQC & OR Unit, Kolkata, SQC & OR Unit, Delhi & ASU, Kolkata
2.	Compilation and Digitization	Somnath Ray	SQC & OR Unit, Bangalore
Library, Documentation and Information Sciences Division			
1.	Restitution, Indexing and Editing of Old Photographs of ISI for historical illustrations	Tapas Kumar Basu	Repro-Photo Unit, Library, Kolkata

Completed Projects

Sl. No.	Name of the project	Principal Investigator(s)	Unit(s) involved
Computer and Communication Sciences Division			
1.	Algorithmic and Architecturral Design Issues of Microfluidic Nano-Biochips for Bioassay Execution (MICROBE)	Bhargab B. Bhattacharya	ACMU
2.	Extending the scope of the formal Verification with Assertion Mining from (ASMT)	A. Banerjee	ACMU
3.	Distributed Computation in pervasive Computing Environment (DCPC)	Nabanita Das	ACMU
4.	Power and Bandwidth Management in Wireless Networks (PoBaMa-II)	Bhabani P. Sinha	ACMU
5.	Moving Object Detection and Tracking from Complex Video Sequences	A. Ghosh	MIU
6.	Fuzzy Opinion Mining in Social Networking	D.P. Mandal	MIU
7.	A Computational Approach for Human Gene Function Prediction and Network Analysis.	S.S. Ray	MIU
8.	Pattern Classification with granular neural networks	Saroj Kumar Meher	SSIU

Projects

Physics and Earth Sciences Division			
1.	Tectonics of metabasalt-metagranite association in a geochemical approach	Dilip Saha	GSU
Biological Sciences Division			
1.	Management strategies for rice cultivation in the eastern plateau: Field experimental and crop modelling approach	P. Banik & J. Chattopadhyay	AERU
2.	Allelopathy in an Aquatic and neighbouring Ecosystem and the role of allelochemicals in community structure	S. Mandal Biswas	AERU
3.	Site Specific Nutrient Management (SSNM) System for submerged rice in the eastern plateau region of India	P.K. Ghosal	AERU
4.	Cooperative recovery mechanism: A safeguard for minimizing extinction risk	S. Bhattacharya	AERU
Social Sciences Division			
1.	Bengali Pronunciation Dictionary in Printed and Electronic Form	Niladri Sekhar Dash	LRU
2.	Cognitive processing through PASS model and its role in determining academic performance of school students in North – Eastern India	Anjali Ghosh	Psychology Research Unit
3.	Differential Validity of Computer Programming Abilities	D. Dutta Roy	Psychology Research Unit
4.	Parenting style and academic achievement of the school student	Rumki Gupta	Psychology Research Unit
5.	Policy design in Behavioral Settings	Bharat Ramaswami & Subrato Banerjee	EPU
6.	Climate Change and Industrial Productivity: The Effects of Temperature on Worker Productivity	E. Somanathan, R. Somanathan (DSE) & A. Sudarshan (University of Chicago - Delhi Centre)	EPU
7.	The Macroeconomic Implications of Education:Moving Beyond Labour Productivity	Tridip Ray & Mausumi Das (DSE)	EPU
8.	An Empirical Examination of Consumption Externalitites	Abhiroop Mukhopadhyay & Monishankar Bishnu	EPU
9.	Competition Dynamics and Subtainability of Micro Finance Institutions	Prabal Roy Chowdhury, Indrani Roy Chowdhury (Jamia Millia Islamia)	EPU

		& Brishti Guha (Singapore Management University)	
10.	Does Selective Price Regulation of Pharmaceuticals Improve Welfate	Abhiroop Mukhopadhyay, Kensuke Kubo (Institute of Developing Economies) & Prachi Singh	EPU
11.	Problems and Prospects of Financing Higher Education in India: Efficay of Students Loans	Tridip Ray	EPU
Library, Documentation and Information Sciences Division			
1.	Digitization of Conference Materials Organized by ISI	Bhomra Chatterji	Library, Kolkata
2.	Reorganization of Book Collections and Shifting and updating online catalogues	Ashis Kumar Pal	Library, Kolkata
3.	Digital Preservation and Conservation of Rare Documents	Tapan Kr. Mandal	Library, Kolkata
4.	Arrangements and Description of archival items	Krishna Bhattacharyya	PCMMM&A, Kolkata

Externally Funded Projects

Ongoing Projects

Sl. no.	Name of the project	Principal Investigator(s)	Unit(s) involved	Funded by
Theoretical Statistics and Mathematics Division				
1.	Lectures on Probability and Stochastic Processes (LPS) IX	Antar Bandyopadhyay, Krishanu Maulik & Siva Athreya	Stat-Math Unit, Delhi, Kolkata & Bangalore	Lectures on Probability and Stochastic Processes (LPS) IX
2.	Non Commutative Geometry groups and non-Commutative probability	Debashish Goswami	Stat-Math Unit, Kolkata	DST
3.	J.C.Bose Fellowship	Arup Bose	Stat-Math Unit, Kolkata	DST
4.	J. C. Bose Fellowship	R.B. Bapat	Stat-Math Unit, Delhi	Department of Science and Technology, Government of India.
5.	J. C. Bose Fellowship	Rajendra Bhatia	Stat-Math Unit, Delhi	Department of Science and Technology, Government of India.

Projects

6.	Diophantine Equations With Product of integers in Arithmetic Progressions (DST-CONACyT Indo-Mexican Joint Project)	Shanta Laishram	Stat-Math Unit, Delhi	Department of Science and Technology, Government of India.
7.	Exponential Diophantine Equations: Resolution of some well known Diophantine equations	Shanta Laishram	Stat-Math Unit, Delhi	Department of Science and Technology, Government of India.
8.	Targeted Training on Elliptic Curves and Attacks on ECC based schemes at ISI, Delhi,	Shanta Laishram	Stat-Math Unit, Delhi	DRDO
9.	BOBASIO Region Airspace Safety Assesment Study	Antar Bandyopadhyay & Deepayan Sarkar	Stat-Math Unit, Delhi & Kolkata	Airport Authority of India (AAI)
10.	INSPIRE Faculty Award	Arijit Chakrabarty	Stat-Math Unit, Delhi	Department of Science and Technology, Government of India.
11.	E_0-semigroups: classification and invariants	B.V. Rajarama Bhat & Daniel Markiewicz	Stat-Math Unit, Bangalore	UGC
12.	Uniqueness for Stochastic Partial Differential Equations	Siva Athreya & Leonid Mytnik	Stat-Math Unit, Bangalore	UGC
13.	Etale Fundamental groups	Manish Kumar & Lior Bary-Soroker	Stat-Math Unit, Bangalore	UGC
14.	Indo-Russian Project	S. Ponnusamy	Stat-Math Unit, Chennai	DST – RFBR
Applied Statistics Division				
1.	Indo-German DST Project	Mridul Nandy & Sanjit Chatterjee	ASU & IISc., Bangalore	Department of Science & Technology, New Delhi, Govt. of India.
2.	International Passenger Survey	Ashis SenGupta & G. Ravindran	ASU & SQC & OR Unit, Chennai	Ministry of Tourism, Govt. of India
3.	Methodological Study Towards Compilation and Forecasting of Services Trade Statistics	Ashis SenGupta	ASU	DGCI&S, Ministry of Commerce and Industry, Govt. of India
4.	Design and Development of Database and Analytical Tools for Microarray Data on Leishmani Donovani Parasite	Ashis SenGupta	ASU	Department of Biotechnology, Ministry of Science and Technology,

				Govt. of India
5.	Changes in pattern of irrigation, cultivation and livelihood of rural Bengal: The experience of Jamalpur block of Bardhaman	Debasis Sengupta	ASU & Stat-Math Unit, Kolkata	Department of Science & Technology, Govt. of West Bengal
Computer and Communication Sciences Division				
1.	Automatic Sample Preparation and Validation of Biochemical Assays on a microfluidic Lab-on-a-chip (LOC)	B.B. Bhattacharya	ACMU	India-Tiwan Joint Research Programme in Science & Technology
2.	Delay Fault Modeling and Test Generation for Power Supply Noise	S. Sur-Kolay & B.B. Bhattacharya	ACMU	Intel Corporation, USA
3.	Design for Manufacturability aware Global Routing	S Sur-Kolay	ACMU	IBM, USA
4.	Lithography Aware Physical Design for Below 20nm Process Technology	S. Sur-Kolay	ACMU	Indo-Taiwan joint Research Programme in Science & Technology
5.	IBM University Relations	A. Banerjee	ACMU	IBM University Relations
6.	Development of Robust Document Image Analysis and Recognition System for Printed Indian Scripts: Phase II	B.B. Chaudhuri	CVPR	DIT, Govt. of India
7.	Multilingual Word Spotting for Degraded Documents	U. Pal	CVPR	Indo French Centre for the Promotion of Advanced Research (IFCPAR)
8.	The cognitive architecture of face-processing – understanding the separation of information streams	G. Chatterjee	CVPR	DST - INSA
9.	Development of Online Handwriting Recognition System for Indian Languages – Phase II	S.K. Parui	CVPR	DIT, Govt. of India
10.	Dependency Parser for Bengali	U. Garain	CVPR	Society for Natural Language Technology Research (SNLTR)
11.	Digital Image Reconstruction of Indian Cultural Heritage with Focus on Hampi Ruins	B. Chanda	ECSU	Department of Science & Technology
12.	Analysis Recognition and Synthesis of Facial Expressions	Swapna Agarwal	ECSU	Department of Science & Technology
13.	Analys and Modelling of Atmospheric Pollutant over Indo-Gangetic Plain	S. Pal, N.C. Deb & A.K. Chaudhuri	ECSU	CSIR

Projects

14.	Emotional Expression Analysis from the Video of Face Images	D.P. Mukherjee	ECSU	QUALCOMM
15.	Idenification of Bainite and Martensite from Steel Micrographs	Prasun Das & D.P. Mukherjee	SQC & OR Unit & ECSU	Tata Steel
16.	RADIOMICS	S. Mitra	MIU	Maastricht University
17.	Processing and Analysis of Aircraft Images with Machine Learning Techniques for Locating Objects of Interest	A. Ghosh	MIU	U. S. Army
18.	Rough-Fuzzy Computing and Multiresolution Image Analysis for Segmentation of Brain Tumor from Magnetic Resonance Images	P. Maji	MIU	Indian National Science Academy
19.	Agricultural infrastructure	A.R.D. Prasad & Devika P. Madalli	DRTC	European Commission
20.	ITPAR India-Trento project for Advanced Research	A.R.D Prasad & Devika Madalli	DRTC	DST & University of Trento, Italy
21.	Quantification of neural information and subsequent coding scheme	Kaushik Majumdar	SSIU	DBT
Physics and Earth Sciences Division				
1.	Ganga River Basin Environment Management Plan	T. Chakraborty & P. Ghosh	GSU	Ministry of Environment and Forests
2.	Vertebrate microfossils from the Tiki Formation of the Rewa Gondwana basin: an integrated study on Upper Triassic biodiversity	Saswati Bandyopadhyay	GSU	SERB, DST
3.	Assessing the global pattern of the deadliest mass extinction in Earth history: explorations for fossil vertebrates in the Early Triassic beds of India	Saswati Bandyopadhyay & D.P. Sengupta	GSU	National Geographic
4.	Jurassic Gondwana Vertebrates of India: An Integrated Study on Palaeobiology	Debarati Mukherjee	GSU	SERB, DST
Biological Sciences Division				
1.	Development of information on Agricultural and Horticultural production using RS and GIS technology in some district of West Bengal	P. Banik	AERU	DST, Govt. of WB
2.	Effect of Different sources of Water soluble Phosphetic Fertilizers in Eastern plateau area	P. Banik	AERU	Rashtriya Chemicals And Fertilizers Ltd. Govt. of India
3.	Determination of Functional response under selective predation through experimentation and modeling	J. Chttopadhyay	AERU	DST-SERB

4.	Genome Wide Association Study of Chronic Pancreatitis	S. Ghosh	HGU	Dept. of Atomic Energy, GOI
5.	Evidence theory based uncertainty analysis of ground water flow and contaminant transport	I. Mukhopadhyay	HGU	DST, Govt. of India
6.	Non-invasive identification and validation of Epigenetic biomarker in saliva for early detection of Oral pre-cancer and cancer patients in India.	R. Chatterjee	HGU	CSIR, Govt. of India
7.	A comprehensive genomic and genetic characterization of pancreatic cancer in Indian patient population	N. Sikdar	HGU	DBT, Govt. of India
Social Sciences Division				
1.	Indian Language Corpora Initiative-Bengali-2 (ILCI-2)	Niladri Sekhar Dash	LRU	DIT, Govt. of India
2.	Poverty and Aspiration	Sandip Mitra	SOSU	ESRC grant through CAGE, Warwick
3.	Accountability of Local Governments in West Bengal: A pilot study on Gram Panchayats	Sandip Mitra	SOSU	Government of West Bengal
4.	DFID-ESRC, Growth Research Programme	Sandip Mitra	SOSU	DFID-ESRC
5.	ISI-RBI collaboration research project	Diganta Mukherjee	SOSU	Reserve Bank of India
6.	Setting up of Workstation at the Indian Statistical Institute, Kolkata, for Research on Micro-Data from Census	Diganta Mukherjee	SOSU	Office of Registrar General & Census Commissioner
7.	The Diagnostic Survey of Closed Industrial under Micro & Small Scale Enterprises, West Bengal	Pulakesh Maiti	ERU	Government of West Bengal
8.	Evaluation Study on Boarder Area (BADP) Cluster – B	Buddhadeb Ghosh	ERU	Planning Commission, Government of India
9.	Evaluation Study on Boarder Area (BADP) Cluster – C	Buddhadeb Ghosh	ERU	Planning Commission, Government of India
10.	Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA): Himachal Pradesh, Jammu & Kashmir and Uttarakhand	Buddhadeb Ghosh	ERU	Planning Commission, Government of India
11.	Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA): All India Coordination Report	Buddhadeb Ghosh	ERU	Planning Commission, Government of India
12.	Efficient Allocation of Funds and Performance Evaluation of Urban Local Bodies: A Case for West Bengal	Amita Majumder	ERU	4th State Finance Commission, West Bengal

Projects

13.	Informal Insurance Under Group Lending with Individual Liability: Evidence from India	Abhirup Sarkar	ERU	IGC, London School of Economics, London
14.	Centre for Research on the Economics of Climate, Food, Energy and Environment	E. Somanathan	EPU	PPEC
Statistical Quality Control and Operations Research Division				
1.	Identification of Martensitic and Bainitic second phases of Dual Phase Steels	P. Das	SQC & OR Unit, Kolkata	TATA STEEL
2.	Measuring Diversity and Inclusion	Amitava Bandyopadhyay	SQC & OR Unit, Kolkata	TCS
3.	Six Sigma training and projects	Ashis Chakraborty	SQC & OR Unit, Kolkata	ITC, Tribeni Tissues Division
4.	Normalization of Marks of different Board Examinations	Ashis Chakraborty	SQC & OR Unit, Kolkata	Gujarat State Government
5.	Estimating the Quantity of Fake Indian Currency Notes in Circulation	Abhijit Gupta	SQC & OR Unit, Kolkata	Ministry of Home Affairs
6.	Six Sigma Training & Implementation	Sanjit Ray	SQC & OR Unit, Bangalore	Madura Clothing, Aditya Birla Nuvo Ltd.
7.	Six sigma Training & Implementation	U.H. Acharya, K.K. Chowdhury, A.R. Chowdhury, Sanjit Ray & E.V. Gijo	SQC & OR Unit, Bangalore	TVS Motors Hosur
8.	Six Sigma Training & Implementation	A. R. Chowdhury, Somnath Ray & Sanjit Ray	SQC & OR Division and SQC & OR Unit, Bangalore	ITC, Bollaram, ITC, Kovai
9.	Six Sigma Training & Implementation	Sanjit Ray & E.V. Gijo	SQC & OR Unit, Bangalore	Mother Dairy, Delhi
10.	Six Sigma Training & Implementation	K.K. Chowdhury, U.H. Acharya, Subrata Rath & Boby John	SQC & OR Unit, Bangalore	BEL,Bangalore
11.	Two Day Training on Statistical process Control	A. Roy Chowdhury	SQC & OR Unit, Bangalore	TVS Srichakra Limited, Madurai
12.	Facilitation and guidance for statistical modelling	Boby John	SQC & OR Unit, Bangalore	Hewlett Packard
13.	Development of process performance models	Boby John	SQC & OR Unit, Bangalore	Mindtree Solutions
14.	Statistical Process Control	Surajit Pal	SQC & OR Unit, Chennai	Apollo Tyres Limited

15.	Statistical Quality Control and Sampling Methods	Surajit Pal	SQC & OR Unit, Chennai	RITES
16.	Training on Six Sigma Black Belt	D. Sampangi Raman	SQC & OR Unit, Chennai	Apollo Hospital Enterprises
17.	Review of Six Sigma Black Belt Projects	D. Sampangi Raman	SQC & OR Unit, Chennai	HCL Technologies Limited
18.	General Training Programme on Six Sigma Green Belt and Black Belt including Project Guidance at Office	A. Rajagopal	SQC & OR Unit, Coimbatore	Participants
19.	Design for Six Sigma for Process and Product Design in Brakes Manufacturing	A. Rajagopal	SQC & OR Unit, Coimbatore	TVS Brakes, Chennai
20.	Unbiased estimate of defects, reducing process defects and rework of bottles	A. Rajagopal	SQC & OR Unit, Coimbatore	United Beverages, Palaghat
21.	Panamarthupatti and Cheyyar, mining site- Quality System Implementation	A. Rajagopal	SQC & OR Unit, Coimbatore	SRC Projects, Salem
22.	Increasing the outsourcing and vender identification for meeting the excessive order in Govt. school uniforms	A. Rajagopal	SQC & OR Unit, Coimbatore	TCTP, Erode
23.	Counter measures for quality and profitability for speculative conditions in spinning domain	A. Rajagopal	SQC & OR Unit, Coimbatore	MYK, Hyderabad
24.	Robustness in business in speculative conditions in spinning domain using statistical methodologies	A. Rajagopal	SQC & OR Unit, Coimbatore	Bannariamman Spinning Mills, Dindugal
25.	Feedbacks and Training Effectiveness on 2014 – 2015	A. Rajagopal	SQC & OR Unit, Coimbatore	FCRI, Palaghat
26.	Design and development of New Fancy Slab yarn	A. Rajagopal	SQC & OR Unit, Coimbatore	Shiva Texyarn Unit – II, Coimbatore
27.	In plant Training on Six Sigma Green belt and Black Program	A. Rajagopal	SQC & OR Unit, Coimbatore	GHCL, Madurai
28.	Master Black Belt Training Programme	A. Sarkar	SQC Unit, Mumbai	HDFC Bank
29.	Six Sigma Training and Implementation	A. Sarkar	SQC Unit, Mumbai	Corporate Business Cell, ABMC
30.	Development of Sampling Plan	A. Sarkar	SQC Unit, Mumbai	Sterlite Technologies Limited
31.	Training on Green Belt	A. Sarkar	SQC Unit, Mumbai	Xavier Institute of Management
32.	Survey on Employee Engagement	A. Sarkar	SQC Unit, Mumbai	Essar Steel Limited
33.	Training and Implementation of SPC	S. Sikder	SQC Unit, Mumbai	Jindal Poly Flims Limited, Nasik
34.	Training on Reliability	S. Sikder	SQC Unit, Mumbai	Naval Armament Inspectorate
35.	Training on Green Belt	S. Sikder	SQC Unit, Mumbai	Naval Armament Inspectorate

Projects

36.	DFSS implementation	S. Rath	SQC Unit, Pune	Technova Imaging Systems Limited, Pondicherry
37.	Data Analysis Support	S. Rath	SQC Unit, Pune	Marico Industries Limited, Pondicherry
38.	Champion Program on Six Sigma	S. Rath	SQC Unit, Pune	Maersk, Pune
39.	Six Sigma Black-Belt Program	S. Rath	SQC Unit, Pune	Balasore Alloys Limited, Balasore, Orissa
40.	Six Sigma Champion Program	S. Rath	SQC Unit, Pune	Reliance Industries Limited, Jamnagar
41.	Six Sigma Black-Belt	S. Rath	SQC Unit, Pune	Organizations and Participants
42.	Six Sigma Black-Belt	S. Rath	SQC Unit, Pune	Organizations and Participants
43.	Six Sigma Master Black-Belt	S. Rath	SQC Unit, Pune	Organizations and Participants
44.	Training Program on QFD	S. Rath	SQC Unit, Pune	Bergen engineers Pvt. Limited, (Rolls Royce), New Delhi
45.	Training Program on SPC	S. Rath	SQC Unit, Pune	Pidilite Inustries Limited, Mumbai
46.	Training Program on Advanced Statistical Techniques	S. Rath	SQC Unit, Pune	Maersk, Pune
47.	Six Sigma Master Black-Belt Program	S. Rath	SQC Unit, Pune	Organizations and Participants
48.	Six Sigma Implementation	S. Rath	SQC Unit, Pune	Balasore Alloys limited, Balasore, Orissa
Centre for Soft Computing Research: A National Facility				
1.	J.C. Bose Fellowship	S.K. Pal	CSCR	Department of Science & Technology, Govt. of India
2.	Erusmus Mundus External Cooperation Window (EMECW)	A. Ghosh	CSCR	European Commission

Completed Projects

Sl. no.	Name of the project	Principal Investigator(s)	Unit(s) involved	Funded by
Theoretical Statistics and Mathematics Division				
1.	Risk Analysis, Ruin and Extremes (RARE)	Krishanu Maulik & Parthanil Roy	Stat-Math Unit, Kolkata	Marie Curie Research Staff Exchange Fellowship from the 7th European Community Framework Programme

Computer and Communication Sciences Division				
1.	New Techniques of Fast Image Compression Based on Human Vision Systems and Geometric Data Structures	B.B. Bhattacharya & M.K. Kundu	ACMU & MIU	Intel Corporation, USA
2.	Unrestricted Research Grant	K. Maulik & A. Banerjee	ACMU & Stat-Math Unit, Kolkata	Microsoft Research India
3.	DST-SERB Summer School on Mathematical Morphology in Geosciences	B.S. Daya Sagar	SSIU	DST-SERB
Physics and Earth Sciences Division				
1.	Depositional models and sedimentation history of Proterozoic sedimentary basins of Peninsular India	Sarbani Patranabis-Deb	De Beers Group	GSU
Biological Sciences Division				
1.	An investigation on antimicrobial potential of chebulicmyrobalan (fruit of Terminaliachebula Retz.) against methicillin resistant Staphylococcus aureus	R.R. Chattopadhyay	AERU	DST, Govt. of WB
2.	Eco-epidemiological modelling on disease dynamics with desease on both prey and predator population	J. Chttopadhyay	AERU	Dept of Atomic Energy, Govt. of India
Social Sciences Division				
1.	Indradhanush WordNet Development for Bengali Language	Probal Dasgupta and Niladri Sekhar Dash	LRU	DIT, Govt. of India
2.	Reviewing the existing system of compilation of trade indices	Nachiketa Chattopadhyay	SOSU	DGCI&S, Govt. of India
3.	Econometric Forecast of Electricity Demand	Abhiroop Mukhopadhyay & Eshita Gupta	EPU	Central Electricity Authority
Statistical Quality Control and Operations Research Division				
1.	Six Sigma Black Belt Training and Projects	A.R. Mukhopadhyay	SQC & OR Unit, Kolkata	Price Water House Coopers
2.	Data Quality Assessment for HMIS, NRHM	P. Das	SQC & OR Unit, Kolkata	NRHM, Dept of H&FW, Govt. of W.B.
3.	25 day Business Analytics Course for TCS executives	Ranjan Sett	SQC & OR Unit, Kolkata	TCS
4.	5 day course Business Analytics using R	Amitava Bandyopadhyay	SQC & OR Unit, Kolkata	Infosys, Manufacturing
5.	10 day course on Business Analytics using R	Amitava Bandyopadhyay	SQC & OR Unit, Kolkata	Infosys, Quality Department

Projects

6.	Five Day Training Program on Quality Management & Statistical Tools and Techniques	U. H. Acharya & A. Roy Chowdhury	SQC & OR Unit, Bangalore	NADP (National Academy for Defence Production) Nagpur
7.	Facilitation and guidance for statistical modelling	Boby John & K. K. Chowdhury	SQC & OR Unit, Bangalore	Infosys BPO
8.	Program on statistical tools and techniques for six sigma professionals	Boby John & K.K. Chowdhury	SQC & OR Unit, Bangalore	Mindtree Solutions
9.	Program on Statistical tools and techniques	Boby John	SQC & OR Unit, Bangalore	Tally Solutions
10.	Program on Statistical tools and techniques for process management	Boby John	SQC & OR Unit, Bangalore	Cross-domain Solutions
11.	Six Sigma Green Belt Program (2 batches)	Boby John & K.K. Chowdhury	SQC & OR Unit, Bangalore	Hinduja Global Solutions
12.	Program on statistics for data exploration and modelling	Boby John & K.K Chowdhury	SQC & OR Unit, Bangalore	Deloitte, Hyderabad
13.	Program on statistics for data exploration and modelling	Boby John & K.K Chowdhury	SQC & OR Unit, Bangalore	Deloitte, Mumbai
14.	Business Analytics Program	Boby John & Amitava Banerjee	SQC & OR Unit, Bangalore, Kolkata	Infosys Technologies
15.	Module-wise Training on Statistical Techniques	A.R. Chowdhury, Somnath Ray, Sanjit Ray & E.V. Gijo	SQC & OR Unit, Bangalore	Biocon Ltd.
16.	Training on Reliability Engineering	E.V. Gijo	SQC & OR Unit, Bangalore	L & T, Mysore
17.	Four Day Training on Design of Experiments	A. Roy Chowdhury	SQC & OR Unit, Bangalore	TVS Srichakra Limited, Madurai
18.	In-house training on Quality & Reliability Engineering and Six Sigma Green Belt	G. Murali Rao	SQC & OR Unit, Hyderabad	Defence Institute of Advanced Technology (DIAT), Pune
19.	In-house training on Six Sigma Black Belt	G. Murali Rao	SQC & OR Unit, Hyderabad	FactSet India Pvt. Ltd.
20.	In-house training on Statistical Methods for Process Improvement	G. Murali Rao	SQC & OR Unit, Hyderabad	Amazon India Development Centre

21.	In-house Training on Design for Six Sigma	G. Murali Rao & A.L.N. Murthy	SQC & OR Unit, Hyderabad	Hyundai Motor India Engineering Pvt. Ltd.
22.	Drugs Survey – Statistical Design of the Survey and Data Analysis	GSR Murthy	SQC & OR Unit, Hyderabad	National Institute of Biologicals, Noida
23.	Six Sigma Implementation	S M Subhani & Ashis Chakraborty	SQC & OR Unit, Hyderabad & Kolkata	ITC Limited, Bollaram
Centre for Soft Computing Research				
1.	INAE Chair Professorship	Sankar K. Pal	CSCR, Kolkata	Indian National Academy of Engineering
R.C. Bose Centre for Cryptology and Security				
1.	Computational Aspects of Mathematical Design and Analysis of Secure Communication Systems Based on Cryptographic Primitives	Sushmita Ruj & Kouichi Sakurai	RCBCCS, Kolkata	India-Japan Cooperative Science Programme (DST-JSPS)
2.	Study of Security and Privacy issues of Internet of Things	Sushmita Ruj	RCBCCS, Kolkata	Samsung, Korea

North East Projects

Ongoing Projects

Sl. no.	Name of the project	Principal Investigator(s)	Unit(s) involved
Social Sciences Division			
1.	The Biaxial Syntax of Inflected Clauses in Assamese and Bangla	Probal Dasgupta	LRU

Completed Projects

Sl. no.	Name of the project	Principal Investigator(s)	Unit(s) involved
Computer and Communication Sciences Division			
1.	Mobile Networks - from Devices to Computing	ACMU Faculty Members	ACMU

4. SYMPOSIA, CONFERENCES, WORKSHOPS, LECTURES AND SEMINARS ORGANISED

Symposia and Conferences

NCM Advanced Instructional Symposium on "*Diophantine Equations*": Stat-Math Unit, Delhi, held in H. P. University, Shimla, June 16-July 04, 2014.

Symposium on "*Mathematics of Public Key Cryptography*": Stat-Math Unit, Delhi, October 16-17, 2014.

Indo-Russian Joint Conference on "*Statistics & Probability*": Stat-Math Unit, Delhi, January 15-18, 2015

International Workshop and Conference on "*Recent Advances in Operator Theory and Operator Algebras (OTOA 2014)*": Stat-Math Unit, Bangalore, December 09–19, 2014.

Symposium on "*Statistics and Mathematics*" by Doctoral and Post-Doctoral Fellows: Stat-Math Unit, Bangalore Centre, July 16-17, 2014.

Symposium on "*Probability*": Stat-Math Unit, Bangalore, January 19, 2015.

Symposium on "*Quantum Guassian states, their covariance matrices and structure*": Stat-Math Unit, Bangalore, February 02-06, 2015.

Symposium on "*Geometry*" by Research Scholars: Stat-Math Unit, Bangalore, February 26-28, 2015.

One day Symposium on "*Analysis*": Stat-Math Unit, Bangalore, March 9, 2015.

One day symposium on "*Mathematical Analysis*": Stat-Math Unit, Chennai, December 09, 2014.

One Day Symposium on "*Geometric Function Theory – I*": Stat-Math Unit, Chennai, February 09, 2015.

One day Symposium on "*Various Techniques in Mathematical Statistics and Its Applications*": Stat-Math Unit, Chennai, held at Bharathidasan University, Tiruchirappalli, February 28, 2015.

One Day Symposium on "*Geometric Function Theory – II*": Stat-Math Unit, Chennai, March 30, 2015.

International Conference on "*Robust Statistics (ICORS 2015)*": ISRU, Kolkata, January 12-16, 2015.

8th International Conference on "*Advances in Pattern Recognition (ICAPR 2015)*": ECSU, Kolkata, in collaboration with IEEE Computational Intelligence Society and the Indian Unit for Pattern Recognition and Artificial Intelligence, January 04-07, 2015.

International Symposium on "*Data Science*": DRTC, Bangalore, in collaboration with CODATA, Paris, France, March 19-20, 2015.

Instructional Symposium on *"Logical Aspects of Multi-Agent Systems (ISLAMAS 2015)"*: CSU, Chennai, in collaboration with and held at Institute of Mathematical Sciences (IMSc), Chennai, February 01-03, 2015.

International Conference on "*India Biodiversity Meet, 2014*": AERU, Kolkata, November 21-23, 2014.

National Conference on "*Human Diversity: Biological Anthropological Approaches*": BAU, Kolkata, March 26-27, 2015.

National Conference on *"Human Genetics: Techniques and Statistical Analyses*": HGU, Kolkata, held at Assam University, Silchar, Assam, November 10-14, 2015.

National Conference on *"Human Genetics: Techniques and Statistical Analyses*", HGU, Kolkata, held at Sikkim Central University, Gangtok, Sikkim, March 16-20, 2015.

National Conference on "*Adolescent Development: Issues & Challenges*": Psychology Research Unit, Kolkata, January 29-30, 2015.

National Conference on "*Agriculture and Rural Development Issues in Eastern India*": SRU, Kolkata and Giridih, held at ISI Giridih Branch, March 12-13, 2014.

10th Annual Conference on "*Economic Growth and Development*": EPU, Delhi, December 18-20, 2014.

Symposia on "*Official Sources of Statistics on Land holdings in Rural India*": EAU, Bangalore, March 06, 2015.

Symposium on "*Business Analytics*": SQC & OR Unit, Kolkata, December 17-18, 2014.

Symposium on "*Reliability Theory, Survival Analysis and Related Topics*" (for Research Scholars): SQC & OR Unit, Kolkata, January 22-23, 2015.

Conference on "*Six Sigma Case Study*": SQC & OR Unit, Bangalore, held at Hotel Atria, Bangalore February 13-14, 2015.

1st Conference on "*Business Analytics*": SQC & OR Unit, Chennai, February 28-March 01, 2015.

International Seminar on "*Dynamics of museum and social inclusion*": P.C. Mahalanobis Memorial Museum & Archives, Library, Documentation and Information Science Division, Kolkata, February 26-28, 2015.

Symposium on "*Artificial Intelligence"*: CSCR, Kolkata, in collaboration with All India Institute of Medical Sciences, New Delhi, August 23-24, 2014.

North-East Symposia and Conferences

Symposium on "*DoE and Statistical Data Modelling*": SQC & OR Unit, Bangalore and Hyderabad, held at NIT Sikkim, March 02–04, 2015.

Workshops and Training Programmes

Workshop on "*Growth Curve Model (GCM)*": Stat-Math Unit, Kolkata, held at Giridih Branch, ISI, Jharkhand, February 27-28, 2015.

NCM Advanced Instructional School on "*Diophantine Equations*": Stat-Math Unit, Delhi, in collaboration with H.P. University, Shimla, held at Shimla, June 16-July 04, 2014.

Workshop on "*Mathematics of Public Key Cryptography*": Stat-Math Unit, Delhi, October 16-17, 2014.

Training Programme on "*Statistics for the employees of the Power System Operation Corporation Ltd. (POSOCO)*": Stat-Math Unit, Delhi, February 25–27, 2015.

Conferences and Seminars

Training Programme on "*Stream Ciphers, their Properties and Cryptanalytic Attacks*": Stat-Math Unit, Delhi, in collaboration with DRDO, March 17-25, 2015.

Training Programme on "*Elliptic Curves & Attacks on ECC based Schemes*": Stat-Math Unit, Delhi, in collaboration with DRDO, March 08-April 08, 2015.

Advanced Instructional School on "*Operator Theory (2014)*": Stat-Math Unit, Bangalore Centre, June 02–21, 2014.

Workshop on "*Mathematics Day*" (for the teachers and students of colleges & schools): Stat-Math Unit, Bangalore, November 19, 2014.

International Workshop and Conference on "*Recent Advances in Operator Theory and Operator Algebras (OTOA 2014)*": Stat-Math Unit, Bangalore, December 09–19, 2014.

Advanced Instructional Schools on *"Cryptography*": ASU, Kolkata, held at SETS, Chennai, June 16-July 04, 2014.

Winter School on "*Interplay between Statistics and Cryptology*": ASU, Kolkata, December 01-05, 2014.

Workshop on *"Environmental Statistics*" (VI-MSS): ASU, Kolkata in collaboration with Statistical and Applied Mathematical Sciences Institute (SAMSI), North Carolina, USA, March 02-04 2015.

Winter School on "*Application of Statistical Methods in Medicine, Public Health and Environment Using Computer*": ASU, Kolkata, March 23-27, 2015.

Winter School on "*Statistical Data Analysis Methods*": ISRU, Kolkata, February 16-20, 2015.

Training Programme on *"Statistics*" (National Level Advanced Orientation): ASU, Chennai, August 18-22, 2014.

International Workshop on *"Statistical Methods for Business and Industry Applications":* ASU, Chennai, January 08-09, 2015.

Training Programme on *"Independent Component Analysis*": ASU, Chennai, January 06-09, 2015.

Training Programme on "*An Introduction to Regenerative Monte Carlo procedures including IIDMC and MCMC*": ASU, Chennai, January 12-22, 2015.

Workshop *on "Statistical Methods and Applications":* AOSU, Tezpur in collaboration with Department of Statistics, Manipur University, held at Manipur University, Imphal, Manipur, January 30-February 02, 2015.

Indo-German Workshop on "*Algorithms*": ACMU, Kolkata, March 09-13, 2015.

Workshop on "*Data and Security*": ECSU, Kolkata, September 22, 2014.

6th Workshop on "*Forum for Information Retrieval Evaluation*": CVPR, Kolkata, held at Bangalore Centre, ISI, December 05-07, 2014.

Workshop on "*Computational Aspects of Game Theory*": ECSU, Kolkata, June 16-20, 2014.

Tutorial on "*Essence - A Foundation for Software Development Games*": ECSU, Kolkata, June 04, 2014.

Workshop on "*Data and Security*": ECSU, Kolkata, September 22, 2014.

Workshop on "*SODAR Technology: Applications in Environmental & Disaster Management*": ECSU, Kolkata, Friday, September 26, 2014.

International Workshop on "*Semantics for Data*": DRTC, Bangalore, held at Conventional Centre, Jawaharlal Nehru University, New Delhi, November 02, 2014.

Workshop on "*Strategies for Open Science*": DRTC, Bangalore, held at Conventional Centre, Jawaharlal Nehru University, New Delhi, November 05 2014.

International Workshop on "*Big Data*": DRTC, Bangalore, in collaboration with Committee on Data for Science and Technology (CODATA), Paris, France, March 09-20, 2015.

Summer School on "*Mathematical Morphology in Geosciences*": SSIU, Bangalore, in collaboration with Science and Engineering Research Board (SERB), Department of Science & Technology, March 24-April 08, 2015.

Training Programme on "*Methodology of Sedimentary Faeces Analysis*": GSU, Kolkata, in collaboration with Wojtek Nemec, University of Bergen, Norway, October 10–11, 2014.

Workshop on "*Sedimentary faeces analysis*": GSU, Kolkata, held at Cuddapah Basin, Andhra Pradesh, in collaboration with Wojtek Nemec, University of Bergen, Norway, October 13–21, 2014.

Training Programme on "*Methods of recognition and study of paleosols*": GSU, Kolkata, in collaboration with Giorgio Basilici, University of Campina, Brazil, November 24-27, 2014.

Workshop on "*Statistical Applications to Cosmology and Astrophysics*": PAMU, Kolkata, in collaboration with Inter-University Centre for Astronomy and Astrophysics (IUCAA) February 10-13, 2015.

Workshop on "*Researcher's Meet 2015*": PAMU, Kolkata, March 18–20, 2015.

Workshop on "*R-Programming"* (for the Students and Researchers): AERU, Kolkata, September 16-17, 2014.

Workshop on "*Doctoral Students"*: ERU, Kolkata, in collaboration with Indira Gandhi Institute of Development Research, Mumbai, March 18-20, 2015.

Workshop on "*Game Theory and Mechanism Design*": ERU, Kolkata, March 24, 2015.

Training Programme on "*Data Mining in Psychological Research*": Psychology Research Unit, Kolkata, February 19-21, 2015.

Workshop on "*Census Data Dissemination*": SOSU, Kolkata, December 19, 2014.

4th Workshop on "*West Bengal Growth*": SOSU, Kolkata, December 26-27, 2014.

Training Programme on "*Official Statistics and Related Methodology*": SOSU, Kolkata, July 21-25, 2014.

Training Programme on "*Sample Survey Methodology and Estimation*": SOSU, Kolkata, December 29, 2014- January 9, 2015.

Conferences and Seminars

Training Program on "*Macro and Microeconomics*" (for ISS Probationers): EPU, Delhi, July 21–August 01, 2014.

Workshop on "*3rd Delhi Macroeconomics*": EPU, Delhi, October 31, 2014.

Workshop on *"ISI-ISER Young Economists*": EPU, Delhi, February 12, 2015.

Workshop on "*Design of Experiments*": SQC & OR Unit, Kolkata, November 10-14, 2014.

Training Programme on "*Six Sigma Black Belt 1st Module*": SQC & OR Unit, New Delhi, August 20–22, 2014.

Training Programme on "*Six Sigma Green Belt"*: SQC & OR Unit, New Delhi, April 22–24, 2014.

Training Programme on "*Six Sigma Green Belt"*: SQC & OR Unit, New Delhi, August 04–06, 2014.

Training Programme on "*Six Sigma Black Belt 2nd Module*": SQC & OR Unit, New Delhi, September 16–19, 2014.

Training Programme on "*Six Sigma Green Belt"*: SQC & OR Unit, New Delhi, September 24 – 26, 2014.

Training Programme on "*Six Sigma Black Belt 3rd Module*": SQC & OR Unit, New Delhi, October 14–17, 2014.

Training Programme on "*Six Sigma Black Belt 4th Module"*: SQC & OR Unit, New Delhi, November 12-14, 2014.

Training Programme on "*Six Sigma Green Belt"*: SQC & OR Unit, New Delhi, December 03–05, 2014.

Workshop on *"Applied Optimization Models and Computation"*: SQC & OR Unit, New Delhi, January 28–30, 2015.

Training Programme on "*Six Sigma Green Belt"*: SQC & OR Unit, New Delhi, February 04–06, 2015.

Training Programme on "*Six Sigma Master Black Belt 1st Module*": SQC & OR Unit, New Delhi, February 16–20, 2015.

Training Programme on *"Environmental Data Interpretation, Compilation and Reporting"*: SQC & OR Unit, New Delhi, in collaboration with Central Pollution Control Board, Govt. of India*,* February 24–26, 2015.

Training Programme on "*Six Sigma Master Black Belt 2nd Module*": SQC & OR Unit, New Delhi, March 16–21, 2015.

Certification Program on "*Six Sigma Black Belt (BB-19)*": SQC & OR Unit, Bangalore, April 19-27, 2014 (Phase-1) & May 23-26, 2014 (Phase-2).

Certification Program on "*Six Sigma Green Belt (GB-29)*": SQC & OR Unit, Bangalore, May 03-05 & May 09-11, 2014.

Training Program on "*Statistics for Data Exploration & Modelling (SDEM-01)*": SQC & OR Unit, Bangalore, June 13-15 & June 28-29, 2014.

Certification Program on "*Six Sigma Green Belt (GB-30)*": SQC & OR Unit, Bangalore, July 05-07 & July 11-13, 2014.

Certification Program on "*Six Sigma Master Black Belt (MBB-23)*": SQC & OR Unit, Bangalore, July 19-August 03, 2014.

Certification Program on "*Six Sigma Black Belt (BB-20)*": SQC & OR Unit, Bangalore, August 09-17 (Phase-1) and September 26-29, (Phase-2) 2014.

Certification Program on "*Six Sigma Green Belt (GB-31)*": SQC & OR Unit, Bangalore, August 23–25 & 29–31, 2014.

Certification Program on "*Six Sigma Green Belt (GB-32)*": SQC & OR Unit, Bangalore, September 06-08 & 12-14, 2014.

Training Program on "*Six Sigma Black Belt*": SQC & OR Unit, Chennai, April 26-May 04, 2014.

Training Program on "*Six Sigma Black Belt*": SQC & OR Unit, Chennai, May 24-August 31, 2014.

Training Program on "*Business Analytics*": SQC & OR Unit, Chennai, June 21-August 03, 2014.

Training Program on "*Business Analytics*": SQC & OR Unit, Chennai, November 01-December 14, 2014.

Training Program on "*Six Sigma Black Belt*": SQC & OR Unit, Chennai, November 15, 2014-February 22, 2015.

Training Program on "*Business Analytics*": SQC & OR Unit, Chennai, February 07-March 29, 2015.

Workshop on "*Achieving Breakthrough Quality (Edition 4)*": SQC & OR Unit, Coimbatore, in collaboration with Southern India Mills' Association, Coimbatore, June 29, 2014.

Training Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Hyderabad, April 17-21, 2014.

Training Programme on "*Six Sigma Black Belt*": SQC & OR Unit, Hyderabad, June, 2014.

Training Programme on "*Optimization Tools for Business Analytics- Optimal Decision Making through Intelligent Modelling*": SQC & OR Unit, Hyderabad, June-September, 2014.

Training Programme on "*Statistical Process Control*": SQC & OR Unit, Hyderabad, held at Bharat Dynamics Ltd., Hyderabad, August 20-21, 2014.

Training Programme on "*Statistical Methods for Process Improvement*": SQC & OR Unit, Hyderabad, held at Amazon India Development Centre, Hyderabad, August-September, 2014.

Training Programme on "*Quality & Reliability Engineering and Six Sigma Green Belt*": SQC & OR Unit, Hyderabad, held at Defence Institute of Advanced Technology (DIAT), Pune, September-October, 2014.

Training Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Hyderabad, October 10-14, 2014.

Training Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Hyderabad, October 24-28, 2014.

Training Programme on "*Design for Six Sigma*": SQC & OR Unit, Hyderabad, held at Hyundai Motor India Engineering Pvt. Ltd., October-November, 2014.

Conferences and Seminars

Training Programme on "*Six Sigma Black Belt (Phase – I)*": SQC & OR Unit, Hyderabad, November 13-18, 2014.

Training Programme on "*Six Sigma Black Belt (Phase – II)*": SQC & OR Unit, Hyderabad, December 11-16, 2014.

Training Programme on "*Pre-workshop (DOE & SM) lectures*": SQC & OR Unit, Hyderabad, December 22, 2014.

Training Programme on "*Workshop on DOE & Statistical Modeling*": SQC & OR Unit, Hyderabad, January 05-09, 2015.

Training Programme on "*Six Sigma Green Belt*": SQC & OR Unit, Hyderabad, February 12-16, 2015.

Training Programme on *"Six Sigma Green Belt":* SQC & OR Unit, Mumbai, April 12-13 & 18–20, 2014.

Training Programme on "*Statistical Techniques for Six Sigma Black Belt":* SQC & OR Unit, Mumbai, held at Thai Phosphate, Thailand, May 19-22, 2014.

Training Programme on "*Statistical Techniques for Six Sigma Black Belt":* SQC & OR Unit, Mumbai, held at ABMS, Mumbai, June 10-13, 2014.

Training Programme on *"Reliability for Indian Navy*": SQC & OR Unit, Mumbai, held at NIA, Karanja, June 20 & 23–25, 2014.

Training Programme on "*Six Sigma Black Belt":* SQC & OR Unit, Mumbai, July–September, 2014.

Training Programme on "*Statistical Techniques for Data Mining & Business Analytics*"*:* SQC & OR Unit, Mumbai, August 09-10 & 22-23, 2014.

Training Programme on "*Six Sigma Green Belt":* SQC & OR Unit, Mumbai, September 06-07 & 12-14, 2014.

Training Programme on "*Six Sigma Master Black Belt":* SQC & OR Unit, Mumbai, October - November 2014.

Training Programme on "*Statistical Techniques for Six Sigma Black Belt":* SQC & OR Unit, Mumbai, held at INDAL, Renukoot, November 04-07, 2014.

Training Programme on *"Six Sigma Green Belt":* SQC & OR Unit, Mumbai, December 05-07 & 20–21, 2014.

Training Programme on "*Statistical Techniques for Six Sigma Black Belt":* SQC & OR Unit, Mumbai, held at ABMS financial services, Mumbai, November 11-14, 2014.

Training Programme on "*Six Sigma Master Black Belt":* SQC & OR Unit, Mumbai, held at HDFC Bank, Mumbai, October 27-31 & November 17-21, 2014.

Training Programme on "*Sigma* Green *Belt":* SQC & OR Unit, Mumbai, held at Aditya Birla Science and Technology, Taloja, Mumbai, September 01-03 & December 01-03, 2014.

Training Programme on "*Six Sigma Green Belt":* SQC & OR Unit, Mumbai, January 09-11 & 24–25, 2015.

Training Programme on *"Statistical Process Control*": SQC & OR Unit, Mumbai, held at JPL, Nasik, January 05-07, 2015.

Training Programme on "*Six Sigma Black Belt":* SQC & OR Unit, Mumbai, January–March, 2015.

Training Programme on *"Six Sigma Black Belt for Indian Navy*": SQC & OR Unit, Mumbai, held at NIA, Karanja, January 28-30 & February 02-03, 2015.

Training Programme on *"Statistical Technique for data analysis*": SQC & OR Unit, Mumbai, held at Mahindra and Mahindra, Mumbai, March 19-20, 2015.

3rd Training Programme on "*Adobe Photoshop: a Basic Course*": Repro-Photo Unit, Library, Documentation and Information Science Division, Kolkata, January 20-27, 2015.

5th Workshop on "*Digital Pictorial Photography*": Repro-Photo Unit, Library, Documentation and Information Science Division, February 02-06, 2015.

Workshop on "*Open Source Integrated Library Management Software Koha*": Library, Documentation and Information Science Division*,* Kolkata, February 02-06, 2015

Workshop on "*Soft Computing and Applications*": CSCR, Kolkata in collaboration with JSS Academy of Technical Education, Noida, September 02-04, 2014.

Workshop on "*International Workshop on Soft Computing and Applications",* CSCR, Kolkata in collaboration with South Asian University, New Delhi, March 25-27, 2015.

Training Program on "*MS Windows, MS-Word & Excel*" (for ISI Workers of Giridih): CSSC, Kolkata, January 06-09, 2015.

Training Program on "*MS Windows, MS-Word & Excel*" (for ISI Workers of Kolkata): CSSC, Kolkata, January 19-23, 2015.

Training Program on "*SPSS*" (for ISI Workers of Kolkata): CSSC, Kolkata, January 12-16, 2015.

Training Program on "*Programming with Java*" (for ISI Workers and Wards of Kolkata): CSSC, Kolkata, March 09–27, 2015.

Workshop on "*Quantum Paradigms and Security*": RCBCCS, Kolkata held at IISER Kolkata, September 27-28, 2014

Workshop on "Secure Networking and Forensic Computing (SNFC)": RCBCCS, Kolkata in collaboration with IEEE-ICC, Sydney, Australia, June 10-14, 2014.

North-East Workshops and Training Programmes

Training Programme on "*Basic Statistics Using Software*": ASU, Kolkata, held at National Institute of Technology, Silchar, August, 14-18, 2014.

Training Programme on "*Statistical Data Analysis*": ASU, Kolkata, September 01-12, 2014.

Training Programme on "*Basic Statistics with SPSS*": ASU, Kolkata, held at Department of Mathematics, Sikkim Government College, Gangtok, Sikkim, November, 05-07, 2014.

Conferences and Seminars

Workshop on "*Techniques of Data Analysis*": ISRU, Kolkata, held at Dimapur Government College, Dimapur, Nagaland, September 15-19, 2014.

Short-term Course on *"Statistical Methods*": ISRU, Kolkata, held at Arya Vidyapeeth College, Guwahati, Assam, November 17-22, 2014.

Workshop on "*Mobile Networks - from Devices to Computing (MNDC - 2015)*": ACMU, Kolkata, held at Sikkim Manipal Institute of Technology, Rongpo, Sikkim, February 14-16, 2015.

Workshop on "Pattern Analysis and Applications": CVPR, Kolkata, held at Nagaland University, Dimapur, Nagaland, February 09-13, 2015.

Workshop on "*Computational Information Processing*": ECSU, Kolkata, held at NIT Sikkim, Ravangla, South Sikkim, September 10-13, 2014.

Workshop on "*Computational Information Processing*": ECSU, Kolkata, held at ICFAI University, Agartala, Tripura, February 03-04, 2015.

Autumn School on "*Machine Intelligence and Applications*": MIU, Kolkata, held at Sikkim University, Gangtok, Sikkim, September 22− 26, 2014.

Spring School on "*Computational Biology: Tools and Techniques*": MIU, Kolkata, held at Department of Computer Science and Engineering, National Institute of Technology, Silchar, Assam, March 20–24, 2015.

Workshop on "*Statistical and Computing Methods for Life Science data Analysis" (*for the faculty members and research scholars of Mizoram University): BAU, Kolkata and Department of Environmental Science (PUC), Aizawl, February 09-16, 2015.

2nd Workshop on "*Official Statistics"* : SOSU, Kolkata, September 13-15, 2014.

Workshop on "*Data Analysis"*: SOSU, Kolkata, held at Guwahati, March 23-27, 2015.

Training Programme on "*Basic Statistics including Official Statistics and Use of Computer/IT for Statistical Work for DESMI*": SOSU, Kolkata, held at Gangtok, Sikkim, June 01-12, 2014.

Workshop on "Reliability": SQC & OR Unit, Kolkata, held at NIT, Silchar, January 16-19, 2015.

Workshop on "*Process Control, Improvement and Optimization*": SQC & OR Unit, Kolkata, held at M.B.B College, Agartala, February 16-18, 2015.

Workshop on "*Six Sigma*": SQC & OR Unit, Kolkata, held at Assam University, Silchar, February 23-28, 2015.

Workshop on "*Data Quality, Predictive Analytics and Business Decision Making*": SQC & OR Unit, Kolkata, held at Kaziranga University, Jorhat, March 13-14, 2015.

Certification Program on "*Six Sigma Green Belt*": SQC & OR Unit, Bangalore, held at ISI Kolkata, January 20–24, 2015.

Certification Program on "*Six Sigma Green Belt*": SQC & OR Unit, Bangalore, held at Tezpur University, Assam, March 26-29, 2015.

Training program on "*Data Mining and Business Analytics (DMBA-NE)*": SQC & OR Unit, Bangalore, held at Pachhunga University College, Aizawl, Mizorum, March 02–04, 2015.

Training Programme on "*Workshop on DOE & Statistical Modeling*": SQC & OR Unit, Hyderabad, held at National Institute of Technology, Sikkim, March 25-28, 2015.

National Workshop on "*Open Source Library Management Software (KOHA) [NATLIMS-2015]*": Library, Documentation and Information Science Division, in collaboration with Manipur University and Kolkata, March 16-20, 2015.

Workshop on "*C Language and Linux Operating System*": CSSC, Kolkata, March 16-28, 2015.

Lectures and Seminars

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Asanuma, T., University of Toyama, Japan (06.03.2015): Some Topic in Polynomial Rings and Affine Fibrations.

Asanuma, T., University of Toyama, Japan (23.03.2015): Genus formula for algebraic curves.

Ayyer, Arvind, Department of Mathematics, Indian Institute of Science, Bangalore (05.12.2014): Correlations in the multispecies exclusion process.

Bandyopadhyay, Soutir, Department of Mathematics, Lehigh University, Bethlehem, PA, USA (02.12.2014): A Frequency Domain Empirical Likelihood Method for Irregularly Spaced Spatial Data.

Banerjee, Moulinath, Department of Statistics, University of Michigan, USA (05.01.2015): M Estimation under Multistage Sampling.

Banerjee, Moulinath, University of Michigan, USA (23.06.2014): Change Point Inference for time-Varying Erdos-Renyi Graphs.

Banerjee, Sayan, University of Warwick, UK (07.01.2015): Maximal couplings and geometry.

Basak, Anirban, Department of Mathematics, Duke University, UK (29.12.2014): Circular law for spaces non-hermitian matrices.

Basu, Ridhhipratim, University of California, USA (07.08.2014): Berkeley Maximal Increasing Sequence.

Bertoin, Jean, University of Zurich, Switzerland (22.01.2015): Self-similar Markov Processes.

Bertoin, Jean, University of Zurich, Switzerland (23.01.2015): Self-similar Scaling Limits of Markov chains on the Positive Integers.

Bhattacharya, Angshuman, University of Regina, Canada (16.06.2014): Weak Expentation Property and Crossed Product of C* -algebras.

Bhattacharya, Angshuman, University of Regina, Canada (25.06.2014): Relative weak injectivity and operator system pairs.

Conferences and Seminars

Biswas, Kingshook, Ramakrishna Mission Vivekananda University, Belur (28.04.2014): An introduction of geodesic flows in negative curvature.

Burman, Prabir, University of California, Davis, USA (15.09.2014): Generalized Exponential Prediction in Time Series.

Chakraborty, Sagnik, School of Mathematics, TIFR, Mumbai (23.12.2014): Pure Extensions of Commutative Rings.

Chakraborty, Santanu, Department of Mathematics, The University of Texas-Pan American, USA (26.06.2014): Limit Distributions of Random Walks on Stochastic Matrices.

Chakraborty, Sayan, University of Munster, Germany (05.01.2015): K theory of twisted group C*-algebras.

Chandgotia, Nishant, University of British Columbia (02.09.2014): Graph Foldings and Markov random fields.

Collins, Benoit, Department of Mathematics and Statistics, University of Ottawa, Canada (25.09.2014): Random Positive Maps.

Dani, S.G., Department of Mathematics, IIT, Bombay (01.01.2015): geodesics on the modular surface and values of binary quadratic forms.

Dani, S.G., Department of Mathematics, IIT, Bombay (11.09.2014): Continued fractions and their applications in geometry and Diophantine approximation.

Das, Kajal, Universite Paris-Sud, France (15.09.2014): A survey on measurable group theory.

Das, Kajal, Universite Paris-Sud, France (16.09.2014): Ingtegrable measure equivalence and the central extension of surface group.

Das, Soumya, Department of Mathematics, Indian Institute of Science, Bangalore (27.02.2015): Jacobi forms and Differential operators.

Dey, Arihjit, IIT, Chennai (02.01.2015): Introduction to moduli of vector bundles over Riemann surfaces(2 talks).

Dey, Arihjit, IIT, Chennai (30.12.2014): Introduction to moduli of vector bundles over Riemann surfaces(2 talks).

Dutta, Subhajit, King Abdullah University of Science and Technology, Saudi Arabia (24.07.2014): A (non-Gaussian Multivariate Distribution.

Gatsinzi, J.B., University of Namibia, Windhoek, Namibia (08.12.2014): A model for function spaces.

Ghorpade, Sudhir, Department of Mathematics, IIT, Bombay (30.12.2014): Two Exercises in Probability, with an interlude on Weil Conjectures.

Goswami, Anindya, Indian Institute of Science Education & Research, Pune (06.08.2014): Risk-Sensitive cost for a Markovian multiclass queue with priority.

Gupta, Ankit, ETH, Zurich, Switzerland (10.07.2014): Sensitivity analysis of stochastic reaction networks.

Jha, Somnath, Department of Mathematics, Jawaharlal Nehru University, New Delhi (22.12.2014): Functional equation for Selmer groups.

Kumar, Neeraj, The Institute of Mathematical Sciences (IMSc.), Chennai (11.02.2015): Koszul property of diagonal subalgebras.

Mahanta, Snigdhayan, Research Associate, University of Regensburg, Germany (23.12.2015): Universal coefficient theorem in bivariant K-theory.

Mandal, Abhyuday, Dept. of Stat., University of Georgia, USA (12.12.2014): Optional Designs for 2K Factorial Experiments with Binary Response.

Mandal, Satya, University of Kansas, USA (14.01.2015): Trilogy: Witt, grothendieck-Witt, K-Theory.

Mandal, Satya, University of Kansas, USA (16.01.2015): Trilogy: Witt, grothendieck-Witt, K-Theory.

Marron, J.S., National University of Singapore and University of North Carolina, Chapel Hill (27.02.2015): High Dimension Low Sample Size Asymptotics.

Marron, J.S., National University of Singapore and University of North Carolina, Chapel Hill (27.02.2015): Object Oriented Data Analysis.

Mondal, Debashis, Department of Statistics, Oregon State University (02.01.2015): Matrix-free computations for Gaussian Markov random fields and related spatial processes.

Mukherjee, Sumit, Columbia University, USA (21.01.2015): Exponential family on permutations.

Mukhopadhyay, Subhadeep, Fox School of Businees, Temple University, USA (08.08.2014): LP Approach to Statistical Modeling.

Munshi, Ritabrata, School of Mathematics, TIFR, Mumbai (10.06.2014): Counting rational points on intersection of two quadrics.

Munshi, Ritabrata, School of Mathematics, TIFR, Mumbai (09.03.2015): New forms of “circle method”.

Raghavan, University of Illinois at Chicago, USA (02.02.2015): Correlated Equilibria-Existence and some properties for bimatrix games.

Rajan, C.S., School of Mathematics, TIFR, Mumbai (15.10.2014): Number theory and geometry.

Ramanan, Kvita, University of Brown, USA (06.01.2015): Large deviations for finite-state particle systems.

Raskutti, Garvesh, Department of Statistics, University of Wisconsin-Madison, USA (02.01.2015): Early stopping and non-parametric regression: An optimal data-dependent stopping rule.

Roy, Sutanu, University of Ottawa, Canada (13.03.2015): The Drinfeld Double for C*-Algebraic Quantum Groups.

Roy, Vivekananda, Iowa State University, USA (16.02.2015): Statistical estimation of integrals with respect to infinite measures.

Sathaye, Avinash, University of Kentucky, USA (02.06.2014): Forty years after the Abhyankar-Moh Epimorphism theorem.

Conferences and Seminars

Sathaye, Avinash, University of Kentucky, USA (09.06.2014): Zero and Infinity in Indian Mathematics.

Sethuraman, Sunder, University of Arizona, USA (11.07.2014): A scaling limit for evolving preferential random graphs.

Sinha, K.B., Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore (22.09.2014): Tomita Takesaki theory.

Sinha, K.B., Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore (23.09.2014): Tomita Takesaki theory.

Wiens, Doug, University of Alberta, Edmonton, Canada (03.11.2014): Robustness of Design: A Survey.

Wiens, Doug, University of Alberta, Edmonton, Canada (03.11.2014): Robustness of Design: A Survey.

Stat-Math Unit, Delhi

Aithal, Vikram, TIFR- Centre for Applicable Mathematics, Bangalore (08.12.2014): Geodesic conjugacy and isometries of Riemannian manifolds.

Anandavardhanan, U.K., IIT, Mumbai (09.02.2015): Symplectic root numbers for *GL(2)*.

Athreya, K.B., Iowa State University, USA (28.01.2015): Statistical estimation of integrals w.r.t. infinite measures.

Athreya, K.B., Iowa State University, USA (29.01.2015): Coalescence in branching processes.

Basu, Sudeshna, Washington State University, USA (16.03.2015): Small combination of slices in Banach spaces.

Berg, Christian, Department of Mathematics, Universitetsparken, Copenhagen, Denmark (21.01.2015): On the determinancy / indeterminancy of the Stieltjes moment sequence $(n!)^c$, $c > 0$.

Bertoin, Jean, Institut für Mathematik der Universität Zürich, Switzerland (27.01.2015): Compensated fragmentation processes and limits of dilated gragmentations.

Borisagar, Gautam, Zakir Hussain College, Delhi University, Delhi (26.11.2014): Iwahori-Hekce model for supersingular representation for GL_2 (Q_p).

Chakraborty, Arindom, Visva-Bharati University, Santiniketan (29.10.2014): Joint model for ordinal longitudinal and time-to-event data and related inferences.

Chaubey, Y. P., Concordia University, Montreal, Canada (19.11.2014): On nonparametric density estimation for size biased data.

Das, Ishapathik, Kumaun University, Almora (24.09.2014): On generalized multinomial models and joint percentile estimation.

David, Sinnou, Institut de Mathematiques de Jussieu, Paris, France (31.07.2014): On the lower bounds of heights.

Deshouillers, Jean-Marc, Institut de Mathematique de Bordeaux, France (17.09.2014): Pseudo s-th powers are a basis of order $s+\varepsilon$.

Deshpande, Amogh, University of Liverpool, UK (14.01.2015): On the role of Follmer-Schweizer minimal martingale measure in risk sensitive control asset management.

Doosti, Hassan, Mashhad University of Medical Sciences, Mashhad, Iran (25.03.2015): Making a nonparametric density estimator more attractive, and more accurate, by data perturbation.

Ghate, Eknath, Tata Institute of Fundamental Research, Mumbai (05.03.2015) & (10.03.2015): Reductions of Galois representations.

Ghate, Eknath, Tata Institute of Fundamental Research, Mumbai (11.03.2015): The Tau of Ramanujan.

Jha, Somnath, Jawahar Lal Nehru University, New Delhi (07.01.2015): Functional equation for Selmer groups.

Kumar, Narasimha, IIT, Hyderabad (28.05.2014): On the algebraicity of the Fourier coefficients of half-integral weight modular forms.

Manoharmayum, Jayanta, University of Sheffield, UK (19.08.2014): Universal deformation rings and the inverse deformation problem.

Midhu, N.N., Cochin University of Science and Technology, Cochin (01.10.2014): A class of distributions with linear mean residual quantile function and it's generalizations.

Mishra, Alok, IIT, Delhi (13.01.2015): On the normal bases over finite fields.

Moriya, B.K., Harish-Chandra Research Institute, Allahabad (03.09.2014): Some weighted zero sum problems.

Mubayi, Dhruv University of Illinois, Chicago (24.12.2014): Hypergraph Turan problems and shadows.

Mukherjee, Bhramar, Univesity of Michigan School of Public Health, USA (23.12.2014): Shrinkage methods utilizing auxiliary information to improve prediction models with many covariates.

Pal, Debashish, University of California, Davis, USA (18.02.2015): A brief review of random matrix theory in statistics.

Pal, Debashish, University of California, Davis, USA (19.02.2015): A robust version of Hotellings T^2 test in high dimensions.

Rajpal, Vandana, Shivaji College, University of Delhi, Delhi (12.11.2014): Schur tensor product of operator spaces.

Sharma, Arun, IIT, Mumbai (30.07.2014): Subordinated stochastic processes.

Sinha, K.B., Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru (04.03.2015): Helton-Howe and Krein trace formulas.

Sreedevi E.P., Carmel College, Thrissur, Kerala (30.04.2014): On testing problems in current status competing risks data.

Conferences and Seminars

Sritharan, S.S., Naval Postgraduate School, California, USA (12.09.2014): Probabilistic aspects of the Navier-Stokes Equations.

Srivastava, Ashish, Saint Louis University, USA (20.08.2014): Modules invariant under automorpisms of their covers and envelopes.

Srivastava, Nikhil, Microsoft Research, Bangalore (15.10.2014): Ramanujan graphs and the solution of the Kadison-Singer problem.

Suresh K., IIT, Bombay (19.01.2015): Risk-sensitive control and Collatz-Weilandt formula.

Suresh K., IIT, Bombay (20.01.2015): Risk-sensitive control problem for continuous time Markov chains.

Stat-Math Unit, Bangalore

Accardi, Luigi, University of Rome, Italy (12.03.2015): Identification of the theory of d-dimensional orthogonal polynomials with the theory of symmetric interacting Fock spaces over $\mathbb{C}^d$.

Anoop, T.V., University of West Bohemia, Czech Republic (23.12.2014): On eigenvalue problems for the *p*-Laplacian.

Athreya, Krishna B., Iowa State University, USA (06.01.2015): Statistical estimation of integrals w.r.t. infinite measures by regenerative sequence Monte Carlo.

Ayyer, Arvind, Indian Institute of Science, Bangalore (27.10.2014): Correlations in the multispecies exclusion process.

Banerjee, Abhishek, Indian Institute of Science, Bangalore (21.01.2015): Schemes over abelian symmetric monoidal categories and quasi-coherent sheaves.

Belkale, Prakash, The University of North Carolina at Chapel Hill, USA (14.08.014): The Eigenvalue Problem.

Bhattacharya, Soumya, Centro Internazionale per la Ricerca Matematica (CIRM), Trento, Italy (24.03.2015): Factorization of holomorphic eta quotients.

Dan, Krishanu, Institute of Mathematical Sciences, Chennai (05.03.2015): Certain Vector Bundles over Symmetric Product of Curves.

Deshouillers, Jean-Marc, Ecole Polytechnique, France (24.09.2014): Presentation, of Ecole Polytechnique, France.

Douglas, Ronald G., Texas A&M University, USA (19.03.2015): The Averson conjecture and index theory.

Gadgil, Sulochana, Indian Institute of Science, Bangalore (16.09.2014): The Indian Monsoon: variability and prediction.

Garg, Rahul, Technion, Israel (25.09.2014): The lattice point counting problem on the Heisenberg groups.

Gopalan, Aditya, Indian Institute of Science, Bangalore (27.10.2014): How to Infect a Network from the Outside.

Joseph, Mathew, The University of Sheffield, UK (12.01.2015): Approximation of the Fractional Stochastic Heat Equation by Interacting Diffusions.

Kannapan, S., Queens University, Canada (12.08.2014): A very brief introduction to SAGE.

Kashyap, Navin, Indian Institute of Science, Bangalore (23.03.2015): Correlation inequalities arising from 2-D lattice models with pairwise interactions.

Kumar, Ashok, Indian Institute of Science, Bangalore (15.09.2014): Minimization problems based on a parametric family of relative entropies.

Kummini, Manoj, Chennai Mathematical Institute, Chennai (26.02.2015): A geometric technique of constructing interesting complexes.

Mahanta, Snigdhayan, University of Münster, Germany (25.07.2014): Bivariant homology theories for noncommutative spaces.

Masuti, Shreedevi K., Institute of Mathematical Sciences, Chennai (29.01.2015): Zariski's theorem on complete ideals.

Nair, Arvind, TIFR, Mumbai (24.02.2015): Odd zeta values and the cohomology of A_g.

Parthasarathy, K.R., Distinguished Emeritus Scientist (02.02.2015 and 10.02.2015): Quantum Gaussian states, their covariance matrices and structure & What is Brownian Motion?

Roy, Prosenjit, TIFR-Centre for Applicable Mathematics, Bangalore (16.10.2014): Eigenvalue problems (Dirichlet-Neumann Type Boundary Conditions) on domains tending to infinity.

Seshadri, Harish, Indian Institute of Science, Bangalore (13.11.2014): Negative curvature and fibrations.

Shah, Riddhi, Jawaharlal Nehru University, Delhi (03.07.2014): Dynamics of Distal Group Actions.

Shekhar, Atul, Technische Universität, Berlin (12.01.2015): On the trace of Loewner chains.

Skeide, Michael, University of Molise, Italy (04.09.2014): Subproduct Systems and Word Systems.

Skraba, Primoz, Jozef Stefan Institute, Slovenia (08.01.2015): Persistence, Clustering and Different Shapes.

Sitaram, Alladi, Indian Institute of Science, Bangalore (23.09.2014): Harish Chandra (1923-1983).

Subramaniam, Annapurni, Indian Institute of Astrophysics, Bangalore (21.10.2014): Upcoming major Astronomical projects in India.

Suresh, V., Emory University, Atlanta, USA (18.07.2014): Quadratic forms and Galois cohomology.

Tupurani, Srikanth, Institute of Mathematical Sciences, Chennai (08.09.2014): An interesting result about finite dimensional complex semi-simple algebras.

Stat-Math Unit, Chennai

Asha, G., Department of Statistics, Cochin University of Science and Technology, Cochin (24.02.2015): An Extension of the Freund's Bivariate Distribution to Model Cascading Failures.

Conferences and Seminars

Athreya, Krishna B., Iowa State University, USA (25.07.2014): What is probability theory?

Baricz, Arpad, Department of Economics, Babe-Bolyai University, Romania (05.03. 2015): Starlikeness of normalized Bessel functions and their derivatives.

Bhattacharya, Sayan, IMSc, Chennai (04.03.2015): Deterministic Fully Dynamic Data Structures for Vertex Cover and Matching.

Chakraborty, Sounak, Department of Statistics, University of Missouri- Columbia, USA (07.01.2015): Bayesian Regularization via Graph Laplacian.

Dey, Dipak K., Department of Statistics, University of Connecticut, USA (05.01.2015): Bayesian Modeling of Sparse High Dimensional Data using Divergence Measures.

Dutschke, Markus, University of Augsburg, Germany (21.08.2014): Continuous time quantum Monte-Carlo solver for correlated Electrons in a magnetic field.

Joseph. Mathew, University of Trento, Italy (04.09.2014): Query Answering over Contextualized RDF/OWL Knowledge with Forall-Existential Bridge Rules Attaining Decidability using Acyclicity.

Kannan, Rajesh M., Department of Mathematics, Technion-Israel Institute, Haifa, Israel (30.10.2014): Spectral theory of nonnegative tensors.

Kumarapandiyan, G., Pondicherry University (17.09.2014): Estimation the finite popular mean and variance using the known parameters of the Auxiliary Variable.

Lakshminarayanan, Mani Pfizer, Incorporated. USA (05.09.2014): Grammar of Graphics: A Visual Data Excursion in R.

Majumdar, Anandamayee, Center for Advanced Statistics and Econometrics, Soochow University, Suzhou, China (02.03.2015): Bayesian Modeling of Skewed Spatial Distributions.

Murthy, Karthyek, R.A., Industrial Engineering and Operations Research, Columbia University, USA (18.03.2015): How do you get delayed for long in multi-server queues?

Oja, Hannu, Department of Mathematics and Statistics, University of Turku, Finland (06.01.2015): Multivariate Nonparametric Methods based on Spatial Signs and Ranks.

Oja, Hannu, Department of Mathematics and Statistics, University of Turku, Finland (20.01.2015): Linear Dimension Reduction.

Pandey, Sumit Kumar, C R Rao Advanced Institute of Mathematics, Statistics and Computer Science, Hyderabad (10.02.2015): Signcryption - Achieving Confidentiality and Authentication at the Same Time.

Pogany, Tibor, Department of Sciences, Faculty of Maritime Studies, University of Rijeka, Republic of Croatia (24.02.2015): Sampling theorems -- historical background and controversies.

Pogany, Tibor, Department of Sciences, Faculty of Maritime Studies, University of Rijeka, Republic of Croatia (25.02.2015): Sampling theorems for stochastic signals.

Ravisankar, Sivaguru, Oklahoma State University, USA (19.06.2014): Tangential Lipschitz Gain II: Results and Examples.

Roy, Vivekananda, Department of Statistics, Iowa State University, USA (05.02.2015): Spectral analytic comparisons for data augmentation.

Sahoo, Swadesh Kumar, IIT Indore (22.04.2014): The hyperbolic and quasihyperbolic metrics associated with certain analytic functions.

Sano, Katsuhiko, Japan Advanced Institute of Science and Technology, Japan (13.01.2015): Revising a Labelled Sequent Calculus for Public Announcement Logic.

Sarkar, Santanu, Chennai Mathematical Institute (29.04.2014): Cryptanalysis of RSA Variants and Implicit Factorization.

Sinha, Sitabhra, Theoretical Physics, Institute of Mathematical Sciences, Chennai (08.04.2014): Econophysics: Towards a physical theory of socio-economic phenomena.

Sreelakshmy, N., Department of Statistics, M. A. College, Kothamangalam, Kerala (17.12.2014): Role of quantile based reliability concepts in the study of income inequality measures.

Tetenov, Andrei, Gorno-Altaisk University, Russia (06.03.2015): Geometry of self-similar continua.

Vellaisamy, P., IIT Bombay (10.06.2014): Simpson's Paradox and Collapsibility Results for Survival Models.

Vellaisamy, P., IIT Bombay (11.06.2014): On the construction and the cardinality of finite sigma-fields.

Applied Statistics Division

Applied Statistics Unit, Kolkata

Banerjee, Raja, Department of Bioinformatics, West Bengal University of Technology, Kolkata (13.01.2015): Genomics-Proteomics and Mathematics.

Beran, Jan, University of Konstanz, Department of Mathematics and Statistics, Konstanz, Germany (24.03.2015): On Randomly Perturbed Functional Data Analysis (FDA) under General Dependence Conditions.

Bhattacharyya, Arnab, Department of Computer Science and Automation, Indian Institute of Science, Bangalore (25.04.2014): Spectral Graph Theory and Graph Partitioning.

Bhattacharyya, Arnab, Dept. of Computer Science and Automation, Indian Institute of Science, Bangalore (09.05.2014): Polynomial Decompositions in Polynomial Time.

Chattopadhyay, Bhargab, University of Texas at Dallas, Dallas, USA (22.07.2014): Estimation of Gini Index with Minimum Sample Size.

Deshpande, J.V., Indian Institute of Science Education and Research, Pune (17.06.2014): Models and Tests for Effect of Load Sharing.

Ghosh, Palash, Duke-NUS Graduate Medical School, Singapore (25.07.2014): Estimating Optimal Dynamic Treatment Regimes with Shared Decision Rules across Stages.

Jones, Byron, Senior Biometrical Fellow, Statistical Methodology Group, Novartis Pharma AG (08.04.2014): Model-Based Bayesian Adaptive Dose-Finding Designs for a Phase II trial.

Kulkarni, H.V., Department of Statistics, Shivaji University, Kolhapur (05.08.2014): Analysis of Mean Directions based on Integrated Likelihood Methods.

Ng, C.M., Institute of Mathematical Sciences, Faculty of Science, University of Malaya, Kuala Lumpur, Malaysia (23.12.2014): Jeffrey's Divergence Using Probability Generating Functions for Statistical Inference.

Panjwani, Saurabh, Alcatel Lucent, Bangalore (29.04.2014): Adaptive Security of Multi-party Encryption Protocols.

Roy, Vivekananda, Department of Statistics, Iowa State University, USA (24.02.2015): Spectral Analytic Comparisons for Data Augmentation with Applications in Bayesian Mixture Models.

Smith, Adam, Department of Computer Science and Engineering, Pennsylvania State University, USA (27.01.2015): Pinning Down "Privacy" in Statistical Databases.

Tiwari, Neeraj, Department of Statistics, Kumaun University, S.S.J. Campus, Almora (17.02.2015): Temporal Scan Statistics on a Circle with its Applications to IPS Data.

Wiens, Douglas P., University of Alberta, Edmonton, Alberta, Canada (05.11.2014): Robust Model-based Sampling Designs.

Interdisciplinary Statistical Research Unit, Kolkata

Chakravarty, Aloka, Division of Biometrics, Food and Drug Administration, USA (18.12.2014): Working in FDA as Statistician.

De, Shyamal Krishna, National Institute of Science Education and Research, Bhubaneshwar (26.02.2015): Stepwise Methods of Multiple Testing Controlling Desired Error Rates in Sequential Trials.

Ghatak, Anirban, Indian Institute of Technology, Bombay (21.08.2014): A Behavioral and Spatial Game Theoretic Analysis of Conflict and Identity.

Ghosh, Malay, Department of Statistics, University of Florida, USA (17.07.2014): Bayesian Variable Selection and Estimation for Group LASSO.

Ghosh, Sucharita, Statistics Lab, Forest Resources and Management Unit, Swiss Federal Research Institute WSL, Birmensdorf, Switzerland (23.03.2015): On Kernel Smoothing under Gaussian Subordination.

Kumar, Ashok, M., Indian Institute of Science, Bangalore (11.12.2014): Minimization problems based on a Parametric Family of Relative Entropies.

Mukherjee, P.K., Geological Survey of India; Kolkata (03.12.2014): Geological and Geomorphological Control on Arsenic Pollution of Groundwater in Bengal Delta and Its Remediation.

Pal, Tarak, Geological Survey of India, Kolkata (05.09.2014): Arsenic Contamination in Ground Water of West Bengal.

Sanyal, Nilotpal, University of Missouri, Columbia, USA (28.08.2014): Recovering a Smooth Function from Its Noisy Observations Using Bayesian Wavelet Analysis With Non-Local Prior.

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit, Kolkata

Audhya, Goutam K., Bharat Broadband Nigam Limited, (03.07.2014): Channel Allocation for Multimedia Signals in Cellular Mobile Networks.

Chakraborty, Sandip, Dept. of Computer Science & Engineering, IIT, Guwahati (02.06.2014): IEEE 802.11s Mesh Networks: Distributed Service Level Flow Control and Fairness.

Drechsler, Rolf, University of Bremen, Germany (17.06.2014): Exact One-pass Synthesis of Digital Microfluidic Biochips.

Dev, Tamal Krishna, Dept. of Computer Science & Engineering, Ohio State University (12.11.2014): Computational Technology in Reconstruction, Mesh Generation, and Data Analysis.

Dutta, Rudra, North Carolina State Univ., Raleigh, USA (15.07.2014): Internet Architecture: The Role of Economy and Choice in the Internet Services

Dutta, Kunal Max Planck institutes, Germany (11.12.2014): Counting Independent Sets in Hypergraphs.

Guha, Saikat Researcher at Microsoft Research India (11.02.2015): Towards Catching Click-Spam on Facebook Ads.

Laskar, Renu, Dept. of Mathematics, Clemson University, South Carolina (07.11.2014): Some Open Problems on Graphs and Trees.

Maity, Soumyadev, IISc, Bangalore (20.10.2014): Efficient Self-Organized Public Key Management in Mobile Ad hoc Networks (MANETs).

Mitra, Sayan, Associate Professor Electrical and Computer Engineering Coordinated Science Laboratory, University of Illinois at Urbana Champaign (14.01.2015): From Simulations to proofs for Cyberphysical Systems.

Ou, Hung-Chin, Researcher of National Taiwan University, Taiwan (04.03.2015): Cutting Structure-Aware Analog Placement Based on Self-Aligned Double Patterning with E-Beam Lithography.

Rahaman, Anisur, University of Bangladesh, Bangladesh (31.03.2015): Distributed Computation of Sparse Cuts.

Sen, Sandeep, Dept. of Computer Science & Engineering, IIT, Delhi (18.06.2014): Approximation Algorithms for the Weight-Reducible Knapsack problem.

Sinha, Koushik, Qatar Computing Research Institute, Doha, Qatar (27.10.2014): Crowd Cloud: Human-augmented Cloud Computing.

Valtr, Pavel and Balko, Martin, Charles University, Prague, Czech Republic (29.01.2015 & 30.01.2015): Turan type Questions on Geometric Graphs.

Ray Rajarshi, Assistant Professor, NIT Shillong (30.01.2015): An Introduction to Hybrid Automata

Electronics and Communication Sciences Unit, Kolkata

Purkait, Pulak, University of Adelaide, Australia (11.03.2015): Clustering with Hypergraphs: The Case for Large Hyperedgest.

Das, Abhishek, Tripura University (25.03.2015): Automated Early Detection and Classification of Uterine Cervical Cancer.

Ghosh, Aurobrata, INRIA Sopjia Antipolis, France (27.08.2014): One-day Seminar on Diffusion MRI.

Mahanand, B.S., Sri Jayachamarajendra College of Engineering, Mysore (26.03.2015): Computer Aided Detection of Neurological Disorders.

Purkait, Pulak, University of Adelaide, Australia (13.06.2014): Super Resolution Image Reconstruction based on Efficient Priorst.

Purkait, Pulak, University of Adelaide, Australia (18.03.2015): Efficient Globally Optimal Consensus Maximisation as Tree Search.

Ray, Nilanjan, University of Alberta, Canada (23.06.2014): Stabilization of In Vivo Microscopy Videos for Atherosclerosis Study.

Machine Intelligence Unit, Kolkata

Agarwal, Shivani, Department of Computer Science and Automation, Indian Institute of Science, Bangalore, India (23.04.2014): Statistically Consistent Algorithms for Complex Prediction Problems.

Brahmachari, S.K., Institute of Genomics & Integrative Biology, New Delhi, India (30.03.15): High Performance Computing: Biological Inspiration.

Chatterjee, Sandip, Neurosurgeon, Park Clinic, Kolkata, India (24.07.2014): Brain Tumours: Why This represents a True Challenge to Medicine.

Dash, D., Institute of Genomics and Integrative Biology, India (22.01.2015): Genosuite: A computational proteomics pipeline for discovery of novel proteins in biological systems.

Desai, U.B., Director, Indian Institute of Technology, Hyderabad, India (09.03.2015): Cyber Physical Systems and Internet of Things.

Dutta, Suprakash, Department of Electrical Engineering and Computer Science Dept. York University, Toronto, Canada (07.11.2014): Genome annotation using signal processing and machine learning.

Kothari, Ravi, IBM Research, New Delhi, India (30.03.2015): Swarm Intelligence.

Mallik, R.K., Indian Institute of Technology, Delhi, India (30.03.2015): Solutions of Linear Recurrences with Variable Coefficients.

Mukherjee, S.K., Genetics Department, University of Delhi, India (20.10.2014): RNAi and its suppression: Excitement and Applications.

Venkatesh, K.V., Indian Institute of Technology, Bombay, India (23.03.2015): Evaluation of phenotypic space in metabolic networks – Connecting genotype to phenotype.

Documentation Research and Training Centre, Bangalore

Chatterjee Amitabha, Retired Professor, Dept. of Library and Information Science, Jadavpur University, Kolkata (06.02.2015): Index and Indexing.

Chatterjee Amitabha, Retired Professor, Dept. of Library and Information Science, Jadavpur University, Kolkata (10.11.2015): Indexing Language.

Chatterjee Amitabha, Retired Professor, Dept. of Library and Information Science, Jadavpur University, Kolkata (13.02.2015): Controlled Vocabulary.

Chatterjee Amitabha, Retired Professor, Dept. of Library and Information Science, Jadavpur University, Kolkata (18.02.15): Indexing Techniques.

Chatterjee Amitabha, Retired Professor, Dept. of Library and Information Science, Jadavpur University, Kolkata (20.2.2015): Derived Indexing.

Chatterjee Amitabha, Retired Professor, Dept. of Library and Information Science, Jadavpur University, Kolkata (24.02.2015 and 27.02.2015): Assigned Indexing.

Munshi, Usha Mujoo, Librarian, Indian Institute of Public Administration, New Delhi (12.08.2014): Open Data and Open Data Policies.

Neupane, Bhanu, Global Programme Manager for ICT and Sciences and Open Access to Scientific Research (6.8.2014): UNESCO and Open Access.

Partap, Satija Mohinder, Professor (Retd.), Dept. of Library and Information Science, Guru Nanak Dev University, Amritsar (10.10.2014 – 04.11.2014): series of lecture on UDC.

Satpathi Jatindra Nath, Ex-President, IASLIC, Member, IFLA Standing Committee, Kolkata (30.9.2014): Role of IASLIC in Developing Computers Sills among LIS Professionals in India.

Satpathi Jatindra Nath, Ex-President, IASLIC, Member, IFLA Standing Committee, Kolkata (8.10.2014): Information Networking.

William, Middleton C., Information Resource Officer, South Asia Region, US Department of State, US Embassy, New Delhi (25.4.2014): New Directions for Libraries in the United Sates and Around the World.

Systems Science and Informatics Unit, Bangalore

Egozcue, Jose, University of Barcelona, Spain (15.10.2014): Bayes Spaces: from compositions to densities.

Koike, Katsuaki, Kyoto University, Japan (20.10.2014): Geostatistics-based modeling of fractures, hydroquality, and hydrofacies in rocks and sediments for clarification of comprehensive groundwater

Pawlsky-Glahn, Vera, University of Girona, Spain (15.10.2014): The simplex: the sample space of compositional data (Aitchison geometry and exploratory analysis).

Ramapriyan, H.K., National Aeronautics and Space Administration (NASA), USA, (11.11.2014): Earth Science Informatics: An Overview.

Conferences and Seminars

Hirose, Akira, University of Tokyo, Japan (08.12.2014): Advanced Neural Adaptive Processing in Interferometric and Polarimetric Radar Imaging.

Physics and Earth Sciences Division

Geological Studies Unit, Kolkata

Basilici, G., State University of Campinas, Brazil (28.11.14): Influence of subaqueous processes on the construction and accumulation of aeolain sand sheets.

Chinsamy-Turan, A., University of Cape Town, South Africa (03.12.14 - 04.12.14): (i) The origin and Early Radiation of Birds and (ii) Biological insight from fossil bones.

Ezcurra, M. D., University of Birmingham, UK (27.01.15): The early evolution of archosauromorphs across the Permo-Triassic boundary.

Hughes, N., University of California, Riverside, USA (04.04.15): Trilobites of Himalaya.

Richard, B., University of Birmingham, UK (23.01.15): The first dinosaur from Venejuala, and new constrains on early ornithischian evolution.

Simplicio F., State University of Campinas, Brazil (28.11.14): The Bandeirinha Formation: a thick succession of Paleoproterozoic aeolain sand sheet.

Sookias, R., University of Birmingham, UK (23.01.15): Euperkiidae and the rise of archosauria.

Physics and Applied Mathematics Unit, Kolkata

Bhattacharjee, S., Department of Physics, Indian Institute of Science Education and Research (IISER), Mohali (28.04.2014): Applicability of first law for rindler horizon.

Chatterjee, A., Harish-Chandra Research Institute, Allahabad University (09.07.2014): Resurrecting left-sneutrino Dark Matter in SUSY in the light of direct Dark Matter searches.

Chattopadhyay, Indrajit, Department of Physics, Aryabhatta Research Institute for observational Science (ARIES), Nainital, Uttrakhand (11.11.2014): Numerical simulation with relativistic equation of state of astrophysical plasma.

Dey, Subhasish, Indian Institute of Technology, Kharagpur (15.04.2014): Turbulence in mobile-bed streams.

Ghosh, Sibasish, Department of Theoretical Physics, The Institute of Mathematical Sciences (IMSc), Chennai (21.11.2014): Ancilla assisted suppression of decoherence.

Mallick, Bireswar Basu, Theory Division, Saha Institute of Nuclear Physics, Salt Lake City, Kolkata (22.07.2014): Bound states of a quantum many-body system and number theory.

Rahaman, R., Department of Mathematics, Allahabad University (25.06.2014): Device-independent quantum key distribution based on Hardy's paradox.

Saha, Bijan, Department of Physics, Dubna, Russia (07.11.2014): Spinor field and anisotropic cosmological models.

Biological Sciences Division

Human Genetics Unit, Kolkata

Roy, Pradipta, The University of Texas at Dallas, USA (21.01.2015): Harnessing Correlative Structure between Different Epigenetic Modifications, across Developmental Time Points, and inside Spatial Regulatory domains for in Silico Prediction of Epigenetic Marks.

Ray, Upasana, NCI, Bethesda, USA (28.01.2015): Development of a Method for Early Diagnose of Progressive Multifocal *leukoencephalopathy*.

Das, Sanjeev, Molecular Oncology Laboratory, National Institute of Immunology, New Delhi (13.01.15): Exploring the Regulatory Landscape of Tumor Suppressor p53.

Social Sciences Division

Economic Research Unit, Kolkata

Bandyopadhyay, Subhayu, Federal Reserve Bank of St. Louis (13.06.2014): Offshoring and Dual Labour Markets in Developing Nations.

Banerjee, Ritwik, Department of Economics, University of Aarhus (29.01.2015): Corruption, Norm Violation and the Decay in Social Capital.

Bera, K. Anil, University of Illinois, Urbana Champaign, USA (09.07.2014): Contrasts between Modelling Time Series and Spatial Data.

Bhattacharya, Debopam, Department of Economic, University of Oxford, United Kingdom (08.04.2014): Nonparametric Welfare Analysis for Discrete Choice.

Bhattacharya, Kaushik, Indian Institute of Management, Lucknow (29.05.2014): Impact of Technology on the Seasonality of Currency in Circulation: Evidence from the USA and India.

Bloch, Francis, University Paris 1 Pantheon Sorbonne and Paris School of Economics, France (11.02.2015): Dynamic Allocation of Objects to Queuing Agents.

Chatterjee, Rittwik, Centre for Studies in Social Sciences, Kolkata (10.04.2014): A Collusion-proof and Efficient Mechanism for Asymmetric Bidders.

Chatterjee, Kalyan, Department of Economics, Pennsylvania State University, USA (02.07.2014): Self-control Preferences and Expected Utility.

Chatterjee, Kalyan, Department of Economics, Pennsylvania State University, USA (04.07.2014): Diffusion of Innovation.

Chatterjee, Arpita, Department of Economics, University of New South Wales, Australia (30.10.2014): Trade and Intergenerational Occupational Mobility in India: Theory and Evidence.

Chakrabarti, Avik, Department of Economics, University of Wisconsin-Milwaukee, USA (17.07.2014): Cross-Border Mergers and Market Concentration in a Vertically Related Industry: Theory and Evidence.

Conferences and Seminars

Chakrabarti, Avik, Department of Economics, University of Wisconsin-Milwaukee, USA (24.03.2015): Cross-border Mergers and Privatization.

Chakrabarti, Rajashri, Federal Reserve Bank, New York (26.03.2015): The Impact of Accountability Threats on Schools: Extricating the Role of Stigma versus Sanctions.

Das, Kaustav, Department of Economics, University of Exeter Business School, United Kingdom (14.08.2014): Strategic Experimentation with Heterogeneous Agents and Payoff Externalities.

Dey, Oindrila, Department of Economics, Jadavpur University, Kolkata (04.12.2014): Endogenous Favouritism with Status Incentives: A Model of Optimal Inefficiency.

Ghosh, Parikshit, Delhi School of Economics, New Delhi (25.09.2014): Character Endorsements and Electoral Competition.

Gupta, Ashmita, Department of Economics, University of Houston (11.12.2014): Effect of Trade Liberalization on Gender Inequality: A Case of India.

Jeon, Young, Joo, Department of Economics, University of East Anglia (18.12.2014): Profitability and Collusion: An Experimental Investigation.

Munshi, Soumyanetra, Indira Gandhi Institute of Development Research, Mumbai (12.06.2014): Arranged Marriage Education and Dowry: A Contract-theoretic Perspective.

Pramanik, Anup, Institute of Social and Economic Research, Osaka University (27.02.2015): Further Results on Dictatorial Domains.

Roychoudhury, Saurav, Capital University, Columbus, Ohio, USA (03.07.2014): Innovation Governance and Competition.

Roy, Nilanjana, Department of Economics, University of Victoria, Canada (20.11.2014): Gains or Pains? Female Inheritance Rights in India and the Health of Young Girls.

Saha, Shrabani, Lincoln Business School, University of Lincoln, United Kingdom (21.08.2014): The Nexus between Democracy and Good Governance: A Cross-National Analysis in a Non-Linear Framework.

Sengupta, Sarbajit, Department of Economics, Visva Bharati University, West Bengal (02.02.2015): Choosing Between Formal and Informal Sector Ventures: Property Rights, Credit and Threat of Eviction.

Seth, Suman, University of Oxford, United Kingdom (10.07.2014): Measuring and Decomposing Inequality among the Multidimensionally Poor using Ordinal Data: A Counting Approach.

Sharma, Siddhartha, Indian School of Business, Hyderabad (13.11.2014): Vertical Integration Strategy by Platforms in the Smartphone Industry.

Tsubota, Kenmei, Institute of Developing Economies, Japan (25.08.2014): Economic Impact of Political Protests (Strikers) on Firms: Evidence from Bangladesh.

Linguistic Research Unit, Kolkata

Kar, Somdev, Indian Institute of Technology, Ropar, India (23.12. 2014): Optimality Theory: A theory of variation rather than a theory of universals.

Rajendran, S., Amrita Vishwa Vidyapeetham, Coimbatore, India (10.02.2015): Lexical Semantics and Lexical Profile.

Rajendran, S., Amrita Vishwa Vidyapeetham, Coimbatore, India (12.02.2015): Generative Lexicon and Lexical Generativity.

Rajendran, S., Amrita Vishwa Vidyapeetham, Coimbatore, India (13.02.2015): Ontology and Word Sense Disambiguation.

Population Studies Unit, Kolkata

Chakraborty, Achin, Institute of Developmental Studies, Kolkata (24.03.2015): Reckoning inequality in non-income dimensions – Some difficulties.

Mukherjee, S.P., Department of Statistics, Calcutta University and Mentor of Indian Association for Productivity Quality and Reliability (04.03 2015): Assessing Improvement in Public Health.

Pasupuleti, S.S.R., Visiting Scientist, P.S.U., Formerly Postdoctoral Research Fellow, Alfred Deakin Research Institute, Deaking University, Australia (31.03.2015): Health of Asian migrants in Australia: a longitudinal Investigation.

Sampling and Official Statistics Unit, Kolkata

Bairagi Radheshyam Bairagi, Freelance Consultant in Health, Nutrition and Population, USA (04.04.2014): Anthropometric Investigation of Nutritional Status for Young Children: Lesson Learnt from Somalia MICS-3.

Dev Pritha, Departmento Academico De Administracion, Instituto Technologico Autonomo De Mexico, Mexico City (30.01.2015): Group Identity in a Network Formation Game with Cost Sharing.

Giri Bimal Kumar, (Retired) Deputy Director General, CSO (IS Wing), MOS& PI (18.11.2014): Sample Design Adopted in Socio-Economic Surveys of NSSO and some Issues.

Ghatak Maitreesh, Professor of Economics, London School of Economics, UK (26.08.2014): Group Lending without joint liability.

Lahiri Sajal, Vandeveer Professor of Economics, Department of Economics, Southern Illinois University of Carbondale, USA (11.02.2015): Departments of Privatization in China.

Mukhopadhyay Jyoti Prasad, Institute for Financial Management & Research, Sri City, Andhra Pradesh (21.10.2014): The Dynamics of Income Growth and Proverty in India.

Mookherjee Dilip, Professor of Economics, Boston University, USA (23.07.2014): Asymmetric Information and Middleman Margins: An Experiment with West Bengal Potato Farmers.

Maitra Pushkar, Professor of Economics, Monash University, Australia (17.06.2014): Religion, Minority Status and Trust: Evidence from a field experiment.

Raut K. Lakshmi, Social Security Administration, Washington DC, USA (24.12.2015): Globalization, Quality and Inequity in Education and Economic Growth – Lesson for India from China.

Rao T. J., Adjunct Professor at the C. R. Rao Institute of Advanced Studies of Mathematics, Statistics and Computer Science, Hyderabad (26.05.2014): Mahalanobis and Indian Official Statistics.

Conferences and Seminars

Rao T. J., Adjunct Professor at the C. R. Rao Institute of Advanced Studies of Mathematics, Statistics and Computer Science, Hyderabad (29.05.2014): Efficient Use of Auxiliary Information.

Visaria Sujata, Department of Economics, Hong Kong University of Science & Technology, Hong Kong (23.07.2014): Asymmetric Information and Middleman Margins: An Experiment with West Bengal Potato Farmers.

Sociological Research Unit, Kolkata

Banerjee, Anirban, Department of Sociology, University of Burdwan, West Bengal (06.05.2014): Student Radicalism in Contemporary Bengal.

Bhattacharyya, Gayatri, Department of Sociology, University of Calcutta, West Bengal (25.04.2014): Use of Census as a source Economic and Cultural Data.

Das, Arnab, Department of Anthropology, Calcutta University (27.06.2014): Gender Within and Beyond the Development Discourse.

De, Utpal Kumar, Department of Economics, North Eastern Hill University, Shillong, Meghalaya (15.01.2015): Does Agricultural Diversity Always Contribute to the Progress of Farmers? An Example from North East India?

Ghosh Dostidar, Prabir, Director, Ministry of Earth Sciences, New Delhi (10.03.2015): Role of Social Network Analysis (SNA) in deciphering internal structure of Knowledge Systems and Innovation Studies.

Maruthakutti, Rangasamy, Professor of Sociology, Manonmaniam Sundaranar University, Tamil Nadu (09.03.2015): Family Organization and Housing among the Kani Tribes.

Saha, Sumita, Presidency University, Kolkata (23.05.2014): Ageing as a social problem.

Sen Chaudhuri, Ritu, West Bengal State University, Barasat (12.09.2014): Conceptualizing the caste-gender system: Revisiting “Annihilation of Caste”.

Economics and Planning Unit, Delhi

Anand, Rahul, International Monetary Fund (25.04.2014): Food Inflation: The Role of Monetary Policy in India.

Banerjee, Abhijit, Massachusetts Institute of Technology, Cambridge, USA (24.10.2014): Gossip: Identifying Central Individuals in a Social Network.

Banerjee, Prasenjit, University of Manchester, UK (09.01.2015): Coasean Bargaining under Insecure Property Rights and Capital Investment

Bhargava, Alok, University of Maryland School of Public Policy, Washington, DC, USA (14.07.2014): Diet Quality, Child Health and Food Policies in Developing Countries**.**

Bhattacharya, Sourav, University of Pittsburgh, Pennsylvania. USA (11.08.2014): A Possibility Theorem on Information Aggregation in Elections.

Chakrabarti, Anindya S., Boston University, USA (16.01.2015): Globalization of Volatility.

Chakravarty, Abhishek, University of Essex, UK (05.09.2014): Fertility Limits on Local Politicians in India**.**

Dean, Spears, Centre for Development Economics, New Delhi (04.04.2014): Sanitation and Health Externalities: Resolving the Muslim Mortality Paradox**.**

Dhingra, Swati, London School of Economics, UK (31.10.2014): Contracting and the Division of the Gains from Trade**.**

Duflo, Esther, Massachusetts Institute of Technology, USA (19.09.2014): Public Service Delivery and Corruption: Experimental Evidence from NREGA in Bihar**.**

Dutta, Prajit, Columbia University, USA (12.08.2014): The Prisoner's Dilemma with Transfers.

Gupta, Ashmita, University of Houston, USA (22.11.2014): Effect of Trade Liberalization on Gender Inequality: The Case of India.

Heraklis, Polemarchakis, University of Warwick, UK (15.07.2014): Savings Trap.

Jose, Asturias, School of Foreign Service in Qatar, Georgetown University, Doha, Qatar (08.08.2014): Misallocation, Internal Trade, and the Role of Transportation Infrastructure.

Kala, Namrata, PhD Student, Yale University, USA (20.03.2015): Ambiguity Aversion and Learning in a Changing World: The Potential Effects of Climate Change from Indian Agriculture.

Köhlin, Gunnar, University of Gothenburg, Sweden (24.11.2014): A New Policy to Reduce Land Conflict.

Kumar, Rajnish, Queen's University, Belfast, UK (01.12.2014): Resource Allocation in a Network.

Patil, Sumeet R., University of California, Berkeley, USA (30.01.2015): The Dirty Business of Eliminating Open Defecation: Findings from Two Randomized Control Trials of Sanitation Programs in Odisha and Madhya Pradesh.

Pattanayak, Subhrendu K, Duke University, USA (11.11.2014): Cooking up change in the Himalayas: Evidence from mixing quasi-experiments with an experiment on cook stove promotion.

Saran Rene, Yale University – Singapore, Malaysia (02.04.2014): Mechanism Design with Bounded Depth of Reasoning and Small Modelling Mistakes.

Saggi, Kamal, Vanderbilt University, USA (20.10.2014): Compulsory Licensing and Patent Protection: A North-South Perspective.

Sarin, Rajiv, University of Exeter, UK (27.10.2014): A Model of Satisfying.

Shasikanta, Nandeibam, University of Bath, UK (05.08.2014): Menu Contracts in Teams.

Singh, Ram, Delhi School of Economics, New Delhi (21.11.2014): Uncertainty and Asymmetric Competitions.

Thakurata, Indrajit, IIM Indore, Madhya Pradesh (23.07.2014): Rich Dad, Poor Dad: Life-Cycle Portfolio Savings & Human Capital Accumulation.

Vandewalle, Lore, Graduate Institute of International and Development Studies, Geneva, Switzerland (13.02.2015): Saving by Default: Evidence from a Field Experiment in Rural India.

Volodymyr, Tulin, International Monetary Fund (25.04.2014): Food Inflation: The Role of Monetary Policy in India.

Economic Analysis Unit, Bangalore

Chaturvedi, Rakesh, Penn State University, USA (15.05.2014): Multiplayer Bargaining,

Choudhury, Govinda, North Bengal University, West Bengal (16.03.2015): Land rent, scientific forestry and tribal rights in India.

Miyata, Kazuyasu, Hokkaido University of Education, Japan (21.08.2014): Societal Norms and Marxian Theory: A critique of Post-Structuralism.

Majumdar, Atreyi, Delhi University, New Delhi (27.11.2014): Social and Economic Impact of International Migration: A case study of India Diaspora in the U.K.

Mukherjee, Sanchari Roy, North Bengal University, West Bengal (10.03.2015): Wage Determination in the tea Plantation Industry.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Bangalore

Ramamohan, K.V., Vice President - Quality, Infosys Technologies (24.04.2015): Challenges and opportunities in Business Analytics.

Center for Soft Computing Research: A National Facility, Kolkata

Bakshi, S., NIT Jamshedpur, India (13.03.2015): Periocular Localization and Feature Extraction for Human Recognition.

Manna, I., IIT Kanpur, India (15.09.2014): Materials science and engineering-An interface between society and technology.

Mukherjee, R.N., Indian Institute of Science Education and Research (IISER), Kolkata, India (02.03.2015): Excitements in Basic Sciences.

Onifade, O. F. Williams., University of Ibadan, Ibadan, Nigeria (17.10.2014): A fuzzy model for improving relevance ranking in information retrieval process.

5. SANKHYĀ

The internationally renowned journal *Sankhyā,* an official publication of the Indian Statistical Institute*,* was founded by Professor P.C. Mahalanobis in 1932 and began publication under his editorship. It is devoted to original research articles in Probability, Mathematical Statistics and Applied Statistics. Reviews and discussion articles on current research activity in the above areas are also published. A rigorous peer review process is followed for acceptance of articles submitted for publication in *Sankhyā*. Many seminal articles in Probability, Theoretical Statistics and Applied Statistics have appeared in *Sankhyā.* The journal is published in two separate series – Series A and Series B. *Sankhyā* Series A covers Probability and Theoretical Statistics and publishes two issues per year, one in February and the other in August. *Sankhyā* Series B covers Applied and Interdisciplinary Statistics and also publishes two issues per year, one in May and the other in November. The current Editorial Board (2014-2016) of *Sankhyā* is:

Editor-in-Chief : B.L.S. Prakasa Rao, C.R. Rao Advanced Institute of Mathematics, Statistics and Computer Science, Hyderabad, India

Series A Editors : Alok Goswami, Indian Statistical Institute, Kolkata, India
: Sourav Chatterjee, New York University, USA
: Hemant Ishawaran, University of Miami, USA
: Subhashis Ghosal, North Carolina State University, USA

Series B Editor : Atanu Biswas, Indian Statistical Institute, Kolkata, India
: Nilanjan Chatterjee, National Cancer Institute, USA
: Hemant Ishwaran, University of Miami, USA
: Lijian Yang, Michigan State University, USA

Technical Support : Urmichhanda Bhattacharya, Indian Statistical Institute, Kolkata, India

Editorial Office Support: Kajal De, Indian Statistical Institute, Kolkata, India
Elango Vinothini, Springer Journals Editorial Office, India

Beginning 2010, Springer has entered into a co-publication agreement with the Institute and has taken over exclusive rights for the international distribution of the journal, in both print and electronic editions. The editorial system is now completely electronic, that is, the entire process starting from submission of articles to editorial processing ending in final editorial decision for articles is now done on line. The process of Springer making free access to the electronic editions of *Sankhyā* available for all scientific workers of the institute is currently under way and should be implemented soon.

Since the time Springer took over, the international subscription sale volume has multiplied manifolds and is steadily increasing now. The figures below on sale volume (in Indian Rupees) for the last three years will highlight this growth:

	Print Edition	Online Subscription	Total	Royalty Received by ISI (After TDS)
2012:	A		10,37,063.51	
	B		8,18,479.04	
				6,95,512.00

Sankhyā

2013:	A+B		21,67,317.47	
	A	5,58,317.08	1,34,628.36	
	B	5,70,301.91	1,36,836.82	
				19,14,298.00
2014:	A+B		19,12,657.33	
	A	6,92,917.60	1,72,700.09	
	B	6,96,247.91	1,52,171.48	
				20,08,242.00

The following issues have been published during April 2014 to April 2015:

May, 2014 : Series B, Part I, Volume 76 [Both Electronic and Print Editions]
August, 2014 : Series A, Part II, Volume 76 [Both Electronic and Print Editions]
November, 2014 : Series B, Part II, Volume 76 [Both Electronic and Print Editions]
February, 2015 : Series A, Part I, Volume 77 [Both Electronic and Print Editions]

The following issues are currently under process for publication and are expected to be published in time:

Series B, Part I, Volume 77 : Due to be published in May, 2015
Series A, Part II, Volume 77 : Due to be published in August, 2015

6. SCIENTIFIC PAPERS AND PUBLICATIONS

(Some Publications may have multiple entries due to collaboration across units)

Books Published

Theoretical Statistics and Mathematics Division

Stat Math Unit, New Delhi

1. Bapat, R.B.: *Graphs and Matrices*, Second Edition, Hindustan Book Agency, New Delhi and Springer, 2014.

Applied Statistics Division

Applied Statistics Unit, Kolkata

1. Chakravarty, S.R. (ERU), Mitra, M. (ERU) and Sarkar, P.: *A Course on Cooperative Game Theory,* Cambridge University Press, 2015.

2. Sarkar, P. and Iwata, T. (eds.): *Advances in Cryptology – ASIACRYPT 2014, Part I and Part II*, Proceedings of ASIACRYPT 2014, Lecture Notes in Computer Science, Springer-Verlag, **8873 & 8874,** 2014.

3. SenGupta, A., Samanta, T. and Basu, A. (ISRU): *Statistical Paradigms: Recent Advances and Reconciliations*, ISI Platinum Jubilee Volume, **14**, World Scientific, Singapore, 2014.

Interdisciplinary Statistical Research Unit, Kolkata

1. SenGupta, A. (ASU), Samanta, T. and Basu, A.: *Statistical Paradigms: Recent Advances and Reconciliations*, ISI Platinum Jubilee Volume, **14**, World Scientific, Singapore, 2014.

Computer and Communication Sciences Division

Electronics and Communication Sciences Unit, Kolkata

1. Pal, S: *Engineering Mathematics*, Oxford University Press, 1040, ISBN–13: 978-0–19–807089–4, ISBN–10: 0–19–807089–6, 2015.

2. Mohanta, P.P.: *Proceedings of the 2015 Eighth International Conference on Advances in Pattern Recognition (ICAPR)*, IEEE Xplore, ISBN: 978–1-4799–7458–0, 2015.

Machine Intelligence Unit, Kolkata

1. De, R.K. and Tomar, N. (eds.): *Immunoinformatics*, second edition, under the Series titled Methods in Molecular Biology, J. Walker (Series Editor), Humana, Press, USA, 2014.

Publications

2. Ghosh, K. (ed.*): Computational Intelligence and Networks (CINE)*, Proceedings of 2015 International Conference, Publisher: IEEE, Print ISBN: 978-1-4799-7548-8, 2015.

3. Maji, P**.** and Paul, S.: *Scalable Pattern Recognition Algorithms: Applications in Computational Biology and Bioinformatics*, Springer-Verlag, London, 2014.

Computer Science Unit, Chennai

1. Ghosh, S. and Szymanik, J. (eds.): *The Facts Matter, Essays on Logic and Cognition in Honour of Rineke Verbrugge*, College Publication, London, 2015.

Biological Sciences Division

Biological Anthropology Unit, Kolkata

1. Shome, S.(SRU) and Bharati, P.: *Safe Motherhood, Women Autonomy, Household Status Index, Temporal Trend*, LAP LAMBERT Academic Publishing, 2014.

Social Sciences Division

Economic Research Unit, Kolkata

1. Chakravarty, S.R., Mitra, M. and Sarkar, P. (ASU): *A Course on Cooperative Game Theory*, Cambridge University Press, New Delhi, Pages 268, ISBN:978-1-107-05879-8 (Hardback), 978-1-107-69132-2, 2014 (Paperback).

Linguistic Research Unit, Kolkata

1. Dasgupta, P., Camacho, J. and Ertl, I.: *Beletra Almanako 20,* Mondial, New York, 2014.

2. Dasgupta, P., Camacho, J. and Ertl, I.: *Beletra Almanako 21,* Mondial, New York, 2014.

3. Dasgupta, P., Camacho, J. and Ertl, I.: *Beletra Almanako 22,* Mondial, New York, 2015.

4. Dasgupta, P. and Sengupta, P.: *Droit et Cultures 67: special number on 'Les cultures à la rencontre du droit: l'Inde',* L'Harmattan, Paris, 2014.

5. Dasgupta, P. (Translated into Bangla): *Nemesis*, by Alfred Nobel (1833-1896), M.C. Sarkar, Kolkata, 2014.

6. Dasgupta, P.: *Merur Prarthona: Bishuber Uttor*, Abhijan, Kolkata, 2015.

7. Dasgupta, P. (ed.): *Rabindranath: Ek Asamanwito Dwandwo*, by Manashi Dasgupta, Ebong Mushayera, Kolkata, 2015.

8. Dash, N. S.: *A Descriptive Study of the Bengali Words*, Cambridge University Press, Cambridge-New Delhi, ISBN: 9781107064249, 2015.

Sociological Research Unit, Delhi

1. Faizi, A.A.A. and Behera, H.C. (eds.): *Land Records Management in India: A Plea for Reforms*: Concept Publishing Company Pvt. Ltd., New Delhi, pages xx+219, ISBN-13:978-93-5125-095-1, 2014.

2. Ghosh, B. N.: *Empowerment of Women in North east India*, Concept Publishing Company (P) Ltd, New Delhi, pages xxii + 183, ISBN-13:978-93-5125-104-0, 2014.

3. Ghosh, B. N.: **(**Bengali Translation by Himanshu Ghosh), *Gramin Netritya O Unnayan*, Pragatisil Prakasak, Kolkata, Pages 222, ISBN: 978-81-89846-62-6, 2015.

4. Shome, S. and Bharati, P. (BAU): *Women Autonomy and its Influence on Safe Motherhood*, Lambert Academic Publishing, Germany, pages 160, ISBN: 978-3659614446, 2014.

Papers Published in Journals

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

1. Biswas, M., Mukhopadhyay, M. and Ghosh, A.K.: A distribution-free two-sample run test applicable to high dimensional data, *Biometrika*, **101(4)**, 913-926, 2014.

2. Biswas, M., Mukhopadhyay, M. and Ghosh, A.K.: On some exact distribution-free one sample tests for high dimension, low sample size data, *Statistica Sinica*, DOI:10.5705/ss.2014.155, 2014.

3. Das, P. and Dutta, A. K.: A note on residual variables of an affine fibration, *Journal of Pure and Applied Algebra*, **218(10),** 1792-1799, 2014.

4. Dutta, S. and Ghosh, A. K.: On some transformations of high dimension, low sample size data for nearest neighbor classification, *Machine Learning*, doi: 10.1007/s10994-015-5495-y, 2015.

5. Dasgupta, R.: Moment bounds for Strong-Mixing processes with applications, Statistical Paradigms, *World Scientific*, ISI Platinum Jubilee Volume, **14**, 281-291, 2014.

6. Dasgupta, R.: Characterization Theorems for Weibull Distribution with Applications, *Journal of Environmental Statistics,* **6(4)**, 1-25, 2014.

7. Dasgupta, R.: Growth of Tuber Crops and Almost Sure Band for Quantiles, *Communications in Statistics - Simulation and Computation*, DOI:10.1080/03610918.2014.990097, 2015.

8. Das, B., Goswami, D. and Sinha, K.B.: A homomorphism theorem and a Trotter product formula for quantum stochastic flows with unbounded coefficients, *Comm. Math. Phys.*, **330(2)**, 435-467, 2014.

9. Goswami, D.: Quadratic independence of coordinate functions of certain homogeneous spaces and action of compact quantum groups, *Proc. Ind. Acad. Sci. Math. Sci.*, **1**, 127-138, 2015.

10. Goswami, D. and Joardar, S.: Quantum isometry groups of noncommutative manifolds obtained by deformation using dual unitary 2-cocycles, *SIGMA Symmetry Integrabilty Geom. Methods Appl*, **076**, 18, 2014.

11. Gupta, N.: On the family of affine threefolds x^m y= F(x, z, t), *Compositio Mathematica*, **150**, 979-998, 2014.

12. Gupta, N.: On faithfully flat fibrations by a punctured line, *J. Algebra*, **415**, 13-34, 2014.

13. Gupta, N.: On Zariski's Cancellation Problem in positive characteristic, *Advances in Mathematics*, **264**, 296-307, 2014.

14. Karmakar, B., Dhara, K., Dey, K.K., Basu, A. and Ghosh, A.K.: Testing statistical significance of a treatment effect in the presence of hidden sub-populations, *Statistical Methods and Applications*, **24(1)**, 97-119, 2015.

15. Mandal, P.S. and Ghosh, A.K.: A statistical approach towards secure location verification in noisy wireless channels, *International Journal of Foundations of Computer Science*, **25(5),** 563-584, 2014.

Stat-Math Unit, Delhi

1. Athreya, S., Bandyopadhyay, A. and Dasgupta, A.: Random Walks in I.I.D. Random Environment on Non-Abelian Free Groups: Statist. Probab. Lett, *Elsevier*, **92**, 39 – 44, 2014.

2. Bandyopadhyay, A. and Sajadi, F.: On the Expected Total Number of Infections for a Virus Spread on Finite Networks: Ann. Appl. Probab., *Institute of Mathematical Statistics (IMS)*, **25(2)**, 663 – 674, 2015.

3. Bandyopadhyay, Antar and Chaudhuri, Sanjay: On Standard Deviation Estimates for Tree Order Restricted Models: Statistics, *Taylor & Francis*, **48(5),** 1122 - 1137, 2014.

4. Bandyopadhyay, Antar and Thacker, Debleena. : Rate of Convergence and Large Deviations for the Infinite Color Pólya Urn Schemes: Statist. Probab. Lett., *Elsevier*, **92**, 232 – 240, 2014

5. Bandyopadhyay, A. and Sajadi, F.: On the Nearest-Neighbor Algorithm for the Mean Field Traveling Salesman Problem: J. Appl. Probab., *Applied Probability Trust*, **51**, 1–12, 2014.

6. Bapat, R.B. and Ghorbani, E.: Inverses of triangular matrices and bipartite graphs, *Linear Algebra and Its Applications*, **447**, 68-73, 2014.

7. Bhatia, R. and Jain, T.: Positivity properties of the matrix $[(i+j)^{i+j}]$, *Archiv der Mathematik*, **103**, 279-283, 2014.

8. Bhatia, R. and Sharma, R.: Positive linear maps and spreads of matrices, *American Mathematical Monthly*, **121**, 619-624, 2014.

9. Bapat, R.B., Lal, A.K. and Pati, S.: A formula for all minors of the adjacency matrix and an application, *Special Matrices*, **2**, 89-98, 2014.

10. Bapat, R.B. and Sivasubramanian, S.: Product distance matrix of a tree with matrix weights, *Linear Algebra and Its Applications*, **468**, 145-153, 2015.

11. Bravo, J. G., Das, S., Das, P. and Laishram, S. : Powers in products of terms of Pell's and Pell-Lucas Sequences, *Int. Jour. of Number Theory*, DOI: 10.1142/S1793042115500682.

12. Chatterjee, A., Gupta, S. and Lahiri, S.N.: On the residual empirical process based on the ALASSO in high dimensions and its functional oracle property. *Journal of Econometrics*, 186(2), 317-324, 2015.

13. Dewan, I., Rani, M. and Jain, K.: Estimation of Parameters for Phased Mission Systems-Parallel Network, *Advances in Reliability,* **1**, 15-20, 2014.

14. Dewan, I., Sankaran, P.G. and Sreedevi, E.P.: A non-parametric test for stochastic dominance using total time on test transform, *American Journal of Mathematical and Management Sciences*, **34**, 162-183, 2015.

15. Dewan, I., Soni, P. and Jain, K.: Tests for successive differences of quantiles, *Statistics and Probability Letters*, **97**, 1-8, 2015.

16. Dewan, I.: Comments: EM-Based likelihood distributions based on left truncated and right censored data and associated model discrimination, *South African Statist. J.,* **48**,183–185, 2014.

17. Dey, A. and Sarkar, D.: A Note on the Construction of Orthogonal Latin Hypercube Designs, *Journal of Combinatorial Designs*, Online Version: DOI:10.1002/jcd.21408, 2014.

18. Jain, T. and Bhatia, R.: The geometric mean of exponentials of Pauli matrices, *J. Ramanujan Math. Soc.*, **30**, 199-204, 2015.

19. Kannan, M. Rajesh and Bapat, R.B.: Generalized principal pivot transform, *Linear Algebra and Its Applications*, **454**, 49-56, 2014.

20. Laishram, S. and Luca, F.: Fibonacci numbers of the form $x^a\pm x^b\pm 1$, Fibonnaci Quart., **52(4)**, 290-295, 2014.

21. Laishram, S.: On the Galois groups of generalized Laguerre Polynomials, *Hardy Ramanujan Journal*, **37**, 8-12, 2015.

22. Saha, K., Roy, R. and Sarkar, A.: Random directed forest and the Brownian web, *Annales de l'Institut Henri Poincaré*, Online Version: http://www.e-publications.org/ims/ submission/AIHP/ user/submissionFile/17975? confirm=93049452.

23. Thakur, M.: Invariants mod-2 and subgroups of G_2 and F_4, Neha Hooda, *Journal of Algebra,* **411**, pages 312-336, 2014.

Stat-Math Unit, Bangalore

1. Athreya, S.: Bandyopadhyay, Antar and Dasgupta, Amites: Random walks in I.I.D. random environment on Cayley trees, *Statistics & Probability Letters*, **92**, 39-44, 2014.

2. Bagchi, B.: A tightness criterion for homology manifolds with or without boundary, *European J. Combin.*, **46**, 10–15, 2015.

3. Bagchi, B. and Datta, B.: Corrigendum to Combinatorial triangulations of homology spheres, *Discrete Math.*, **338(4)**, 569–570, 2015.

Publications

4. Bagchi, B., Panigrahi, P. and Sahoo, U. K.: On the strongly regular unit distance graphs, *J. Combin. Math. Combin. Comput,* **89**, 293–302, 2014.

5. Bhar, S. and Rajeev, B.: Differential operators on Hermite Sobolev spaces, *Proceedings of the Indian Academy of Sciences – Mathematical Sciences*, **125 (1)**, 113-125, 2015.

6. Bhat, B. V. R. and Mallick, N.: Nilpotent completely positive maps*, Positivity,* **18**, 567–577, MR 3249920, 2014.

7. Bhat, B. V. R. and Ravichandran, M.: The Schur-Horn theorem for operators with finite spectrum, *Proc. Amer. Math. Soc*., **142(10)**, 3441-3453, MR 3238420, 2014.

8. Chattopadhyay, A., Das, B.K. and Sarkar, J.: Tensor product of quotient Hilbert modules, *Journal of Mathematical Analysis and Applications,* **424**, 727-747, 2015.

9. Chattopadhyay, A., Das, B.K. and Sarkar, J.: Star-Generating Vectors of Rudin's Quotient Modules, *Journal of Functional Analysis*, **267**, 4341-4360, 2014.

10. Chattopadhyay, A., Das, B.K., Sarkar, J. and Sarkar, S.: Wandering subspaces of the Bergman space and the Dirichlet space over polydisc, *Integral Equations Operator Theory*, **79**, 567-577, 2014.

11. Das, B.K., Sarkar, J. and Sarkar, S.: Maximal contractive tuples, *Complex Analysis and Operator Theory*, **8**, 1325-1339, 2014.

12. Das, B.K. and Sarkar, J.: Rudin's Submodules of $H^2(\boldsymbol{D}^2)$, *C. R. Acad. Sci. Paris*, **353,** 51-55, 2015.

13. Gorai, S.: A note on polynomial convexity of the union of finitely many totally-real planes in $\mathcal{C}^2$, *J. Math. Anal. Appl.*, **418 (2)**, 842–851, 2014.

14. Keshari, D. K.: Trace formulae for curvature of jet bundles over planar domains, *Complex Anal. Oper.Theory*, **8 (8)**, 1723–1740, 2014.

15. Ji, K., Jiang, C., Keshari, D. K. and Misra, G.: Flag structure for operators in the Cowen-Douglas class, *C. R. Math. Acad. Sci. Paris*, **352(6)**, 511–514, 2014.

16. Naolekar, A. C. and Thakur, A. S.: Vector bundles over iterated suspensions of stunted real projective spaces, *Acta Math. Hungar*, **142 (2)**, 339-347, 2014.

17. Naolekar, A. C. and Thakur, A. S.: Note on the characteristic rank of vector bundles, *Math. Slovaca*, **64 (6)**, 1521-1540, 2014.

18. Naolekar, A. C. and Thakur, A. S.: On trivialities of Chern classes, *Acta Math. Hungar*, **144 (1)**, 90-109, 2014.

19. Prajapati, S.K. and Sury, B.: On the total character of finite groups, *International Journal of Group Theory*, **3,** 47-67, 2014.

20. Rao, T.S.S.R.K.: Best constrained approximation in Banach spaces, *Numerical Functional Analysis and Optimization*, **36**, 248-255, 2015.

21. Rao, T.S.S.R.K.: Approximation properties for spaces of Bochner integrable functions, *Journal of Mathematical Analysis and Applications*, **423**, 1540-1545, 2015.

22. Rao, T.S.S.R.K.: Existence sets of best coapproximation and Projections of norm one, *Monatshefte fur Mathematik*, **176**, 607-614, 2015.

23. Rao, T.S.S.R.K.: On intersections of ideals in Banach spaces, *Houston Journal of Mathematics*, **41,** 2015.

24. Sahoo, B.K. and Sastry, N.S.N.: Binary code for the symplectic generalized quadrangle of even order, *Des. Codes Cryptogr*, *Springer*, 2015.

25. Sarkar, J.: Jordan Blocks of $H^2(\boldsymbol{D}^2)$, *Journal of Operator theory,* **72**, 371-385, 2014.

26. Sarkar, J.: Submodules of the Hardy module over polydisc, *Israel Journal of Mathematics*, **205**, 317-336, 2015.

27. Sreekantan, R.: Higher Chow cycles on Abelian surfaces and a non-Archimedean analogue of the Hodge-D-conjecture, *Compos. Math.*, **150 (4)**, 691–711, 2014.

28. Nikolov, N. and Sury, B.: Bounded generation of wreath products, *Journal of Group Theory*, DOI 10.1515/jgth-2015-0006, 2015.

29. Sury, B.: Macaulay expansion, *The Amer. Math. Monthly*, **121**, 359-360, 2014.

30. Sury, B.: A polynomial parent to a Fibonacci-Lucas relation, *The Amer. Math. Monthly*, **121**, 236, 2014.

31. Sury, B.: A heuristic argument to Hua's identity using geometric series, *The Amer. Math. Monthly*, **121**, 522, 2014.

32. Biswas, I., Mj, M. and Thakur, A. S.: Infinitesimal deformations and Brauer group of some generalized Calabi-Eckmann manifolds, *Tokyo J. of Math.*, **37 (1)**, 61-72, 2014.

Stat-Math Unit, Chennai

1. Bharanedhar, S.V. and Ponnusamy, S.: Uniform close-to-convexity radius of sections of functions in the close to-convex family*, Journal of Ramanujan Mathematical Society,* 29(3), 243-251, 2014.

2. Bharanedhar, S.V. and Ponnusamy, S.: Coefficient conditions for harmonic univalent mappings and hypergeometric mappings, *Rocky Mountain Journal of Mathematics*. **44(3)**, 753-777, 2014.

3. Balakumar, G.P., Mahajan, P. and Verma, K.: Bounds for invariant distances on pseudoconvex Levi corank one domains and applications, *Annales de la Faculte des Sciences de Toulouse*, **24(2)**, 281-388*,* 2015.

4. Baricz, A., Pogany, T., Ponnusamy, S. and Rudas, I., Bounds for Jaeger Integrals, *Journal of Mathematical Chemistry, **53**,* 1257-1273, 2015.

5. Chen, Sh., Ponnusamy, S. and Rasila, A.: Lengths, areas and Lipschitz-type spaces of planar harmonic mappings, *Nonlinear Analysis,* **115(15)**, 62-70*, 2015*.

6. Chen, Sh., Ponnusamy, S. and Rasila, A.: On characterizations of Bloch-type, Hardy-type and Lipschitz-type spaces, *MathematischeZeitschrift,* **279**, *163-183, 2015*.

7. Chen, Sh., Ponnusamy, S. and Wang, X.: Stable geometric properties of pluriharmonic and biholomorphic mappings, and Landau-Bloch's theorem, *Monatshefte fuer Mathematik,* **177 (1)**, 33-51, 2015.

8. Kalaj, D., and Ponnusamy, S.: Polyharmonic mappings and J.C.C. Nitsche type inequalities, *Glasnik Matematicki*, **44(69)**, (2014), 163--178.

9. Kalaj, D., Ponnusamy, S. and Vuorinen, M.: Radius of close-to-convexity of harmonic functions, *Complex Var. Elliptic Equ*. **59(4)**, 539-552, 2014.

10. Li, Y., Ponnusamy, S. and Vuorinen, M.: Freely quasiconformal maps and distance ratio metric, *J. Aust. Math. Soc*., **97**, 383-390, 2014.

11. Li, L. and Ponnusamy, S.: Convolutions of harmonic mappings convex in one direction, *Complex Anal. Oper. Theory,* **9(1)**, 183-*199, 2015.*

12. Muhanna, Y. Abu, Bharanedhar, S.V. and Ponnusamy, S.: One parameter family of univalent biharmonic Mappings, *Taiwanese Journal ofmathematics*. **18(4)**, 1151-1169, 2014.

13. Muhanna, Y. Abu, Li, L. and Ponnusamy, S.: Extremal problems on the class of convex functions of order -1/2, *Arch. Math. (Basel),* **13(6)**, 461-471, 2014.

14. Obradovic, M. and Ponnusamy, S.: Univalence of quotient of analytic functions, *Appl. Math. Comput,* **247**, 689-694, 2014.

15. Obradovic, M. and Ponnusamy, S.: Starlikeness of sections of univalent functions, *Rocky Mountain J. Math*. **44(3)**, 1003-1014, 2014.

16. Obradovic, M. and Ponnusamy, S.: Disk of univalence of the ratio of two analytic functions, *Complex Var. Elliptic Equ.,* **60(2)**, 392-404, 2015.

17. Obradovic, M., Ponnusamy, S. and Wirths, K.-J.: Integral means and Dirichlet integral for analytic functions, *Math. Nachr.,* **288(2-3)**, 334-342, 2015.

18. Ponnusamy, S. and Qiao, J.: Classification of Univalent harmonic mappings on the unit disk with half-integer coefficients, *J. Aust. Math. Soc.,* **98**, 257-280, 2015.

19. Ponnusamy, S., Sahoo, S.K. and Sugawa, T.: Radius problems associated with pre-Schwarzian and Schwarzian derivatives, *Analysis,* **34**, 163-171, 2014.

20. Ponnusamy, S. and SairamKaliraj, A.: Univalent harmonic mappings convex in one direction, *Anal. Math. Phys*., **4**, 221-236, 2014.

21. Ponnusamy, S. and Wirths, K.J.: On the problem of L. Gromova and A. Vasil'ev on integral means, and Yamashita's conjecture forspirallike functions, *Ann. Acad. Sci. Fenn. Ser. A I Math*., **39**, 721-731, 2014.

Applied Statistics Division

Applied Statistics Unit, Kolkata

1. Banerjee, B. and Biswas, A.: Odds ratio for 2 x 2 tables: Mantel-Haenszel estimator, profile likelihood and presence of surrogate responses, *Journal of Biopharmaceutical Statistics,* **24**, 649-659, 2014.

2. Banerjee, B. and Biswas, A.: Linear increment in efficiency with the inclusion of surrogate endpoint, *Statistics and Probability Letters,* **96**, 102-108, 2015.

3. Banik, S., Maitra, S. and Sarkar, S., Improved differential fault attack on MICKEY 2.0, *Journal of Cryptographic Engineering,* **5(1)**, 13-29, 2015.

4. Bhattacharya, R., Pradhan, B. (SQC&OR Unit, Kolkata) and Dewanji, A.: Optimum life testing plans in presence of hybrid censoring, a cost function approach, *Applied Stochastic Models in Business and Industry,* **30**, 519-528, 2014.

5. Bhattacharya, R., Pradhan, B. (SQC&OR Unit, Kolkata) and Dewanji, A.: Computation of optimum reliability acceptance sampling plans in presence of hybrid censoring, *Computational Statistics and Data Analysis,* **83**, 91-100, 2015.

6. Bhattacherjee, S. and Sarkar, P.: Concrete analysis and trade-offs for the (complete tree) layered subset difference broadcast encryption scheme. *IEEE Transactions on Computers*, **63(7)**, 1709-1722, 2014.

7. Biswas, A**.,** Pardo, M.C. and Guha, A.: Auto association measures for stationary time series of categorical data, TEST, **23**, 487-514, 2014.

8. Biswas, A**.,** Hwang, J.-S. and Angers, J.-F.: Air pollution effects on clinic visits in small areas of Taiwan revisited, *Environmental and Ecological Statistics*, **22**, 17-32., 2015.

9. Bose, M. and Mukerjee, R. Optimal design measures under asymmetric errors, with application to binary design points, *Journal of Statistical Planning and Inference*, **159**, 28-36, 2015.

10. Chakraborty, D, Mancillas-Lopez, C. and Sarkar, P.: STES: a stream cipher based low cost scheme for securing stored data, *IEEE Transactions on Computers,* Online Version: http://doi.ieeecomputersociety.org/10.1109/TC.2014.2366739, 2014.

11. Chattopadhyay, A.K., Mondal, S. and Biswas, A.: Independent component analysis and clustering for pollution data*, Environmental and Ecological Statistics*, **22**, 33-43, 2015.

12. Ghosh, P. and Dewanji, A.: Matched case-control study with reporting bias, *Journal of Statistical Planning and Inference,* **157-158,** 121-136, 2015.

13. Gupta, K. C. and Ghosh Roy, I.: Finding biaffine and quadratic equations for S-boxes based on power mappings, *IEEE Transactions on Information Theory*, **61(4)**, 2000-2209, 2015.

14. Gupta, K. C. and Ghosh Roy, I.: Cryptographically significant MDS matrices based on circulant and circulant-like matrices for light weight applications, *Cryptography and Communications*, **7(2)**, 257-287, 2015.

Publications

15. Hassan, Sk. S., Pal Choudhury, P**.,** Nayak, B.K. and Ghosh, A.: Integral Value Transformation: class of discrete dynamical systems and an applications, *Journal of Advanced Research in Applied Mathematics*, **7**, 1-12, 2015.

16. Kanika, K. S. and SenGupta, A**.**: A unified approach to decision-theoretic properties of the MLEs for the mean direction of several Langevin distributions, *Journal of Multivariate Analysis*, **133**, 160-172, 2015.

17. Liu, R., Chakrabarti, A., Samanta, T., Ghosh, J.K. and Ghosh, M.: On divergence measures leading to Jeffreys and other Reference priors, *Bayesian Analysis*, **9**, 331-370, 2014.

18. Mandal, S. and Biswas, A.: Shift-invariant target in allocation problems, *Statistics in Medicine,* **33**, 2597-2611, 2014.

19. Mukhopadhyay, M., Samanta, T. and Chakrabarti, A.: On consistency and optimality of Bayesian variable selection based on g-prior in normal linear regression models, *Annals of the Institute of Statistical Mathematics*, Online Version: DOI 10.1007/s10463-014-0483-8, 2014.

20. Riley, R.D., Takwoingi, Y., Trikalinos, T., Guha, A., Biswas, A**.**, Ensor, J., Morris, R.K. and Deeks, J.J.: Meta-analysis of test accuracy studies with multiple and missing thresholds: a multivariate-normal model, *Journal of Biometrics and Biostatistics,* **5**, Online Version: DOI: 10.4172/2155-6180.1000196, 2014.

21. Rout, R.K., Pal Choudhury, P**.,** Sahoo, S. and Ray, C.: Partioning 1-variable Boolean functions, *International Journal of Computer Mathematics*, DOI:10.1080/00207160.2014.975418, 2014.

22. Salehabadi, S., Mirzaei, S., Sengupta, D. and Das, R.: Parametric estimation of menarcheal age distribution based on recall data, *Scandinavian Journal of Statistics,* **42**, 290-305, 2015.

23. Sarkar, G. N., Basu, K., Chowdhury, S. P. and Mukhopadhyay, T.: GeoSpatial distribution of anemia in hilly Darjeeling, *National Journal of Research in Community Medicine*, **3(3)**, 208-216, 2014.

24. Sarkar, P.: On Some connections between statistics and cryptology*, Journal of Statistical Planning and Inference*, **148**, 20-37, 2014.

25. Sarkar, P.: Modes of operations for encryption and authenticationusing stream ciphers supporting an initialisation vector, *Cryptography and Communications-Discrete Structures, Boolean Functions and Sequences*, 2014, **6(3),** 189-231, 2014.

26. SenGupta, A**.,** Kulkarni, H.V. and Hubale, U.D.: Prediction intervals for environmental events based on Weibull distribution*, Environmental and Ecological Statistics*, **22**, 87-104, 2015.

27. SenGupta, A**.** and Ong, S.H.: A unified approach for construction of probability models for bivariate linear and directional data, *Communications in Statistics–Theory and Methods*, **43**, 2563-2569, 2014.

28. Uesu, K., Shimizu, K. and SenGupta, A: A possibly asymmetric multivariate generalization of the Mobius distribution for directional data, *Journal of Multivariate Analysis*, **134**, 146-162, 2015.

Interdisciplinary Statistical Research Unit, Kolkata

1. Alin, A. and Basu, A.: Robust confidence regions for multinomial probabilities, *Journal of Statistical Computation and Simulation*, **85**, 538-551, 2015.

2. Banerjee, S., Basu, A., Bhattacharya, S., Bose, S., Chakraborty, D. and Mukherjee, S.S.: Minimum distance estimation of milky way model parameters and related inference, *Journal of Uncertainly Quantification*, **3(1)**, 91-115, 2015.

3. Chakraborty, B., Bhattacharya, S., Basu, A., Bandyopadhyay, S. and Bhattacharjee, A.: Goodness-of-fit testing for the Gompertz growth curve model, *Metron*, **72**, 45-64, 2014.

4. Chandra, T.K.: On an extension of the weak law of large numbers of Kolmogorov and Feller, *Stochastic Analysis and Application*, **32**, Online Version: DOI: 10.1080/07362994.2014.886263, 421-426, 2014.

5. Das, K. and Sobel, M.: Dirichlet Lasso, A Bayesian Approach to Variable Selection, *Statistical Modelling,* Online Version: DOI: 10.1177/1471082X14551245, 2014.

6. Das, K.: Some additional considerations in modelling the dynamic traits and genome-wide association studies, *Physics of Life Reviews*, Online Version: DOI: 10.1016/j.plrev.2015.03.005, 2015.

7. Kuchibhotla, A.K. and Basu, A.: A general set up for minimum disparity estimation, *Statistics and Probability Letters*, **96**, 68-74, 2015.

8. Pal, A., Bose, S., Basak (SMU, Kolkata), G. K. and Mukhopadhyay A.: Speaker identification by aggregating Gaussian mixture models (GMMs) based on uncorrelated MFCC-derived features, *International Journal of Pattern Recognition and Artificial Intelligence*, **28(4)**, Online version: DOI: 10.1142/S0218001414560060, 2014.

9. SahaRay, R. and Morgan, H.I.: Critical sets in F-squares, *Ars Combinatoria*, **118,** 333-347, 2015.

10. Sharma, M., Nayak, J., Koul, M.K., Bose, S., Mitra, A., Dhar, V. K., Tickoo, A. K. and Koul, R.: Validation of a new background discrimination method for the TACTIC TeV γ-ray telescope with Markarian 421 data, *Nuclear Instruments and Methods in Physics Research A*, **770**, 42-47, 2015.

11. Sharma, M., Nayak, J., Koul, M.K., Bose, S. and Mitra, A.: Gamma/ hadron segregation for ground based imaging atmospheric Cherenkov telescope using the machine learning methods: Random Forest leads, *Research in Astronomy and Astrophysics*, **14**, 1491–1503, 2014.

12. Sur, P., Shmueli, G., Bose, S. and Dubey, P.: Modeling bimodal discrete data using Conway-Maxwell-Poisson mixture models, *Journal of Business and Economic Statistics*, Online Version: DOI**:** 10.1080/07350015.2014.949343, 2014.

Applied Statistics Unit, Chennai

1. Sen, R. and Ray, N.: Forecasting Wind Power Generation, *Pioneer Journal of Theoretical and Applied Statistics*, **7(1),** 1-13, 2014.

Publications

Applied and Official Statistics Unit, North-East Centre, Tezpur

1. Bhattacharyya, P., Karak, T., Chakrabarti, K., Chakraborty, A., Paul, R.K. and Tripathi, S.: Is Tsunami tremor jolted on microbial biomass and their activities in soils?-A case study in Andaman Island, India, *Environmental Earth Sciences*, **72**, 1443-1452, 2014.

2. Danielsson, C.B., Chungkham, H.S., Wulff, C. and Westerlund, H.: Office design impact on sick leave rates, *Ergonomics,* **57(2)**, 139-47, 2014.

3. Das, D. (AERU), Powell, M., Bhattacharyya, P. and Banik, P. (AERU): Changes of carbon, nitrogen, phosphorous and potassium content during storage of vermicomposts prepared from different substrates, *Environmental Monitoring and Assessment*, **186**, 8827-8832. 2014.

4. Goswami, L., Raul, P., Sahariah, B., Bhattacharyya, P. and Bhattacharya, S.S.: Characterization and risk evaluation of tea industry coal ash for environmental suitability, *Clean-Soil, Air, Water*, **42**, 1470-1476, 2014.

5. Goswami, L., Sarkar, S., Mukherjee, S., Das, S., Barman, S., Raul, P., Bhattacharyya, P., Mandal, N.C., Bhattacharya, S. and Bhattacharya, S.S.: Vermicomposting of tea factory coal ash: metal accumulation and metallothione in response in *Eiseniafetida* (Savigny) and *Lampitomauritii* (Kinberg), *Bioresource Technology*, **166**, 96-102, 2014.

6. Hamren, K., Chungkham, H.S. and Hyde, M.: Religion, spirituality, social support and quality of life: measurement and predictors CASP-12 (v2) amongst older Ethiopians living in Addis Ababa, *Aging & Mental Health*, **19**, Online Version: 10.1080/13607863.2014.952709, 2014.

7. Hyde, M., Magnusson Hanson, L.L., Chungkham, H.S., Leineweber, C. and Westerlund, H.: The impact of involuntary exit from employment in later life on the risk of major depression and being prescribed anti-depressant medication, *Aging & Mental Health,* **19**, Online Version: DOI: 10.1080/13607863.2014.927821, 2015.

8. Karak, T., Bhattacharyya, P. and Paul, R.K.: Assessment of co-compost quality by physico-chemical and exploratory data analysis, *Clean- Soil, Air, Water*, **42**, 836-848, 2014.

9. Leineweber, C., Chungkham, H.S., Westerlund, H., Tishelman, C. and Lindqvist, R.: Hospital organizational factors influence work-family conflict in registered nurses: multilevel modelling of a nation-wide cross-sectional survey in Sweden, *International Journal of Nursing Studies,* **51(5)**, 744-51, 2014.

10. Leineweber, C., Westerlund, H., Chungkham, H.S., Lindqvist, R., Runnesdotter, S. and Tishelman, C.: Nurses' practice environment and work-family conflict in relation to burn out: a multilevel modelling approach, *PLOS One*, **9(5)**, 1-9, 2014.

11. Lima, F., Hyde, M., Chungkham, H.S., Novaes, M., Correia, C., Junqueira, F., Campos, M., Laks, J. and Petribu, K.: Quality of life amongst older Brazilians: A cross-cultural validation of the CASP-19 into Brazilian-Portuguese, *PLOS One*, **9(4)**, 1-8, 2014.

12. Magnusson Hanson, L.L., Chungkham, H.S., Åkerstedt, T. and Westerlund, H.: Does disturbed sleep mediate the relationship between work stress measured by work demands and social support and depression? Longitudinal mediation analyses based on the Swedish Longitudinal Occupational Survey of Health (SLOSH), *Sleep,* **37(12)**, 1977-1985, 2014.

13. Magnusson Hanson, L.L., Leineweber, C., Chungkham, H.S. and Westerlund, H.: work-to-home interference and its prospective relation to major depression and treatment with antidepressants using the Swedish Longitudinal and Occupational Survey of Health (SLOSH), *Scandinavian Journal of Work Environment and Health,* **40(1)**, 66-73, 2014.

14. Tripathy, S., Bhattacharyya, P., Mohapatra, R., Som, A. and Chowdhury, D.: Influence of different fractions of heavy metals on microbial ecophysiological indicators and enzyme activities in century old municipal solid waste amended soil, *Ecological Engineering*, **70**, 25-34, 2014.

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit, Kolkata

1. Bunet, A., Bandyapadhyay, S., Das, S. and Sarkar, H.: Voronoi game on graphs Theoretical Computer Science, **562**, 270 – 282, 2015.

2. Bunet, A., Bhattacharya, B. and Das, S.: Minimum enclosing circle of a set of fixed point and a mobile point Computational Geometry: Theory & Application, **49 (a)**, 891–898, 2014

3. Dash, D., Bishnu, A., Gupta, A. and Nandy, S.C. : Line coverage measures in wireless sensor Networks, *Journal of Parallel & Distributed Computing (JPDC),* **74**(**7**), 2596-2614, 201**4.**

4. Dutt, M., Biswas, A., Bhowmick, P. and Bhattacharya B. B.: On the family of shortest isothetic paths in a digital object—An algorithm with applications, *Computer Vision and Image Understanding*, **129**, 75-88, 2014.

5. Dutt, M., Biswas, A., Bhowmick, P. and Bhattacharya, B.B.: On finding a shortest is orthotic path and ts monotonicity inside a digital object, *Annals of Mathematics and Artificial Intelligence*, Springer, 1-25, 2014.

6. Das, G.K., De, M., Kolay, S. Nandy, S. C. and Sur-Kolay, S.: Approximation algorithms for maximum independent set of a unit disk graph, Inf. Process. Lett, **115(3),** 439-446, 2015.

7. De, M., Nandy, S. C. and Roy, S.: Prune-and-search with limited workspace, *J. Comput. Syst. Sci*, **81(2)**, 398-414, 2015.

8. **Das, G., De, M., Kolay,** S., Nandy, S.C. and Sur-Kolay, S.: Approximation Algorithms for maximum independent set of a unit disk graph, Information Processing Letters, **115(3)**, Online Version: DOI: 10.1016/j.ipl.2014.11.002, 2014, 439-446, 2015.

9. Deb, A., Das, D. K. and Sur-Kolay, S.: A Modular Design to Synthesize Symmetric Functions using Quantum Quaternary Logic, *Journal of Low Power Electronics* , **10**, Online Version: DOI: 10.1166/jolpe.2014.1340, 443-454, 2014.

10. Luo, Y., Bhattacharya, B.B., Ho, T.-Y. and Chakrabarty, K. : Design and optimization of a cyber- physical digital-microfluidic biochip for the polymerase chain reaction, *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems* (TCAD), **34(1)**, 29-42, 2015.

11. Lin, C.-C., Sur-Kolay, S. and Jha, N.K.: PAQCS: Physical Design-aware Fault-tolerant Quantum Circuit Synthesis, *IEEE Transactions on VLSI Systems* , Online Version: DOI: 1109/TVLSI.2014.2337302.

Publications

12. Mitra, D., Roy, S., Bhattacharjee, S., Chakrabarty, K. and Bhattacharya, B.B.: On-chip sample preparation for multiple targets using digital microfluidics, *IEEE Transactions on Computer- Aided Design of Integrated Circuits and Systems* (TCAD), **33(8)**, 1131-1144, 2014.

13. Mozaffari-Kermani, M., Sur-Kolay, S., Raghunathan, A. and Jha, N. K.: Systematic Poisoning Attacks on and Defenses for Biomedical Machine Learning, *IEEE Journal of Biomedical and Health Informatics (J-BHI)*, Online Version: DOI: 10.1109/JBHI.2014.2344095.

14. Mandal, S. B., Chakrabarti, A. and Sur-Kolay, S.: Quantum Ternary Circuit Synthesis Using Projection Operations, *Journal of Multiple-Valued Logic and Soft Computing* , **24(1-4)**, 73-92, 2015.

15. Mondal, K., Mandal, P. S. and Sinha, B. P.: Analysis of Multi-Bound Signals towards Localization: A Theoretical Approach, *Wireless Personal Communications*, **83(1)**, 49-67, 2015.

16. Roy, S., Bhattacharya, B.B., Ghoshal, S. and Chakrabarty, K.: Theory and analysis of generalized mixing and dilution of biochemical fluids using digital microfluidic biochips, *ACM Journal on Emerging Technologies in Computing Systems* (JETC), **11(1)**, Article 2, 2.1 - 2.33, 2014.

17. Roy, S., Bhattacharya, B. B., Ghoshal S.and Chakrabarty, *K.*: An optimal two-mixer dilution engine with digital microfluidics for low-power applications, *Journal of Low-Power Electronics (JOLPE),* **10*(3)***, 506-518, 2014.

18. Roy, S., Bhattacharya, B. B., Ghoshal, S. and Chakrabarty, K.: High-throughput dilution engine for sample preparation on digital microfluidic biochips, *IET Computers and Digital Techniques*, **8(4)**, 163-171, 2014.

19. Sahoo, M.,Rahaman H. and Bhattacharya B. B.*:* On the suitability of single-walled carbon nanotube bundle interconnects for high-speed and power-efficient applications *, Journal of Low-Power Electronics (JOLPE),* **10*(3)***, 479-494, 2014.

20. Saha, D. and Sur-Kolay, S. : Watermarking in Hard Intellectual Property for Pre-Fab and Post-Fab Verification, IEEE Transactions on VLSI Systems, Online Version: DOI: 10.1109/TVLSI.2014.2322138, 2014.

Computer Vision and Pattern Recognition Unit, Kolkata

1. Chatterjee, G.: Results of late surgical intervention in children with early-onset bilateral cataracts**,** *Br Jophthalmol* 2014, **98**, 1424-1428, Online Version: DOI: 10.1136/bjophthalmol-2013-304475, 2014.

2. Chatterjee G.: Ophthalmology beyond ophthalmologists and also including ophthalmologists, *Curr Ind Eye Res,* **1**, 42-43, 2014.

3. Mukhopadhyay, P., and Chaudhuri, B.B.: A Survey of Hough Transform, *Pattern Recognition*, **48**(**3)**, 993-1010, 2015.

4. Mukherjee, A., Garain U. and Biswas, A.: Experimenting with Automatic Text-to-Diagram Conversion, *A Novel Teaching Aid for the Blind People. Educational Technology & Society*, **17(3)**, 40-53, 2014.

5. Maiti, S., Garain, U., Dhar A. and De, S.: A novel method for performance evaluation of text chunking, *Language Resources and Evaluation*, Springer, **49(1)**, 215-226, 2015.

6. Paik, J.H., Pal, D. and Parui, Swapan K.: Incremental Blind Feedback: An Effective Approach to Automatic Query Expansion, *ACM Transactions on Asian Language Information Processing*, **13**(**3**), 13:1-13.22, 2014.

7. Roy, P. P., Pal, U. and Llados, J.: Word Searching in Unconstrained Layout using Character Pair Coding, *International Journal on Document Analysis and Recognition* (*IJDAR*), **17**(**4)**, 343-358, 2014.

8. Roy, A., and Parui, S. K.: Pair-copula based mixture models and their application in clustering, *Pattern Recognition*, **47(4)**, 1689-1697, 2014.

9. Som, S., Datta, S., Singha, R., Kotal, A. and Palit, S.: Confusion and Diffusion of Colour Images with Multiple Chaotic Maps and Chaos based Pseudo Random Binary Number Generator, *Non-linear Dynamics*, Online Version: DOI: 10.1007/s11071-015-1893-8.

10. Samanta, O., Bhattacharya, U., and Parui, S. K.: Smoothing of HMM parameters for efficient recognition of online handwriting, *Pattern Recognition*, **47(11)**, 3614-3629, 2014.

11. Shivakumar, P., Phan, T. Q., Bhowmick, S., Li, S., Tan Chew, Lim and Pal, U.: Semi-Automatic Ground Truth Generation for Text Detection and Recognition in Video Images, *IEEE Trans. on Circuits and Systems for Video Technology*, **24**(**8**), 1277-1287, 2014.

12. Sharma, N., Shivakumara, P., Pal, U., Blumenstein, M. and Tan Chew, L.: Piece-Wise Linearity Based Method for Text Frame Classification in Video, *Pattern Recognition*, **48(3)**, 862-881, 2015.

13. Shivakumara, P., Dutta, A., Tan Chew, L. and Pal, U.: Multi-Oriented Scene Text Detection in Video based on Wavelet and Angle Projection Boundary Growing, *Multimedia Tools and Applications*, **72**(**1**), 515-539, 2014.

Electronics and Communication Sciences Unit, Kolkata

1. Purkait, P.K., Pal, N. R. and Chanda, B.: Fuzzy-Rule Based Approach for Single Frame Super Resolution, *IEEE Tr. on Image Processing*, **23(5)**, 2277-2290, 2014.

2. Samanta, S. and Chanda, B.: Space-time Facet Model for Human Activity Classification, *IEEE Trans. on Multimedia*, **16(6)**, 1525--1535, October, 2014.

3. Dutta, D., Saha, S.K. and Chanda, B.: A Shot Detection Technique Using Linear Regression of Shot Transition Pattern, Multimedia Tools and Applications, Online Version: DOI: 10.1007s/11042-014-2273-y, 2014.

4. Ghorai, M. and Chanda, B.: An image inpainting method using pLSA-based search space estimation, *Machine Vision and Application*, **26**, 69--87, 2015.

5. Nag, K. and Pal, N.R.: A Multiobjective Genetic Programming based Ensemble for Simultaneous Feature Selection and Classification, *IEEE Transactions on Cybernetics*, DOI 10.1109/TCYB.2015.2404806, 2015.

Publications

6. Wang, Hsei-Wei, Sun, Hsing-Jen Sun, Chang, Ting-Yu, Lo, Hung-Hao, Cheng, Wei-Chung, Tseng, George C., Lin, Chin-Teng, Chang, Shing-Jyh, Pal, N.R. and I-Fang, Chung: Discovering monotonic stemness marker genes from time-series stem cell microarray data, *BMC Genomics*, **16 (Suppl 2)**, Online Version: DOI: 10.1186/1471-2164-16-S2-S2v, 2015.

7. Jimenez, S. G., Bustince, H., EykeHullermeier, R.M., Pal, N.R. and Pradera, A.: Overlap indices: construction of and application to interpolative fuzzy systems, *IEEE Transactions on Fuzzy systems*, Online Version: DOI: 10.1109/TFUZZ.2014.2349535, 2014.

8. Lin, Y.-Y., Pal, N.R. and Lin, C.-T.: An Interval Type-2 Neural Fuzzy System for Online System Identification and Feature Elimination (IT2NFS-SIFE), *IEEE Transactions on Neural Networks and Learning Systems*, Online Version: DOI: 10.1109/TNNLS.2014.2346537, 2014.

9. Gee, S.B., Tan, K.C., Shim, V.A. and Pal, N.R.: Online Diversity Assessment in Evolutionary Multiobjective Optimization: A Geometrical Perspective, *IEEE Transactions on Evolutionary Computation*, Online Version: DOI: 10.1109/TEVC.2014.2353672, 2014.

10. Singh, A., Kishore, A. and Pal, N.R.: Stancu OWA Operator, *IEEE Transactions on Fuzzy systems*, Online Version: DOI: 10.1109/TFUZZ.2014.2336696, 2014.

11. Chakraborty, R. and Pal, N.R.: Sensor (Feature-Group) Selection with Controlled Redundancy in a Connectionist Framework, *International Journal of Neural Systems*, **24(6):1450021**, Online Version: DOI: 10.1142/S012906571450021X, 2014.

12. Chakraborty, S., Konar, A., Ralescu, A. and Pal, N.R.: A Fast Algorithm to Compute Precise Type-2 Centroids for Real-Time Control Applications, *IEEE Transactions on Cybernetics*, **45(2)**, 340-353, Online Version: DOI: 10.1109/TCYB.2014.2308631, 2015.

13. Chakraborty, R. and Pal, N. R.: Feature Selection Using a Neural Framework with Controlled Redundancy, *IEEE Transactions on Neural Networks and Learning Systems*, **26(1)**, 35-50, Online Version: DOI: 10.1109/TNNLS.2014.2308902, 2015.

14. Banerjee, M. and Pal, N.R: Feature Selection with SVD Entropy: some modification and extension, *Information Science*, **264**, 118-134, Online Version: DOI: http://dx.doi.org/10.1016/j.ins.2013.12.029, 2014.

15. Dasgupta, S., Pal, P., Mazumdar, C. and Bagchi, A.: Resolving Authorisation Conflicts by Ontology Views for Controlled Access to a Digital Library*, Journal of Knowledge Management*, **19**, 45-59, 2015.

16. Mukherjee, S. and Mukherjee, D. P.: A Motion-Based Approach to Detect Persons in Low-Resolution Video, *Multimedia Tools and Applications*, Springer, Online Version: DOI: 1007/s11042-014-2128-6, 2014.
17. Sen, A., Ahammed, Y. Nazeer, Arya, B.C., Banerjee, Tirthankar, Begam, G. Reshma, Burah, B. P., Chatterjee, A., Choudhuri, Anil K., Dhir, Amit, Das, Trupti, Dhayni, Pitamber Prasad, Deb, N.C., Gadi, Ranu, Gauns, Mangesh, Ghosh, Sanjay, Gupta, Abhishek, Sharma, K.C., Khan, A.H., Kumar, Arnn, Kumari, K. Maharaj, Kumar, Manish, Chandra, Jagdish, Kuniyal, Lakhani, Anita, Meena, R.K., Mahapatra, P.S., Naqvi, S.W.A., Pal, Dharam, Pal, S., Panda, Sipra, J. Saikia, Rohtash, Saikia, P., Sharma, A., Sharma, Priyanka, Saxena,M., Shenoy, D.M., Vachaspati, C. Viswanatha, Sharma, S.K. and Mandal1, T.K.: Atmospheric Fine and Coarse Mode Aerosols at Different

Environments of India and the Bay of Bengal during Winter-2014: Implications of a Coordinated Campaign, *MAPAN*, **29(4)**, 269-272, 2014.

18. Pal, S.: Skeletonization of Binary Image in Immunecomputing Paradigm and Its Analysis, *Neural, Parallel & Scientific Computations*, **22**, 461-484, 2014.

19. Pal, S. and Kolay, P. K.: Quantum K-means Clustering, *Neural, Parallel & Scientific Computations*, **22**, 127-148, 2014.

20. Saha, C., Das, S., Pal, K. and Mukherjee, S.: Fuzzy Rule-Based Penalty Function Approach for Constrained Optimization, *IEEE Transactions on Cybenetics*, Online Version: DOI: 10.1109/TCYB.2014.2359985, 2014.

21. Saha, A. and Das, S.: Categorical Fuzzy k-Modes Clustering with Automated Feature Weight Learning, *Neurocomputing*, Online Version: DOI: 10.1016/j.neucom.2015.03.037, 2015.

22. Dasgupta, P. and Das, S.: A Discrete Inter-Species Cuckoo Search for flowshop scheduling problems, *Computers & Operations Research*, **60**, 111–120, 2015.

23. Sarkar, S., Das, S. and Choudhury, S. S.: A multilevel color image thresholding scheme based on minimum cross entropy and differential evolution, *Pattern Recognition Letters*, **54**, 27-35, 2015.

24. Chatterjee, S and Das, S: Ant colony optimization based enhanced dynamic source routing algorithm for mobile Ad-hoc network, Information Sciences, **295**, 67-90, 2015.

25. Kundu, S., Das, S., Vasilakos, A. V. and Biswas, S.: A modified differential evolution-based combined routing and sleep scheduling scheme for lifetime maximization of wireless sensor networks, *Soft Computing*, **19(3)**, 637-659, 2015.

26. Ahmed, F. and Das, S.: Removal of high density salt-and-pepper noise in images with an iterative adaptive fuzzy filter using alpha-trimmed mean, *IEEE Trans. on Fuzzy Systems* (Impact Factor 6.306), **22(5)**, 1352-1358, 2014.

27. Ray, K. S., Chatterjee, K. and Ganguly, D.: State Complexity of Deterministic Watson-Crick Automata and Time Varying Watson-Crick Automata, *Natural Computing (Springer)*, Online Version: DOI: 10.1007/s11047-015-9494-5, 2015.

28. Ray, K.S.: Pattern Recognition based on fuzzy set and genetic algorithm, *International Journal of Image and Graphics*, **14, 1450009**, 37, Online Version: DOI: 10.1142/S0219467814500090, 2014.

Machine Intelligence Unit, Kolkata

1. Bandyopadhyay, S., Bhadra, T., Mitra, P. and Maulik, U.: Integration of Dense Subgraph Finding with Feature Clustering for Unsupervised Feature Selection, *Pattern Recognition Letters*, **40**, 104–112, 2014.

2. Bandyopadhyay, S., Ghosh, D., Mitra, R. and Zhao, Z.: MBSTAR: Multiple Instance Learning for Predicting Specific Functional Binding Sites in microRNA Targets, *Scientific Reports* (Nature Publishing Group), **5 (Artcle No. 8004)**, Online Version: DOI: 10.1038/srep08004, 2015.

3. Bandyopadhyay, S. and Mukherjee, A.: An Algorithm for Many-Objective Optimization with

Publications

Reduced Objective Computations: A Study in Differential Evolution, *IEEE Transactions on Evolutionary Computation*, Online Version: DOI: 10.1109/TEVC.2014.2332878, 2015.

4. Bandyopadhyay, S., Ray, S., Mukhopadhyay, A. and Maulik, U.: A Review of In Silico Approaches for Analysis and Prediction of HIV-1-Human Protein-Protein Interactions, *Briefings in Bioinformatics,* Online Version: DOI: 10.1093/bib/bbu041, 2014.

5. Basu, K., Debusschere, V., Bacha, S., Maulik, U. and Bandyopadhyay, S.: Non Intrusive Load Monitoring: A Temporal Multi-Label Classification Approach, *IEEE Transactions on Industrial Informatics,* **11(1)**, 2015.

6. Basu, T. and Murthy, C.A. : Towards enriching the quality of k-nearest neighbor rule for document classification, *International Journal of Machine Learning and Cybernetics,* **5(6)**, 897-905, 2014.

7. Bhattacharya, A., Chowdhury, N. and De, R.K.: Concepts of Relative Sample Outlier (RSO) and Weighted Sample Similarity (WSS) for improving performance of clustering genes: Co-function and co-regulation, *International Journal of Data Mining and Bioinformatics*, **11(3)**, 314-330, 2015.

8. Bhattacharyya, M, Nath, J. and Bandyopadhyay, S.: MicroRNA Signatures Highlight New Breast Cancer Subtypes, *Gene (Elsevier*), **556 (2)**, 192-198, 2015.

9. Bhattacharyya, M. and Bandyopadhyay, S.: Finding Quasi Core with Simulated Stacked Neural Networks, *Information Sciences*, **294**, 1-14, 2015,

10. Chakraborty, C., Priya Doss, C.G., Bandyopadhyay, S. and Agoramoorthy, G.: Influence of miRNA in insulin signaling pathway and insulin resistance: Micro-molecules with immense role in type-2 diabetes (T2D), *WIREs RNA*, **5(5),** 697–712, 2014.

11. Das, C. and Maji, P.: Possibilistic Biclustering Algorithm for Discovering Value-Coherent Overlapping ∂-Biclusters, *International Journal of Machine Learning and Cybernetics*, **6(1**), 95-107, 2015.

12. Ghosh, A. and De, R.K.: Development of a fuzzy entropy based method for detecting altered gene-gene interactions in carcinogenic state, *Journal of Intelligent & Fuzzy Systems*, **26(6)**, 2731-2746, 2014.

13. Karmakar, Dhiman and Murthy, C.A.: Generation of new points for training set and feature-level fusion in multimodal biometric identification*,* M*ach.Vis.App*l, **25(2**)*,* 477-487, 2014.

14. Maji, P. and Garai, P.: Simultaneous Feature Selection and Extraction Using Feature Significance, *Fundamenta Informaticae*, **136(4)**, 405--431, 2015.

15. Mitra, S. and Uma Shankar, B.: Integrating radio imaging with gene expressions towards a personalized management of cancer, *IEEE Transactions on Human-Machine Systems,* **44(),** 664-677, 2014.

16. Mondal, A., Ghosh, S. and Ghosh, A.: Efficient contour tracking using local information and fuzzy k-Nearest-Neighbor Soft Computing, *Springer Berlin Heidelberg*, 1-21, 2014.

17. Parmar, C., Velazquez, E. R., Leijenaar, R., Jermoumi, M., Carvalho, S., Mak, R. H., Mitra, S., Uma Shankar, B., Kikinis, R., Haibe-Kains, B., Lambin, P. and Aerts, H. J. W. L.: Robust radiomics feature quantification using semiautomatic volumetric segmentation, *PLOS ONE*, **9**, e102107, 2014.

18. Paul, S. and Maji, P.: City Block Distance and Rough-Fuzzy Clustering for Identification of Co-Expressed microRNAs, *Molecular BioSystems*, **10(6)**, 1509-1523, 2014.

19. Paul, S. and Maji, P.: Gene Ontology Based Quantitative Index to Select Functionally Diverse Genes, *International Journal of Machine Learning and Cybernetics*, **5(2)**, 245-262, 2014.

20. Ray, S. S. and S. Maiti, Noncoding RNAs and their annotation using metagenomics algorithms**,** *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery***, 5(1)**, 1-20, 2015**.**

21. Sengupta, S., Roy, D. and Bandyopadhyay, S.: Structural Insight into Mycobacterium Tuberculosis Maltosyl Transferase Inhibitors: Pharmacophore Based Virtual Screening, Docking and Molecular Dynamics Simulations, *Journal of Biomolecular Structure and Dynamics (Taylor and Francis)*, Online Version: http://www.ncbi.nlm.nih.gov/pubmed/25669125, 2015.

22. Subudhi, B. N., Ghosh, S. and Ghosh, A.: Application of Gibbs Markov random field and Hopfield-type neural networks for detecting moving objects from video sequences captured by static camera, *Soft Computing,* Springer Berlin Heidelberg, **1-13**, 2014.

23. Tomar, N. and De, R. K.: A comprehensive view on metabolic pathway analysis methodologies, *Current Bioinformatics*, **9(3)**, 295-305, 2014.

Documentation Research and Training Centre, Bangalore

1. Dutta, B., Chatterjee, U. and Madalli, D.P.: YAMO: Yet Another Methodology for Large-scale Faceted Ontology Construction, *Journal of Knowledge Management,* **19(1)**, 6–24, 2015.

2. Dutta, P. and Madalli, D.P.: Trends in Knowledge Modelling and Knowledge Management: an Editorial, *Journal of Knowledge Management*, **19(1)**, 1-5, 2015.

3. Madalli, D. P. and Amin, S.: Augmenting OAI-Based Service Providers with Non-OAI Metadata Sources, *Journal of Library Metadata,* **15(1)**, 50-62, 2015.

4. Mani, M. and Krishnamurthy, M.: Emerging Technology and Innovation of Library Services using Open Source Software (FOSS) in Academic Environment: A Current Trends, *Indian Journal of Information Sources and Services,* **4(2)**, 50-53, 2014.

5. Meeeramani, N. and Krishnamurthy, M.: Innovative Library Services in School of Commerce and Management Studies in Jain University: An Indian Experience, *Managing Information*, **21(3/4)**, 72-76, 2014.

6. Puttaswamy R. and Krishnamurthy, M.: Exploring the usefulness of e-Resources for engineering college teachers and scholars for their Academic and Research activities: A study, *International Journal of Information Science Theory and Practice (JISTap)***, 2(1),** 62-70, 2014.

7. Puttaswamy R. and Krishnamurthy, M.: Information Use Pattern of Faculty members and dependency level on e-Resources - A study, *International Journal of Information Dissemination and Technology***, 4(1),** 50-54, 2014.

8. Puttaswamy R. and Krishnamurthy, M: Information Seeking Behaviour in an Electronic Environment: A Review, *SRELS Journals of Information Management,* **51(4),** 271-277, 2014.

Publications

9. Padmavathi, Krishnamurthy, M.: Ontology Supported Information Systems, A Review *Journal of Information Science Theory and Practice*, **2(4),** 61-76, 2014.

10. Roopa, E. and Krishnamurthy, M: Perspective of digital library services: A review, *International Journal of Next Generation Library and Technologies*, **1(1)**, 2015.

11. Satija, M.P., Madalli, D.P. and Dutta, B: Modes of growth of subjects, *Knowledge Organization*, **41(3)**, 195-204, 2014.

Systems Science and Informatics Unit, Bangalore

1. Biswas, R., Khamaru, K. and Majumdar, K.: A peak synchronization measure for multiple signals, *IEEE Transactions on Signal Processing*, **62(17)**, 4391-4399, 2014.

2. Behera, S.K., Meher, S.K. and Park, H-C.: Artificial neural network model for predicting methane percentage in biogas recovered from a landfill upon injection of liquid organic waste, *Clean Technologies and Environmental Policy*, Springer, 1-11, 2014.

3. Meher, S. K. and Singhawat, B.: An improved recursive and adaptive median filter for high density impulse noise, *AEU-International Journal of Electronics and Communications, Elsevier Science*, **68**, 1173-1179, 2014.

4. Prasad, P.D., Harsha, N.H., John, J.P. and Majumdar, K.: Single trial EEG classification using logistic regression based on ensemble synchronization, *IEEE Journal on Biomedical and Health Informatics*, **18(3)**, 1074–1080, 2014.

5. Sagar, B.S.D. and Lim, S. L.: Ranks for pairs of spatial fields via metric based on grayscale morphological distances, *IEEE Transactions on Image Processing*, **24(3)**, 908-918, 2015.

Computer Science Unit, Chennai

1) Chakraborty, P. and Kumar, S.: Suppression of s-wave superconductivity by kinetic disorder in a two-dimensional attractive Hubbard model, *European Physics Journal B*, **88(3)**, Online Version: DOI: 10.1140/epjb/e2015-50733-2, 2015.

2) Ghosh, S., Kyaw, T. H. and Verbrugge, R.: Conditional Preference Networks support multi-issue negotiations with mediator, Transactions on Computational Collective Intelligence XVII, **LNCS 8790**, 171-195, 2014.

3) Francis, M., Hell, P. and Stacho, J.: Blocking Quadruple: A New Obstruction to Circular-Arc Graphs, SIAM Journal of Discrete Mathematics, **28(2)**, 631–655, 2014.

4) Basavaraju, M. and Francis, M. C.: Strong Chromatic Index of Chordless Graphs, *Journal of Graph Theory*, Online Version: DOI: 10.1002/jgt.21839, 2014.

5) Karthick, T.: Note on equitable coloring of graphs, *Australasian Journal of Combinatorics*, **59 (2)**, 251-259, 2014

6) Karthick, T. and Maffray, F: Maximum weight independent sets is classes related to claw-free graphs, *Discrete Applied Mathematics,* Online Version: http://dx.doi.org/10.1016/j.dam. 2015.02.012, 2015.

7) Sekar, G and Bhattacharya, S: Practical (Second) Preimage Attacks on the TCS_SHA-3 Family of Cryptographic Hash Functions*, Journal of Information Processing Systems*, Online Version: 10.3745/JIPS.03.0021, 2014.

8) Sekar, G, Mouha, N and Preneel, B: Meet-in-the-middle attacks on reduced-round GOST*, Mathematical Aspects of Cryptography*, **5(2)**, 117-125, 2014.

Physics and Earth Sciences Division

Geological Studies Unit, Kolkata

1. Amarasinghe*,* U., Chaudhuri*,* A.K., Collins, A.S., Deb, G.K. and Patranabis-Deb, S.: Evolving Provenance in the Proterozoic Pranhita-Godavari Basin, India*, Geoscience Frontier,* Online Version: DOI: 10.1016/j.gsf.2014.03.009, 2015.

2. Banerjee, A.: Groundwater fluoride contamination: A reappraisal, *Geoscience Frontiers*, **6 (2)**, 277-284, 2015.

3. Collins, A.S., Patranabis-Deb, S., Alexander, E., N. Bertram, C.N., Falster, G.M., Gore, R.J., Mackintosh, J., Dhang, P.C., Saha, D., Payne, J.L., Jourdan, F., Backé, G., Halverson, G.P. and Wade, B.P.: Detrital Mineral Age, Radiogenic Isotopic Stratigraphy and Tectonic Significance of the Cuddapah Basin, India, *Gondwana Research*, Online Version: DOI: 10.1016/j.gr.2014.10.013, 2015.

4. Ghosh, P., Sinha, S. and Misra, A.: Morphometric properties of the trans-Himalayan river catchments: Clues towards a relative chronology of orogen-wide drainage integration, *Geomorphology*, **233**, 127-141, 2015.

5. Henderson, B., Collins, A.S., Payne, J., Forbes, C. and Saha, D.: Geologically constraining India in Columbia: The age, isotopic provenance and geochemistry of the protoliths of the Ongole Domain, Southern Eastern Ghats, India, *Gondwana Research*, **26,** 888-906, 2014.

6. Howald, T., Person, M. Campbell, A., Lueth, V., Hofstra, A., Sweetkind, D., Gable, C. W., Banerjee, A., Luijendijk, E., Crossey, L., Karlstrom, K., Kelley S. and Phillips, F. M.: Evidence for long timescale (>10^3 years) changes in hydrothermal activity induced by seismic events, *Geofluids*, **15(1-2),** 252-268, 2015.

7. Kar, R. and Chakraborty, T.: Comment on “Geomorphology in relation to tectonics: A case study from the eastern Himalayan foothills of West Bengal, India” by Chandreyee Chakrabarti Goswami, Dhruba Mukhopadhyay, B.C. Poddar (Quaternary International, **298,** 80-92), *Quaternary International,* **338**, 113-118, 2014.

8. Kar, R., Chakraborty, T., Chakraborty, C., Ghosh P., Tyagi, A.K. and Singhvi, A.K.: Morpho-sedimentary characteristics of the Quaternary Matiali fan and associated river terraces, Jalpaiguri, India: Implications for climatic controls. *Geomorphology***, 227,** 137-152, 2014.

9. Mallick, S., Bardhan, S., Das, S.S., Paul, S. and Goswami, P.: Naticid drilling predation on gastropod assemblages across the K-T boundary in Rajahmundry, India: New evidence for escalation hypothesis. *Palaeogeography, Palaeoclimatology, Palaeoecology,* **411**, 216-228, 2014.

10. Saha, D. and Patranabis-Deb, S.: Proterozoic evolution of Eastern Dharwar and Bastar cratons, India – An overview of the intracratonic basins, craton margins and mobile belts, *Journal of Asian Earth Sciences*, **91**, 230-251, 2014.

11. Sarkar, K., Chakraborty, C. and Mazumder, B.S.: Space-time dynamics of bed forms due to turbulence around submerged bridge piers, *Stochastic Environ, Research and Risk Assessment*, Springer*,* **29(3)**, 995-1017, 2015.

12. Sen, S., Mishra, M. and Patranabis-Deb, S.: Petrological study of the Kaimur Group sediments, Vindhyan Supergroup, Central India: implications for Provenance and tectonics, *Geosciences Journal*, **18**, 307-324, 2014.

13. Sinha, R., Kale, V.S. and Chakraborty, T.: Tropical rivers of south and southeast Asia: Landscape evolution, morpho-dynamics and hazards, *Geomorphology***, 227**, 01-04, 2014.

Physics and Applied Mathematics Unit, Kolkata

1. Arroyo, M.L.E., de, S., Dutra, A., Hott, M.B. and Roy, P.: Wide localized solutions of PT symmetric nonautonomous nonlinear Schroedinger equation, *Physical Review,* **E91,** 013205-1-15, 2015.

2. Bhowmick, S.K., Bera, B.K. and Ghosh, D.: Generalized counter-rotating oscillators: Mixed synchronization, *Communication in Nonlinear Science and Numerical Simulations*, **22**, 692-701, 2015.

3. Chowdhury, D., Basu, B. and Bandyopadhyay, P.: Electron vortex beams in a magnetic field and spin filter, *Physical Review,* A **91**, 033812-1-6, 2015.

4. Chowdhury, D. and Basu, B.: Effect of non-uniform exchange field in ferromagnetic graphene, *Annals of Physics,* **355**, 338-347, 2015.

5. Chowdhury, D. and Basu, B.: Effect of cosmic string on spin dynamics, *Physical Review, **D*** **90**, 125014 -1-9, 2014.

6. Chowdhury, D. and Basu, B.: Spin Transport in non-inertial frame, *Physica B*, **448,** 155-161, 2014.

7. Das, S., Pramanik, S. and Ghosh, S.: Effects of a Maximal Energy Scale in Thermodynamics for Photon Gas and Construction of Path Integral, *SIGMA,* **10**, 104 -1-26, 2014.

8. Dutta, P., Maiti, S. K. and Karmakar, S.N.: A renormalization group study of persistent current in a quasiperiodic ring, *Physics Letters A*, **378(20),** 1388--1391, 2014.

9. Dutta, P., Maiti, S. K. and Karmakar, S.N.: Electric field induced localization phenomena in a ladder network with superlattice configuration: Effect of backbone environment, *AIP Advances*, **4(9)**, 097126-1-11, 2014.

10. Ghosh, D. and Roy, B. : Nonlinear dynamics of classical counterpart of the generalized quantum nonlinear oscillator driven by position dependent mass, *Annals of Physics* **353**, 222-237 2015.

11. Hazra, D.K., Majumdar, S., Pal, S., Panda, S. and Sen, A.A.: Post-Planck Dark Energy Constraints, *Physical Review D,* **91**, 083005-1-14, 2015.

12. Ho, C. and Roy, P.: Dirac equation with complex potentials, *Modern Physics Letters,* **A29,** 1450210-1-9, 2014.

13. Ho, C. and Roy, P.: On zero energy states in graphene, *Euro Physics Letters,* **108**, 20004-1-5, 2014.

14. Maiti, S.K.: Externally controlled local magnetic field in a conducting mesoscopic ring coupled to a quantum wire, *Journal of Applied Physics*, **117(2),** 024306-1-7, 2015.

15. Maiti, S.K.: Curvature effect on spin polarization in a three-terminal geometry in presence of Rashba spin-orbit interaction, *Physics Letters A*, **379(4)**, 361--366, 2015.

16. Maiti, S.K.: Theoretical verification of experimentally obtained conformation-dependent electronic conductance in a biphenyl molecule, *Physica E: Low-Dimensional Systems and Nanostructures*, **61**, 125--128, 2014.

17. Maiti, S.K., Dey, M. and Karmakar, S.N.: Persistent charge and spin currents in a quantum ring using Green's function technique: Interplay between magnetic flux and spin-orbit interactions, *Physica E: Low-Dimensional Systems and Nanostructures*, **64,** 169--177, 2014.

18. Maiti, S.K.: Quantum transport in mesoscopic ring structures: Effects of impurities, long-range hopping and interactions, *Quantum Matter*, **4(5),** 413--434, 2014.

19. Menculini, L., Panella, O. and Roy, P.: Quantum phase transitions of the Dirac oscillator in a minimal length scenario, *Physical Review,* **D91**, 045032-045039, 2015.

20. Nath, D. and Roy, P.: Dirac oscillator in perpendicular magnetic and transverse electric field, *Annals of Physics,* **351,** 13-21, 2014.

21. Pramanik, S., Ghosh, S. and Pal, P.: Conformal Invariance in noncommutative geometry and mutually interacting Snyder Particles, *Physical Rev*iew, **D90**, 105027-1–10, 2014.

22. Pramanik, S., Das, S. and Ghosh, S.: Noncommutative Extension of AdS-CFT and Holographic Superconductors, *Physics Letters,* **B742**, 266-273, 2015.

23. Rana, S. and Parashar, P.: Maximally discordant separable two-qubit X states, *Quantum Information Processing,* **13(12)**, 2815–2822, 2014.

24. Roy, B. and Tanaka, T.: Two-step shape invariance in the framework of N-fold Supersymmetry, *European Physical Journal Plus,* **130(25),** 01-23 2015.

25. Schulze-Halberg, A. and Roy, B.: Time dependent potentials associated with exceptional orthogonal Polynomials, *Journal of Mathematical Physics,* **55**, 123506, 1-24, 2014.

26. Schulze-Halberg, A. and Roy, B.: Darboux partners of pseudoscalar Dirac potentials associated with exceptional orthogonal polynomials *Annals of Physics,* **349,** 159–170, 2014.

Biological Sciences Division

Agricultural and Ecological Research Unit, Kolkata

1. Bag, A. and Chattopadhyay, R.R.: Efflux pump inhibitory activity of a gallotannin from Terminalia chebula fruit against multidrug resistant uropathogenic Escheria coli, *Natural Product Research,* **28(16)**, 1280-1283, 2014.

Publications

2. Banik, P., Edmonds, C. and Fuwa, N.: Sustainability Implications of the evolution of rice farming amid rural poverty: The case of the Chhotanagpur plateau in eastern India, *Journal of Sustainable Development*, **7(4)**, 282-297, 2014.

3. Bhowmick, A., Saha B., Chattopadhyay, J. and Bhattacharya, S.: A modified theta-logistic model with cooperation for understanding species extinction, *Journal of the Indian Society of Agricultural Statistics*, **68(2)**, 163-179, 2014.

4. Bhowmick, A. and Bhattacharya, S.: A new growth curve model for biological growth: Some inferential studies on the growth of cirrhinus mrigala, *Mathematical Biosciences,* **254**, 28-41, 2014.

5. Bhowmick, A., Saha, B., Chattopadhyay, J. and Bhattacharya, S.: A modified theta-logistic model with cooperation for understanding species extinction, *Journal of the Indian Society of Agricultural Statistics,* **68(2)**, 163–179, 2014.

6. Chatterjee, A. and Dewanji, A.: Effect of varying *Alternanthera philoxeroides* cover on the macrophyte species diversity of pond ecosystems: A quadrate based study, *Aquatic Invasions*, **9(3)**, 343-355, 2014.

7. Das, D., Powell, M., Bhattacharya, P. and Banik, P.: Changes of carbon, nitrogen, phosphorous, and potassium content during storage of vermicomposts prepared from different substrates, *Environmental Monitoring and Assessment*, **186(12)**, 8827-8831, 2014.

8. Das, K.P, Dhar, R., Sen, S. and Chattopadhyay, J.: Role of delay in a predator-prey model with prey infection, *Nonlinear Studies*, **21(3)**, 505-529, 2014.

9. Dasgupta, N, Sengupta, C and Das, S.: Role of secondary metabolites and radical scavenging aptitude for better adaptability of mangroves in varying salinity of Sundarbans, India, *Annals of Tropical Research*, **36(2)**, 1–22, 2014.

10. Greenhalgh, D., Samanta, S., Sardar, S., Bhattacharya, S. and Chattopadhyay, J.: Awareness programs control infectious disease - multiple delay induced mathematical model, *Applied Mathematics and Computation,* **251**, 539–563, 2015.

11. Gupta, S, Bag, A. and Chattopadhyay, R.R.: Evaluation of antibacterial potential of different solvent extracts of Terminalia chebula fruit against methicillin-resistant Staphylococcus aureus, *Recent Progress in Medicinal Plants*, **39**, 1-12, 2014.

12. Das, K.P. and Chattopadhyay, J.: A mathematical study of a predator-prey model with disease circulating in both the populations, *International Journal of Biomathematics*, **8(2)**, 2015.
13. Chakraborty, N., Patra, S.R. and Mandal Biswas, S.: Evaluation of bioactive traits of (L.)*Ecliptaalba*Hassk root exudates, *Annals of Tropical Research,* **37(1)**, 52-66, 2015.

14. Pal, N., Samanta, S. and Chattopadhyay, J.: Revisited Hastings and Powell model with omnivory and predator switching, *Chaos, Solitons and Fractals*, **66**, 58-73, 2014.

15. Rana, S., Bhowmick, A. and Bhattacharya, S.: Impact of prey refuge on adiscrete time predator-prey system with allee effect, *International Journal of Bifurcation and Chaos,* **24(9)**, 1-19, 2014.

16. Biswas, S., Chatterjee, S. and Chattopadhyay, J.:Cannibalism may control disease in predator population: Result drawn from a model based study, *Mathematical Methods in the Applied Sciences*, DOI :10.1002/mma.3220, 2014.

17. Biswas,S., Samanta,S. and Chattopadhyay, J.: A Model Based Theoretical Study on Cannibalistic Prey–Predator System with Disease in Both Populations, *Differential Equations and Dynamical Systems*, DOI :10.1007/s12591-014-0211-0, 2014.

18. Samanta, S., Mandal, A. K., Kundu, K. and Chattopadhyay, J.:Control of disease in prey population by supplying alternative food to predator, *Journal of Biological Systems*, **22(4)**,1-14, 2014.

19. Biswas, S., Sasmal, S.K., Samanta, S., Saifuddin, M.Q., Khan, J.A. and Chattopadhyay, J.: A delayed eco-epidemiological system with infected prey and predator subject to the weak allee effect, *Mathematical Biosciences*, 198-208, DOI:10.1016/j.mbs.2015.02.013, 2015.

20. Sarkar, A**.**, Banik, P. and Dattagupta, R**.:** Resurrection and being of a Haat: Case study of rural markets of the eastern plateau region, *International Journal of Scientific and Engineering Research*, **5(12)**, 365-369**,** 2015.

21. Sharma, R.C., Banik, P.: Baby corn-legumes intercropping systems: I Yields, resource utilization efficiency, and soil health, *Agroecology and Sustainable Food Systems*, **39(1)**, 41-61, 2015.

22. Sheue, C. R., Ho, J. F., Yao, A.W., Wu, Y.H., Liu, J.W., Das, S., Tsai, C. C., Chu, H.A., Chesson, P.and Ku, M.S.B.: A variation on chloroplast development: the bizonoplast and photosynthetic efficiency in the deep shade plant Selaginellaerythropus, *American Journal of Botany*, **102**, 500-511,2015.

23. Sil, N., Datta, A, Samanta, S., Bhattacharya, S. and Roy, P. K.: Effect of migration of susceptible prey and predator in eco-epidemiological System: A mathematical approach, *Mathematical Sciences International Research Journal,* **3(1)**, 447-451, 2014.

24. Sil, N., Roy, P.K., Nandi, S., Chatterjee, A.N., Mukhopadhyay, S., Bhattacharya, S. and Jung, I. H.: Optimal control therapeutic approach to recovery infected cells in HIV model with expected time to extinction of the disease, *Bio medical Engineering and Research,* **3(2)**, 47-63, 2014.

25. Chakraborty, S., Kooi, B., Biswas, B. and Chattopadhyay, J.: Revealing the role of predator interference in a predator-prey system with disease in prey population, *Ecological Complexity*, **21**, 100-111, 2015.

26. Mandal Biswas, S., Chakraborty, N. and Pal, B.: Foliar gall and antioxidant enzyme responses in *Alstoniascholaris*, R. Br. after psylloid herbivory– An experimental and statistical analysis, *Global Journal of Botanical Science,* **2**,12-20, 2014.

27.Tiwari, P., Rana, S., Misra, A. K. and Chattopadhyay, J.: Effect of cross diffusion on the patterns of algal bloom, *Nonlinear Studies*, **21(3)**, 443-462, 2014.

28. Sardar, T., Rana, S. and Chattopadhyay, J.: A mathematical model of dengue transmission with memory, *Communications in Nonlinear Science and Numerical Simulation*, **22(1)**, 511-525, 2014.

29. Kang, Y. Sasmal, S.K., Bhowmick, A.R. and Chattopadhyay, J.: A host-parasitoid system with predation-driven component allee effects in host population, *Journal of Biological Dynamics,* **8**, 1-20, 2014.

Publications

Biological Anthropology Unit, Kolkata

1. Adak, D.K., Gharami, A.K. and Bharati, P.: Effect of age at marriage and effective marital period on natural fertility: A study among the Ladiya of Sagar, Madhya Pradesh, *Human Biology Review*, **3(2)**, 184-188, 2014.

2. Adak, D.K., Dhar, R. , Mitra, S. and Bharati, P.:Culture, nutrition and child mortality: A study in a village of West Bengal, India, *Human Biology Review*, **3(4)**, 346-363, 2014.

3. Bharati, S. (SRU), Pal, M. (ERU) and Bharati, P.: Women Autonomy, Nutritional and Immunization Status of their Children, *Anthropol*, **2**, 1-7, 2014.

4. Mandal Biswas, S., Chakraborty, N. and Pal, B.: Foliar Gall and Antioxident Enzyme Responses in Alstonia scholaris, R. Br. After Psylloid Herbivory–An Experimental and Statistical Analysis, *Global Journal of Botanical Science*, **2(1)**, 12-20, 2014.

5. Gultekin, T., Dasgupta, P. and Ozer, B.K.: Segmental bioelectrical impedance analysis in children aged 7-18 years living in Ankara- Turkey: Age and sex difference in the measures of adiposity, *Papers on Anthropology,* **XXIII/*2***, 23–36*,* 2014.

6. Malakar, B. and Roy, S.K.: Selection Intensity of two Santal groups exposed to different environmental conditions of Birbhum district, West Bengal, *Human Biology Review,* **3(4)**, 327-336, 2014..

7. Mallick, N., Ray, S. and Mukhopadhyay, S.: Eating behaviors and weight concerns among adolescent girls, *Advances in Public Health*, **Article ID.:257396**, Online Version: http://dx.doi.org/10.1133/2014/ 257396, 2014.

8. Mozumdar, A., Das, B.M. and Roy, S.K.: Life table analysis of a small sample of Santal population living in a rural locality of West Bengal, India, *Anthropological Review, **77(2)**,* 233-248, 2014.

9. Mukhopadhyay, S, Ganguly, N. and Mishra, S.K.: Body weight concerns among urban adolescent girls: A micro level study. *Journal of Anthropology*, **Article ID: 264925** Online Version: http://dxoi.org/ 10.1155/2014/264925, 2014.

10. Pal, B, Seal, B. and Roy, S.K.: Nutritional status of fishermen communities: Validation of conventional methods with discriminant function analysis, *Bulletin of Mathematical Sciences and Applications,* **3(2)**, 66-80, 2014.

11. Pal, S., Chattopadhyay, S.K., Danda, T.K. and Bharati, P.: Triradii of the Palm in primary glaucoma patients, *International Journal of Scientific Research*, 376-377, 2014.

12. Som, N. and Mukhopadhyay, S.: Body weight and body shape concerns and related behaviours among Indian urban adolescent girls, *Public Health Nutrition*, **8(6)**, 1075-1083, 2015.

13. Shome, S.(SRU), Srimani, P., De (Bose), A. and Bharati, P.: Height, weight and BMI of the teenagers: A comparative study of Jharkhand, Bihar, West Bengal and Orissa, *Human Biology Review*, **3(2)**, 116-139, 2014.

14. Shome, S. (SRU), Roy, P., Pal. M. (ERU) and Bharati, P.: Variation of adult heights and weights in India: State and zonewise analysis, *Human Biology Review*, **3(3)**, 242-257, 2014.

Human Genetics Unit, Kolkata

1. Roy, R., De Sarkar, N., Ghose, S., Paul, R.R., Ray, A., Mukhopadhyay, I. and Roy, B.: Association between risk of oral precancer andgenetic variations in microRNA and related processing genes, *Journal of Biomedical Science*, 21, 48, 2014.

2. De Sarkar, N., Roy, R., Mitra, J.K., Ghose, S., Chakraborty, A., Paul, R.R., Mukhopadhyay, I. and Roy, B.: A quest for miRNA bio-marker: A track back approach from gingivo buccal cancer to two different types of precancers, *Plos One*, 9(8), DOI:10.1371/journal.Pone.0104839, 2014,

3. Datta, S., Chattopadhyay, E., Ray, J.G., Majumder, M., Das Roy, P. and Roy, B.: D-loop somatic mutations and ~5kb "common" deletion in mitochondrial DNA: Important molecular markers to distinguish oral precancer and cancer, *Tumor Biology, 2014.*

4. Maiti, G.P., Ghosh, A., Mondal, P., Baral, A., Datta, S., Samadder, S., Nayak, S.P., Chakraborty, J., Biswas, J., Sikdar, N., Choudhury, S., Roy, B., Roychowdhury, S. and Panda, C.: The SNP rs1049430 in the 3'UTR of SH3GL2 regulates its expression: Clinical and prognostic implication in head and neck cancer squamous cell carcinoma, *Biochem Biophys Acta*, **1852**,1059-1067, 2015.

5. Chandra, A., Ray, A., Senapati, S. and Chatterjee, R.: Genetic and epigenetic basis of Psoriasis pathogenesis, *Molecular Immunology*, **64(2)**, 313-323, 2015.

6. Chatterjee, R., He, X., Di, H., Fitzgerald, P., Smith, A. and Vinson, C.: High Resolution Genome-wide DNA Methylation Maps of Mouse Primary Female Dermal Fibroblasts and Keratinocytes, *Epigenetics and Chromatin*, **7(1)**, 35, 2014.

7. He, X., Chatterjee, R., Smith, A., Fitzgerald, P. and Vinson, C.: Nucleosomes are enriched at the boundaries of hypomethylated regions (HMRs) in mouse dermal fibroblasts and keratinocytes, *Epigenetics and Chromatin,* **7(1)**, 34, 2014.

8. Chowdhury, R., Karak, P., Sen, A.K., Chatterjee, R. and Chaudhuri, K.: Arsenic extrusion and energy derivation as survival mechanism in a novel *exiguobacterium* isolated from arsenic contaminated groundwater of West Bengal, *American International Journal of Research in Formal, Applied and Natural Sciences*, **7(1)**, 19-27, 2014.

9. Ghosh, S.: Multivariate analyses of blood pressure related phenotypes in a longitudinal framework: Insights from Genetic Analysis Workshop 18, *Genetic Epidemiology,* **38**, 63-67, 2014.

10. Jaiswal, P., Guhathakurta, S., Singh, A.S., Verma, D., Pandey, M., Sinha, S., Ghosh, S., Mohankumar, K.P. and Rajamma, U.: SLC6A4 markers modulate platelet 5-HT level and specific behaviors of autism: A study from Indian population, *Progress in Neuro-Psychopharmacology and Biological Psychiatry,* **56**,196-206, 2014.

11. Majumdar, A., Mukhopadhyay, I. and Ghosh, S.: Association mapping of blood pressure levels in a longitudinal framework using binomial regression, *BMC Proceedings,* **8**, S74, 2014.

12. Haldar, T., Mukhopadhyay, I. and Ghosh, S.: A novel transmission-based test of association for multivariate phenotypes: An application to systolic and diastolic blood pressure levels, *BMC Proceedings,* **8**, S71, 2014.

13. Chattopadhyay, G. and Mukhopadhyay, I.: On a class of partially sequential two-sample test procedures for multivariate continuous data, *Statistics*, Online Version: http://dx.doi.org/10.1080/02331888.2014.960868, 2014.

14. Datta Chakraborty, P., Goswami, S., Bera, S. and Mukhopadhyay, I.: Quantitation of polydeoxyribonucletides (PDRNs) in human placental extract by fluorescence spectroscopy using ethidium bromide, *American Journal of Analytical Chemistry*, **5**, 784-795, Online Version: http://dx.doi.org/10.4236/ajac.2014.512087, 2014.

15. Ghosh, P., Das Ghosh, D., Majumdar (Giri), A., Sengupta, S., Das, C. and Mukhopadhyay, I.: Polymerase chain reaction and deoxyribonucleic acid-sequencing based study on distribution of human papillomavirus 16/18 among histopathological types of cervical intra-epithelial neoplasia and primary invasive cervical carcinoma: A scenario in North Bengal, India, *Journal of Mid-life Health*, **5(1)**, 14-22, Online Version: DOI:10.4103/0976-7800.127786, 2014.

Social Sciences Division

Economic Research Unit, Kolkata

1. Barari, M., Sarkar, N., Kundu, S. and Chowdhury Banik, K.: Forecasting House Prices in the United States with Multiple Structural Breaks, *International Econometric Review*, **6(1)**, 1–23, 2014.

2. Bharati, S. (SRU), Pal, M. and Bharati, P. (BAU): Women Autonomy, Nutritional and Immunization Status of their Children, *Anthropology*, **2(2)**, 118, 2014.

3. Bharati, S. (SRU), Pal, M., Som, S. (SRU) and Bharati, P. (BAU): Temporal Trend of Anemia Among Reproductive-Aged Women in India, *Asia-Pacific Journal of Public Health,* **27(2),** 1193–1207, 2015.

4. Bharati, S. (SRU), Pal, M., Chakrabarty, S. and Bharati, P. (BAU): Socioeconomic Determinants of Iron-Deficiency Anemia Among Children Aged 6 to 59 Months in India, *Asia-Pacific Journal of Public Health*, **27(2)**, 1432–1443, 2015.

5. Bose, A. (SMU), Chakravarty, S. R. and D'Amrrosio, C.: Richness Orderings, *Journal of Economic Inequality*, **12**, 5–22, 2014.

6. Burger, R., Dasgupta, I. and Owens, T.: Why Pay NGOs to Involve the Community? *Annals of Public and Cooperative Economics*, **86(1)**, 7-31, 2015.

7. Chandra, S. and Sarkar, N.: A Restricted *r-k* Class Estimator in Mixed Regression Model with Autocorrelated Disturbances, *Statistical Papers*, DOI:10.1007/s00362-015-0664-4, 2015.

8. Chattopadhyay, S. and Tarun, K.**:** Incomplete Information and R&D Organization, *Economics Bulletin***, 35(1),** 14–20, 2015.

9. Das, S., Sinha, G. and Mitra, K.T.: Economic Growth and Income Inequality: Examining the Links in Indian Economy, *Journal of Quantitative Economics*, New Series, **12**, 86–95, 2014.

10. Das, S., Ghate, C. (EPU) and Robertson, P.: Remoteness, Urbanization, and India's Unbalanced Growth, *World Development*, **66**, 572–587, 2015.

11. Gupta, M. R., and Dutta, B. P.: Skilled Unskilled Wage Inequality, Growth of Skilled Labour and Development Policies, *Journal of Globalisation and Development*, **5(1),** 103–128, 2014.

12. Gupta, M.R. and Dutta, B. P.: International Trade and Wage Inequality in a Dynamic Model, *Keio Economic Studies*, **50**, 29–49, 2014.

13. Hossain, G. Md., Khatun, S. Mst., Islam, R.Md., Mondal, I. N. Md., Bharati, P. (BAU) and Pal, M.: Factors Associated with Age at Menarche of Secondary School Girls in Rajshahi City, Bangladesh, *Advances in Life Sciences,* **4(2)**, 88–93, 2014.

14. Mitra, M., Goswami, P. M. and Sen, A.(EPU): Strategy-proofness and Pareto-efficiency in Quasi-linear Exchange Economies, *Theoretical Economics*, **9(2)**, 361–381, 2014.

15. Mitra, M. and Sen, D.: An Alternative Proof of Fishburn's Axiomatization of Lexicographic Preference, *Economics Letter*, **124(2),** 168–170, 2014.

16. Mitra, M., Chun, Y. and Mutuswami, S.: Egalitarian Equivalence and Strategyproofness in the Queueing Problem, *Economic Theory*, **56(2),** 425–442, 2014.

17. Mitra, M., Chun, Y. and Mutuswami, S.: Characterizations of Pivotal Mechanisms in the Queueing Problem, *Mathematical Social Sciences*, **72**, 62–66, 2014.

18. Mitra, M., and Ghosh, A.: Reversal of Bertrand-Cournot Rankings in the Presence of Welfare Concerns, *Journal of Institutional and Theoretical Economics*, **170(3),** 496–519, 2014.

19. Mitra, M. and Chun, Y.: Subgroup Additivity in the Queueing Problem, *European Journal of Operational Research*, **238(1),** 281–289, 2014.

20. Kabiraj, T. and Sinha, U.B.: Strategic Outsourcing with Technology Transfer under Cournot Competition, *Economics Bulletin*, **34(2),** 1133-1140, 2014.

21. Saha, J. and Pal. M.: A Modified Chow Test Approach Towards Testing Differences in the Engel Elasticities, *Asian-African Journal of Economics and Econometrics*, **14(1)**, 57–67, 2014.

22. Sarkar, A.: Muslims in Gujarat and West Bengal: Comparing Prosperity and Vulnerability, *Economic and Political Weekly*, **XLIX (38),** 2014.

23. Som, S. (SRU), Roy, P., Pal, M. and Bharati, P. (BAU): Variation of Adult Heights and Weights in India: State and Zone wise Analysis, *Human Biology Review*, **3(3),** 242–257, 2014.

24. Roy, S. and Bapat, R. B. (SMU, Delhi): On the Adjacency Matrix of a Block Graph, *Linear and Multilinear Algebra,* **62(3)**, 406-418, 2014.

25. Roy, S., Pramanik, A. and Mishra, D. (EPU): Multidimensional Mechanism Design in Single Peaked Type Spaces, *Journal of Economic Theory*, Elsevier, **Vol. 153**, Pages 103-116, 2014.

26. Roy, S., Storcken, T., Peters, H. and Sen, A. (EPU): Probabilistic Strategy-proof Rules over Single-peakeddomains, *Journal of Mathematical Economics*, **52(C)**, 123-127, 2014.

Linguistic Research Unit, Kolkata

1. Dasgupta, P.: Bangla bake go-re-r gero, *Anushtup,* **49(1),** 198-207, 2014.

Publications

2. Dasgupta, P.: Sunitikumarer janla-darja, *Alochonachakro,* **37**, 22-29, 2014.

3. Dasgupta, P.: Bistaari banam shangstaari onubader bibadi istahar, *Alochonachakro,* **37**, 276-284, 2014.

4. Dasgupta, P.: Esperanto bhasha-carcaay Badal Sircar, *Pashchimbanga Natya Akademi Patrika,* **16**,196-208, 2014.

5. Dasgupta, P.: (tr into English) To get the new temple started, by Alokeranjan Dasgupta, *Ebong Mushayera,* **21(1),** 322, 2014.

6. Dasgupta, P.: Bhashatattwer karmopoddhotite 'bedag' banam 'dagi' proshongge jatkincit montobbo, *Charvaak,* **2(2)**, 167-176, 2014.

7. Dasgupta, P.: Judges and grammarians in Britain's liberal pedagogic performance: a diglossic approach to colonial Bengal, *Droit et Cultures,* **67**, 151-186. 2014.

8. Dasgupta, P. and Dasgupta, M.: Esperantor doutte shishu-shahitter lenden, *Alochonachakro,* **37**, 306-311, 2014.

9. Dasgupta, P.: Shangshkriter phashol aar warishder shattaashatto, *Bwakalam,* **4(2),** 69-95, 2014.

10. Dasgupta, P.: Bhashatattwer ar Banglar ubho-dut Pabitrababu, *Rudrakal,* **3(2)**, 12-13, 2014.

11. Dasgupta, P.: Ashamprikto ishter shadabhidha, *Alochonachakro,* **38**, 159-63, 2015.

12. Dasgupta, P.: A mori Bangla bhasha, *Arek Rakam,* [Review of *Moder garob moder asha* by Sisirkumar Das, Kolkata: Chirayata, 1999], **3(4),** 40-42, 2015.

13. Dash, N.S.: Investigating into the patterns of usage and nature of pronunciation of some consonant grapheme clusters in Bengali, *Asian Journal of Humanities and Social Studies,* **2(2),** 330-340, 2014.

14. Dash, N.S.: Baidyutin bangla uccharan abhidhan, *Alochana Chakra,* **37**, 155-187, 2014.

15. Dash, N.S. and Ray, A.: Investigating the nature of use of animal names in Bengali written texts. *Language Forum (Special Issue on Sociolinguistics),* **40(1-2)**, 87-120, 2014.

16. Dash, N.S.: Consonant graphic variants in Bengali: their patterns of usage and their nature of pronunciation within words, *Journal of Advanced Linguistic Studies*, **3(1-2)**, 168-186, 2014.

17. Pal, A. R., Diganta S.and Dash, N.S.: Automatic classification of Bengali sentences based on sense definitions present in Bengali Wordnet, *International Journal of Control Theory and Computer Modelling,* **5(1)**, 1-13, 2015.

Population Studies Unit, Kolkata

1. Jatrana, S., Pasupuleti, S.S.R. and Richardson, K.: Nativity, duration of residence and chronic health conditions: do trends converge towards the native-born population? *Social Science & Medicine*, **119**, 53-63, 2014.

2. Jatrana, S. and Pasupuleti, S.S.R.: Women's autonomy, education and birth intervals: visiting the less familiar, *Asian Population Studies,* **11**. Online Version: DOI: 10.1080 /17441730.2015. 1050083, 2015.

Psychology Research Unit, Kolkata

1. Gupta, R.: Indian Sea Farers Along With Their Professional Amenities for Endurance, *International Journal of Education and Applied Research*, **4(2)**, 14–16, 2014.

2. Gupta, R.: Study on Self-Concept, Academic Achievement, and Achievement Motivation of the students, *Journal of Humanities and Social Science*, **19(5)**, 88-93, 2014.

3. Karmakar, R. and Ghosh, A.: The Development of Distributive Justice: Does type of Schooling really matter? *International Journal of Indian Psychology*, **1(3)**, 115-124, 2014.

4. Shah, H. and Dutta Roy, D.: Structure of Rabindrik human values, *Indian Journal of Positive Psychology*, **5(4),** 368-375, 2015.

Sampling and Official Statistics Unit, Kolkata

1. Chattopadhyay, N., Ghosh, A. and Chakrabarti, B.K.: Inequalities in Societies, academic Institutions and Science Journals: Gini and k-indices, *Physica A***, 410**, 30-34, 2014.

2. Dihidar, K.: Estimating population mean with missing data in unequal probability sampling, *Statistics in Transition*, New Series, **15(3),** 369-388, Summer 2014.

3. Dihidar, K. and Chaudhuri, A.: Generating randomized response by inverse mechanism, *Model Assisted Statistics and Applications*, **9**, 343-351, 2014.

4. Dihidar, K.: Simultaneous estimation of several survey population parameters in complex surveys by Bayesian and classical methods, *Model assisted Statistics and Applications*, **10**, 163-173, 2015.

5. Mitra, S. and Poddar, M.: Regional Inequalities of Land associated to Health Facilities in Rural India, *Journal of Social and Development Sciences*, **5(2)**, 2014.

6. Mukherjee, D. and Ghosh Dastidar, K.: Corruption in Delegated Public Procurement

7. Auction, *European Journal of Political Economy*, **35**, 122–127, 2014.

Sociological Research Unit, Kolkata

1. Bharati, S., Pal, M. (ERU): Shome, Suparna and Bharati, Premananda (BAU): Temporal Trend of Anemia among Reproductive-Aged Women in India, *Asia Pacific Journal of Public Health*, **27 (2),** 1193-1207, 2015.

2. Bharati, S.: Domestic violence against women in Jharkhand, *International Journal of Current Research*. **7(I),** 11748-11752, 2015.

3. Bharati, S., Pal, M. (ERU), Chakrabarty, S. and Bharati, P. (BAU): Socioeconomic determinants of iron-deficiency anemia among children aged 6 to 59 months in India, *Asia Pacific Journal of Public Health,* **27 (2),** 1432-1443. 2015

4. Ghosh, B. N.: Causes of HIV/AIDS in underdeveloped Countries: A critical Review, *Asian Journal of Science and Technology,* **5(6),** 308-312, ISSN: 0976-3376, Online Version: www.journalajst.com, 2014.

5. Ghosh, B. N.and Bhattacharya, A.: Contextualizing Intergenerational Mobility of Women 'Techies' of Kolkata, *Bangladesh e-Journal of Sociology*, *the Official Journal of Bangladesh Sociological Society*, **11(1),** 38-53, ISSN:1819-8465, Online Version: www.bangladeshsociology.org, 2014.

6. Ghosh, B.N.: Development of Tribal Women in Rural Jharkhand, *The Grassroots Governance Journal,* **XI (2),** 243-257, ISSN: 0973-0257, 2014.

7. Ghosh, B. N., Karmakar, Ranjit and Das, Kamalakhya: Existing status of co-operatives, specially milk cooperatives in India: The case study of West Bengal, *The Grassroots Governance Journal,* **XI(1),** 6-20, ISSN:0973-0257, 2014

8. Jana, R. and Bagchi, S.B.: Distributional aspects of some statistics in weighted social networks, *Journal of Mathematical Sociology*, **39,** 1-28, 2015.

9. Misra, S., Goswami, R., Basu, D. and Jana, R.: Application of Social Network Analysis in livelihood system study, *Space and Culture, India*, **2(3)**, 24-46. 2014.

10. Shome, S., Roy, P. (BAU), Pal, M. (ERU) and Bharati P. (BAU): Variation of adult heights and weights in India: State & Zone wise Analysis, *Human Biology Review,* **3(3),** 242-257, 2014.

11. Shome, S., Srimani, P., Bose De, A. and Bharati P. (BAU): Height, weight and BMI of the teenagers: A Comparative study of Jharkhand, Bihar, West Bengal and Orissa, *Human Biology Review,* **3(2),** 116-139, 2014.

12. Shome, S.: Women's intra-household decision making power in Jharkhand state, India, *International Journal of Current Research,* **7(1)**, 11742-11747, 2015.

Economics and Planning Unit, Delhi

1. Farzana, A., Xin Li, S. and Ren, Y.: Social Identity and Inequality: The Impact of China's Hukou System, *Journal of Public Economics*, **123**, 17-29, 2015.

2. Ghate, C., Robertson, P. and Das, S. (ERU, Kolkata): Remoteness, urbanization and India's unbalanced growth, *World Development*, **66**, 572-587, 2015.

3. Jordi, M., Antonio, N., Sen, A., Sharma, T. and Ulkü, L.: On cost sharing in the provision of a binary and excludable public good, *Journal of Economic Theory*, **155**, 30–49, 2015.

4. Mishra, D. and Marchant, T.: Mechanism Design with two alternatives in quasi-linear environment, *Social Choice and Welfare*, **44**, 433-455, 2015.

5. Mishra, D. and Deb, R.: Implementation with contingent contracts, *Econometrica*, **82**, 2371-2393, 2014.

6. Mishra, D., Pramanik, A. and Roy, S. (ERU): Multidimensional Mechanism Design in single peaked type spacs, *Journal of Economic Theory*, **153,** 103-116, 2014.

7. Mishra, D., Duives, J., Heydenreich, B., Muller, R. and Uetz, M.: On Optimal Mechanism Design for a sequencing problem, *Journal of Scheduling*, **18**, 45-59, 2015.

8. Mukhopadhyay, A., Himashu and Sharan, M.: The National Rural Employment Guarantee Scheme in Rajasthan: Rational funds and their allocation across villages, *Economic and Political Weekly*, **50(6)**, 2015.

9. Roy Chowdhury, P., Chowdhury, S. and Sengupta, K.: Gradual repayment with sequential financing in micro-finance, *Journal of Development Economics*, Elsevier, **111(C)**, 167-180, 2014.

10. Roy Chowdhury, P.and Das, S. P.: Panic, pre-emption and deterrence: A common enemy problem of terrorism, *Economic Inquiry,* Western Economic Association International, **52(1)**, 219-238, 2014.

11. Sen, A., Chatterji, S. and Zeng, H.: Random dictatorship domains, *Games and Economic Behavior*, **86**, 212-236, 2014.

12. Sen, A., Peters, H., Roy, S. (ERU) and Storcken, T.: Probabilistic strategy-proof rules over single-peaked domains, *Journal of Mathematical Economics*, **52**,123-127, 2014.

13. Sen, A. and Kar, A.: The Shapley value as the maximizer of expected Nash welfare, *International Journal of Game Theory*, **43**, 619-627, 2014.

14. Sen, A., Goswami, M. P. and Mitra, M. (ERU): Strategy-proofness and Pareto-efficiency in quasi-linear exchange economies, *Theoretical Economics*, **9**, 361-381, 2014.

Economic Analysis Unit, Bangalore

1. Ramachandran, V.K.: Ägrarian Issues: Local and National, *Review of Agrarian Studies*, **4(2)**, 2014.

2. Reddy, A. B. and Swaminathan, M.: Intergenerational Occupational Mobility in Rural India: Evidence from Ten Villages, *Review of Agrarian Studies*, **4(1)**, 2014.

3. Sarkar, B., Ramachandran, V.K. and Swaminathan, M.: Aspects of the Political Economy of Crop Incomes in India, *World Review of Political Economy,* **5(3)**, 392-413, 2014.

4. Swaminathan, M.: Dalit Workers in Rural India: Evidence from Village Studies, *Indian Journal of Labour Economics*, **57(1),** 53-65, 2014.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Kolkata

1. Anis, M. Z.: Tests of non-monotonic stochastic aging notions in reliability theory, *Statistical Papers,* **55(3)**, 691-714, 2014.

2. Anis, M.Z., and Basu, K.: Tests for exponentiality against NBUE alternatives: a Monte Carlo comparison, *Journal of Statistical Computation and Simulation,* **84**, 231-247, 2014.

3. Baral, A.K. and Anis, M.Z.: Assessment of C_{pm} in the presence of measurement errors, *Journal of Statistical Theory and Application,* **14**, 13-27, 2015.

4. Bhattacharya, S., Pradhan, B. and Kundu, D.: Analysis of hybrid censored competing risks data, *Statistics*, **48**, 1138-1154, 2014.

Publications

5. Bhattacharya, R., Pradhan, B. and Dewanji A. (ASU): Optimum life testing plans in presence of hybrid censoring: A cost function approach, *Applied Stochastic Models in Business and Industry*, **30**, 519-528, 2014.

6. Bhattacharya, R., Pradhan, B. and Dewanji, A. (ASU): Computation of optimum reliability acceptance sampling plans in presence of hybrid censoring, *Computational Statistics and Data Analysis*, **83**, 91-100, 2015.

7. Chatterjee, M. and Chakraborty, A.K.: Exact Relationship of C''_{pk} with Proportion of Nonconformance and Some Other Properties of $C''_{p}(u,v)$, *Quality and Reliability Engineering International*, **30**, 1023-1034, 2014.

8. Chatterjee, M. and Chakraborty, A.K.: A Superstructure of Process Capability Indices for Circular Specification Region, *Communications in Statistics: Theory and Methods*, **44(6)**, 1158-1181, 2015.

9. Chatterjee, M. and Chakraborty, A.K.: A Simple Algorithm for Calculating values for folded normal distribution, *Journal of Statistical Computation and Simulation*, Online Version: DOI: 10.1080/ 00949655.2015.1007984, 2015.

10. Das, A.K.: Properties of Some Matrix Classes Based on Principal Pivot Transform, *Annals of Operations Research,* Online Version: DOI:10.1007/s10479-014-1622-6, 2014.

11. Das, P. and Mondal, S.: Optimum Formulation of Cathode Mix for a Multi-Response Set-up using Design Optimality Criteria, *Int. J. Experimental Design and Process Optimization*, **4(2)**, 143-165, 2014.

12. Das, P. and Bose, D.: Design of controller for mixed data type – a composite fuzzy-neural approach, *Journal of Engineering Science and Technology*, 1-11, 2014.

13. Das, P., Pettersson, F. and Dutta, S.:Pruned-bimodular neural networks for modeling of strength-ductility balance of HSLA steel plates, *Int. J. Artificial Intelligence and Soft Computing*, **4(4)**, 354-372, 2014.

14. Dey, S., Dey, T. and Anis, M.Z.: Weighted Weibull distribution: properties and estimation, *Journal of Statistical Theory & Practice,* **9**, 250-265, 2015.

15. Dey, S. and Pradhan, B.: Generalized inverted exponential distribution under hybrid censoring, *Statistical Methodology*, **18**, 101-114, 2014.

16. Pal, A., Mitra, M. and Anis, M.Z.: On testing exponentiality against NBAFR alternatives, *Communications in Statistics – Theory and Methods,* **43**, 1834-1844, 2014.

17. Pradhan, B. and Kundu, D.: Analysis of interval-censored data with Weibull lifetime distribution, *Sankhya Ser. B*, **76**, 120-139, 2014.

18. Mukherjee, S. and Das, P.: Criteria for customer agglomeration for a new footwear retail: a case study of a regional footwear brand in India, *Int. J. Business Excellence,***7(5)**, 626-645, 2014.

19. Sarkar, A. (SQC & OR, Mumbai), Mukhopadhyay, A.R. and Ghosh, S. K.: Developing A Model for Process Improvement Using Multiple Regression Technique: A Case Example, *The TQM Journal*, **26 (6)**, 625-638, 2014.

20. Sarkar, A. (SQC & OR, Mumbai), Mukhopadhyay, A. R. and Ghosh, S. K.: An Outline of the 'Control Phase' for Implementing Lean Six Sigma, *International Journal of Lean Six Sigma*, **5(3)**, 230-252, 2014.

21. Sarkar, A. (SQC & OR, Mumbai), Mukhopadhyay, A. R. and Ghosh, S. K.: Measurement System Analysis for Implementing Design for Six Sigma, *International Journal of Productivity and Quality Management*, **14(3)**, 373-386, 2014.

22. Sarkar, A. (SQC & OR, Mumbai), Mukhopadhyay, A. R., and Ghosh, S. K.: Productivity Improvement by Reduction of Idle Time Through Application of Queuing Theory, *OPSEARCH*, ISSN 0030-3887, Online Version: DOI: 10.1007/s 12597-014-0177-2, 2014.

SQC & OR Unit, Delhi

1. Bapat, R.B. and Neogy, S.K.: On a quadratic programming problem involving distances in trees, *Annals of Operations Research*, Online Version: DOI:10.1007/s10479-014-1743-y, 2014.

2. Neogy, S.K., Pathasarathy, T. and Das, A.K. (eds.): Applied Optimization and Game-Theoretic Models, Part-I, *International Game Theory Review*, Online Version: DOI: 10.1142/ S0219198915020016, **17(2)**, 1502001-1502004, 2015.

3. Mondal, P., Sinha, S., Neogy, S.K. and Das, A.K.: On discounted AR–AT semi-Markov games and its complementarity formulations*, Int. J. Game Theory,* Online Version: DOI: 10.1007/s00182-015-0470-1, 2014.

SQC & OR Unit, Bangalore

1. Gijo, E.V. and Antony, J.: Reducing Patient Waiting Time in Outpatient Department Using Lean Six Sigma Methodology, *Quality and Reliability Engineering International*, **30(8)**, 1481-1491, 2014.

2. Gijo, E.V., Bhat, S. and Jnanesh, N.A.: Application of Six Sigma methodology in a small scale foundry industry, *International Journal of Lean Six Sigma*, **5(2)**, 193-211, 2014.

3. Bhat, S., Gijo, E.V. and Jnanesh, N.A.: Application of Lean Six Sigma methodology in the registration process of a hospital, *International Journal of Productivity and Performance Management*, **63(5)**, 613-643, 2014.

4. Antony, J., Sivanathan, L. and Gijo, E.V.: Design of Experiments in a higher education setting, *International Journal of Productivity and Performance Management*, **63(4)**, 513-521, 2014.

5. John, B.: Application of Mahalanobis - Taguchi system and design of experiments to reduce the field failures of splined shafts, *International Journal of Quality and Reliability Management*, **31(6)**, 681-697, 2014.

6. John, B. and Kadadevaramath. R.S.: A methodology for achieving the design review defect density goals in software development process, *International Journal of Manufacturing, Industrial & Management Engineering*, **2(1)**, 181–191, 2014.

7. John, B.: A methodology to reduce the counter gear subassembly reworks, *Journal of Engineering Science and Technology*, **9**, 46-56, 2014.

Publications

SQC & OR Unit, Chennai

1. Gauri S.K. and Pal, S.: The Principal Component Analysis (PCA) based approaches for the multi-response optimization: Some areas of Concerns, *The International Journal on Advanced Manufacturing Technology*, **70(9–12)**, 1875–1887, 2014.

2. Seetharama, G.M. and Ravindran, G.: On the Game-Theoretic Value of a Linear Transformation Relative to a Self-Dual Cone, *Linear Algebra and its Applications*, **469**, 440–463, 2015.

SQC & OR Unit, Hyderabad

1. Subhaniet, S.M.: Generalized Common Fixed Point Theorems in Fuzzy Metric Spaces, *International Journal on Mathematical Archive,* **5(7)**, 240-245, 2014.

SQC & OR Unit, Mumbai

1. Sarkar, A., Mukhopadhyay A.R. and Ghosh, S.K.: Developing a Model for Process Improvement Using Multiple Regression Technique: A Case Example, *The TQM Journal*, **26(6)**, 625-638, 2014.

2. Sarkar, A., Mukhopadhyay A.R. and Ghosh, S.K.: Measurement System Analysis for implementing design for six sigma, *International Journal of Productivity and Quality Management*, 14(3), 373-386, 2014.

3. Sarkar, A., Mukhopadhyay A.R. and Ghosh, S.K.: An outline of the 'Control Phase' for implementing Lean Six Sigma accepted, *International Journal of Lean Six Sigma*, 5(3), 230-252, 2014.

4. Sarkar, A., Mukhopadhyay A.R. and Ghosh, S.K.: Productivity Improvement by Reduction of Idle Time through Application of Queuing Theory, OPSEARCH, Online Version: DOI 10.1007/s12597-014-0177-2, 2014.

Library, Documentation and Information Sciences Division

Library, Kolkata

1. Das, P. K.: Authorship Pattern and Research Collaboration of Journal of Informetrics, *International Journal of Information Dissemination and Technology*, **5(1)**, 53-62, 2015.

2. Mandal, T.K.: Applications of webometric tools in ranking of management institutes in India: A Case Study in Northern and North Eastern States, *International Journal of Information Sources and Services*, **1(1)**, 69-94, 2014.

3. Mandal, T.K. and Chakraborty, B.: Webometric Analysis of Managament Institutes: A case Study in West Bengal, *Vidyasagar University Journal of Library and Information Science*, 18-19: 1-23, 2014.

4. Paul, P. and Raychaudhury, A.: Application of RDA for description of websites, *RBU Journal of Library and Information Science*, **16**, 23-31, 2014.

Center for Soft Computing Research: A National Facility, Kolkata

1. Chattopadhyay, S., Murthy, C.A. and Pal, S.K.: Fitting truncated geometric distributions in large scale real world networks, *Theoretical Computer Science*, **551**, 22-38, 2014.

2. Kalia, H., Dehuri, S. and Ghosh, A.: A comprehensive survey of multi-objective genetic and fuzzy approaches in rule mining problem of knowledge discovery in databases, *International Journal of Information Technology, Communications and Convergence*, **3 (1)**, 13-45, 2014

3. Kundu, S. and Pal, S.K.: Fuzzy-rough community in social networks, *Pattern Recognition Letters* (Special issue on Granular mining and knowledge discovery), Online Version: DOI: 10.1016/j.patrec.2015.02.2005, 2015.

4. Kundu, S. and Pal, S. K.: FGSN: Fuzzy granular social networks - model and applications, *Information Sciences,* **314,** 100-117, 2015.

5. Lopes, F. M., Ray, S.S., Hashimoto, R.F. and Cesar, R. M.: Entropic biological score: a cell cycle investigation for GRNs inference, *Gene*, **541(2)**, 129-137, 2014.

6. Mahanta, P., Bhattacharyya, D.K. and Ghosh, A.: FUMET: A Fuzzy net- work Module Extraction Technique for Gene Expression Data, *Journal of Biosciences*, **39(3)**, 351-364, 2014.

R.C. Bose Centre for Cryptology and Security, Kolkata

1. Mukherjee, I., Paul, G. and Jawahar, J. A.: Defeating Steganography with Multibit Sterilization using Pixel Eccentricity, *IPSI BgD Transactions on Advanced Research (IPSI Bgd Internet Research Society)*, **11(1)**, 25-34, 2015.

2. Maitra, A. and Paul, G.: A Resilient Quantum Secret Sharing Scheme, *International Journal of Theoretical Physics (Springer)*, Online Version: DOI: 10.1007/s10773- 014-2233-3, 2014.

3. Pandit, T., Barua, R. and Tripathy, S.: eCK Secure Single Round ID-Based Authenticated Key Exchange Protocols with Master Perfect Forward Secrecy (Extended Version), *Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications*, **5(4)**, 65-85, 2014.

4. Sarkar, S., Sen Gupta, S., Paul, G. and Maitra, S.: Proving TLS-attack related open biases of RC4. Designs, *Codes and Cryptography (Springer)*, Online Version: DOI: 10.1007/s10623-014-0003-0, 2014.

Central Stores, Kolkata

1. Pal, J.K., Mukhopadhyay, B. K. and Gupta, S.K.: Myers Blended Method: An Alternative Approach, *Journal of Scientifice Research & Reports*, **3(18)**, 2459-2465, 2014.

Papers Published in Conference Proceedings

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

1. Goswami, D.: Deformation by dual unitary cocycles and generalized fixed point algebra for quantum group actions, *Operator Algebras and Mathematical Physics*, **247**, T. Bhattacharyya, M. A. Dritschel (eds.), Operator Theory: Adv. and Appl., Springer Basel AG, Basel, 2015.

Stat-Math Unit, Bangalore

1. Raja, C.R.E.: Liouville property on G-spaces, *Proceedings of the Conference on Recent Trends in Ergodic Theory and Dynamical Systems*, Contemporary Mathematics, **631**, AMS, Providence, Rhode Island, 21-31, 2015.

Applied Statistics Division

Applied Statistics Unit, Kolkata

1. Datta, N. and Nandi, M.: ElmE: a misuse resistant parallel authenticated encryption, *Information Security and Privacy: Proceedings of ACISP* 2014, Lecture Notes in Computer Science, **8544**, 306-321, 2014.

2. Datta, N. and Nandi, M.: Characterization of EME with Linear Mixing, *Advances in Information and Computer Security, Proceedings of IWSEC 2014*, Lecture Notes in Computer Science, **8639**, 221-239, 2014

3. Datta, N. and Nandi, M.: Equivalence between MAC and PRF for Blockcipher based Constructions, *Provable Security: Proceedings of the International Conference on Provable Security*, Lecture Notes in Computer Science, **8782**, 300-308, 2014.

4. Gupta, K.C. and Ghosh Roy, I.: On Constructions of Circulant MDS Matrices for Lightweight Cryptography, *Information Security Practice and Experience: Proceedings of ISPEC* 2014, Lecture Notes in Computer Science, **8434**, 564-576, 2014.

5. Nandi, M.: Forging Attacks on Two Authenticated Encryption Schemes COBRA and POET, *Advances in Cryptology – ASIACRYPT 2014,* Lecture Notes in Computer Science, **8873**, 126-140, 2014.

6. Nandi, M.: XLS is not a strong pseudorandom permutation, *Advances in Cryptology – ASIACRYPT 2014*, Lecture Notes in Computer Science, **8873**, 478-490, 2014.

7. Ramanna, S.C., and Sarkar, P.: Efficient (anonymous) compact HIBE from standard assumptions, *Provable Security: Proceedings of the International Conference on Provable Security*, Lecture Notes in Computer Science, **8782**, 243--258, 2014.

8. Samajder, S. and Sarkar, P**.:** Some randomness experiments on TRIVIUM, *Security, Privacy, and Applied Cryptography Engineering*: *Proceedings of the 4th International Conference on Security, Privacy, and Applied Cryptography Engineering*, Lecture Notes in Computer Science, **8804**, 219--236, 2014.

Computer and Communications Sciences Division

Advanced Computing and Microelectronics Unit, Kolkata

1. Agrawal, M., Das, S., Ghosh, S.C., Nandi, S.and Panigrahy, N.: Efficient channel assignment for cellular networks modeled as honeycomb grid, *ICTCS 2014*, 183-295, 2014.

2. Banerjee, S., Majumder, S. and Bhattacharya , B.B.: A Graph-Based 3D IC Partitioning Technique, *IEEE Computer Society Annual Symposium on VLSI (ISVLSI)*, 613-618, 2014.

3. Bandyopadhyay, O., Biswas, A. and Bhattacharya, B.B.: Long-Bone Fracture Detection in Digital X-ray Images Based on Concavity Index, *IWCIA,* LNCS - 8466, 212-223, 2014.

4. **Bardhan, O., Bhattacharya, A.** and Sinha, B.P.: Staganographic technique based on VLSB method using RC4 Stream upher, *International Conference on Advanes in Computing, Communications and Informations (ICACCI 2014)*, IEEE, 1402–1407, 2014.

5. Bhattacharya, B.K., De, M., Maheshwari, A., Nandy, S.C. and Roy S.: Rectilinear Path Problems in Restricted Memory Setup, *CALDAM 2015*, 69-80, 2015.

6. Bhattacharya,B.K., De, M., Nandy, S.C. and Roy, S.: Maximum Independent Set for Interval Graphs and Trees in Space Efficient Models, *CCCG*, 226-232, 2014.

7. Bhattacharya, B.K., Nandy, S.C. and Roy S.: Space-Efficient Algorithm for Computing a Centerpoint of a Point Set in R^2, *CCCG*, 26-32, 2014

8. Banerjee, A., Paul, H.S., Mukherjee, A., Datta, P. and Das, S.K .: An access point to device association technique for optimized data transfer in mobile grids, *ICPADS 2014 workshop*, Taiwan, 774-779, 2014.

9. Banerjee, A., Paul, H.S., Mukherjee, A., Dey, S. and Dutta, P .: A framework for speculative scheduling and device selection for task execution on a mobile cloud, *ARMS-CC-2014*, Paris, 36-51, 2014.

10. Bhattacharjee, D., Banerjee, A. and Chattopadhyay, A.: EvoDeb: Debugging Evolving Hardware Designs, *VLSI Design 2015*, 481-486, 2015.

11. Bhore, S. K., Chakraborty, A., Chakraborty, D., Das, S. and Sen, S.: On a Special Class of Boxicity 2 Graphs, *CALDAM 2015*, 157-168, 2014.

12. Bhattacharya, B.K., Das , S ., Sasao, T.K., Sinha Mahapatra , P . R .and Song, Z.: Optimizing Squares Covering a Set of Points, *COCOA 2014*, 37-52, 2014.

13. Chakrabarty, K., Bhattacharya, B.B. and Banerjee , A.: Design automation for biochemistry synthesis on a digital microfluidic lab-on-a-chip, *IEEE-ACM International Computer- Aided Design* (ICCAD), 286-288, 2014.

14. Chatterjee, P., Das, N.: Multiple Sink Deployment in Multi-Hop Wireless Sensor Networks to Enhance Lifetime, *International Conference on Applications and Innovations in Mobile Computing (AIMoC-2015)*, IEEE Xplore, India, 48-54, 2015.

15. Chakrabarty, K., Bhattacharya, B.B. and Banerjee, A.: Design automation for biochemistry synthesis on a digital microfluidic lab-on-a-chip, *ICCAD 2014*, 286-288, 2014.

16. Chakrabarti, **A.** , Mandal, S. B . and Sur-Kolay, S.: Synthesis of Ternary Grover's Algorithm, *IEEE 44th International Symposium on Multiple-Valued Logic - ISMVL 2014* , Bremen, Germany, 184-189, 2014.

17. Das, N. and Kundu, S: Event Boundary Detection and Gathering in Wireless Sensor Networks, *International Conference on Applications and Innovations in Mobile Computing (AIMoC-2015)* , IEEE Xplore, India, 62-67, 2015.

18. Das, S., Maheshwari, A., Michiel, H, Nandy, A. and Smid, M..: A Facility Coloring Problem in 1D*, AAIM 2014,* 88-99, 2014.

19. Das, D.K., Chowdhury, D., Bhattacharya, B.B. and Sasao, T.: Inadmissible class of Boolean functions under stuck-at faults, *Proc. IEEE 44th International Symposium on Multiple-Valued Logic* (ISMVL), 237-242, 2014.

20. Dash, A. and Banerjee, A. : When to Schedule an Application? An Energy-Aware Decision , *CloudCom*, Singapore, 704-707, 2014.

21. Kar, B., Saha, S. and Sur-Kolay, S.: A Novel Architecture for QPSK Modulation based on TimeMode Signal Processing, *Proc.18th International Symposium on VLSI Design and Test*, 1-6, 2014.

22. Mitra, R., Das, D.K. and Bhattacharya , B.B.: On designing robust path-delay fault testable combinational circuits based on functional properties, *Proc. IEEE Computer Society Annual Symposium on VLSI* (ISVLSI), 201-207, 2014.

23. Roy, S., Kumar, S., Chakrabarti, P.P., Bhattacharya, B.B. and Chakrabarty, K.: Demand- driven mixture preparation and droplet streaming using digital microfluidic biochips, *Proc. ACM-IEEE Design Automation Conference* (DAC), 1-6, 2014.

24. Saha, D., Das, N., Bhattacharya, B.B.: Fast estimation of coverage area in a pervasive computing environment, *Advanced Computing, Networking and Informatics*, Springer, **2**, 19-27, 2014.

Computer Vision and Pattern Recognition Unit, Kolkata

1. Mouchère, H., Viard-Gaudin, C., Zanibbi R. and Garain, U.: Competition on Recognition of On-Line Handwritten Mathematical Expressions (CROHME), *14th International Conference on Frontiers in Handwriting Recognition* (ICFHR 2014), Crete, Greece, 791-796, 2014.

2. Roy, P. P., Roy, S. and Pal, U.: Multi-Oriented Text Recognition in Graphical Documents using HMM, *11th IAPR International Workshop on Document Analysis and Systems*, 136-140, 2014.

3. Adak, C. and Chaudhuri, B.B.: An Approach of Strike-through Text Identification from Handwritten Documents, *Proc. 14th International Conference on Frontiers in Handwriting Recognition(ICFHR)*, 643-648, 2014.

4. Banerjee, P., Bhattacharya, U. and Chaudhuri, B.B.: Automatic Detection of Handwritten Texts from Video Frames of Lectures, *Proc. of the 14th International Conference on Frontiers in Handwriting Recognition* (*ICFHR* 2014), Crete, Greec, 627-632, 2014.

5. Baral, S., Bhattacharya, S., Chakraborty, A., Bhattacharya, U. and Parui, S. K.: A Machine Learning Approach to Detection of Core Region of Online Handwritten Bangla Word Samples, *Proceedings of the 14th International Conference on Frontiers in Handwriting Recognition*, Crete, Greece, 458-463, 2014.

6. Biswas, B., Bhattacharya, U. and Chaudhuri, B.B.: A Global-to-Local Approach to Binarization of Degraded Document Images, *Proc. of the 22nd International Conference on Pattern Recognition* (*ICPR* 2014), Stockholm, Sweden, 3008 – 3013, 2014.

7. Chanda, S., Das, D., Pal, U. and Kimura, F.: Offline Hand-Written Musical Symbol Recognition, *Proc. 14th International Conference on Frontiers in Handwriting Recognition* (*ICFHR*-2014), 405-410, 2014.

8. Das, A. and Garain, U.,: Moses for Indic Languages, *Proc. 11th Int. Conference on Natural Language Processing* (ICON), Goa, India, 2014.

9. Das, A., Garain, U., and Senapati, A.: Automatic detection of subject/object drops in Bengali, *Proc. Int. Conf. on Asian Language Processing* (IALP), Kuching, Malaysia, 91-94, 2014.

10. Das, A., Senapati, A., and Garain, U.: Pro-drop Resolution in Bengali, *Proc. 11th International Conference on Natural Language Processing* (*ICON*), Goa, India, 2014.

11. Das, A., Pal, U., Ballaster, M.F. and Blumenstein, M.: A New Efficient and Adaptive Sclera Recognition System, *IEEE Symposium Series on Computational Intelligence, Computational Intelligence in Biometrics and Identity Management (CIBIM-2014)*, Orlando, USA, 1-8, 2014.

12. Das, A., Pal, U., Ballaster, M.F. and Blumenstein, M.: A New Wrist Vein Biometric System, *IEEE Symposium Series on Computational Intelligence, Computational Intelligence in Biometrics and Identity Management (CIBIM-2014)*, Orlando, USA, 68-75, 2014.

13. Das, A., Pal, U., Ballaster, M.F. and Blumenstein, M.: Multi-angle Based Lively Sclera Biometrics at a Distance, *IEEE Symposium Series on Computational Intelligence, Computational Intelligence in Biometrics and Identity Management (CIBIM-2014)*, Orlando, USA, 22-29, 2014.

14. Das, A., Pal, U., Ballaster, M.F. and Blumenstein, M.: Fuzzy Logic Based Sclera Recognition, *International Joint Conference on Neural Networks* (*IJCNN*), FUZZ-IEEE, 561-568, 2014.

15. Dutta, D., Roy Chowdhury, A., Bhattacharya, U. and Parui, S.K.: Stroke Level User-Adaptation for Stroke Order Free Online Handwriting Recognition, *Proceedings of the 14th International Conference on Frontiers in Handwriting Recognition*, Crete, Greece, 250-255, 2014.

16. Ferrer, M.A., Morales, A., Rodríguez, N. and Pal, U.: Multiple Training – One Test methodology for Handwritten Word Script Identification, *Proc. 14th International Conference on Frontiers in Handwriting Recognition* (*ICFHR*-2014), 754-759, 2014.

17. Frinken, V., Bhattacharya, N., Uchida, S. and Pal, U.: Improved BLSTM Neural Networks for Recognition of On-line Bangla Complex Words, *Proc. S+SSPR*, 404-413, 2014

Publications

18. Frinken, V., Bhattacharya, N. and Pal, U.: Design of Unsupervised Feature Extraction System for On-Line Handwriting Recognition, *11th IAPR International Workshop on Document Analysis and Systems*, 355-359, 2014.

19. Halder, B., Garain, U., Darbar, R. and Mondal, A.: Inverse of Low Resolution Line Halftone Images for Document Inspection, *6th IAPR International Workshop on Computational Forensics (IWCF- 2014)*, Stockholm, Sweden, 95-103, 2014.

20. Hati, A. J., Roy, P. P. and Pal, U.: Writer Identification in Music Score Documents without Staff-Line Removal, *Proc. 14th International Conference on Frontiers in Handwriting Recognition* (*ICFHR*-2014), 595-600, 2014.

21. Jomy, J., Pramod, K.V., Balakrishnan, K. and Chaudhuri, B.B.: A two stage approach for handwritten Malayalam character recognition, *14th International Conference on Frontiers in Handwriting Recognition (ICFHR)*, 199-204, 2014.

22. Kunwar, R., Pal, U. and Blumenstein, M.: Semi-Supervised Online Bayesian Network Learner for Handwritten Characters Recognition, *22nd International Conference on Pattern Recognition* (*ICPR*-2014), 3104-3109, 2014.

23. Mitra, R.N., Pramanik, S., Mitra, S. and Chaudhuri, B.B.: Pattern Classification of Time Plane Features of ECG Wave from Cell-Phone Photography for Machine Aided Cardiac Disease Diagnosis, *36th Engineering in Medicine and Biology Conference Management System (EMBC) Conf.*, 2014.

24. Mondal, T., Ragot, N., Ramel, J.-Y. and Pal, U.: A Flexible Sequence Matching Technique for Word Spotting in Degraded Documents, *14th International Conference on Frontiers in Handwriting Recognition* (*ICFHR*-2014), 210-215, 2014.

25. Mullick, K., Banerjee, S. and Bhattacharya, U.: An efficient line segmentation approach for handwritten Bangla document image, *8th International Conference on Advances in Pattern Recognition* (*ICAPR*), India, 2015.

26. Nagabhushan, P., Javed, M. and Chaudhuri, B.B.: Entropy Computations of Document Images in Run-Length Compressed Domain, *5th International Conference on Signal and Image Processing (ICSIP)*, Bengaluru, India, 287-291, 2014.

27. Rajmohan, P. and Chaudhuri, B.B.: Mallikarjun Hangarge, K.C. Santosh, Automatic Handwritten Indian Scripts Identification, *14th International Conference on Frontiers in Handwriting Recognition (ICFHR)*, 375-380, 2014.

28. Roy, P.P., Dey, P., Roy, S., Pal, U. and Kimura, F.: A Novel Approach of Bangla Handwritten Text Recognition using HMM, *14th International Conference on Frontiers in Handwriting Recognition* (*ICFHR*-2014), 661-666, 2014.

29. Senapati, A. and Garain, U.: One-expression classification in Bengali and its role in Bengali-English machine translation, *International Conference on Asian Language Processing* (IALP), Kuching, Malaysia, 162-165, 2014.

30. Sharma, N., Pal, U. and Blumenstein, M.: A Study on Word-Level Multi-script Identification from Video Frames, *International Joint Conference on Neural Networks* (*IJCNN*), 1827-1833, 2014.

31. Shaw, B., Bhattacharya, U. and Parui, S.K.: Combination of Features for Efficient Recognition of Offline Handwritten Devanagari Words, *14th International Conference on Frontiers in Handwriting Recognition*, Crete, Greece, 240-245, 2014.

32. Shivakumara, P., Sharma, N., Pal, U., Blumenstein, M. and Tan, C.L.: Gradient-Angular-Features for Word-Wise Video Script Identification, *22nd International Conference on Pattern Recognition* (*ICPR*-2014), 3098-3103, 2014.

33. Sinha, D., Garain, U. and Bandyopadhyay, S.: Event Extraction from Cancer Genetics Literature, *8th International Conference. on Advances in Pattern Recognition*, Kolkata, India, 2015.

34. Som, S., Kotal, A., Mitra, A., Palit, S. and Chaudhuri, B.B.: A Chaos Based Partial Image Encryption Scheme, *International Conference on Business and Information Management (ICBIM-2014)*, Durgapur, 2014.

35. Srimany, A., Dutta Chowdhury, S., Bhattacharya, U. and Parui, S.K.: Holistic Recognition of Online Handwritten Words Based on an Ensemble of SVM Classifiers, *11th IAPR International Workshop on Document Analysis Systems 2014,* Tours, France, 86-90, 2014.

36. Suwanwiwat, H., Blumenstein, M., Nguyen, V. and Pal, U.: Off-line Handwritten Thai Name Recognition for Student Identification in an Automated Assessment System, *International Joint Conference on Neural Networks* (*IJCNN*), 2347-2353, 2014.

37. Suwanwiwat, H., Nguyen, V., Blumenstein, M. and Pal, U.: Off-line Handwritten Bilingual Name Recognition for Student Identification in an Automated Assessment System, *14th International Conference on Frontiers in Handwriting Recognition* (*ICFHR*-2014), 595-600, 2014.

38. Tarafdar, A., Pal, U., Ramel, J.-Y., Ragot, N. and Chaudhuri, B. B.: Word Spotting in Bangla and English Graphical Documents, *22nd International Conference on Pattern Recognition* (*ICPR*-2014), 3044-3049, 2014.

39. Zhang, X., Pal, U. and Tan, C.L.: Segmentation-free Keyword Spotting for Bangla Handwritten Documents, *14th International Conference on Frontiers in Handwriting Recognition* (*ICFHR*-2014), 381-386, 2014.

Electronics & Communication Sciences Unit, Kolkata

1. Biswas, S., Mandal, S., Das, A.K. and Chanda, B.: Land Map Images Binarization Based on Distance Transform and Adaptive Threshold, *11th IAPR International Workshop on Document Analysis Systems (DAS*), Tours-Loire Valley, France, 334--338, 7--10 April 2014.

2. Samanta, S. and Chanda, B.: Indian Classical Dance Classification on Manifold using Jensen-Bregman LogDet Divergence, *international Conference on Pattern Recognition (ICPR*), Stockholm, Sweden, 4507-4512, 2014.

3. Ghorai, M. and Chanda, B.: An Image Inpainting Algorithm Using Higher Order Singular Value Decomposition, *International Conference on Pattern Recognition (ICPR*), Stockholm, Sweden, 2867-2872, 2014.

4. Dutta, D., Saha, S. K. and Chanda, B.: Indexing video database for a CBVCD system, *International Conference on Advanced Computing, Networking, and Informatics*, Kolkata, 301--308, 2014.

Publications

5. Mandal, S., Biswas, S., Das, A.K. and Chanda, B.: Binarisation of Colour Map Images through Extraction of Regions, *International Conference on Computer Vision and Graphics (ICCVG*), Warsaw, Poland, 418-427, 2014.

6. Ghorai, M. and Chanda, B.: A Two-Step Image Inpainting Algorithm Using Tensor SVD, *ACCV Workshop on Emerging Topics in Image Restoration and Enhancement*, Singapore, 2014.

7. Dasgupta, J. and Chanda, B.: An Efficient Slope and Slant Correction Technique for Off-line Handwritten Text Word, *Fourth Intl. Conf. of Emerging Applications of Information Technology (EAIT)*, Kolkata, 2014.

8. Ghorai, M., Chanda, B. and Mandal, S.: Image Completion Assisted By Transformation Domain Patch Approximation, *Indian Conf. on Computer Vision, Graphics and Image Processing*, Bangalore, 2014.

9. De, I. and Chanda, B.: Registration of multi-focus images by combining global and local transformation models, *Proc. of the Third Intl. Conf. on Computer, Communication, Control and Information Technology (C3IT-2015*), Kolkata, 2015.

10. Nag, K., Pal, T. and Pal, N.R.: Robust Consensus: A New Measure for Multicriteria Robust Group Decision Making Problems Using Evolutionary Approach, *The 13th International Conference on Artificial Intelligence and Soft Computing (ICAISC 2014*), Artificial Intelligence and Soft Computing Lecture Notes in Computer Science, Poland, **8467**, 384-394, 2014.

11. Jana, N. D., Sil, J. and Das, S.: Particle Swarm Optimization with population adaptation, *IEEE Congress on Evolutionary Computation,* 573-578, 2014.

12. Biswas, S., Eita, M. A., Das, S. and Vasilakos, A.V.: Ealuating the performance of Group Counseling Optimizer on CEC 2014 problems for Computational Expensive Optimization*, IEEE Congress on Evolutionary Computation 2014*, 1076-1083, 2014.

13. Burman, R., Das, S., Haque, Z., Vasilakos, A.V. and Chakrabarti, S.: The Monarchy Driven Optimization technique, *IEEE Congress on Evolutionary Computation 2014*, 3008-3015, 2014.

14. Biswas, S., Das, S., Suganthan, P.N. and Coello, C.A. C.: Evolutionary multi-objective optimization in dynamic environments: A set of novel benchmark functions, *IEEE Congress on Evolutionary Computation 2014*, 3192 – 3199, 2014.

15. Mukherjee, S., Majumder, B. P., Piplai, A. and Das, S.: A novel fuzzy non-homogeneity measure based kernelized image segmentation for noisy images, *FUZZ-IEEE 2014*, 245-252, 2014.

16. Consylman, M., Mukherjee, S., Mukherjee, D.P., Condron, B. and Acton, S. T.: Social Behavior Analysis of Drosophila Larvae via Motion Activity Recognition, *IEEE Southwest Symposium on Image Analysis and Interpretation* 2014, Online Version: DOI: 10.1109/SSIAI.2014.6806054, San Diego, 161-164, 2014.

17. Mukherjee, D.P. and Acton, S.: Segmentation of Ultrasound Images for Phlebotomy Applications, *IEEE ICASSP* 2014, Online Version: DOI: 10.1109/ICASSP.2014.6854581, Florence, 5135-39, 2014.

Machine Intelligence Unit, Kolkata

1) Chakraborty, A and S. Bandyopadhyay, S.: A Layered Locality Sensitive Hashing based Sequence Similarity Search Algorithm for Web Sessions, *ASE International Conference on Big Data Science and Computing*, Stanford University, CA, USA, 2014.

2) Ghosh, K., Bakshi, A., Mallick, A. and Roy, S.: Experimental studies on the sinusoidal grating, square grating and Hermann grid illusions for perceptibility thresholds, *37th European Conference on Visual Perception (ECVP 2014),* **43,** Pion, ECVP Abstract Supplement, Belgrade, Serbia, 131, 2014.

3) Karmakar, Dhiman and Murthy, C.A.: **Face** Recognition using Face-Autocropping and Facial Feature Points Extraction, *Proceedings of the 2nd International conference on Perception and Machine Intelligence* (PerMIn), 116-122, 2015.

4) Khatua, A., Khatua, A., Ghosh, K. and Chaki, N.: Can# Twitter_Trends Predict Election Results? Evidence from 2014 Indian General Election, *48th Hawaii International Conference on System Sciences (HICSS),* IEEE Computer Society, 1676-1685, 2015.

5) Maji, P., Mandal, A., Ganguly, M. and Saha, S.: An Automated Method for Counting and Characterizing Red Blood Cells Using Mathematical Morphology, *Proceedings of the 8th International Conference on Advances in Pattern Recognition (ICAPR2015),* Kolkata, India, 2015.

6) Naskar, N., Adak, S**.,** Maji, P. and Das, S.: Synthesis of Non-uniform Cellular Automata having Only Point Attractors, *Proceedings of the 11th International Conference on Cellular Automata for Research and Industry (ACRI2014), Poland*, 105-114, 2014.

7) Roy, R. and Ghosh, A.: Rule induction based object tracking, *International Conference on Advances in Computing, Communications and Informatics (ICACCI-2014)*, Delhi, India 1871-1875, 2014.

8) Roy, S. and Maji, P.: A Simple Skull Stripping Algorithm for Brain MRI, Proceedings of the 8th *International Conference on Advances in Pattern Recognition (ICAPR2015*), Kolkata, India, 1-6, 2015.

9) Sinha, D., Garain, U. and Bandyopadhyay, S.: Event Extraction from Cancer Genetics Literature, *International Conference on Advances in Pattern Recognition*, Kolkata, 2015.

Documentation Research and Training Centre, Bangalore

1. Sangam, S.L., Madalli, D. and Patil, U.: Indicators to Measure Genetics Literature: A Comparative Study of Selected Countries, *proceedings of the 10th International Conference on Webometrics Informetrics and Scientometrics,* Markscheffel, Bernd, et.al (ed.), Ilmenau, Germany, 449-458, September 3-5, 2014.

2. Krishnamurthy, M: Information Management and its role in library and Information Centres: Issues and Challenges, *National Conference on Trends National Conference on Trends in Management of Academic Libraries in Digital Environment,* Jain University, Bangalore, M.Krishnamurthy et.al (ed.), 397-405, ISBN 978-81-920992-6-2, 2014.

3. Saha, K. and Krishnamurthy, M: Assessing the value of E-learning Management Systems for Higher Education, N *National Conference on Trends National Conference on Trends in Management of Academic Libraries in Digital Environment. Organised by Learning Resource*

Centre, Jain University, Bangalore, M.Krishnamurthy et.al (ed.), 41-48, ISBN 978-81-920992-6-2, 2014.

4. Roopa, E., Krishnamurthy, M: Digital Library Infrastructure at Engineering Colleges in Karnataka: A Study, *National Conference on Trends National Conference on Trends in Management of Academic Libraries in Digital Environment,* Jain University, Bangalore, M.Krishnamurthy et.al (ed.), 144-151, ISBN 978-81-920992-6-2, 2014.

5. Das, S., Krishnamurthy, M: Architectural Components of Digital Lirbary: A Practical Example, *National Conference on Trends National Conference on Trends in Management of Academic Libraries in Digital Environment,* Jain University, Bangalore, M. Krishnamurthy et.al (ed.), 152-160, ISBN 978-81-920992-6-2, 2014.

6. Jayamma, Krishnamurthy, M: Implementation of Library Automation in Government First Grade Colleges in Bangalore; A Survey, *National Conference on Trends National Conference on Trends in Management of Academic Libraries in Digital Environment,* Jain University, Bangalore, M. Krishnamurthy et.al (ed.), 152-160, ISBN 978-81-920992-6-2, 2014.

7. Meeramani, N.and Krishnamurthy, M: Application of Emerging Technology in promoting innovative practices in Management Schools affiliated to Bangalore University: A Study, *National Conference on Trends National Conference on Trends in Management of Academic Libraries in Digital Environment,* Jain University, Bangalore, M.Krishnamurthy et.al (ed.), 177-184, ISBN 978-81-920992-6-2, 2014.

8. Manjunatha, P.S., Puttaswmay, R.M. and Krishnamurthy. M: Innovative Library Services through Newspaper Clippings: Using Dspace Software at BNMIT Library: A Case Study, *National Conference on Trends National Conference on Trends in Management of Academic Libraries in Digital Environment,* Jain University, Bangalore, M. Krishnamurthy et.al (ed.), 371-377, ISBN 978-81-920992-6-2, 2014.

9. Krishnamurthy, M: Emergence of Digital Libraries: Issues and Challenges, *National Conference of Digital Libraries of the Future,* Central Library, Kakinada, Ramesha et.al (ed.), 23-27, ISBN 9789383635351, 2014.

10. Freihat, A.A., Dutta, B. and Giunchiglia, F.: Compound Noun Polysemy and Sense Enumeration in WordNet, *Proceedings of 7th International Conference on Information, Process, and Knowledge Management (eKNOW)*, Lisbon, Portugal, 166-171, Online Version: http://www.thinkmind.org/ ISBN: 978-1-61208-386-5, 2015.

Systems Science and Informatics Unit, Bangalore

1. Arun, D. and Meher, S.K.: Granular neural networks models with class-belonging granulation, *IEEE International Conference on Contemporary Computing and Informatics (IC3I)*, Mysore, India, 1198-1202, 2014.

2. Sharma, R. and Sagar, B.S.D.: 2014, Fractal characterization via morphological analysis, *IAMG Conference Proceedings*, New Delhi, 2014.

Computer Science Unit, Chennai

1) Sarkar, S. and Venkateswarlu, A.: Partial Key Exposure Attack on CRT-RSA, *INDOCRYPT 2014*, Springer, LNCS, **8885**, 255–264, 2014.

2) Karthick, T. and Maffray, F.: Weighted independent sets in classes of P_6-free graphs (Extended Abstract), *Proceedings of 9th International Colloquium on Graph Theory and Combinatorics (ICGT-2014)*, France, 2014.

3) Karthick, T.: New polynomial case for efficient domination in P_6-free graphs, *Proceedings of Conference on Algorithms and Discrete Applied Mathematics (CALDAM -2015)*, Lecture Notes in Computer Science, **8959**, 81-88, 2015.

4) Francis, M., Hell, P. and Stacho, J.: Forbidden Structure Characterization of Circular-Arc Graphs and a Certifying Recognition Algorithm, *Proceedings of the Twenty-Sixth Annual ACM-SIAM Symposium on Discrete Algorithms (SODA 2015)*, SIAM, San Diego, USA, 1708−1727, 2015.

Physics and Earth Sciences Division

Geological Studies Unit, Kolkata

1. Mazumder, B.S., Sarkar, K. and Chakraborty, C.: Spatiotemporal changes in bed elevations with turbulence around submerged cylinders embedded in sand beds, River Flow – 2014, *7th International Conference on Fluvial Hydraulics*, EPFL, Lausanne, Switzerland, 1373-1380, 2014.

Physics and Applied Mathematics Unit, Kolkata

1. Basu, B. and Chowdhury, D.: Spin transport in tilted electron vortex beams, *ICNPAA 2014, AIP Conference Proceedings,* **1637**, 127-133, 2014.

2. Chowdhury, D. and Basu, B.: Quantum transport in ferromagnetic graphene, role of Berry curvature, *ICNPAA 2014, AIP Conference Proceedings,* **1637**, 201-205, 2014.

Social Sciences Division

Economic Research Unit, Kolkata

1. Bharati, P. (BAU), De, K.U. and Pal, M.: A Modified Diversity Index and its Application to Crop Diversity in Assam, India, Citation: AIP Conference Proceedings, **1643**, Pahang, Malaysia, Online Version: http://dx.doi.org/10.1063/1.4907421, 19-29, 2015.

2. Pal, M. and De, K.U.: Informal Household Water Market and Determinants of Price: Evidence from an Indian Hill City, AIP Conference Proceedings, **1643**, Online Version: http://dx.doi.org/10.1063/1.4907484, 487-493, 2015.

Linguistic Research Unit, Kolkata

1. Das, B.R., Patnaik, S., Baboo, S. and Niladri, S.D.: A system for recognition of named entities in Odia text corpus using machine learning algorithm, *Proceedings of the International*

Conference on Computational Intelligence in Data Mining (ICCIDM-2014), **1**, Burla, Sambalpur, India, 315-324, 2014.

2. Dash, N.S.: Back to basics: a road to return to nominal base through lemmatization, *Proceedings of Abstracts of the 36th International Conference of the Linguistic Society of India (ICOLSI-36)*, **94**, Trivandrum, India, 2014.

Population Studies Unit, Kolkata

1. Sahu, D., Pandey, A. and De, P.: Levels, Trends and Projection of Under-five mortality Rates and Prospects of Achievement of Millennium Development Goal 4 in India, *Proceedings of 20th IEA World Congress of Epidemiology, Global Epidemiology in a Changing Environment: The Circumpolar Perspective*, Anchorage, Alaska, USA, Online Version: https://wce.confex.com /wce /2014/ webprogram/Paper3254.html, 2014.

Psychology Research Unit, Kolkata

1. Ghosh, A.: Emotional Display Rules of Visually and Hearing Impaired Students, *Toward Sustainable Development through Nurturing Diversity: Selected Papers from the Twenty – First Congress of the International Association for Cross – Cultural Psychology,* L. Jackson., D. Meiring., F. Van de Vijver and E. Idermudia (eds.), International Association for Cross- Cultural Psychology, *Melbourne, FL., USA,* 193-199, 2014.

Sociological Research Unit, Kolkata

1. Ghosh, B.N. and De, U.: Women in natural resource collection: experience from rural Jharkhand in India, **1643**, *AIP Conference proceedings*, The 2nd ISM International Statistical Conference 2014 (ISM-II), 476-486, Online Version: 10.1063/1.4907483 @2015 AIP Publishing LLC 978-0-7354-1281-1, 2015.

Economic Analysis Unit, Bangalore

1. Ramachandran, V.K. and Dixit, A.: Proletarianisation of the Peasantry in India: A Note, Conference Proceedings of the Ninth Forum of the World Association of Political Economy, Vietnam Academy of Social Sciences (VASS), Hanoi, Vietnam, 2014.

2. Swaminathan, M. and Das, A.: Differentiation of the Peasantry and Economies of Scale in Indian Agriculture: Evidence from Village Studies, Conference Proceedings of the Ninth Forum of the World Association of Political Economy, Vietnam Academy of Social Sciences (VASS), Hanoi, Vietnam, 2014.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Kolkata

1. Sen, J. and Das, A.K.: Artificial neural network model for forecasting the stock price of Indian IT company, *Proceedings of the Second International Conference on Soft Computing for Problem Solving*, Springer Publication, 1153-1159, 2014.

SQC & OR Unit, Bangalore

1. John, B.: A methodology to qualitatively managing the bug fixing process using Mahalanobis – Taguchi System, *Proceedings of 2nd International Conference on Robust Quality Engineering (ICRQE 2014),* Bangalore, 2014.

Library, Documentation and Information Sciences Division

Library, Kolkata

1. Mandal, T.K. and Chakraborty, B.: Management literature from India: an informetric study, *Bilingual International Conference on Information Technology: Yesterday, Today, and Tomorrow,* DESIDOC, Delhi, India, 205-214, 2015.

Center for Soft Computing Research: A National Facility, Kolkata

1. Datta**,** A., Ghosh, S. and Ghosh, A.: Maximum Margin Criterion based Band Extraction of Hyperspectral Imagery, *Proceedings of Fourth International Conference on Emerging Applications of Information Technology,* IEEE Xplore, Kolkata, India, 300-304, 2014.

2. Roy, A., Maiti, A.K. and Ghosh, K.: A perception based color image adaptive watermarking scheme in YCbCr space, *2nd International Conference on Signal Processing and Integrated Networks (SPIN),* IEEE, 537-543, 2015.

3. Mondal, A., Subudhi, B.N. Roy, M., Ghosh, S. and Ghosh, A.: A Study on Nonlinear Classifier-Based Moving Object Tracking, *Proceedings of Intelligent Computing, Communication and Devices,* Springer, India, **308**, 571-578, Bhubaneswar, India, 2014.

R.C. Bose Centre for Cryptology and Security, Kolkata

1. Balani, N. and Ruj, S.: Temporal Access Control with User Revocation for Cloud Data, *IEEE Trustcom'14*, Beijing, China, 2014.

2. Biswal, S., Paul, G. and Raizada, S.: Preserving Privacy in Location - Based Services Using Sudoku Structures, *10th International Conference on Information Systems Security (ICISS)*, Hyderabad, India, **8880,** LNCS, Springer, 449–464, 2014.

3. De, S. J., Ruj, S. and Pal, A.K.: Should Silence be Heard? Fair Rational Secret Sharing with Silent and Non-Silent Players, *International Conference on Cryptology and Network Security (CANS'14)*, Crete, Greece, Springer, 2014.

4. Dutta, A.and Paul, G.: Deterministic Hard Fault Attack on Trivium, Proceedings of the 9th International Workshop on Security (IWSEC), Hirosaki, Japan, **8639**, LNCS, Springer, 134–145, 2014.

5. Khalid, A., Ravi, P., Chattopadhyay, A. and Paul, G.: One Word/Cycle HC-128 Accelerator via State-Splitting Optimization, *15th International Conference on Cryptology in India (INDOCRYPT)*, New Delhi, India, **8885**, LNCS,Springer, 283–303, 2014.

6. Pandit, T., Barua, R. and Tripathy, S.: eCK Secure Single Round ID-Based Authenticated Key Exchange Protocols with Master Perfect Forward Secrecy, *8th International Conference on Network and System Security (NSS 2014)*, **8792**, Ho, Man Ho, Carminati, Barbara, Kuo, C.-C. Jay (eds.), LNCS, Springer 2014, 435-437, 2014.

7. Pandit, T., Pandey, S. and Barua, R.: Attribute-Based Signcryption : Signer Privacy, Strong Unforgeability and IND-CCA2 Security in Adaptive-Predicates Attack, *8th International Conference on Provable Security* (*ProvSec 2014)*, **8782**, S.S.M. Chow, J.K. Liu, L.C.K.Hui, S.M. Yiu (eds.), LNCS, Springer, 274-290, 2014.

8. Paul, G., Sarkar, P. and Mukherjee, S.: Towards a More Democratic Mining in Bitcoins, *10th International Conference on Information Systems Security (ICISS)*, Hyderabad, India, **8880**, LNCS, Springer, 186–204, 2014.

9. Ruj, S. and Pal and A.: Analyzing Cascading Failures in Smart Grids under Random and Targeted Attacks, *IEEE AINA'14*, Victoria, Canada, 2014.

10. Sen, A., Ghosh, S., Basak, A., Puria, H. and Ruj, S.: Achieving Data Survivability and Confidentiality in Unattended Wireless Sensor Networks, *AINA*, Gwangju, Korea, 2015.

11. Verma, R. and Ruj, S.: Security Services using Crowdsourcing, *5th International Conference on Ambient Systems, Networks and Technologies (ANT-2014)*, Hasselt, Belgium, 2014.

12. Wang, Z., Paul, G. and Chattopadhyay, A.: Processor Design with Asymmetric Reliability, *13th IEEE Computer Society Annual Symposium on VLSI (ISVLSI)*, Tampa, Florida, USA, 565–570, 2014.

Publication and Printing Unit, Kolkata

1. Bhattacharya, C.: Implementing TQM in small Offset Lithographic Printing Organisations, *International Conference on Imaging and Printing Technologies (ICIPT 2014)*, Department of Imaging and Printing Technology, Chulalongkorn University & Kanagawa Institute of Technology, Bangkok, Thiland, 62-68, 2014.

Papers Published in Books

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Delhi

1. Sarkar, D.: R Graphics, *Handbook of Statistics 32: Computational Statistics with R*, Marepalli Rao and C.R. Rao (eds.), Elsevier, Oxford, 2014.

Stat-Math Unit, Bangalore

1. Blaszczyszyn, B. and Yogeshwaran, D.: Clustering comparison of point processes with applications to random geometric models, *Stochastic Geometry, Spatial Statistics and Random Fields*, V. Schmidt (ed.), Lecture Notes in Mathematics, Springer, 31-71, 2015.

Applied Statistics Division

Applied Statistics Unit, Chennai

1. Chaplot, A. and Sen, R.: Performance of Inequality Indices, *Econophysics and Data Driven Modelling of Market Dynamics*, F. Abergel, H. Aoyama, B.K. Chakrabarti, A. Chakraborti, A. Ghosh (eds.), Springer, 191-212, 2015.

Computer and Communications Sciences Division

Computer Vision and Pattern Recognition Unit, Kolkata

1. Chanda, S., Bu, G., Guan, H., Jo, J., Pal, U., Loo, Y.-C. and Blumenstein, M.: Automatic Bridge Crack Detection – A Texture Analysis-Based Approach, *Artificial Neural Networks in Pattern Recognition*, *LNAI,* **8774**, Neamat El Gayar, F. Schwenker and C.Y. Suen (eds.), 2014.

2. Halder, B., Darbar, R., Garain, U. and Mondal, A.: Analysis of fluorescent paper pulps for detecting counterfeit Indian paper money, *Information Systems Security: Proc. of 10th International Conference* (ICISS), Atul Prakash, Rudrapatna Shyamasundar (eds.), **LNCS 8880**, 411-424, 2014.

3. Mukherjee, A., Garain, U. and Biswas, A.: Evaluation of Diagrams Produced by Text-to-Graphics Conversion Systems, *Graphics Recognition: Current trends and Challenges*, Bart Lamiroy and Jean-Marc Ogier (eds.), **LNCS 8746**, 252-265, 2014.

4. Senapati, A. and Garain, U.: A Computational Approach for Corpus Based Analysis of Reduplicated Words in Bengali, *Computational Linguistics and Intelligent Text Processing*, Gelbukh (ed.), **LNCS 8403**, Cairo, Egypt, 456-466, 2015.

Electronics and Communication Sciences Unit, Kolkata

1. Das, S.: Evaluating the Evolutionary Algorithms – Classical Perspectives and Recent Trends, in Computational Intelligence, *Encyclopedia of Life Support Systems (EOLSS)*, Hisao Ishibuchi (ed.), Developed under the Auspices of the UNESCO, Eolss Publishers, Oxford, UK, Online Version: http://www.eolss.net, 2014.

2. Ray, K.S., Ganguly, D. and Chatterjee, K.: An Automated Surveillance System for Public Places, *Case Studies in Intelligent Computing Achievements and Trends,* Biju Issac and Nauman Israr (eds.), Taylor & Francis, **10**, 197–226, ISBN 9781482207033, 2014.

Machine Intelligence Unit, Kolkata

1. Tomar, N. and De, R.K.: A brief outline of the immune system, *Immunoinformatics*, R.K. De and N. Tomar (eds.), Humana Press, New York, 3-12, 2014.

2. Tomar, N. and De, R.K.: Crosstalk between metabolic and immune systems, *Immunoinformatics*, R.K. De and N. Tomar (eds.), Humana Press, New York, 13-22, 2014.

Publications

3. Tomar, N. and De, R.K.: Immunoinformatics: A brief review, *Immunoinformatics*, R.K. De and N. Tomar (eds.), Humana Press, New York, 23-55, 2014.

Physics and Earth Sciences Division

Geological Studies Unit, Kolkata

1. Chaudhuri, A.K., Deb, G.K. and Patranabis-Deb, S.: Conflicts in stratigraphic classification of the Puranas of the Pranhita–Godavari Valley: review, recommendations and status of the 'Penganga' sequence, *Precambrian Basins of India: Stratigraphic and Tectonic Context,* R. Mazumder & P.G. Eriksson (eds.) Geological Society, London, Memoirs, **43**, 165–183, 2015.

2. Saha, D., Sain, A., Nandi, P., Mazumder, R. and Kar, R.: Tectonostratigraphic evolution of the Nellore schist belt, southern India, since the Neoarchaean, *Precambrian Basins of India: Stratigraphic and Tectonic Context*, R. Mazumder and P.G. Eriksson (eds.), Geological Society of London, Memoirs, **43**, 269-282, 2015.

Biological Sciences Division

Biological Anthropology Unit, Kolkata

1. Reddy, B.M.: Origins of Austro-Asiatic populations and their status in the peopling of India, *Darwin and Human Evolution: Origin of Species Revisited,* R.Ray, D.Chattopadhyay and S.Banerjee (eds.),The Asiatic Society, Kolkata, 144-163, 2014.

2. Reddy, B.M.: People of India: Implications of recent DNA studies, *History of Ancient India, Prehistoric Roots*, D.K. Chakrabarti and M. Lal (eds), Vivekananda International Foundation and Aryan Books International, New Delhi, **1***,* 28-58, 2014.

Social Sciences Division

Economic Research Unit, Kolkata

1. Chakravarty, S.R. and Chattopadhyay, N.(SOSU): Measuring Vulnerability to Poverty: An Expected Poverty Index, *Contributions to Economic Analysis: Essays in Honor of Satish Jain,* R.P. Kundu, Subramanian and S. Guha (eds.), Routledge, London, UK, 311– 321, 2015.

2. Dasgupta, I.: Is a Free Market in Land Just?, *Neoliberal State and its Challenges*, B. Sarmah and J. Baruah (eds.), Aakar Books, New Delhi, India, 175-186, 2014.

3. Lahiri, H., Ghosh, C**.** and Ghosh, A.: Financial Sector Liberalisation and RBI's Policy Dilemma, *Financial Sector Liberalisation in India: Theory and Empirics*, S. Jana. and A. Karmakar (eds.), Regal Publications, New Delhi, India, 1-24, 2014**.**

4. Majumder, A.: Applied Demand Analysis, *Themes on Quantitative Economics*, Arpita Dhar (ed.) Allied Publishers Private Limited, Kolkata, New Delhi, India, 282-316, 2014.

5. Majumder, A.: Income Distribution and Lorenz Curve, *Themes on Quantitative Economics*, Arpita Dhar (ed.), Allied Publishers Private Limited, Kolkata, New Delhi, India, 17-52, 2014.

6. Pal, M.: Errors-in-Variables, *Themes on Quantitative Economics*, Arpita Dhar (ed.), Allied Publishers Private Limited, Kolkata, New Delhi, India, 139-166, 2014.

7. Pal, M., Ghosh, B.N. (SRU) and Bharati, P. (BAU): Poverty Eradication Programmes in India: Actions Taken and Impacts Made, *Global Social transformation and Social Action: The Role of Social Workers*, Volume III, Social Work – Social Development, Sven Hessle (ed.), Stockholm University, Sweden, ASHGATE, 50-56, 2014.

8. Sarkar, N. and Das, S.: Unit Root Tests in Time Series Econometrics, *Themes in Quantitative Economics,* Arpita Dhar (ed.), Allied Publishers Private Limited, New Delhi, India, 186-232, 2014.

9. Sarkar, N. and Mukhopadhyay, D.: Analysis of Long-run Economic Relationship-The Cointegration Methodology, *Themes in Quantitative Economics,* Arpita Dhar (ed.), Allied Publishers Private Limited, New Delhi, India, 233-281, 2014.

10. Sarkar, A.: Food Price Inflation and Public Procurement: The Indian Experience, *Indian Economy in Transition*, S. Janakarajan et al. (eds.), Sage Publication, New Delhi, India, 41 – 56, 2014.

11. Sarkar, A.: Increasing Returns, Non-Traded Goods and Wage Inequality, *Efficiency, Growth and Inequality*, Satish Jain (ed.), Routlage, New Delhi, India, 83 – 122, 2014.

12. Roy, S. and Gehrlein, W.V.: The Structure of Voters' Preferences Induced by the Dual Culture Condition in *Voting Power and Procedures*, Rudy Fara, Dennis Leech and Maurice Salles (eds.), Springer International Publishing, Switzerland**,** 347-361, 2014.

Linguistic Research Unit, Kolkata

1. Dasgupta, P.: Antauparolo, Louis Couperus, *Pri maljunuloj, la ajhoj, kiuj pasas…* (tr. Gerrit Berveling), New York, Mondial, 7-11, 2014.

2. Dasgupta, P.: Proshonggo, *Goedeler Ashampurnotaatatto,* Goedel ar goddo. Ranjan Mukhopadhyay, Soma Datta, Namita Chaudhuri (eds.), Nandimukh Sansad, Kolkata, 50-75, 2014.

3. Dasgupta, P.: Kothay dnaraye du bahu baraye, *Mononer Modhu*, Arindam Chakrabarti (ed.), Gangchil, Kolkata, 351-367, 2014.

4. Dasgupta, P.: Prezento, *Beletra Almanako,* **22(4)**, 2015.

5. Pal, U. (CVPR) and Dash, N.S.: Language, script and font recognition, *Handbook of Document Image Processing and Recognition*, D. Dobermann and K. Tombre (eds.), Springer, Verlag, London, UK, 290-327, 2014.

6. Das, B.R., Patnaik, S. and Dash, N.S.: Development of Odia language corpus from modern newspaper texts: some problems and issues, *Intelligent Computing, Communication and Devices: Advances of Intelligent and Systems and Computing,* Lakhmi C. Jain, Srikanta Patnaik and Nikhil Ichalkaranje (eds.), Springer, New Delhi, India, 515-522, 2014.

Publications

Sociogical Research Unit, Kolkata

1. Behera, H.C.: Land alienation, dispossession and displacement: a reappraisal of constitutional safeguards and tribal rights, *Dissent, Discrimination and Dispossession*, K.K. Misra and N.K. das (eds.), Manohar, New Delhi, India, 321-337, 2014.

2. Behera, H.C. and Singh, A.P.: Land reforms and record management in tribal areas: pertaining issues and prospects, *Resources, Tribes and Development*, M.C. Behera and Jumyir Basar (eds.), Rawat, 173-187, 2014.

3. Faizi, A.A.A. and Behera, H.C.: Current Trends in Land Records Management, *Land Records Management in India: A Plea for Reforms,* A.A.A. Faizi and H.C. Behera (eds.), Concept Publishing Company Pvt. Ltd., New Delhi, India, 1-10. 2014

Economics and Planning Unit, Delhi

1. Kotwal, A. and Ramaswami, B.: Delivering Food Subsidy: The State and the Market, The *Oxford Handbook of Food, Politics and Society*, R. Herring (ed.), Oxford University Press, 301-326, 2015.

2. Somanathan, E., Sterner, T. and Sugiyama, T.: National and Sub-national Policies and Institutions, *IPCC Report 3*, Cambridge University Press, **15**, 2014.

Economic Analysis Unit, Bangalore

1. Swaminathan, M. and Athreya, V.: Economic Status and Child Deprivation: Findings from Village Surveys, *India's Children: Essays on Social Policy*, A.K. Shiva Kumar, Preet Rustagi and RamyaSubrahmanian (eds.), Oxford University Press, New Delhi, India, 68-97, 2015.

7. VISITING SCIENTISTS, HONOURS AND AWARDS

A number of distinguished scientists from India and abroad participated in the research, training and other scientific activities of the Institute during the year. Some of them came to the Institute on invitation and spent fairly long periods in the Institute to assist in the regular research and teaching programmes, while others came for short periods and gave lectures and seminars. Most of them were available for consultation by the faculty members of the Institute. Names of the visiting scientists are given below.

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Asanuma, T., Dept. Math Statistics & Computer Science, University of Toyama, Japan, March 02-26, 2015.

Basu, Rebeya, Indian Institute of Science Education and Research (IISER), Pune, May 19-June 22, 2014.

Bhattacharya, Angshuman, Department of Mathematics, University of Regina, Canada, May 05-June 27, 2014.

Biswas, Indranil, Tata Institute of Fundamental Research, Mumbai, December 29-January 06, 2015.

Chakrborty, Sayan, University of Munster, Germany, January 05–16, 2015.

Collins, Benoit, Department of Mathematics, University of Ottawa, Canada, September 09-25, 2014.

Das, Prosenjit, Department of Mathematics, Indian Institute of Space Science and Technology (IIST), Trivandrum, June 01-14, 2014.

Das, Soumya, Department of Mathematics, Indian Institute of Science (IISc), Bangalore, April 29- May 04, 2014.

Das, Soumya, Department of Mathematics, Indian Institute of Science (IISc), Bangalore, December 15-18, 2014.

Jha, Somnath, Jawaharlal Nehru University, New Delhi, December 22–24, 2014.

Lokhande, Swapnil Ashok, Department of Mathematics, Indian Institute of Technology, Bombay, October 01-September 30, 2015.

Lokhande, Swapnil Ashok, Department of Mathematics, Indian Institute of Technology, Bombay, September 26-30, 2014.

Munshi, Ritabrata, School of Mathematics, Tata Institute of Fundamental Research, May 20-June 19, 2014.

Munshi, Ritabrata, Tata Institute of Fundamental Research, Mumbai, March 03–12, 2015.

Pal, Sourav, Department of Mathematics, Ben-Gurion University of the Negev, Israel, September 14-24, 2014.

Raghavan, T.E.S., University of Illinois, Chicago, January 31-February 03, 2015.

Rao, B.V., Adjunct Faculty, Chennai Mathematical Institute (CMI), December 17–31, 2014.

Roy, Sutanu, Mathematics Institute, Georg-August-Universitat Gottingen, Germany, August 01-December 31, 2014.

Sathaye, Avinash, University of Kentucky, USA, June 01-21, 2014.

Sengupta, J., School of Mathematics, Tata Institute of Fundamental Research, Mumbai, November 17-21, 2014.

Zinna, Md. Ali, Dept. of Mathematics, Indian Institute of Technology, Bombay, January 08–18, 2015.

Stat-Math Unit, Delhi

Adhya, Sumata, West Bengal State University, 24 Paraganas (N), April 24–May 03, 2014.

Athreya, K.B., Iowa State University, USA, January 27-30, 2015.

Berg, Christian, Universitetsparken 5, Copenhagen, Denmark, January 19-21, 2015.

Bin, Abu Baker, Abdullah, Indian Institute of Technology, Kanpur, March 1-9, 2015.

Chakraborty, Parthasarathi, Institute of Mathematical Sciences, Chennai, November 28-December 12, 2014.

Chaubey, Y. P., Concordia University, Montreal, Canada, August 29, 2014-February 28, 2015.

Das, Ishapathik Das, Indian Institute of Technology, Mumbai, January 01-February 15, 2015.

Das, Ishapathik, Kumaun University, Almora, September 23-24, 2014.

Deshouillers, J. M., University of Bordeaux, France, September 14-21, 2014.

Deshouillers, J.M., University of Bordeaux, France, February 14-19, 2015.

Deshpande, J.V., Indian Institute of Science Education and Research (IISER), Pune, May 13-31, 2014.

Dijoux, Yann, Universite de Technologie de Troyes, France, December 10-19, 2014.

Doosti, Hassan, Mashhad University of Medical Sciences, Mashhad, Iran, March 10-April 8, 2015.

Ganesan, G., École polytechnique fédérale de Lausanne (EPFL), Lausanne, Switzerland, April 30-May 05, 2014.

Ghate, Eknath, Tata Institue of Fundamental Research, Mumbai, March 05-11, 2015.

Gopalakrishnan, Asha, Cochin University of Science and Technology, Cochin, March 02-07, 2015.

Guin, Satyajit, Insitute of Mathematical Scineces, Chennai, November 03, 2014-November 02, 2015.

Karandikar, Rajeeva, Chennai Mathematical Institute, Siruseri, December 12-18, 2014.

Karimi, Masoud, Islamic Azad University of Bojnourd Branch, Bojnourd, Iran, March 13-April 11, 2015.

Kumar, Arun, Mumbai, December 01, 2014–November 30, 2015.

Kumar, Narasimha, Indian Institute of Technology, Hyderabad, May 26-31, 2014.

Kumar, Ravinder, Himachal Pradesh University, Shimla, January 22 -February 19, 2015.

Kumar, Suresh, Indian Institute of Technology, Bombay, January 15-22, 2015.

Liski, Antti, FI-00022 Statistics Finland, Helsinki, Finland, December 12-16, 2014.

Midhu, N. N., Cochin University of Science and Technology, Cochin, August 20, 2014-August 31, 2015.

Miron, Paulo Cesar, Manrique, CIMAT, Guanajuato, Mexico, December 01, 2014-May 31, 2015.

Mishra, Alok, Indian Institute of Technology, Delhi, February 02, 2015-February 01, 2016.

Morya, Bhavin, Chennai Mathematical Institute, Chennai, October 19-28, 2014.

Morya, Bhavin, Harish Chandra Research Institute, Allahabad, August 28-September 05, 2014.

Pal, Sourav (INSPIRE FACULTY), Ben-Gurion University of the Negev, Israel, October 16, 2014-October 15, 2017.

Pandey, Prem Prakash, Chennai Mathematical Institute, Chennai, March 1-10, 2015.

Paul, Debashish, University of California, Davis, USA, February 16-20, 2015.

Saraswat, Vishal, C.R. Rao Advanced Institute of Mathematics, Statistics and Computer Science (AIMCS), Hyderabad, October 13-18, 2014.

Sengupta, Ritabrata, Indian Institute of Science Education and Research (IISER), Mohali, June 02, 2014-June 01, 2015.

Sharma, Rajesh, Himachal Pradesh University, Shimla, January 22-February 19, 2015.

Singull, Martin, Linkoping University, Sweden, December 12-16, 2014.

Sivasubramanian, S., Indian Institute of Technology, Bombay, June 02-10, 2014.

Stat-Math Unit, Bangalore

Accardi, Luigi, University of Rome, Italy, March 11–16, 2015.

Anbu, A., Chennai Mathematical Institute (CMI), Chennai, February 01–07, 2015.

Basu, Madhushree, National Board for Higher Mathematics, Post Doctoral Fellow, since July 01, 2014 for one year.

Visiting Scientists, Honours and Awards

Bertoin, Jean, University of Zurich, January 18–20, 2015.

Chakraborty, Prateep, Institute of Mathematical Sciences (IMSc.), Chennai, September 01, 2014–May 31, 2015.

Chattopadhyay, Arup, National Board for Higher Mathematics, Post Doctoral Fellow, since July 01, 2013 for two years.

Dan, Krishanu, Institute of Mathematical Sciences (IMSc.), Chennai, October 18–26, 2014.

Das, Bata Krishna, National Board for Higher Mathematics, Post Doctoral Fellow, since August 01, 2014 for one year.

Douglas, Ronald, Texas A&M University, March 15–22, 2015.

Gopal, Sharan, National Board for Higher Mathematics, Post Doctoral Fellow, since April 02, 2014 for two years.

Hillier, Robin, Lancaster University, UK, November 29–December 29, 2014.

Jayanarayanan, C.R., Post-Doctoral Fellow, January 15–July 31, 2014.

Joseph, Mathew, University of Sheffield, UK, June 01-05, 2014 and January 5-14, 2015.

Katsoulis, Elias G., East Carolina University, Greenville, December 05–26, 2014.

Keshari, Dinesh Kumar, Texas A&M University, June 03, 2014–March 31, 2015.

Kumar, Anil, Institute of Mathematical Sciences (IMSc.), Chennai, since June 02, 2014 for one year.

Kumar, Ashok M., Institute of Mathematical Sciences (IMSc.), Bangalore, since December 05, 2014 for one year.

Lalithambigai, S., Madurai Kamaraj University, Madurai, July 19-27, 2014.

Majumdar, Dipramit, Indian Institutes of Science Education and Research (IISER), Pune, December 10-23, 2014.

Masuti, Shreedevi K., Institute of Mathematical Sciences (IMSc.), Chennai, January 19-30, 2015.

Mukherjee, Mithun, Indian Institutes of Science Education and Research (IISER), Kolkata, June 16-July 25, 2014.

Nair, Arvind, Tata Institute of Fundamental Research (TIFR), Mumbai, February 23 – 28, 2015.

Pal, Sarbeswar, Chennai Mathematical Institute, since July 30, 2013–March 31, 2015.

Parthasarathy, K.R. Distinguished Emeritus Scientist: January 27-February 20, 2015.

Prajapati, Sunil Kumar, National Board for Higher Mathematics, Post Doctoral Fellow, since July 01, 2013-September 19, 2014.

Raju, Sankara, National Board for Higher Mathematics, Post Doctoral Fellow, since June 03, 2013-May 31, 2014.

Ramachandran, Koushik, Purdue University, since August 14, 2014 for one year.

Ramaseshan, Vittal, Vivekananda College, Chennai (Retd.), January 22-February 22, 2015.

Ronnie, Sebastia, Indian Institute of Science Education and Research (IISER), Pune, April 05-12, 2014.

Sahasrabudhe, Neeraja, Indian Institutes of Technology (IIT), Bombay, Mumbai, September 01-07, 2014.

Sahoo, Binod Kumar, National Institute of Science Education and Research (NISER), Bhubaneswar, June 09-July 11, 2014.

Shah, Riddhi, Jawaharlal Nehru University, Delhi, June 30-July 5, 2014,

Skeide, Michael, University of Molise, Italy, June 30-September 27, 2014.

Skraba, Primoz, Jozef Stefan Institute, Slovenija, January 04-10, 2015.

Srinivasan, R., Chennai Mathematical Institute, Chennai, July 21-30, 2014 and February 01- 07, 2015.

Sumesh, K., Institute of Mathematical Sciences (IMSc.), Chennai, February 01-22, 2015.

Sunder, V.S., Institute of Mathematical Sciences (IMSc.), Chennai, February 01-07, 2015.

Thoppe, Gugan, Tata Institute of Fundamental Research (TIFR), Mumbai, December 01–11, 2014.

Tripathi, Amit, National Board for Higher Mathematics, Post Doctoral Fellow, since December 01, 2012 for two years.

Stat-Math Unit, Chennai

Baricz, Arpad, Tohoku University, Japan, February 26-March 06, 2015.

Hariri, Parisa, University of Turku, Finland, December 08-22, 2014.

Poganj, Tibor, University of Rijeka, Croatia, February 23–March 06, 2015.

Rasila, Annti Hermani, Aalto University, Finland, November 12-December 22, 2014.

Ruscheweyh, St., Universität Würzburg, Germany, February 03-14, 2015.

Sergey, Graf, Petrosavodsk State University, Russia, December 02-17, 2014.

Sugawa, Toshiyuki, Tohoku University, Japan, March 25-April 05, 2015.

Viktor, Starkov, Petrosavodsk State University, Russia, December 02-17, 2014.

Vuorinen, Matti, University of Turku, Finland, December 08-22, 2014.

Applied Statistics Division

Applied Statistics Unit, Kolkata

Chakraborty, Debrup, CINVESTAV, Mexico, October 14, 2014 – March 31, 2015.

Chang, Donghoon, Indraprastha Institute of Information Technology (IIIT), New Delhi, November 10–14, 2014.

Chen, Wooi, University of Malaya, Malaysia, December 18 – 25, 2014.

Chong, Ng Chong Min, University of Malaya, Malaysia, September 14 – 29, 2014.

Deshpande, J.V., University of Pune, Pune, June 12 – 18, 2014.

Huat, Ong Seng, University of Malaya, Malaysia, September 14 – 21, 2014.

Kulkarni, H.V., Shivaji University, Maharastra, August 04 – 11, 2014.

Kundu, Subrata, George Washington University, USA, September 22, 2014 – March 31, 2015.

Patra, Arpita, University of Bristol, U.K., since January 01–December 31, 2014.

Roy, Vivekananda, Iowa State University, USA, January – March, 2015.

Interdisciplinary Statistical Research Unit, Kolkata

Ghosh, Malay, University of Florida, Gainesville, USA, July 10 – July 31, 2014.

Ghatak, Anirban, Indian Institute of Technology, Bombay, September 1, 2014 – August 31, 2015.

Sanyal, Nilotpal, University of Missouri, Columbia, USA, May 01, 2014-March 31, 2015.

Applied Statistics Unit, Chennai

Athreya, Krishna B., Iowa State University, USA January 12-22, 2015.

Chakraborty, Sounak, University of Missouri-Columbia, USA, January 06-08, 2015.

Kumarapandiyan, G., March 01-31, 2015.

Majumdar, Anandamayee, Soochow University, China, March 01-04, 2015.

Oja, Hannu, University of Turku, Finland, January 05-11, 2015.

Roy, Vivekananda, Iowa State University, USA February 04-07, 2015.

Sreelakshmi, N., January 12-March 31, 2015.

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit, Kolkata

Dutta, Kunal, Post- Doctoral Researcher Max-Plank-Institute for Informatics, Sarbrucken, Germany, December 02–21, 2014.

Ghosh, Arijit, Max-Plank-Institute for Informatics, Sarbrucken, Germany, January 27-February 23, 2015.

Maity, Soumyadev, Dept. Of Computer Science and Automation, Indian Institute of Science (IISc.), Bangalore, November 10, 2014–March 31, 2015.

Paul, Subhabrata, Department of Mathematics, Indian Institute of Technology, Delhi, April 01, 2014 – March, 2015.

Sen, Sagnik, University of Bordeaux, Bordeaux, France, April 01, 2014-March 31, 2015.

Computer Vision and Pattern Recognition Unit, Kolkata

Chakraborty, Rupayan, TALP Research Center, UPC, Barcelona, April 01-December 31, 2014.

Mitra, Abhijit, B.A. College of Engineering & Technology, Jamshedpur, January 01-March 31, 2015.

Electronics and Communication Sciences Unit, Kolkata

Dutta, H.N., Former Scientist G, National Physical Laboratory, New Delhi, September 20-28, 2014.

Das, Abhisek, Tripura University, March 23-27, 2015.

Machine Intelligence Unit, Kolkata

Dash, D., Institute of Genomics and Integrative Biology, New Delhi, India, January 22-23, 2015.

Venkatesh, K.V., Indian Institute of Technology, Bombay, India, March 23-24, 2015.

Documentation, Research and Training Centre, Bangalore

Amin, Saiful, Semantic Consulting Services Pvt. Ltd, Bangalore, April 2014 – March 2015.

Chatterjee, Amitabha, Professor (Retd.), Dept. of Library and Information Science, Jadavpur University, Kolkata, February 05– March 06, 2015.

Middleton, William C., Information Resource Officer, South Asia Region, US, Dept. of State, US Embassy, India, April 25, 2014.

Moorthy, A.L., BrahMos Aerospace, an Indian-Russian JV Company, Hyderabad, February 23-28, 2015.

Munshi, Usha Mujoo, Indian Institute of Public Administration, New Delhi, August 12, 2014.

Neupane, Bhanu, Institute of Chemical Technology (ICT) and Sciences and Open Access to Scientific Research, USA, August 06, 2014.

Satija ,Mohinder Partap, Professor (Retd.), Dept. of Lib. & Inf. Sc., Guru Nanak Dev University, Amritsar, October 07– November 06, 2014.

Satpathi, Jatindra Nath, Ex-President, Indian Association of Special Libraries and Information Centres (IASLIC), Member, IFLA Standing Committee, Kolkata, October 01 -10, 2014.

Sonwane, Shashank, Department of Library and Information Science, Dr. Babasaheb Ambedkar Marathwada University Aurangabad, February 16–March 02, 2015.

Systems Science and Informatics Unit, Bangalore

Akira, Hirose, University of Tokyo, Japan, December 07-09, 2014.

Chakravarthy, Bhagvati, University of Hyderabad, Hyderabad, March 27, 2015

Juan-José-Egozcue, Universidad Politecnica de Catalunya, Spain, October 14-16, 2014.

Katsuaki, Koike, Kyoto University, Japan, October 19-21, 2014.

Ramapriyan, H.K., National Aeronautics and Space Administration (NASA), USA, November 09-16, 2014.

Sinha-Roy, Subimal, ES-SERB-DST, March 23-25, 2015.

Ulrich, Furbach, University of Koblenz, Germany, December 11, 2014.

Vera, Pawlsky-Glahn, University of Girona, Spain, October 14-16, 2014.

Wolfgang-Martin, Boerner, University of Illinois-Chicago, USA, December 03-04, 2014.

Computer Science Unit, Chennai

Chacko, Daphna, Research Scholar, National Institute of Technology, Calicut, September 07−October 31, 2014.

Dutschke, Markus, Institute of Physics, University of Augsburg, Germany, August 20-24, 2014.

Salam, Sameera, Research Scholar, National Institute of Technology, Calicut, September 07−October 31, 2014.

Sano, Katsuhiko, Japan Advanced Institute of Science and Technology (JAIST), Japan, January 12-16, 2015.

Physics and Earth Sciences Division

Geological Studies Unit, Kolkata

Butler, R., School of Geography, Earth and Environmental Sciences, University of Birmingham, U.K., January 13-27, 2015.

Basilici, G., State University of Campinas, Brazil, November 21- December 18, 2014.

Chinsamy-Turan, A., Biological Sciences Department, University of Cape Town, South Africa, December 02- 07, 2014.

Ezcurra, M.D., School of Geography, Earth and Environmental Sciences, University of Birmingham, U.K., January 13-February 06, 2015.

Nemec, Wojciech (Wojtek), University of Bergen, Norway, October 09- 21, 2014.

Simplicio, F., State University of Campinas, Brazil, November 21- December 18, 2014.

Sookias, R., School of Geography, Earth and Environmental Sciences, University of Birmingham, U.K. January 13- 27, 2015.

Physics and Applied Mathematics Unit, Kolkata

Chatterjee, A., Harish-Chandra Research Institute, Allahabad, July 07-13, 2014.

Das, S., Indian Institute of Astrophysics, Bangalore, December 29, 2014-January 03, 2015.

Ghosh, S., Department of Theoretical Physics, Institute of Mathematical Science, Chennai, June 12-22, 2014; July 14-23, 2014.

Khajanchi, S., Department of Mathematics, Indian Institute of Technology, Roorkee, July 07-11, 2014.

Rahaman, R., Department of Mathematics, University of Allahabad, Allahabad, May 31-June 27, 2014.

Biological Sciences Division

Agricultural & Ecological Research Unit, Kolkata

HikoFuwa, Nobu, Waseda University, Japan, December 03-23, 2014.

Paul, Debasis, University California at Davis, USA, August 01-31, 2014.

Sadhu, Susmita, Department of Mathematics, Georgia College, Milledgeville, USA, May 18-July 06, 2014.

Social Sciences Division

Economic Research Unit, Kolkata

Bag, Parimal Kanti, Department of Economics, National University of Singapore, Singapore, December 1-31, 2014.

Bhattacharjee, Sushanta K., Department of Statistics, University of Rajshahi, Bangladesh, July 22–August 16, 2014.

Visiting Scientists, Honours and Awards

Bhattacharya, Debopam, Department of Economic, University of Oxford, United Kingdom, December 20, 2014–January 11, 2015.

Chakraborty, Bikas K., Centre for Applied Mathematics & Computational Science, Saha Institute of Nuclear Physics, Kolkara, August, 2014.

Chandra, Shalini, Department of Economics, Banasthali University, Rajasthan, October 29-31, 2014.

Chatterjee, Arpita, Australian School of Business, School of Economics, University of New South Wales, Australia, September 08–December 31, 2014.

Chatterjee, Kalyan, Department of Economics, The Pennsylvania State University, USA, June 10–July 10, 2014 and December 30, 2014-January 14, 2015.

De, Utpal Kumar, Department of Economics, North Eastern Hill University, Shillong, Meghalaya, December 22, 2014 – February 10, 2015.

Kundu, Srikanta, Radha Gobinda Pally, Rajganj, 25, Bardhaman Sadar, P.O. Nutanganj, Burdwan, July 26, 2014–January 25, 2015.

Munshi, Soumyanentra, Indira Gandhi Institute of Development Research, Mumbai, May 19–June 20, 2014.

Ray, Indrajit, Department of Economics, University of Birmingham, United Kingdom, August 18-31, 2014.

Roy, Nilanjana, Department of Economics, Department of Economics, University Victoria, Canada, November 05-26, 2014.

Roychoudhury, Saurav, School of Management, Capital University, Columbus, Ohio, USA, since September 01, 2013–June 30, 2014.

Linguistic Research Unit, Kolkata

Chandra, Pritha, Indian Institute of Technology, Delhi, November 02-13, 2014.

Kar, Somdev, Indian Institute of Technology, Ropar, December 23, 2014.

Nandy, Paromita, University of Kerala, Trivandrum, India, February 05-06, 2015.

Rajendran, S., Amrita Vishwa Vidyapeetham, Coimbatore, February 08-15, 2015.

Ray, Arpita, International Institute of Information Technology, Hyderabad, India, May 06-07, 2014.

Schenkel, Elmar, Dept. of English, Leipzig University, Germany, February 23-24, 2015.

Psychology Research Unit, Kolkata

Basak, Rituparna, Department of Psychology, Salesian College, Siliguri, Darjeeling, April 01–July 31, 2014.

Chatterjee, Susmita, Manindra Chandra College, Kolkata, April 29, May 06 and 08, 2014.

Chatterji, Madhabi, Teachers College, Columbia University, New York, USA, February 20, 2015.

Economics and Planning Unit, Delhi

Anand, Rahul, International Monetary Fund, April 25, 2014

Asturias, Jose, Georgetown University, August 06-08, 2014.

Bag, Parimal, National University of Singapore, October 24- November 06, 2014.

Banerjee, Abhijit, Massachusetts Institute of Technology (MIT), October 24, 2014.

Banerjee, Prasenjit, University of Manchester, September 01 - November 30, 2014, January 09, 2015.

Barua Rashmi, March 01– April 30, 2015.

Bhargava, Alok, University of Maryland School of Public Policy**,** July 14, 2014**.**

Bhattacharya, Prasad, Deakin University, December 11-22, 2014.

Bhattacharya, Saurav, University of Pittsburgh, August 11-30, 2014.

Bloch, Francis, Paris School of Economics, February 07-16, 2015.

Chakrabarti, Anindya S., Boston University, January 16, 2015.

Chakraborty, Rajesh, August 1-November 30, 2014.

Chakravarty, Abhishek, University of Essex, September 05, 2014.

Chakravarty, Shoibal, March 16-23, 2015.

Chand, Srustidhar, University of Venice, April 01-August 31, 2014.

Cremades, Roger, International Max Planck Research School, October 20-December 18, 2014.

Dean, Spears, CDE, April 04, 2014.

Deshmukh, Jayeeta, Presidency University, October 18- November 05, 2014.

Dhillon, Amrita, King's College London, UK, August 11-30, 2014.

Dhingra, Swati, London School of Economics (LSE), UK, October 31, 2014.

Dimitrov, Dinko, Saarland University, Germany, February 23-28, 2015.

Dreze, Jacques, Université Catholique de Louvain, March 15-17, 2015.

Duflo, Esther, Massachusetts Institute of Technology (MIT), September 19, 2014.

Dutta, Prajit, Columbia University, August 12, 2014.

Visiting Scientists, Honours and Awards

Gupta, Ashmita, University of Houston, December 22, 2014.

Heraklis, Polemarchakis, University of Warwick, July 15, 2014.

Köhlin, Gunnar, University of Gothenburg, November 24, 2014.

Kumar, Rajnish, Queen's University, Belfast, December 01, 2014.

Lavy, Victor, University of Warwick, December 15-20, 2014.

Mallick, Debdulal, Deakin University, December 22, 2014-January 15, 2015.

Namrata, Kala, Yale University, March 20, 2015.

Nandeibam, Shasikanta, University of Bath, August 05, 2014.

Nath, Swaprava, Indian Institute of Science, September 01, 2014 – August 31, 2015.

Patil, Sumeet. R, University of California, Berkeley, January 29-30, 2015.

Pattanayak, Subhrendu K., Duke University, September 11, 2014.

Ray, Debraj, New York University, December 18-20, 2014.

Ray, Indrajit, University of Birmingham, August 21-22, 2014.

Rene, Saran, Yale University- Singapore, April 02, 2014.

Roy, Jaideep, University of Surrey, July 01-08, 2014.

Saggi, Kamal, Vanderbilt University, October 20, 2014.

Sahu, Sohini, Indian Institutes of Technology (IIT), Kanpur, October 31 – November 01, 2014.

Sane, Renuka, Indira Gandhi Institute of Development Research (IGIDR), July 01, 2014 - June 30, 2015.

Sarin, Rajiv, University of Exeter, October 27, 2014.

Singh, Gurbachan, January 01 – April 30, 2015.

Singh, Ram, Delhi School of Economics, November 21, 2014.

Tarroux, Benoit, University of Rennes I, February 15 - March 05, 2015.

Thakurata, Indrajit, Indian Institute of Management (IIM), Indore, July 23, 2014.

Tulin, Volodymyr, International Monetary Fund, April 25, 2014

Vandewalle, Lore, Graduate Institute of International and Development Studies, Geneva, February 13, 2015.

Wadhwa, Wilima, Annual States of Education Report Centre, New Delhi, August 01–November 30, 2014.

Zeng, Huaxia, Singapore Management University, October 10–November 10, 2014.

Economic Analysis Unit, Bangalore

Athreya,Venkatesh, M. S. Swaminathan Research Foundation (MSSRF), Chennai, March 06, 2015.

Bakshi, Aparajita, Tata Institute of Social Sciences, Mumbai, March 06, 2015.

Chand, Ramesh, National Centre for Agricultural Economics and Policy Research (NCAP), New Delhi, March 06, 2015.

Chandran, K.P., Central Plantation Crops Research Institute (CPCRI), Kasargod, Kerala, March 06, 2015.

Choudhury, Govinda North Bengal University, Kolkata, March 05 – 19, 2015.

Dhar, NiladriSekhar, Tata Institute of Social Sciences, Tulzhapur, March 06, 2015.

Jayaraman, T., Tata Institute of Social Sciences, Mumbay, April 07-14, 2015.

Mathew, Shalina , University of Hyderabad, India. April – September, 2014.

Miyata, Kazuyasu, Hokkaido University of Education, Japan, August 19-25, 2014.

Motiram, Sripad, Indira Gandhi Institute of Development Research (IGIDR), Mumbai, March 06, 2015.

Mukherjee, Sanchari, North Bengal University, Kolkata, March 05-13, 2015.

Murai, Kamal, Tata Institute of Social Sciences, Mumbai, April 07-14, 2015.

Ramkumar, R., Tata Institute of Social Sciences, Mumbai, March 06, 2015.

Rao, T.J., Vishakhapatnam, March 06, 2015.

Shindo, Junko, University of Yamanashi, Japan, April 07-14, 2015.

V. Surjit, International Crops Research Institute for the Semi-Arid-Tropics (ICRISAT), Hyderabad, March 06, 2015.

Vijay, R., University of Hyderabad, March 06, 2015.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Kolkata

De, P.K., Department of Mathematics, NIT Silchar, July 04-08, 2014.

SQC & OR Unit, Coimbatore

Ashokan, New Found Land University, Canada, December, 2014.

Visiting Scientists, Honours and Awards

Deshpande, Pradeep, Emeritus of Chemical Engineering, University of Louisville, USA, February 04, 2015.

Subramaniam, Uma, Staff Training College RBI, Chennai, June 29, 2014.

Center for Soft Computing Research: A National Facility, Kolkata

El-Baz, Ali Hassan Ali, Dept. of Mathematics, University of Damietta, Egypt, March 01-August 31, 2014.

Onifade, Olufade F., Williams University of Ibadan, Ibadan, Nigeria, October 13-18, 2014.

R.C. Bose Centre for Cryptology and Security, Kolkata

Anada, Hiraoki, International Symposium on Information Theory (ISIT) Labs, Japan, November 24-December 01, 2014.

Kawamoto, Junpei, Kyushu University, Japan, November 24-December 01, 2014.

HONOURS AND AWARDS

Roy, Bimal K.
Awarded: Padma Shri (Education and Literature), Government of India, 2015.

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Goswami, Debashish
Elected: Fellow of the Indian Academy of Sciences, 2015.

Gupta, Neena
Awarded: Ramanujan Prize, 2014, Ramanujan Institute for Advanced Study in Mathematics.

Stat-Math Unit, Delhi

Bandyopadhyay, Antar
Awarded: Finalist, NASI Scopus Young Scientist Award, 2014 (Mathematics), National Academy of Sciences, India and Elsevier Research Solutions.

Bhatia, Rajendra
Elected: Chair, Indian National Committee on Mathematics.

Parthasarathy, K.R.
Awarded: Ramanujan Medal, Indian National Science Academy.

Stat-Math Unit, Bangalore

Athreya, Siva
Elected: Fellow, Indian Academy of Sciences.

Sury, B.:
Elected: Fellow, National Academy of Sciences.

Applied Statistics Division

Applied Statistics Unit, Kolkata

Sen Gupta, Ashis
Awarded: Lifetime Achievement Award, Indian Association for Reliability and Statistics.

Interdisciplinary Statistical Research Unit, Kolkata

Basu, A.
Elected: Fellow, West Bengal Academy of Science and Technology, 2014.

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit, Kolkata

Bhattacharya, B.B.
Awarded: INAE Outstanding Teachers Award, 2014.

Computer Vision and Pattern Recognition Unit, Kolkata

Garain, Utpal
Elected: Technical Chair,
International Association for Pattern Recognition TC-6 (Computational Forensics).

Pal, Umapada
Elected: Fellow, International Association for Pattern Recognition.

Electronics and Communication Sciences Unit, Kolkata

Mukherjee, Dipti Prasad
Elected: Fellow of Computer Society of India.

Pal, Nikhil Ranjan
Awarded: Fuzzy Systems Pioneer Award, IEEE Computational Intelligence Society, USA.

Machine Intelligence Unit, Kolkata

Bandyopadhyay, S.
Selected: Senior Associate, International Centre for Theoretical Physics, Trieste, Italy, 2013 – 2019.
Elected: Fellow, West Bengal Academy of Science and Technology, 2014.

Physics and Earth Sciences Division

Physics & Applied Mathematics Unit

Pal, S.
Selected: Member, Executive Council, SKA-India Consortium
(a part of the Square Kilometer Array Telescope), 2015.

Social Sciences Division

Economics and Planning Unit, Delhi

Ghate, Chetan
Appointed: Member, External Expert Panel (Selection of Best Research Papers in RBI).
Nominated: Future International Leaders Program, UK, April, 2014.

Economic Analysis Unit, Bangalore

Ramachandran, V.K.
Awarded: Distinguished Achievement Award (Political Economy for the Twenty-First Century),
World Association for Political Economy, 2014
Elected: National Fellowship, Indian Council of Social Science Research, 2013-15.

Swaminathan,Madhura
Appointed: Member, Committee on Development Policy of the United Nations,
Department of Economic and Social Affairs, New York, 2014.

Library, Documentation and Information Sciences Division

Library, Kolkata

Basu, Tapas
Awarded: FIAP Bronze Medal, 14th Photographic Society of India, International-Print/ Digital-Salon, 2015;
61st Singapore International Photography Award, 2014 and
Certificate (Merit), 47th Howrah Colour Salon, 2015.

Pal, Jiban Krishna
Awarded: InfoShare Award, 2015, Special Interest Group for International Information Issues (SIG-III),
American Society for Information Science and Technology, USA.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Bangalore

John, Boby
Awarded: Best Paper Award, 2nd International Conference on Robust Quality Engineering, 2014.

Center for Soft Computing Research: A National Facility, Kolkata

Pal, S.K.
Elected: Fellow, Raja Ramanna Fellowship, Department of Atomic Energy.

R.C. Bose Center for Cryptology and Security, Kolkata

Ruj, Sushmita
Awarded: Global Research Outreach Award 2014, Samsung, Korea, 2014.

8. EDITORIAL AND OTHER SCIENTIFIC ASSIGNMENTS

EDITORIAL ASSIGNMENTS

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Delhi

Bapat, R.B. (Member, Advisory Board): *Mathematical Forum,* Dibrugarh University.

Bhatia, R. (Senior Editor): *Linear Algebra and Its Applications,* Elsevier; (Editor): *Operators and Matrices; Journal of Ramanujan Mathematical Society;* (Correspondent): *Mathematical Intelligencer*; (Managing Editor): *Texts and Readings in Mathematics;* Hindustan Book Agency.

Bhatt, A.G. (Co-editor): *Sankhya Series A*, Indian Statistical Institute publication.

Dewan, I. (Associate Editor): *Computational Statistics and Data Analysis; Journal of Indian Statistical Association; (*Associate Editor): *CSDA and JISA.*

Stat-Math Unit, Bangalore

Bhat, B.V. Rajarama (Chief Editor): *Proceedings of the Indian Academy of Sciences, Mathematics;* (Member of Council of Editors): *Resonance, Journal of Science Education*, 2014.

Ramasubramanian, S. (Associate Editor): *Sankhya, Series A*, 76, 2014.

Sarkar, J. (Refereeing Activity): Acta *Scientiarum Mathematicarum (Szeged); Acta Mathematica Scientia; Journal of Mathematical Analysis and its Applications, Journal of Operator theory; Linear Algebra and its Applications,* Proceedings of London Math Society*; Transaction of American Mathematical Society; (*Reviewing Activity): *AMS Reviewer,* Math Zblt.

Sury, B. (Editor): *Mathematical Sciences*, Proceedings of the Indian Academy of Sciences, IAS Bangalore; (Editor): *Mathematics Student,* INSA, Delhi; *Mathematics Newsletter*, Ramanujan Mathematical Society; (Associate Editor): *Resonace,* Indian Academy of Sciences, Bangalore.

Stat-Math Unit, Chennai

Ponnusamy, S. (Editor-In-Chief): *Mathematics Newsletter*, Ramanujam Mathematical Society; (Managing Editor): *Journal of Analysis*; (Associate Editor): *Bulletin of Malaysian Mathematical Sciences Society*.

Applied Statistics Division

Applied Statistics Unit, Kolkata

Biswas A. (Editor): *Sankhya* Series B, 2012-15; (Associate Editor): *Statistics & Probability Letters,* Elsevier; *Sequential Analysis,* Taylor and Francis; Communications *in Statistics: Theory and Methods,* Taylor and Francis; *Communications in Statistics: Simulation and Computation*, Taylor and Francis; *Sri Lankan Journal of Applied Statistics.*

Sen Gupta, A. (Guest Editor): *Environmental and Ecological Statistics*, 22(1); (Editor): *Scientiae Mathematicae Japonicae*, 2014-2015; (Associate Editor): *Statistics and its Applications*, 2014-2015; *Journal of Indian Statistical Association*, 2014-2015.

Interdisciplinary Statistical Research Unit, Kolkata

Basu, A. (Associate Editor): *Statistics and Computing*.

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit, Kolkata

Bhattacharya, B.B. (Editor): *Journal of Electronic Testing: Theory and Applications*, Springer.

Sur-Kolay, S. (Associate Editor): *ACM Transactions on Embedded Computing Systems*.

Computer Vision and Pattern Recognition Unit, Kolkata

Garain, U. (Associate Editor): *International Journal of Document Analysis and Recognition (IJDAR)*, Springer.

Pal, U. (Associate Editor*): Pattern Recognition Letters,* Elsevier*; ACM Transactions on Asian and Low-Resource Language Information Processing (*TALLIP*)*, ACM; *Electronic Journal on Computer Vision and Image Analysis*, CVC Press.

Electronics and Communication Sciences Unit, Kolkata

Mukherjee, D.P. (Associate Editor): *SADHANA*, Academy Proceedings in Engineering Sciences, Springer, 2014; *IEEE Transactions on Image Processing*, 2014; *IEEE Transactions on Systems, Man, and Cybernetics: Systems*; *IEEE Computational Intelligence Magazine*; *IEEE Access; Information Sciences,* Elsevier*; Neurocomputing,* Elsevier*;* (Founding Co Editor-in-Chief): *Swarm and Evolutionary Computing*, Elsevier Journal; (Editor): *Engineering Applications of Artificial Intelligence*, Elsevier.

Pal, N.R: (Associate Editor): *IEEE Transactions on Fuzzy Systems*, IEEE, 2014; *IEEE Transactions on Cybernetics,* IEEE, 2014; *International Journal of Approximate Reasoning,* Elsevier, 2014; *Fuzzy Information and Engineering*, Elsevier, 2014; *Journal of Neuroscience and Neuroengineering*, American Scientific Publishers, 2014; (Editorial Advisory Board Member): *International Journal of Knowledge Based Intelligent Engineering Systems*, IOS Press, 2014; *International Journal of Neural Systems*, World Scientific, 2014.

Machine Intelligence Unit, Kolkata

Bandyopadhyay, S. (Associate Editor): *BioSystems*; INAE-Letters; *IEEE Transactions on Systems, Man and Cybernetics*: *Systems*; *Sadhana Journal*, Springer and Indian Academy of Sciences.

Ghosh, A. (Associate Editor): *IET-Computer Vision*

Editorial and other Assignments

Mitra, S. (Associate Editor): *IEEE/ACM Trans. on Computational Biology and Bioinformatics, (IEEE TCBB),* 2010-15; *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery (WIRE DMKD),* 2008-2015*; Information Sciences,* 2013-2015*; Neurocomputing,* 2005-2015.

Documentation Research and Training Centre, Bangalore

Dutta, B. (Guest Editors): *Journal of Knowledge Management*, **19(1)**, Emerald Group Publishing, 2015.

Madalli, D.P. (Guest Editors): *Journal of Knowledge Management*, **19(1)**, Emerald Group Publishing, 2015.

Systems Science and Informatics Unit, Bangalore

Meher, S.K. (Guest Editor): *Pattern Recognition Letters*.

Sagar, B.S.D. (Editor), *Discrete Dynamics in Nature and Society (DDNS)*, **ISSN: 1026-0226 (Print), ISSN: 1607-887X (Online)**, Hindawi Publishers, 2003-2015; (Editorial Advisory Board Member): *Computers & Geosciences*, ISSN: 0098-3004, Elsevier Publishers, since 2014; (Associate Editor): *Image Analysis & Stereology*, since 2014; (Review Editor): *Frontiers: Environmental Informatics*, since 2014.

Physics and Earth Sciences Division

Geological Studies Unit, Kolkata

Chakraborty, C.: (Associate Editor): *Indian Journal of Geology*.

Chakraborty, T. (Guest Editor): *Tropical Rivers of South and South-East Asia: Landscape Evolution, Morphodynamics and Hazards*, Special issue.

Physics and Applied Mathematics Unit, Kolkata

Maiti, S.K. (Editor): *American Chemical Science Journal,* Science domain International, USA, since 2014.

Biological Sciences Division

Biological and Anthropology Unit, Kolkata

Banik, P. (Associate Editor): *World Journal of Agricultural Sciences; American-Eurasian Journal of Sustainable Agriculture; Research Journal of Agricultural and Biological Sciences.*

Chattopadhyay, J. (Editor/Associate Editor): *Journal of Nonlinear Evolution Equations and Applications; The Journal of Advance Research and Bioinformatics; Journal of Calcutta Mathematical Society.*

Social Sciences Division

Economics Research Unit, Kolkata

Chakravarty, S.R. (Associate Editor): *Social Choice and Welfare*, Springer Verlag, 2014; (Co-editor): *Economics E-Journal*, Kiel Institute of the World Economy, Germany, 2014; (Member of Advisory Board): *Economic Studies in Inequality*, Springer-Verlag.

Sarkar, N. (Associate Editor): *Indian Growth and Development Review*, Emerald Group Publishing Limited; *International Econometric Review*, Econometric Research Association.

Linguistic Research Unit, Kolkata

Dasgupta, P. (Editor): *Language Problems and Language Planning,* Amsterdam: Benjamins.

Dash, N.S. (Editor-in-Chief): *Journal of Advanced Linguistic Studies,* **ISSN: 2231-4075**, since 2011.

Psychology Research Unit, Kolkata

Dutta Roy, D. (Editor-in-Chief): Psybernews, since 2010.

Sociological Research Unit, Kolkata

Jana, R. (Statistical Editor): *Indian Journal of Dermatology*, since 2012.

Economics and Planning Unit, Delhi

Mishra, D. (Associate Editor), *Mathematical Social Sciences*.

Roy Chowdhury, P. (Editor-in-Chief): *Indian Growth and Development Review*, Emerald Press.

Somanathan, E. (Editor**)**: *Environment and Development Economics*, Cambridge University Press.

Economics Analysis Unit, Bangalore

Ramachandran, V.K. (Editor): *Review of Agrarian Studies*; (Contributing Editor): *Social Scientist*; (Editorial Advisory Board): *Critical Asian Studies*; (Editorial Advisory Board): *Journal of Agrarian Change.*

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Bangalore

Chowdhury, K.K. (Member, Academic Council): M.S. Ramaiah University of Applied Sciences, 2014-2016.

Editorial and other Assignments

Library, Documentation and Information Science Division

Library, Kolkata

Pal, J.K. (Member, Board of Editors): *Databib World Repository,* since October 2012.

Centre for Soft Computing Research: A National Facility, Kolkata

Ghosh. A. (Associate Editor): *IET-Computer Vision*.

Pal, S. K. (Associate Editor): *Information Sciences*, Elsevier; *Fuzzy Sets and Systems* , Elsevier; *Fundamenta Informaticae,* IOS Press; *Applied Intelligence*, Kluwer; *International Journal of Computational Intelligence and Applications*, World Scientific; *IET Image Processing,* IEE Press; *LNCS Trans. on Rough Sets*, Springer, *Journal of Intelligent Information Systems*, Springer; (Editor-in-Chief): *International Journal of Signal Processing,* Image Processing and Pattern Recognition, SERSC, Korea; (Executive Advisory Editor): *IEEE Trans. on Fuzzy Systems; International Journal of Approximate Reasoning*; *International Journal of Image and Graphics*; (Guest Editor): *IEEE Systems; Man and Cyberns-A; Pattern Recognition Letters; Fundamenta Informaticae; Theoretical Computer Science: Theory of Natural Computing,* Applied Soft Computing*; IET Image Processing*, Natural Computing, Springer; (Book Series Editor): *Frontiers in Artificial Intelligence and Applications (FAIA)*, IOS Press; Netherlands; *Statistical Science and Interdisciplinary Research,* World Scientific, Singapore.

SCIENTIFIC ASSIGNMENTS/ACADEMIC VISITS ABROAD

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Gupta, Neena:
(1) Tokyo Metropolitan University, Japan, September 08-15, 2014; (2) University of Toyama, Japan, September 15-17, 2014; (4) Fukui University, Japan, September 18-24, 2014.

Stat-Math Unit, Delhi

Bandyopadhyay, Antar:
ICM meeting, South Korea, August 13-21, 2014.

Bapat, R.B.:
(1) University of Tokyo, June 16-27, 2014; (2) 19th International Linear Algebra Society Conference, Seoul, Korea, August 06-09, 2014.

Bhatt, Abhay G.:
ICM meeting, Seoul, South Korea, August 13-21, 2014.

Bhatia, Rajendra:
(1) East China Normal University, Shanghai, China, July 16-18, 2014; (2) Sungkyunkwan University, Suwon, Korea, July 19-31, 2014; (3) International Congress of Mathematicians, Seoul, August 13-21,

2014; (4) General Assembly of International Mathematical Union, Gyeongju, South Korea, August 09-12, 2014; (5) Conference of International Linear Algebra Society, Seoul, August 1-9, 2014; (6) Institute of Statistical Mathematics, Tokyo, Japan, October 07-10, 2014, (7) University of California, Berkeley and San Jose State University, San Jose, California and American Institute of Mathematics, Palo Alto, California, USA, October 12-20, 2014; (8) University of Grenoble, France, January 12-16, 2015.

Chakrabarty, Arijit:
(1) Conference on Random Matrix Theory: Foundations and Applications, Krakow, Poland, July 01-06, 2014; (2) Department of Mathematics, University of Zurich, June 27-30, 2014.

Chatterjee, Arindam:
(1) Patrice Bertail, France; (2) Department of Statistics, North Carolina State University, Raleigh, USA, March 31, 2014-April 10, 2014; (3) 3rd Institute of Mathematical Statistics-Asia Pacific Rim Meeting (IMS-APRM 2014), Taipei, Taiwan, June 29, 2014-July 04, 2014.

Jain, Tanvi:
(1) ILAS (International Linear Algebra Society) Conference, Seoul, South Korea, August 06-09, 2014; (2) ICWM 2015, Seoul, South Korea, August 12-14, 2014; (3) ICM 2014, Seoul, South Korea, August 13-17, 2014.

Roy, Rahul:
(1) Universidade De Sao Paulo, Sao Carlos, Brazil, May 26–June 20, 2014; (2) Sao Carlos, Brazil and University of Waterloo, Waterloo, Canada, October 27-November 26, 2014.

Sarkar, Deepayan:
DSC 2014 (Directions in Statistical Computing) Conference, Brixen, Italy, June 24-30, 2014.

Sengupta, Ritabrata:
(1) Informatio Fenomens Quantics, Univesity Autonoma de Barcelona, Bellatera, Barcelona, Spain, July 15-August 02, 2014; (2) Theoretical Quantum Optics Group, University of Siegen, Germany, August 03-September 20, 2014.

Stat-Math Unit, Bangalore

Athreya, Siva:
(1) Columbia University, New York, USA, May 12–23, 2014; (2) University of Duisburg-Essen, Germany and Eurandom Workshop on Population Dynamics and Statistical Physics in Sinergy, Eindhoven, Netherlands, August 25–29, 2014; (3) Faculty of Industrial Engineering and Management of Technion Institute, Isreal, February 26–March 06, 2015.

Bhaskar Bagchi:
Mathematisches Forschungsinstitut Oberwolfach, Germany, February 01-08, 2015.

Bhat, Rajarama B.V.:
International Congress of Mathematicians 2014 (ICM 2014), Seoul, Korea and attended the 35th International Conference on Quantum Probability and Related Topics at Chungbuk National University, Cheongju, Korea, August 11-26, 2014.

Gorai, Sushil:
Stanford University, USA, September 20–November 20, 2014.

Rajeev, B.:
7th International Conference on Stochastic Analysis and Applications, Seoul, South Korea, August 06-11, 2014.

Editorial and other Assignments

Rao, T.S.S.R.K.:
(1) Department of Mathematical Sciences, University of Memphis, Tennessee, USA, January 05–March 06, 2015; (2) Michigan State University, East Lansing, USA, March 14-15, 2015; (3) Statistics and Probability Department, Michigan State University, USA, March 16-18, 2015.

Sarkar, Jaydeb:
(1) Workshop on Hilbert Modules and Complex Geometry, Oberwolfach, Germany and Institute of Mathematics, Prague, Czech Republic, April 20–May 04, 2014; (2) Romania and Institute of Mathematics, Simion Stoilow, Romanian Academy, Bucharest, Romania, June 30–July 11, 2014; (3) International Centre for Mathematical Sciences, Edinburgh, UK, July 20–27, 2014; (4) International Congress of Mathematicians 2014 (ICM 2014), Seoul, Korea and ICM Satellite Conference on Operator Algebras and Applications, Cheongpung, Korea, August 07–18, 2014.

Sreekantan, Ramesh:
Institute of Missouri, Saint Louis, USA, University of Maryland, USA and Centre de Researches Mathematiques (CRM), Montreal, USA, March 06–April 12, 2015.

Sury, B.:
International Congress of Mathematicians 2014 (ICM 2014), Seoul, Korea, August 12-21, 2014.

Thakur, Ajay:
University of Haifa, Israel, June–July 2014.

Yogeshwaran, D.:
(1) Institute Josef Stefan Institute, Slovenia, March 17-20, 2015; (2) 18th Workshop in Stochastic Geometry, Stereology and Image Analysis, Lingen, Germany, March 22-27, 2015.

Stat-Math Unit, Chennai

Ponnusamy, S.:
(1) Israel Institute of Technology, Technion, Haifa, Israel, May 11, 2014; (2) ORT Braude College, Karmiel, Israel, May 12, 2014; (3) Petrozavodsk State University, Petrozavodsk, Russia, June 29-July 05, 2014.

Sairam, Kaliraj:
Petrozavodsk state University, Petrozavodsk, Russia, June 29 - July 05, 2014.

Applied Statistics Division

Applied Statistics Unit, Kolkata

Bose, M.:
State University of Yogyakarta, Yogyakarta, Indonesia, November 26-30, 2014.

Biswas, A.:
University of Tokyo, Japan, March 28-31, 2015.

Dewanji, A.:
Fred Hutchinson Cancer Research Centre, Seattle, USA, August 2014.

Nandy, M.:
(1) University of Iowa State at Ames, USA, August, 2014; (2) ASIACRYPT 2014, Kaohsiung, Taiwan Republic of China, December 07, 2014; (3) Indo-Russia Workshop, Moscow, Russia, October 15, 2014.

Sarkar, P.:
20th Annual International Conference of the International Association of Cryptologic Research, Kaohsiung (ASIACRYPT 2014), Taiwan, Republic of China, December 07-10, 2014.

Sen Gupta, A.:
(1) Department of Statistics, University of California, Riverside, USA, April-July 2014; (2) University of Maryland, College Park, Maryland, USA, May 29-31, 2014; (4) International Conference of IISA, Riverside, California, USA, July 11-13, 2014; (5) IASSL International Conference 2014: Statistics and Society in the New Information Age, Colombo, Sri Lanka, December 28-30, 2014; (6) Department of Economics, University of California, Riverside, USA, April 28, 2014; (7) Department of Statistics, University of California, Santa Barbara, USA, May 07, 2014; (8) Department of Statistics, University of California, Riverside, USA, May 27, 2014; (9) Georgia Regents University, Augusta, Georgia, USA, September 2014.

Interdisciplinary Statistical Research Unit, Kolkata

Basu, A.:
(1) Complutense University, Madrid, Spain, November 08-15, 2014; (2) Institute of Statistical Research and Training (ISRT), Dhaka University, Bangladesh, December 27-29, 2014.

Bose, S.:
(1) Joint Meeting of International Society for Business and Industrial Statistics (ISBIS) and the American Statistical Association's Section on Statistical Learning and Data Mining (SLDM), Durham, North Carolina, U.S.A., June 09-11, 2014; (2) Renmin University, Beijing, China, November 28–30, 2014.

Pal, A:
(1) Joint Meeting of International Society for Business and Industrial Statistics (ISBIS) and the American Statistical Association's Section on Statistical Learning and Data Mining (SLDM), Durham, North Carolina, U.S.A., June 09-11, 2014; (2) Renmin University, Beijing, China, November 28–30, 2014.

Saharay, R.:
(1) Department of Mathematics and Statistics, Missouri University of Science and Technology, Rolla, MO, USA, August 2014-March 2015; (2) Department of Mathematics and Statistics, Indiana University Purdue University Indiana, USA, March 25-27, 2015.

Applied Statistics Unit, Chennai

Sen, Rituparna:
(1) International Conference organized by IASSL, Colombo, December 28-30, 2014; (2) IMS-APRM, Taipei, Taiwan, June 29-July 03, 2014; (3) International Symposium on Business and Industrial Statistics/ Conference of the ASA Section on Statistical Learning and Data Mining, Durham, NC, USA, June 09-11, 2014.

Sudheesh K.K.:
(1) Michigan State University, USA, November 30-December 03, 2014; (2) International Conference, organized by IASSL, Colombo, December 28-30, 2014; (3) JSM-2014, Boston, August, 02-08, 2014.

Editorial and other Assignments

Applied and Official Statistics Unit, North-East Centre, Tezpur

Chungkham, H.S.:
Stress Research Institute, Stockholm University, Sweden, February 16-27, 2015.

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit, Kolkata

Bhattacharya, B.B.:
(1) ECE Department, Duke University, USA, September 01, 2014-November 30, 2014; (2) San Jose State University, USA, November 06–07, 2014.

Sur-Kolay, S.:
Microsoft Research Global Faculty Summit 2014, Redmond, WA., USA, July 14-16, 2014.

Banerjee, A.:
NTU, Singapore, December 01-31, 2014.

Nandy, S.C.:
(1) Canadian Conference on Computational Geometry in Halifax, Canada , August 11-13, 2014 ; (2) Department of Computer Science, Carleton University, Ottawa, Canada, August 14-December 04, 2014; (3) Simon Fraser University, Canada, November 25-December 02, 2014.

Computer Vision and Pattern Recognition Unit, Kolkata

Bhattacharya, Ujjwal:
14th International Conference on Frontiers in Handwriting Recognition (ICFHR-2014), Crete, Greece, September 01-04, 2014.

Chaudhuri, Bidyut B.:
(1) Université François Rabelais, Tours, France, April 05-19, 2014; (2) International Workshop on Document Analysis Systems (DAS), Tours, France, April 07-10, 2014; (3) ICPR-2014, Stockholm, Sweden, and ICFHR-2014, Crete Island, Greece, August 23-September 06, 2014.
Chatterjee, Garga:
(1) Union of Concerned Scientists, Princeton University, NJ, USA, July 24–August 02, 2014; (2) Asian University of Women, Chittagong, Bangladesh, January 2015.

Garain, Utpal:
(1) 6th IAPR International Workshop on Computational Forensics, Stockholm, Sweden, August 24, 2014; (2) LITIS lab, University of Rouen, France, August 25-September 19, 2014; (3) Laboratoire L3i - Informatique, Image, Interactions, Université de La Rochelle, France, September 5, 2014.

Pal, Umapada:
(1) 11th IAPR International Workshop On Document Analysis Systems, Tours, France, April 07-10, 2014; (2) 14th International Conference on Frontiers in Handwriting Recognition (ICFHR-2014) Crete, Greece, September 01-04, 2014; (3) 22nd International Conference on Pattern Recognition (ICPR-2014), Stockholm, Sweden, August 24-28, 2014; (4) Université François Rabelais Tours, France, February 19-March 12, 2015; (5) 14th International Conference on Frontiers in Handwriting Recognition (ICFHR-2014), Crete, Greece, September 01-04, 2014.

Electronics and Communication Sciences Unit, Kolkata

Das, Swagatam:
18th Asia Pacific Conference on Intelligent and Evolutionary Systems (IES 2014), Singapore, November 10-12, 2014.

Mukherjee, Dipti Prasad:
(1) HCI International 2014, Crete, Greece, June 22, 2014; (2) National University of Singapore, Singapore, May 27-30, 2014.

Pal Nikhil Ranjan:
(1) IEEE Symposium Series on Computational Intelligence, Caribe Royale All-Suite Hotel & Convention Center, Orlando, USA, December 09-12, 2014; (2) Nanyang Technological University, Singapore, November 10-12, 2014; (3) Brain Research Center, National Chiao-Tung University, Taiwan, October 20-November 19, 2014; (4) IEEE CIS World Congress on Computational Intelligence, 2014, Beijing International Convention Center, Beijing, China, July 06-11, 2014; (5) IEEE Computational Intelligence Society, Beijing International Convention Center, Beijing, China, July 11-13, 2014.

Machine Intelligence Unit, Kolkata

Bandyopadhyay, S.:
(1) Institut Polytechnique de Grenoble, France, September 2014; (2) International Center for Theoretical Physics (ICTP), Trieste, Italy, May 2014; (3) INAE-NATF Workshop on Healthcare, Evry, France, October 15, 2014; (4) Universit J. Fourier, Grenoble, France, September 18, 2014.

Ghosh, A.:
University of Trento, Italy, July-August, 2014.

Mitra, S.:
(1) AGH University of Science and Technology, Krakow & University of Warsaw, Warsaw, Poland, September 26-October 11, 2014; (2) Department of Computer Science, Meiji University, Kawasaki, Japan, December 23, 2014-January 11, 2015 and February14-28, 2015.

Documentation, Research and Training Centre, Bangalore

Dutta, Biswanath:
(1) University of Trento, Italy, November 26-December 05, 2014 and February 15–21, 2015; (2) International Conference on Information, Process, and Knowledge Management (eKNOW-2015), Lisbon, Portugal, February 22-27, 2015.

Madalli, Devika P:
(1) University of Trento, Italy, and ISKO Conference, Poland, May 04-23, 2014; (2) Chinese Academy of Science, Beijing, China, June 06-20, 2014; (3) Data Archiving and Networked Services (DANS), Amsterdam University, The Netherlands, September 21-24, 2014; (3) University of Trento, Italy, November 26-28, 2014.

Prasad, A.R.D.:
(1) Chinese Academy of Science, Beijing, China, June 06-14, 2014; (2) University of Trento, Italy September 10-17, 2014 and November 26-28, 2014; (3) AGRIS, FAO, Rome, September 17-22, 2014; (4) Data Archiving and Networked Services (DANS), Amsterdam University, The Netherlands, September 21-24, 2014.

Editorial and other Assignments

Systems Science and Informatics Unit, Bangalore

Majumdar, Kaushik:
Department of Epileptology, University of Bonn, Germany, December 15-December 18, 2014.

Sagar, B.S.D.:
(1) 34th IEEE International Geosciences and Remote Sensing Symposium, Milan, Italy, July 26-31, 2014; (2) 17th International Association for Mathematical Geoscience (IAMG) Conference, Freiberg, Germany, September 05-13, 2015; (3) International Symposium on Mathematical Morphology, Iceland, Rykjavik, 2015; (4) Proposal Reviewer for National Science Foundation-USA (NSF), 2014.

Computer Science Unit, Chennai

Ghosh, Sujata:
(1) ILLC Workshop on Collective Decision Making, Amsterdam, March, 2015; (2) University of Groningen, Netherlands, March, 2015; (3) University of Amsterdam, Netherlands, March, 2015; (4) Membership Committee, Association for Symbolic Logic, 2014; (5) Workshop on Logic and Games, Vienna Summer of Logic, Austria, July, 2014. (6) Multi-Agent Systems Group Seminar, University of Groningen, Netherlands, June, 2014. (7) University of Groningen, Netherlands, April-June, 2014.

Physics and Earth Sciences Division

Geological Studies Unit, Kolkata

Chakraborty, Chandan:
International Conference on Geology and Geophysics, Beijing, China, June 13–15, 2014.

Sengupta, D.P.:
74th Annual General Meeting and Conference of the Society of Vertebrate Paleontology, Berlin, Germany, November 04–09, 2014.

Physics and Applied Mathematics Unit, Kolkata

Basu, Banasri:
International Conference on Mathematical Problems in Engineering, Aerospace and Sciences, Narvik University, Norway, July 14–18, 2014.

Ghosh, Subir:
(1) International Conference on Frontiers in Nuclear, Elementary Particle and Condensed Matter Physics, Dubna, Russia, June 14-26, 2014; (2) TWAS-UNESCO with Department of Physics, National University of La Plata in Buenos Aires, Argentina, March 10–28, May 2015.

Roy, Pinaki:
INFN Sezione di Perugia, November 06–December 06, 2014.

Biological Sciences Division

Agricultural and Ecological Research Unit, Kolkata

Chattopadhyay, Joydev:
Sultan Qaboos University, Muscat, Oman, September 20, 2014-January 21, 2015.

Human Genetics Unit, Kolkata

Chatterjee, Raghunath:
National Cancer Institute, National Institutes of Health, Bethesda, Maryland, USA, June 01-30, 2014.

Ghosh, Saurabh:
(1) European Mathematical Genetics Meeting, Cologne, Germany, April 01-02, 2014; (2) International Biometric Society Meeting, Florence, Italy, July 06-10, 2014.

Social Sciences Division

Economic Research Unit, Kolkata

Chakravarty, Satya Ranjan:
University of International Business and Economics, Beijing, People's Republic of China, September 23–October 22, 2014.

Majumder, Amita:
33rd General Conference of the International Association to Research in Income and Wealth (*IARIW*), Rotterdam, The Netherlands, August 27-31, 2014.

Maiti, Pulakesh:
(1) Institute of Mathematical Research of UPM, Malaysia, August 04-14, 2014; (2) International Conference on Applied Statistics (ICAS), Dhaka, Bangladesh, December 26-30, 2014.

Mitra, Manipushpak:
(1) Adam Smith Business School, University of Glasgow, UK; University of New York, US; University of Leicester, UK and University of Birmingham, UK, April 30–May 15, 2014; (2) Workshop in Seoul National University, Korea, October 15–22, 2014; (3) Department of Economics of Seoul National University, South Korea, December 22–26, 2014.

Pal, Manoranjan:
(1) 2nd ISM International Statistical Conference, at Pahang, Malaysia, August 10-15, 2014; (2) International Conference on Applied Statistics (ICAS), Dhaka, Bangladesh, December 26-30, 2014.

Sarkar, Abhirup:
2nd NZ Indian Research Institute International Conference, University of Waikato in Hamilton, New Zealand, November 29–December 05, 2014.

Linguistic Research Unit, Kolkata

Dasgupta, Probal:
Department of Linguistics, University of Konstanz, Konstanz, Germany, September 29-30, 2014.

Editorial and other Assignments

Dash, Niladri Sekhar:
Interdisciplinary Centre for Social and Language Documentation (CIDLeS), Minde, Portugal, August 18-23, 2014.

Psychology Research Unit, Kolkata

Dutta Roy, D:
Annual Conference on Social Studies, Communication and Education, Kualalumpur, Malayasia, September 07-09, 2014.

Ghosh, Anjali:
28th International Congress of Applied Psychology Paris, France, July 08-13, 2014.

Gupta, Rumki:
International Conference on Advancements in Engineering, Technology and Management, Bangkok, Thailand, July 25-26, 2014.

Sampling and Official Statistics Unit, Kolkata

Mitra, Sandip:
(1) Durban University, South Africa, June 21-22, 2014; (2) Bangladesh Rural Advancement Committee (BRAC) University, Bangladesh, October 14-17, 2014; (3) Bangladesh Rural Advancement Committee (BRAC) University, Bangladesh, December 11-13, 2014.

Sociological Research Unit, Kolkata

Ghosh, Bhola Nath:
(1) University Malaysia, Pahang, Malaysia, August 12–14, 2014; (2) Institute of Research and Training (ISRT), University of Dhaka, December 27-29, 2014.

Behera, H.C.:
Japanese Society of Cultural Anthropology (JASCA) 50th Anniversary Conference, International Conference Hall Makuhari Messe, Chiba City, Tokyo, May 15-18, 2014.

Economics and Planning Unit, Delhi

Ghate, Chetan:
(1) University of Western Australia, Australia, June 04-06, 2014; (2) United Nations University, Finland, September 04-08, 2014.

Mukhopadhyay, Abhiroop:
(1) CMI, Bergen, Norway, June 01-18, 2014; (2) Boston College, USA, June 17-20, 2014; (3) University of Connecticut, USA, October 27-November 14, 2014; (4) Allied Social Science Association Conference, Boston, US, January 2-7, 2015; (5) Monash University and Australian National University, Australia, February 20-March 06, 2015.

Mishra, Debasis:
(1) Osaka University, Japan, May 17-31, 2014; (2) University of Glasgow, UK, April 28–May 02, 2014; (3) Boston College, USA, June 17-20, 2014; (4) Osaka University, Japan, September 15-26, 2014.

Ramaswami, Bharat:
(1) Rutgers University, New Jersey, USA, September 16-19, 2014; (2) IFPRI, Washington DC, November 03-07, 2014; (3) University in Melbourne, Australia, February 02-06, 2015.

Roy Chowdhury, Prabal:
(1) Kennesaw State University, USA, July 15-22, 2014; (2) Murdoch University, Perth and Monash University, Melbourne, Australia, November 10-December 10, 2014.

Sen, Arunava:
(1) University of BATH and University of Glasgow, UK, April 30-June 23, 2014; (2) Sharif University, IPM, Tehran, Iran, November 10-23, 2014; (3) Yale University and Penn State and University of Pennsylvania, USA, March 31- April 21, 2015.

Somanathan, E:
(1) IPCC plenary session, Berlin, April 06-11, 2014; (2) SANDEE Research and Training Workshop, Thimphu, Bhutan, June 16-20, 2014; (3) REDD+ and Community Forestry Workshop, Kathmandu, Nepal, June 24-25, 2014; (4) World Congress of Environmental and Resource Economists, Istanbul, Turkey, June 29–July 02, 2014; (5) IPCC Conference, University of Gothenburg, Sweden, October 16-17, 2014; (6) SANDEE Kathmandu, Nepal, December 08-12, 2014.

Economics Analysis Unit, Bangalore

Ramachandran, V.K.:
(1) Vietnamese Academy of Social Sciences, Hanoi, Vietnam, May 23-26, 2014; (2) School of African and Oriental Studies, UK, October 16, 2014; (3) Chancellor's Lecture, University of Michigan, Dearborn, USA, March 23, 2015.

Swaminathan, Madhura:
(1) University of Alberta, Canada, April 29-May 02, 2014; (2) Vietnamese Academy of Social Sciences, Hanoi, Vietnam, May 23-26, 2014; (3) University of Zurich, Switzerland, July 23-26, 2014; (4) Somerville India Centre, University of Oxford, UK, October 20, 2014.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Coimbatore

Rajagopal, A.:
Quality Management Certification Agency (GCAS), Dubai, January 21-24, 2015.

SQC & OR Unit, Hyderabad

Murthy, G.S.R.:
Department of Industrial and Systems Engineering, Lehigh University, Bethlehem, Pennsylvania, USA, August 15, 2014.

SQC & OR Unit, Mumbai

Ashok Sarkar:
Thai Phosphate, Thailand, May 18-23, 2014.

Editorial and other Assignments

Center for Soft Computing research: A National Facility, Kolkata

Ghosh, A.:
University of Trento, Italy, July 18-August 12, 2014.

Pal, S.K.:
(1) 3rd International Conference on Informatics, Electronics & Vision (ICIEV), Dhaka, Bangladesh, May 22-26, 2014; (2) American International University, Banani, Dhaka, Bangladesh, May 26, 2014; (3) Computer Science Department, Hong Kong Baptist University, Hong Kong, China, June 12, 2014; (4) United International College of HK, Baptist University, Zhuhai, China, June 16, 2014; (5) 6th International Conference on Nature and Biologically Inspired Computing (NaBIC'14), Porto, Portugal, July 30-August 01, 2014; (6) 6th International Conference on Soft Computing and Pattern Recognition 2014 (SoCPaR'14), Tunis, Tunisia, August 11–14, 2014; (7) 3rd International Conference on Information Science and Industrial Applications, Harbin, China, August 22-24, 2014; (8) University of Science & Technology, Cox's Bazar, Chittagong, Chittagong Bangladesh, October 21-23, 2014; (9) 25th General Meeting of TWAS and the Closed Committee and Council Meeting, Shangri La's Barr Al Jissah Resort & Spa Muscat, Sultanate of Oman, October 25-29, 2014; (10) 9th International Conference on Rough Sets and Knowledge Technology (RSKT 2014), Shanghai, China, October 24-26, 2014; (11) 4th World Congress on Information and Information Technology (WICT'14), Melaka, Malaysia, December 08–11, 2014; (12) Gulf University for Science and Technology, Kuwait, December 14-16, 2014.

R.C. Bose Centre for Cryptology and Security, Kolkata

Barua, Rana:
(1) International Congress of Mathematicians (ICM 2014), Seoul, Korea, August 13-22, 2014; (2) University of Nevada, Department of Computer Science, Las Vegas, USA, July 17, 2014.

Paul, Goutam:
University at Albany, State University of New York, Department of Computer Science, USA, July 21, 2014.

Ruj, Sushmita:
(1) Indo-Russia Joint Workshop on Cryptography and Discrete Mathematics, Moscow, Russia, October 15, 2014; (2) IEEE Trustcom, Beijing, China, September 24, 2014; (3) Shanghai, Jiao Tong University, China, September 22, 2014, (4) ISIT, Fukuoka, Japan, September 18, 2014; (5) Institute of Industrial Mathematics, Kyushu University, Japan, September 17, 2014; (6) Department of Informatics, Kyushu University, Japan, September 16, 2014; (7) Incheon National University, Korea, March 23, 2015.

Printing and Publication Unit, Kolkata

Bhattacharya, Chinmay:
International Conference on Imaging and Printing Technology (ICIPT 2014), Bangkok, Thailand, November 05-07, 2014.

SCIENTIFIC ASSIGNMENTS/ ACADEMIC VISITS IN INDIA

Theoretical Statistics and Mathematics Division

Stat-Math Unit, Kolkata

Dutta, Amartya Kumar:
(1) Delivered Lecture, Workshop on Mathematics and Astronomy in Ancient India, IIT, Kanpur, October 31, 2014; (2) Delivered Lecture, 150th Anniversary of St. Paul's Cathedral Mission College, Kolkata, November 13, 2014; (3) Delivered Lecture, UNESCO Programme on International Understanding for Human Unity, Ramakrishna Mission Institute of Culture, Kolkata, November 18, 2014; (4) Delivered Lecture, National Council of Education, Bengal, Kolkata, November 23, 2014; (5) Delivered Lecture, International Conference on History and Development of Mathematics, University of Pune, Maharashtra, November 27, 2014; (6) Delivered Lectures, Special Session on Bhaskaracharya, International Conference on History and Development of Mathematics, University of Pune, Pune, November 30, 2014; (7) Delivered Lectures, Sri Aurobindo International Centre of Education, Pondicherry, January 02--03, 2015; (8) Delivered Lecture, National Seminar on Recent Advances in Mathematics and its Applications, University of Calcutta, Kolkata, March 12, 2015; (9) Delivered Lecture, National Seminar on Bhaskaracharya's Siddhantasiromani, Asiatic Society, Kolkata, March 19, 2015; (10) Delivered Lecture, Postgraduate Diploma Course in Ideology, Ramakrishna Mission Institute of Culture, Kolkata, West Bengal, 2014-15; (11) Member, Advisory Committee, International Conference on History and Development of Mathematics, University of Pune, Maharashtra, November 27, 2014.

Gupta, Neena:
(1) Participated, YWM Symposium, IISER, Pune, July 25-27, 2014; (2) Participated, Discussion Meeting, IIT Bombay, Mumbai, October 27-November 01, 2014; (4) Visited for Research Purpose, School of Mathematics TIFR, Mumbai, November 02-09, 2014; (5) Participated, Networking-cum-Discussion Meet for INSPIRE Faculty Awardees of East and North-Eastern Zone, Tezpur University, Assam, March 20-21, 2015.

Stat-Math Unit, Delhi

Bhatia, R.:
(1) Elected Chair, National Committee on Mathematics of the International Mathematical Union, 2014-15; (2) Elected Member, Council of Indian Academy of Sciences, 2014-15; (3) Elected Member, Selection Committee for Mathematics, Indian National Science Academy, New Delhi, 2014-15; (4) Elected Member, Academic Council, Tata Institute of Fundamental Research, Mumbai, 2014-15; (5) Elected President, Association of Mathematics Teachers of India, Chennai, Tamil Nadu, 2014-15; (6) Elected Member, Selection Committee, I.I.T., Bombay and Panjab University, Chandigarh, 2014-15;(7) Elected Member, Research Advisory Committee, IISER, Mohali, 2014-15; (8) Elected Member, INSA INSPIRE Selection Committee, New Delhi, 2014-15; (9) Attended, International Conference on Linear Algebra and Applications, Manipal University, Manipal, Karnataka, December 18-20, 2014; (10) Attended, Workshop on Numerical Linear Algebra and Its Applications, BITS, Hyderabad, February 01, 2015; (11) Attended, P.V. Sukhatme Memorial Lecture, I.I.T., Bombay, February 10, 2015; (12) Attended, National Conference in Mathematics, Aggarwal College, Ballabgarh, Faridabad, Haryana, February 21, 2015; (13) Attended, Ramanujan Distinguished Lecture, C.R. Rao Institute, Hyderabad, February 27, 2015.

Chatterjee, Arindam:
Visited for Collaborative Research, IIM, Ahmedabad, August 25-26, 2014.

Editorial and other Assignments

Dewan, Isha:
Attended and Delivered Lecture, National Meet of Research Scholars in Mathematical Sciences, Jammu, December 10-12, 2014.

Jain, Tanvi:
(1) Attended, 25th Mid-Year Meeting of the Indian Academy of Science at Indian Institute of Science (IISc), Bangalore, July 02-07, 2014; (2) Attended Delivered Lecture, Indian Academy of Sciences Mid-Year Meeting, IISc, Bengaluru, July 04-05, 2014.

Laishram, Shanta:
(1) Visited for Collaborative Research, Himachal Pradesh University, Shimla, June 16-July 04, 2014; (2) Visited for Research Purpose, Tata Institute of Fundamental Research, Mumbai, November 23-December 12, 2014; (3) Visited for Research Purpose, NISER, Bhubaneswar, April 06-09, 2014; (4) Visited for Research Purpose, IIT, Hyderabad, April, 14-16, 2014; (5) Visited for Research Purpose, IMOTC, HBCSE, May 3-10, 2014; (6) Attended, MTTS Conference, RIE, Mysore, May 17, 2014; (7) Visited for Research Purpose, IISc, Bengaluru, May 18-24, 2014; (8) Visited, AIS on Diophatine Equation, H.P. University, Shimla, June 16-July 04, 2014; (9) Visited for Research Purpose, IIT, Guwahati, October 29-November 01, 2014 ; (10) Visited for Research Purpose, Kerala School of Mathematics, Kozhikode, November 17-24, 2014; (11) Visited for Research Purpose, IIST, Trivandrum, November 21, 2014; (12) Visited for Research Purpose, TIFR, Mumbai, November 23-December 13, 2014; (13) Attended, Discussion Meeting, TIFR, Mumbai, January 05-09, 2015.

Sarkar, Deepayan:
Participated, Fourth Annual Novartis Hyderabad Conference on Statistics, January 07-08, 2015.

Singh, Ajit Iqbal:
(1) Delivered Lecture, Symposium on Finite Groups at the Ramanujan Math Soc Conference, IISER, Pune, June, 2014; (2) Delivered Lecture, International Conference on Linear Algebra and Applications, Manipal University, Mangalore, December 18-20, 2014.

Thakur, Maneesh:
(1) Visited for Collaborative Research, Indian Institute of Technology, Mumbai, April 15-17, 2014; (2) Visited for Collaborative Research, Tata Institute of Fundamental Research, Mumbai, May 05-09, 2014; (3) Visited for Research Purpose, Indian Institute of Science Education and Research, Mohali, June 02-20, 2014.

Stat-Math Unit, Bangalore

Athreya, Siva:
Visited for Research Purpose, IIT Bombay, Mumbai, November 03–06, 2014.

Bagchi, Sunanda:
Attended and Presented Paper, Comnference on Interclass Orthogonal main effect plans, NIT, Surathkal, Mangalore, December 18-20, 2014.

Bhat, Rajarama, B.V.:
(1) Visited for PhD. Viva, IIT, Bombay, Mumbai, May 07, 2014; (2) Delivered Lecture, NIT Surathkal, Karnataka, June 07, 2014; (3) Visited as Mentor, INSPIRE Internship Programme, Trident Academy of Technology, Bhubaneswar, Odisha, June 23-24, 2014; (4) Delivered Lecture, UGC Sponsored seminar on Recent Advances in Mathematics, St. Mary's College, Thrissur, Kerala, September 26, 2014; (5) Attended, Workshop on Master Class in Modular Theory of Von Neumann Algebras, IMSc., Chennai, November 24-25, 2014; (6) Delivered Lecture, Workshop on Master Class in Modular Theory of Von Neumann Algebras, Manipal University, Karnataka, December 19-23, 2014; (7) Delivered Lecture, 80th Annual Conference of the Indian Mathematical Society, Dhanbad, Jharkhand, December

12-31, 2014; (8) Conducted and Delivered Lecture, Workshop on Linear Algebra and Related topics, Rani Channamma University, Belgavi, Karnataka, March 02-03, 2015.

Biswas, Jishnu:
Attended, Workshop in Algebraic Geometry, Manipal University, Mangalore, January 07-09, 2015.

Gorai, Sushil:
Delivered Lecture and Chaired Session, International Conference in Geometric Function Theory and its applications, IIT, Kharagpur, December 18–21, 2014.

Naolekar, Anita:
Delivered Lecture, Young Women in Mathematics Teacher's Training Programme, Erode, Tamil Nadu, November 20-21, 2014.

Nayak, Suresh:
Attended, Workshop in Algebraic Geometry, Manipal University, Mangalore, January 05-09, 2015.

Padmawar, V.R.:
Conducted and Delivered Lecture, Workshop on Linear Algebra and Related topics, Rani Channamma University, Belgavi, Karnataka, March 02-03,2015.

Raja, C.R.E.:
Delivered Lecture, Conference on Recent Advances in Pure and Applied Mathematics, Department of Mathematics, St. Xavier's College, Palayamkottai, Tirunelveli, Tamil Nadu, September 04-05, 2014.

Rajeev, B.:
Delivered Lectures, IIT-Bombay, Mumbai, September 29–October 01, 2014.

Sarkar, Jaydeb:
(1) Delivered Lecture, Department of Mathematics, Tripura University, Agartala, January 19-23, 2015; (2) Delivered Lecture, National Seminar on Mathematical Analysis and Its Applications, University College, Thiruvananthapuram, January 28-29, 2015; (3) Delivered Lecture, Conference on Geometry of Banach Spaces and Operator Theory, IIT, Kanpur, March 26-29, 2015.

Sreekantan, Ramesh:
(1) Attended, Workshop in Algebraic Geometry, Manipal University, Mangalore, January 05-09, 2015; (2) Attended, Conference on Algebraic Cycles, TIFR, Mumbai, December 26-31, 2014; (3) Attended, ICTS Programe on p-adic aspects of modular forms, IISER, Pune, Maharashtra, June 09-22, 2014. (4) Delivered Lecture, IMSc., Chennai, November 19-21, 2014.

Sury, B.
(1) Delivered Lecture, International Math Olympiad Training Camp, Homi Bhabha Centre for Science Education, TIFR, Mumbai, May 05-06, 2014; (2) Visited, Mathematical Olympiad Question Paper Generation Camp, Homi Bhabha Centre for Science Education, TIFR, Mumbai, September 19-24, 2014; (3) Participated & Delivered Lecture, Workshop on the Theory of equation organized by INSA, Shivaji College, Delhi University, New Delhi, October 16-17, 2014; (4) Delivered Lecture, Pavanathma College, Murickassery, Kerala, December 05, 2015; (5) Participated & Delivered Lecture, International Conference in Analytic Number Theory, TIFR, Bombay, January 04–09, 2015.

Stat-Math Unit, Chennai

Balakumar, G.P.:
(1) Delivered Lecture, One day Colloquium, Vaidhyanathaswamy Mathematics Trust, Ramanujan Institute for Advanced Study in Mathematics, University of Madras, Chennai, Tamil Nadu, March 2015;

Editorial and other Assignments

(2) Visited & Delivered Lecture, Department of Mathematics and Statistics, Hyderabad Central University, September 2014; (3) Delivered Lecture, IIT, Bombay, April, 2014.

Ponnusamy, S.:
(1) Delivered Lecture, Inspire Internship Science Camp (an initiative of DST), Sri Lakshmi Ammaal Engineering College, Chennai, January 23, 2015; (2) Delivered Lectures, International Conference on Geometric Function Theory and its Applications (ICGFTA-2014), IIT, Kharagpur, December 17-22, 2014; (3) Delivered Lectures, Refreshed Course for College Teachers, Bharathidasan University, Tiruchirappalli, Tamil Nadu, November 17-18, 2014; (4) Delivered Lecture, Selected Group of HSS Students, Department of Statistics, D.R.B.C.C. Hindu College, Chennai, October 17, 2014.

Sairam, Kaliraj:
Delivered Lecture, International Conference on Geometric Function Theory and its Applications, IIT, Kharagpur, West Bengal, December 18-21, 2014.

Applied Statistics Division

Applied Statistics Unit, Kolkata

Purkayastha, Sumitra:
(1) Delivered Lecture as Mentor, INSPIRE Internship Programme, National Institute of Technology, Sikkim, June 23, 2014; (2) Delivered Lecture as Mentor, INSPIRE Internship Programme, B.N.M. Homeopathy Medical College & Hospital, Saharsa, Bihar, July 15, 2014; (3) Delivered Lecture as Mentor, INSPIRE Internship Programme, Vedant College of Engineering & Technology, Bundi, Rajasthan, November 17, 2014.

Sarkar, P.:
Delivered Lecture, 18th Workshop on Elliptic Curve Cryptography, Institute of Mathematical Sciences, Chennai, October 10, 2014.

SenGupta, A.:
(1) Member, Program Advisory Committee of Mathematical Sciences, Department of Science & Technology, Government of India, 2014; (2) External Member, Board of Research Studies, Department of Statistics, Central University of Bihar, Patna, 2014; (3) External Expert, Faculty Selection and Promotion Committee, Department of Mathematics, Indian Institute of Technology, Kharagpur, March 2015; (4) Ph.D. Viva Voce Examiner, Indian Institute of Technology, Patna, 2014; (5) Delivered Lecture, National Meet of Research Students in Mathematical Sciences (NMRSMS-14), Jammu University, Jammu, December 08-12, 2014; (6) Delivered Lecture, University of Pune, Pune, January 02-03, 2015; (7) Delivered Lecture, Conference on Recent Trends and Developments in Statistics, M.D. University, Haryana, Rohtak, February 21-23, 2015; (8) Delivered Lecture, Conference on Statistics and OR, Aligarh Muslim University, Aligarh, March 24-25, 2015; (9) Examiner Ph.D. Theses, Jadavpur University, Kolkata, 2014-2015.

Interdisciplinary Statistical Research Unit, Kolkata

Bose, S.:
Delivered Lecture, International Workshop on Statistical Methods for Business and Industry Applications, Chennai, India, January 08-09, 2015.

Pal, A.:
Delivered Lecture, Refresher Course on Statistical Analysis of Geoscientific Data using Statistical Software, Regional Training Institute, Eastern Region, Geological Survey of India, Kolkata, April 09, 2014.

Applied Statistics Unit, Chennai

Sen, Rituparna:
(1) Attended and Delivered Lecture, National Conference on Recent Trends, Statistical Theory and Practice, University of Madras, Chennai, March 16–17, 2015; (2) Delivered Lecture, Hindustan University, Chennai, Tamil Nadu, April 08, 2015; (3) Delivered Lecture, 8th Statistics Day Conference, The Reserve Bank of India, Mumbai, September, 2014; (4) Delivered Lecture, National Level Advanced Orientation Programme in Statistics, S.D.N.B., Vaishnav College for Women, Chennai, August 18-22, 2014.

Sudheesh, K.K.:
(1) Delivered Lecture, Department of Statistics, University of Mysore, Mysore, March 9-10, 2015; (2) Delivered Lecture, Department of Statistics, University of Madras, Chennai, January 6, 2015.

Computer and Communication Sciences Division

Advanced Computing and Microelectronics Unit, Kolkata

Bhattacharya, B.B.:
(1) Delivered Lecture, 18th International Symposium on VLSI Design and Test, PSG College of Technology, Coimbatore, July 16-18, 2014; (2) Delivered Lecture, International Conference on Electronic Design, Computer Networks and Automated Verification, NIT, Shillong, Meghalaya, January 29-30, 2015; (3) Delivered Lecture, Workshop on Research Challenges in Reversible and Quantum Computing, NIT, Shillong, March 19-20, 2015.

Das, N.:
(1) Attended, IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS) 2014, CDAC, Delhi and ITRA (Media Lab Asia) Mobile computing Workshop, Delhi, August 2014; (2) Member Advisory Committee, Computer Science & Engineering Department, NITK, Surathkal, Karnataka; (3) Delivered Lecture, CINE 2015, KIIT, Bhubaneswar, January 2015; (4) Tutorial Lecture Faculty Development Program, Recent Advances in Computer Networking, Department of Computer Science & Engineering, RCCIIT, Kolkata, July, 2014; (5) Program Co-Chair, ANTS, 2015; (6) Organizing Co-Chair, Indo-US Bilateral Workshop on Large Scale Complex Network Analysis, Kolkata 2015; (7) Member, Program Committee, INiS, 2015, ICSCTA, Faridabad, India, 2015; (8) Member, Technical Program Committee, NCC, 2015, ReTIS, Jadavpur University, Kolkata, 2015; (9) Member, ICIT, Bhubaneswar, 2014; (10) Member, ETCC, 2014; (11) Member, ICAA, 2014; (12) Member, ICACNI,Orissa, India, 2014.

Sur-Kolay, S.:
(1) Attended, 18th International Symposium on VLSI Design and Test, Coimbatore, July 16-18, 2014; (2) Chair & Delivered Lecture, Workshop on Embedded Systems Security (WESS), co-located with ESWEEK'14, New Delhi, October 12-17, 2014; (3) Visited for Collaborative Research Purpose, Department of Electrical Engineering, IIT, Madras, December 08-09, 2014; (4) Delivered Lecture, 5th International Symposium on Electronic System Design (ISED'14), NIT, Surathkal, Mangalore, December 15-17, 2014.

Editorial and other Assignments

Sinha, B.P.:
Visited as Distinguished Adjunct Professor, National Institute of Technology, Arunachal Pradesh, April 01–30, 2014.

Computer Vision and Pattern Recognition Unit, Kolkata

Bhattacharya, Ujjwal:
Delivered Lecture, North East Workshop on Pattern Analysis and Applications, Nagaland University, Dimapur, February 13, 2015.

Chaudhuri, Bidyut B.:
Delivered Lecture, SEMCCO Conference, SOA University, Bhubaneswar, December 18, 2014.

Chatterjee, Garga:
(1) Delivered Lecture, St. Xaviers College, Kolkata, 2014; (2) Delivered Lecture, Ashoka University, Haryana, 2014; (3) Delivered Lecture, Young Investigator's Meeting, Kashmir, 2014; (4) Delivered Lecture, MACE, Kolkata, 2014.

Garain, Utpal:
(1) Delivered Lecture, North East Workshop on Pattern Analysis and Applications, Nagaland University, Dimapur, February 12, 2015; (2) Delivered Lecture, Short Term Course on Computer Vision and Pattern Recognition, NIT, Durgapur, West Bengal, June 20, 2014; (3) Delivered Lecture, IEEE CALCON, IEEE Kolkata Chapter, Kolkata, November 07, 2014.

Majumdar, Debapriyo:
(1) Delivered Lecture, First Alumni Conference of Chennai Mathematical Institute, Chennai, January, 2015; (2) Committee Member for selecting best poster, ACM IKDD Conference on Data Science (CoDS) 2015, Bangalore, March 2015.

Pal, Umapada:
Delivered Lecture, First National Conference on Digital Image and Signal Processing, Pune, March 12-13, 2015.

Parui, Swapan Kumar:
Delivered Lecture, North East Workshop on Pattern Analysis and Applications, Nagaland University, Dimapur, February 12, 2015.

Palit, Sarbani:
Teaching Digital Signal Processing, Department of Computer Science and Engineering, Calcutta University, Kolkata, 2014-15.

Electronics and Communication Sciences Unit, Kolkata

Chanda, Bhabatosh:
(1) Delivered Lecture, Workshop on Engineering Applications of Computational Intelligence, RCC, IIT, Kolkata, April 07-11, 2014; (2) Delivered Lecture, Bengal Engineering and Science University, Shibpur, April 17, 2014; (3) Delivered Lecture, Dept. of Computer and System Sciences, Visva-Bharati University, Santiniketan, May 29, 2014; (4) Delivered Lecture, Workshop on Artificial Intelligence and Soft Computing, 2014; (5) AIIMS, New delhi, August 23-24, 2014; (6) Delivered Lecture, Workshop on Soft Computing and Applications (SCA'14), JSS Academy of Technical Education, Noida, September 02-04, 2014; (7) Delivered Lecture, 17th Workshop on Computational Information Processing, NIT, Sikkim, Ravangla, September 10-13, 2014; (8) Delivered Lecture, IIEST, Shibpur, November 26-28,

2014; (9) Delivered Lecture, National Workshop on Computational Information Processing, ICFAI University, Tripura, February 03-04, 2015; (10) General Chair, Eighth International Conference on Advances in Pattern Recognition, Kolkata, January 04-07, 2015.

Das, Swagatam:
(1) Delivered Lecture, 2015 IEEE Computational Intelligence Society (CIS) Sponsored Summer School, Arya College of Engineering, Jaipur, March 02–06, 2015; (2) Delivered Lecture, 3rd National Conference On Advanced Research Trends in Mathematical Sciences, G.H. Raisoni College of Engineering, Nagpur, Maharashtra, January 02–03, 2015; (3) Delivered Lecture, 1st International Conference on Intelligent Computing and Applications (ICICA 2014), NIT, Durgapur, West Bengal, December 22–24, 2014; (4) Delivered Lecture, 49th Annual Convention of Computer Society of India (Golden Jubilee Year), Hyderabad, December 12-15 2014; (5) Co-General Chair, 5th International Conference on Swarm, Evolutionary and Memetic Computing (SEMCCO 2014), Bhubaneswar, December 18–20, 2014; (6) Delivered Lecture, 17th Workshop on Computational Information Processing, NIT, Sikkim, Ravangla, September 10-13, 2014; (7) Program Committee Member, Ninth Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP), Bangalore, December 14—17, 2014; (8) Program Chair, Eighth International Conference on Advances in Pattern Recognition (ICAPR), Kolkata, January 04-07, 2015.

Mukherjee, Dipti Prasad:
(1) Delivered Lecture, National Workshop on Computational Information Processing, ICFAI University, Tripura, February 03-04, 2015; (2) Course on Research Methodology, Computer Society of India, Kolkata Chapter, January 17, 2015; (3) Delivered Lecture, Research Scholar's Day, School of Information Technology, IIT, Kharagpur, January 10, 2015; (4) Delivered Lecture, IIIT, Sri City, Andhra Pradesh , November 22, 2014; (5) Delivered Lecture, VIT University, Chennai, November 21, 2014; (6) Delivered Lecture, National Workshop on Frontiers of Computer Vision, VIT University, Chennai, November 21, 2014; (7) Delivered Lecture, Workshop on Image and Video Processing, IIIT, Bhubaneswar, June 27, 2014; (8) Delivered Lecture, National Conference on VLSI, Signal Processing and Trends in Telecommunication, C.V. Raman College of Engineering, Bhubaneswar, May 10, 2014; (9) Delivered Lecture, 1st International Doctoral Symposium on Applied Computation and Security Systems, University of Calcutta, Kolkata, April 18, 2014.

Pal, Nikhil Ranjan:
(1) Delivered Lecture, International Conference on Soft Computing for Problem Solving, Silchar, Assam, December 27-29, 2014; (2) Delivered Lecture, International Conference Innovative Applications of Computational Intelligence on Power, Energy and Controls with their impact on Humanity (CIPECH-14), Ghaziabad, November 28-29, 2014; (3) Delivered Lecture and Guest of Honour, International Conference on Issues and challenges in Intelligent Computing Techniques, Ghaziabad, February 07-08, 2014; (4) Delivered Lecture, Workshop by INAE, Heritage Institute of Technology, Calcutta, February 18, 2015.

Machine Intelligence Unit, Kolkata

Bandyopadhyay, S:

(1) Examiner, PhD Thesis, Indian Institute of Management, Kolkata, India, 2015; (2) Examiner, PhD Thesis, School of Computer & Information Science, University of Hyderabad, India, 2014; (3) Examiner, PhD Thesis, Kalinga Institute of Information Technology, Bhubaneshwar, 2014; (4) Chancellor's Nominee, Department of Computer Science, University of Calcutta, Kolkata, 2014-2015; (5) Nominee of the Hon'ble President of India, School of Physical Sciences, Assam University, Silchar, 2013-2015; (6) Delivered Lecture, INAE Seminar, Heritage Institute of Technology, Kolkata, February 18, 2015; (7) Delivered Lecture, Fourth International Conference of Emerging Applications of Information Technology (EAIT), Computer Society of India, December 20, 2014; (8) Delivered Lecture,

Editorial and other Assignments

Rajasthan University, Rajasthan, December 13, 2014; (9) Delivered Lecture, IIT Jodhpur, December 08, 2014; (10) Delivered Lecture, INDO-CHILE Workshop on Big Data Handling, BITS Pilani KK Birla Goa Campus, Goa, June 05, 2014; (11) Delivered Lecture, Summer School on Advances in Computational Intelligence (SSACI-2014), Institute of Technical Education and Research (ITER) and Siksha O Anusandhan University, Bhubaneswar, Odisha, April 15, 2014.

Ghosh, A.:
(1) Examiner, Ph. D Viva Voice, NIT, Rourkela, May 23, 2014; (2) Examiner, Ph. D Viva Voice, IIT, Bombay, May 29, 2014; (3) Expert, USER Committee Meeting, Banaras Hindu University, Varanasi, Uttar Pradesh, September 17-18, 2014; (4) Examiner, Ph. D Viva Voice, SSN college of Engineering , Tamil Nadu, November 03, 2014; (5) Examiner, Ph. D Viva Voice, VNIT, Surat, December 01, 2014; (6) Delivered Lecture, Institute of Mathematics & Application, Odisha, December 08-11, 2015; (7) Delivered Lecture, ICAFW 2015, Coimbatore, January 2015; (8) Examiner, Ph. D Viva Voice, Tripura University, Tripura, February 16, 2015; (9) Delivered Lecture, International Workshop on Soft Computing and Applications, New Delhi, March 25-27, 2015;

Ghosh, K.:
(1) Co-convener and Delivered Lecture, Workshop on Computational Intelligence, School of Computer Engineering, KIIT University, Bhubaneswar, June 24-28, 2014; (2) Delivered Lecture, Physics Colloquium, Presidency University, Kolkata, September 24, 2014; (3) Delivered Lecture, National Conference on Recent Advances in Business Intelligence and Data Mining (RABIDM-2015), Gandhi Institute for Technology, Bhubaneswar, March 24-25, 2015.

Maji, P.:
(1) Delivered Lecture, Workshop on Computational Intelligence, School of Computer Engineering, KIIT University, Bhubaneswar, June 24-28, 2014; (2) External Examiner, Dual-Degree M. Tech, Department of Computer Science and Engineering, Indian Institute of Technology, Kharagpur, April, 2014; (3) External Examiner, M. Tech Thesis, Department of Computer Science and Technology, Indian Institute of Engineering Science and Technology, Shibpur, May, 2014; (4) External Examiner, M. Tech Thesis, Department of Information Technology, Indian Institute of Engineering Science and Technology, Shibpur, June, 2014;

Mitra, S.:
(1) Member, Board of Studies, Dept. of Computer Science & Engineering, Tezpur University, 2014; (2) Member, Board of Studies, Dept. of Information Technology, Govt. College of Engineering and Ceramic Technology, Kolkata, 2014; (3) Jury Member, Rise Prize on Driverless Cars, Mahindra and Mahindra Limited, 2014; (4) Expert, BRNS, BARC, Dept. of Atomic Energy, Govt. of India, 2014; (5) Delivered Lecture, South Asian University, New Delhi, March 27, 2015; (6) Delivered Lecture, JSS Academy of Technical Education, Noida, UP, September 04, 2014; (7) Delivered Lecture, South Asian University, New Delhi, September 04, 2014; (8) Delivered Lecture, Vignan University, Vadlamudi, Andhra Pradesh, August 20, 2014; (9) Delivered Lecture, RCC Institute of Information Technology, Kolkata, March 27, 2014.

Murthy, C.A.:
(1) NCSM Research Advisory Board Meeting, April 22, 2014; (2) Evaluator, Dissertations for Masters degree in Computer Science, Benaras Hindu University, Varanasi, May 22-23, 2014; (3) Ph. D. Viva Voce Examiner, Computer Science, IIT, Madras, June 19, 2014; (4) Delivered Lecture, KIIT University, Bhubaneswar, June 25, 2014; (5) Delivered Lecture, National Workshop on Optimization and Fuzzy Mathematics, Vidyasagar University, Medinapur, West Bengal , September 12, 2014; (6) Research Advisory Board Meeting, NCSM, Bangalore, October 10, 2014; (7) Delivered Lecture, 8th Multidisciplinary International Workshop on Artificial Intelligence (MIWAI-2014), December 9, 2014; (8) Research Council Meeting, Delhi, NISTADS, December 12, 2014.

Documentation, Research and Training Centre, Bangalore

Dutta, Biswanath:
(1) Delivered Series of Lectures, Workshop on Semantic Web and Agent Technologies (SWAT-2014), Department of Information Technology, National Institute of Technology (NIT), Durgapur, April 14-18, 2014; (2) Delivered Lecture, International Conference on Problems in Information Retrieval, Jadavpur University, Kolkata, India, August 09, 2014.

Krishnamurthy, M.:
(1) Attended Project Review Meeting, Amrita University, Coimbatore, July 07, 2014; (2) Invited Resource Person, National Workshop on KOHA, BMS Institute of Technology, Belgaum, July 24-25, 2014; (3) Invited Resource Person, Sree Veeerendra Patil Degree College of Science Art & Commerce, Bangalore, September 26, 2014; (4) Delivered Lecture, National conference-JNTUK, Kakinada, Andhra Pradesh, October 30-31, 2014; (5) Delivered Lecture, Bharathidasan University, Trichy, Tiruchirappalli, Tamil Nadu, February 23, 2015; (6) Delivered Special Lecture, Indian Audit and Accounts Dept., Regional Training Centre, Bangalore, March 03-05, 2015

Madalli, Devika P.:
(1) Attended, Ph. D Viva-Voc, University of Calcutta, Kolkata, September 07, 2014; (2) Delivered Lecture, UGC-Academic Staff College, University of Mysore, Karnataka , September 13, 2014; (3) Invited as Guest Lecturer, DRDO Training Course, DRDO lab, Bangalore, October 14, 2014; (4) Attended Meeting of the Sub- Committee, National Mission on Libraries, Central Secretary Library Building, New Delhi, October 13, 2014; (5) Delivered Lecture, Workshop on Open access to agricultural knowledge, National Academy of Agricultural Research Management, Hyderabad, October 29-30, 2014; (6) Participated, SciData Conference 2014, New Delhi, November 01-05, 2014; (7) Attended Research Committee Meeting, Calcutta University, Kolkata, December 16-17, 2014; (8) Participated, Several Evaluation Meetings, Karnataka Evaluation Committee member, Evaluation Authority, Karnataka, 2014-15.

Prasad, A.R.D.:
(1) Attended, National Mission on Libraries meeting, RRLF, Kolkata, April 30, 2014; (2) Attended, 7th National Mission on Libraries Meeting, New Delhi, June 18, 2014; (3) NML Meeting, New Delhi, October 13, 2014; (4) Attended Meeting of the Sub-Committee National Mission on Libraries, Central Secretary Library Building, New Delhi, October 13, 2014; (5) Delivered Lecture, Workshop on Open access to agricultural knowledge, National Academy of Agricultural Research Management, Hyderabad, October 29-30, 2014; (6) Participated, SciData Conference 2014, New Delhi, November 01-05, 2014; (5) Delivered Lecture, NACLIN conference, Pondicherry, December 10-11, 2014,

Systems Science and Informatics Unit, Bangalore

Majumdar, Kaushik:
(1) Delivered Lecture, Indo-French Workshop, Indo-French Centre for Applied Mathematics, Indian Institute of Science, July 28-31, 2014; (2) Delivered Lecture, Super Computing Education and Research Center (SERC), Indian Institute of Science, October 17-18, 2014.

Meher, S.K.:
(1) Doctoral Expert Committee Member, Doctoral review committee for the Research Scholar of R.V. College of Engineering, Bangalore, 2014; (2) Delivered Lecture, Faculty Development Program, School of Computer Science, Kalinga Institute of Industrial Technology, Bhubaneswar, Odisha, June 28-30, 2014; (3) Delivered Lecture, Chhatrapati Shivaji Institute of Technology, Durg, Chhattisgarh, October 08, 2014; (4) Delivered Lecture, SKAMC Hospital and Research Center, RPC Layout, Vijaya Nagar, Bangalore, October 29, 2014.

Editorial and other Assignments

Sagar, B.S.D.:
(1) Member, Doctoral Committees, Indian Institute of Technology, Bombay, 2015; (2) Delivered Lecture, Multidisciplinary International Workshop on Artificial Intelligence (MIWAI), Bangalore, December 10, 2014; (3) Delivered Lecture, International Summer and Winter Term (ISWT), Indian Institute of Technology, Kharagpur, December 15-27, 2014; (4) Delivered Lecture, PES University South Campus, Bengaluru, Karnataka, RETCAMP 2015, January 09, 2015.

Computer Science Unit, Chennai

Ghosh, Sujata:
(1) Delivered Lecture, 14th Asian Logic Conference, Mumbai, January, 2015; (2) Secretary, Association for Logic in India, 2014-15; (3) Delivered Lecture, Indian Women and Mathematics Teacher's Training Programme, Erode, Tamil Nadu, November, 2014; (4) Delivered Lecture, Calcutta Logic Circle Annual Meet, Kolkata, October, 2014.

Karthick, T.:
(1) Delivered Lecture, CALDAM Pre-Conference, Indo-Czech School on Discrete Mathematics, IIT, Kanpur, February 05-06, 2014.

Mathew, C. Francis.:
(1) Member & Thesis Examiner, Department of Computer Science and Engineering, IIT, Madras; (2) Delivered Lecture, Department of Mathematics, IIT, Madras, December 22, 2014; (3) Delivered Lecture, Department of Mathematics, IIT, Madras, January 22, 2015 and February 05, 2015; (4) Delivered Lecture, Department of Computer Science and Engineering, IIT, Kharagpur.

Venkateswarlu, Ayineedi:
Delivered Lecture, NCM-Advanced Instructional School on Cryptology, Society for Electronic Transactions and Security, Chennai, June 16-July 04, 2014.

Physics and Earth Sciences Division

Geological Studies Unit, Kolkata

Chakraborty, Tapan:
Delivered Lecture, Department of Geography and Environmental Management, Vidyasagar University, Medinipur, West Bengal, April 10–11, 2014.

Saha, Dilip:
(1) Delivered Lecture, Regional BSS for 36th IGC at Geological Survey of India, Hyderabad, February 18–19, 2015; (2) Member Ph.D. Committee, Department of Geology, Calcutta University, Kolkata, 2014-15; (3) Delivered Lecture and Participated, SGTSGI Biennial Meeting (RDS-III), Dibrugarh University, Dibrugarh, October 29-31, 2014.

Physics and Applied Mathematics Unit, Kolkata

Kar, Guruprasad:
(1) Collaborative Research Work, The Institute of Mathematical Science, Chennai, May 26–30, 2014; (2) Delivered Lecture, Workshop of Quantum and Nano Computing Advanced School (QANSAS,

2014), Dayalbagh, Agra, November 26–28, 2014; (3) Collaborative Research Work, I.M.Sc, Chennai, March 25-31, 2015.

Maiti, Santanu K.:
Delivered Lecture, National Science Day 2015, Department of Physics, Kakatiya University, Warangal, Telangana State, India, February 28, 2015.

Pal, Supratik:
(1) Delivered Lecture, Winter School in Gravitation and Cosmology, Assam University, Silchar, January 08-11, 2015; (2) Delivered Lecture, Workshop on Cosmology, Interface, Saha Institute of Nuclear Physics, Kolkata, January 28-30, 2015; (3) External Expert, Postdoctoral Fellow Selection Committee, S.N Bose National Centre for Basic Sciences, Kolkata, 2015; (4) Session Chair, Workshop on Cosmology at the Interface, Saha Institute of Nuclear Physics, Kolkata, January 28-30, 2015; (5) Member of the Doctoral Committee, Saha Institute of Nuclear Physics, Kolkata, 2015; (6) External Expert for the Doctoral Committee, Indian Institute of Technology, Kharagpur, 2015; (7) Member of Judges Panel for Scientific Creativity Test, Jagadis Bose National Science Talent Search, Kolkata, West Bengal, 2014; (8) Session Chair, 2nd Topical Conference on Gravity and Cosmology, Presidency University, Kolkata, August 09, 2014; (9) Delivered Lecture, National Seminar on New Horizons of Physics: 2015, Bhairab Ganguly College, Kolkata, February 3, 2015; (10) Delivered Lecture as Resource Person, National Seminar on Introductory Astronomy and Astrophysics, Ramananda College, Bishnupur, November 26-27, 2014.

Roy, Barnana:
Collaborative Research Work, Centre for Nonlinear Dynamics, Bharathidasan University, Tiruchirapalli, Tamilnadu, September 22–29, 2014.

Roy, Ashim Kumar:
Collaborative Research Work, Inter-University Centre for Astronomy and Astrophysics (IUCCA), Pune, December 01–12, 2014.

Biological Sciences Division

Biological Anthropology Unit, Kolkata

Mukhopadhyay, Susmita:
(1) Delivered Lecture, National Seminar on New Arenas of Biological Anthropology, Department of Anthropology, North Eastern Hill University, Shillong, November 19-21, 2014; (2) Delivered Lecture, Seminar on Occupational Safety & Health of Indian Women at Workplace, Women's Studies Center, Vidyasagar University, Medinipur, March 24, 2015.

Reddy, B.M.:
(1) Delivered Lecture, National Seminar on The New Arenas of Biological Anthropology in India, Department of Anthropology, North East Hill University, Shillong, November 19-21, 2014; (2) Attended Seminar, Sandor Proteomics & Prema Life Sciences, Hyderabad, July 23, 2014; (3) Attended, Conference, Nizam's Institute of Medical Sciences, Hyderabad, March 15, 2014; (3) Plenary Lecture, National Seminar on the Recent Advances in Human Genetics, Department of Human Genetics, Punjabi University, Panjub, March, 23-24, 2015; (4) Delivered Lecture, North East Hill University, Shillong, March 27, 2015.

Editorial and other Assignments

Human Genetics Unit, Kolkata

Chatterjee, Raghunath:
(1) Delivered Lecture, International Conference on Disease Biology and Therapeutics, (ICDBT-2014), Institute of Advanced Study in Science and Technology, (IASST), Guwahati, Assam, December, 03-05 2014; (2) Delivered Lecture, National Conference on Recent Advances in Cancer Biology and Therapeutics-2014 (RACBT-2014), Department of Biotechnology, Indian Institute of Technology, Guwahati, Assam, December 05, 2014; (3) Delivered Lecture, Continuing Dental Education, Indian Dental Association, Guru Nanak Institute of Dental Science and Research, Kolkata, August 31, 2014; (4) Delivered Lecture, The XIV P.G. Convention of Indian Association of Oral and Maxillofacial Pathologists, Dr. R Ahmed Dental College and Hospital, Park Hotel, Kolkata, July 19-20, 2014; (5)Delivered Lecture, MAXOPATH, Dr. R Ahmed Dental College and Hospital, Kolkata, February 08, 2014; (6) Delivered Lecture, CSIR-IICB PhD Course Work 2014-15 (Autumn Semester), IICB, Kolkata.

Social Sciences Division

Economic Research Unit, Kolkata

Chakravarty, Satya Ranjan:
Delivered Lecture, 51st Annual Conference of the Indian Econometric Society, Punjab University, Patiala, December 12-14, 2014.

Dasgupta, Indraneel:
(1) Delivered Lecture, Centre for Social Studies, Surat, October 14, 2014; (2) Delivered Lecture, Conference on Contemporary Issues in Development Economics, Department of Economics, Jadavpur University, Kolkata, December 20-23, 2014; (3) Delivered Lecture, Azim Premji University, Bangalore, January 06, 2015.

Kabiraj, Tarun:
(1) Delivered Lecture, Tariffs and Consumers' Welfare, Workshop on Innovation and Technology, Department of Economics, Calcutta University, Kolkata, December 02, 2014; (2) Delivered Lecture, Workshop on Bundle Pricing, Department of Economics, Rabindra Bharati University, Kolkata, March 27, 2015.

Pal, Manoranjan:
Delivered Lecture, Conference on International Business and Trade, School of Management Studies, Techno India University, Kolkata, May 24, 2014.

Sarkar, Nityananda:
Visited, Institute of Social and Economic Change, Bengaluru, August 11-14, 2014.

Linguistic Research Unit, Kolkata

Dasgupta, Probal:
(1) Delivered Lecture, Dhyanesh Narayana Chakraborty Memorial Committee, Dattapukur, West Bengal, April 26, 2014; (2) Chaired, Krishna Bhattacharya's Lecture on the contribution of Suniti Kumar Chatterji, Kolkata Society for Asian Studies, Jadavpur University, Kolkata, May 21, 2014; (3) Delivered Lecture, 5th IIIT Advanced School on Natural Language Processing, International Institute of Information Technology, Hyderabad, July 08, 2014; (4) Delivered Lecture, International symposium on Radiating Globalities: Old Histories and New Geographies in Global Locations, Centre for Studies in

Social Sciences, Kolkata, December 09, 2014; (5) Delivered Lecture, Department of HSS and Lingchai [a linguistics discussion forum], IIT, Delhi, January 08, 2015; (6) Delivered Lecture, Indian Council of Philosophical Research's one day symposium, India International Centre, Delhi, January 09, 2015; (7) Delivered Lecture, Manipal Centre for Philosophy and the Humanities, Manipal, January 15-17, 2015; (8) Delivered Lecture, Centre for Applied Linguistics and Translation Studies, University of Hyderabad, March 02, 2015; (9) Delivered Lecture, National Seminar on Right to Education and the Future of Our Languages, Dept. of Linguistics, Mumbai University, Mumbai, Maharastra, March 09-11, 2015.

Dash, Niladri Sekhar:
(1) Delivered Lecture, International Conference on Intelligent Computing, Communication and Devices, Siksha o Anusandhan University, Bhubaneswar, Odisha, India, April 18, 2014; (2) Delivered Lecture, International Seminar on Recent Innovations in Engineering and Technology, Gandhi Institute of Technological Advancement, Bhubaneswar, Odisha, India, April 19, 2014; (3) National Chair, International Conference on Information Science, Dept. of Computer Science, College of Engineering, Cherthala, Pallipuram, Alappuzha, Kerala, India, July 04-05, 2014; (4) Delivered Lecture, National Translation Mission, Central Institute of Indian Languages, Mysore, Ministry of HRD, Govt. of India, July 27-31, 2014; (5) Delivered Lecture, National Translation Mission, Central Institute of Indian Languages, Mysore, Ministry of HRD, Govt. of India, September 24-27, 2014; (6) Participated, 36th International Conference of the Linguistic Society of India, University of Kerala, Thiruvananthapuram, Kerala, India, December 01-04, 2014; (7) Session Chair, 36th International Conference of the Linguistic Society of India, University of Kerala, Thiruvananthapuram, Kerala, India, December 01-04, 2014; (8) Delivered Lecture, National Seminar on Translation Corpora and MT Technology, Central Institute of Indian Languages, Mysore, Ministry of HRD, Govt. of India, January 16-17, 2015; (9) Program Committee Member and Paper Reviewer, Regional Symposium on Natural Language Processing, IIT-BHU, Varanasi, India, March 21-22, 2015.

Psychology Research Unit, Kolkata

Bhattacharya, Himani:
Presented Paper, Annual InSPA International Conference, Department of Psychology, Gauhati University, Assam, November 21-23, 2014.

Dutta Roy, D.:
(1) Conducted, Workshop Academic Achievement Test Construction, Department of Psychology, Gauhati University, Guwahati, Assam, December 21-23, 2014; (2) Delivered Lecture, Annual InSPA International Conference on School Psychology, Gauhati University, Guwahati, Assam, December 21-23, 2014; (3) Conducted, Pre-Conference Workshop titled Estimating Test-Retest Reliability, Multivariate Modelling, 24th Annual Convention of National Academy of Psychology, Bhopal, December 12-14, 2014; (4) Presented Papers, 24th Annual Convention of National Academy of Applied Psychology held at IIFM, Bhopal, December 12–14, 2014; (5) Conducted, Symposium titled Rabindrik Psychotherapy and Violence prevention in School, 16th National Conference, Puducherry, February 14-15, 2015; (7) Delivered Lecture, Rotary Club of Calcutta, Kolkata, February 17, 2015.

Ghosh, Anjali:
(1) Visited, Department of Clinical Psychology, NIMHANS, Bangalore, August, 18-22, 2014; (2) Chaired and Presented Paper, InSPA International Conference, Gauhati University, Department of Psychology, Guwahati, Assam, November 21-23, 2014; (3) Visited, Indian Institute of Management, Kolkata, November 10, 2014; (4) Attended, Workshop on Dyscalculia, Dyslexia Association, Andhra Pradesh, Hyderabad, January 11, 2015; (4) External Expert, Department of Psychology, University of Kolkata, Kolkata, February 18, 2015.

Gupta, Rumki:
(1) Presented Paper, Annual InSPA International Conference, Department of Psychology, Gauhati University, Assam, November 21-23, 2014; (2) Advisory Committee Member, The International

Editorial and other Assignments

Conference on Interdisciplinary Research and Technological Developments (IRTD), Punjab University, Chandigarh, 2014.

Sampling and Official Statistics Unit, Kolkata

Chattopadhyay, Nachiketa:
Member, Working Group, NSS 73rd Round, NSSO, Ministry of Statistics and Programme Implementation, 2014-15.

Mitra, Sandip:
(1) CTRPFP, CSSSC, Kolkata, October 27, 2014 and December 19-20, 2014; (2) NABARD, Mumbai, July 07, 2014.

Mukherjee, Diganta:
(1) Member, Working Group, NSS 72nd Round and Member, Core Committee, NSSO, Ministry of Statistics and Programme Implementation, 2014-15; (2) Member, Pratap Narain Committee on National Accounts, Indian Association for Research in National Income & Wealth, New Delhi, 2014; (3) Technical Advisor, Index Committee of MCX-SX, since 2013.

Pathak, Prasanta:
(1) Member, Working Group, NSS 71st Round, NSSO, Ministry of Statistics and Programme Implementation, 2014-15; (2) Delivered Lecture, ITEC, Fluid Control Research Institute, Palaghat, Kerala, February 24-25, 2015; (3) Delivered Lecture, World Standards Day, Bureau of Indian Standards, October 14, 2014.

Sociological Research Unit, Kolkata

Ghosh, Bhola Nath:
(1) Delivered Lecture, Department of Social Work, Visva-Bharati and International Consortium for Social Development-Asia Pacific, Santiniketan, January 16-18, 2015; (2) Delivered Lecture, South Asian Forum Aged Women Zonal Conference on Mainstreaming Issues and Concerns of Aged Women, Kolkata, April 21, 2014; (3) Delivered Lecture, 12th Conference of Indian Association for Social Sciences and health (IASSH), University of Lucknow, Lucknow, Uttar Pradesh, November 21-23, 2014; (4) Delivered Lecture, XL All India Sociological Conference, Mahtma Gandhi Kashi Vidyapith, Varanasi, U.P., November 29-December 01, 2014; (5) Delivered Lecture, UGC Sponsored National Level Seminar, Bangabasi College, Kolkata, September 21, 2014; (6) Delivered Lecture, ICSSR Sponsored National Seminar, Gandhigram Rural Institute-Deemed University, Gandhigram, Tamil Nadu, July 10-11, 2014.

Ghosh, Tirthankar:
(1) Participated and Presented Paper, 17th Biennial Conference of Association of Gerontology, India (AGI) and International Conference on Engaging and Empowering the Elderly (ICEEE), Centre for Development Studies, Thiruvanthapuram, Kerala, September 15-16, 2014; (2) Participated, International Seminar on Migration, Care Economy and Development (in honour of Professor K.C. Zachariah), Centre for Development Studies, Thiruvanthapuram, Kerala, September 17-19, 2014.

Jana, Rabindranath:
(1) Participated and Presented Paper, 17th Biennial Conference of Association of Gerontology, India (AGI) and International Conference on Engaging and Empowering the Elderly (ICEEE), Centre for Development Studies, Thiruvanthapuram, Kerala, September 15-16, 2014; (2) Participated, International Seminar on Migration, Care Economy and Development (in honour of Professor K.C. Zachariah), Centre for Development Studies, Thiruvanthapuram, Kerala, September 17-19, 2014; (3)

Designated Member, Ph D Supervisory Committee, Faculty Centre for Integrated Rural Development and Management (IRDM), Ramakrishna Mission Vivekananda University (RKMVU), Narendrapur, South 24 Parganas, West Bengal, Since 2012.

Economics and Planning Unit, Delhi

Ghate, Chetan:
Visited for Research purpose, IIT, Madras, November 2014.

Ray, Tridip:
(1) Visited for Research purpose, Shiv Nadar University, Greater Noida, NCR, November 19, 2014; (2) Visited for Research purpose, Delhi School of Economics, Delhi, November 27, 2014; (3) Visited for Research purpose, National University of Educational Planning and Administration (NUEPA), New Delhi, January 07, 2015; (4) Visited for Research purpose, South Asian University, New Delhi, March 19, 2015.

Roy Chowdhury, Prabal:
(1) Visited for Research purpose, Vidyasagar University, West Bengal, February 17-18, 2015; (2) Visited for Research purpose, CSSSC, Kolkata, February 19-20, 2015.

Somanathan, E.:
(1) Delivered Lecture, SCCS Conference, Bangalore, September 25, 2014; (2) Delivered Lecture, Climate Change Seminar, IIT, Bombay, October 01, 2014.

Economic Analysis Unit, Bangalore

Ramachandran, V.K.:
Delivered Lecture, School of Habitat Studies, Tata Institute of Social Sciences, Mumbai, January 31, 2015.

Swaminathan,Madhura:
Presented Paper, Platinum Jubilee Conference of the Indian Society of Agricultural Economics, Hyderabad, October 12-13, 2014.

Statistical Quality Control and Operations Research Division

SQC & OR Unit, Bangalore

Chowdhury, K.K.:
(1) Delivered Lecture, One Day Workshop Best Practices and Benchmarking in Defence Industries, Society of Defence Technologists (SODET), Mumbai, September 05, 2014; (2) Delivered Lecture, Workshop on Knowledge Analytics in Corporate Sector, P.E.S. University, Bangalore, January 13, 2015; (3) Delivered Lecture, Indian Machine Tool Manufacturers' Association (IMTMA), Workshop on Improving Process Capability, Bangalore, June 13, 2014; (5) Delivered Lecture, Department of Industrial Engineering & Management, Faculty Development programme on Achieving Organisational Excellence through Modern Industrial Engineering Techniques, M.S. Ramaiah Institute of Technology (MSRIT), Bangalore, November 22, 2014; (6) Delivered Lecture, Central Manufacturing Technological Institute (CMTI), Workshop on Mathematical Modelling for the employees, July 04, 2014.

Editorial and other Assignments

John, Boby:
(1) Delivered Lecture, Central Manufacturing Technology Institute, Bangalore, June 24–25, 2015; (2) Delivered Lecture, Thiagarajar College of Engineering, Madurai, Tamil Nadu, August 02–03, 2014; (3) Delivered Lecture, Sri Ramakrishna Engineering College, Coimbatore, Tamil Nadu, September 13, 2014; (4) Delivered Lecture, Vellore Institute of Technology, Chennai campus, Tamil Nadu, October 11, 2014; (5) Delivered Lecture, PQR Software, Bangalore, November 21, 2014.

Ray, Sanjit:
Delivered Lecture, R.V. College of Engineering, Bengaluru, Karnataka, 2014-15.

SQC & OR Unit, Chennai

Chakraborty, Prabuddha:
Visited for Academic Collaboration, IISER, Mohali, May 2014.

Ravindran G.:
(1) Delivered Lecture, Workshop on Recent Trends in Statistical Theory and Practices, Department of Statistics, University of Madras, Chennai, 16–17 March, 2015; (2) Delivered Lecture, International Conference on New Horizons in Statistical Modeling and Applications, Diamond Jubilee Celebrations of the Department of Statistics, Presidency College, Kolkata, February 27–28, 2015.

SQC & OR Unit, Hyderabad

Subani, S.M.:
(1) Delivered Lecture, College of Defence Management, Telangana, September 04, 2014; (2) Delivered Lecture, Dept. of Mechanical Engg., Osmania University, Hyderabad, May 21-22, 2014.

Library, Documentation and Information Science Division

Library, Kolkata

Ganguly, Nibedita:
Delivered Lecture, Asiatic Society, Kolkata, March 23, 2015.

Pal, Ashis Kumar:
(1) Academic Counsellor-cum-Evaluator and Practical Supervisor, IGNOU, BLIS & MLIS courses, April & October, 2014.

Pal, Jiban K.:
(1) Reviewer and Received Certificate of Recognition, Journal of the Institution of Engineers (India): Series B (ISSN:2250-2106, Springer), 2014-15; (2) Academic Counsellor-cum-Evaluator and Practical Supervisor, IGNOU, BLIS & MLIS courses, April & October, 2014.

Raychaudhury, Arup:
(1) Delivered Lecture, Department of Library and Information Science, Manipur University, Imphal, March 19, 2015; (2) Delivered Lectures, UGC Refresher Course in Library & Information Science, Mizoram University, Aizawl, Mizoram, November 26-27, 2014.

Center for Soft Computing Research: A National Facility, Kolkata

Ghosh, A.:
(1) Examiner, Ph. D viva voice, NIT, Rourkela, May 23, 2014; (2) Examiner, Ph.D viva voice, IIT, Bombay, May 29, 2014; (3) Delivered Lecture, Symposium on Artifical Intelligence, AIIMS, New Delhi, August 23-24, 2014; (4) Delivered Lecture, Workshop on Soft Computing and Applications, JSS Academy of Technical Education, Noida, September 02-04, 2014; (5) Expert, USER Committee Meeting, Banaras Hindu University, Varanasi, Uttar Pradesh, September 17-18, 2014; (6) Examiner, Ph. D viva voice, Anna University, Chennai, Tamil Nadu, November 03, 2014; (7) Examiner, Ph. D viva voice, VNIT, Surat, December 01, 2014; (8) Invited Talk, Insititute of Mathematics & Application, Odisha, December 08-11, 2015; (9) Delivered Lecture, ICAFW 2015, Coimbatore, January 08, 2015; (10) Examiner, Ph. D viva voice, Tripura University, Agartala, Tripura, February 16, 2015; (11) Delivered Lectures, SCA 2015, New Delhi, March 25-27, 2015.

Ghosh, K.:
(1) Programe Chair, 1st International Conference on Computational Intelligence and Networks (CINE 2015), KIIT, Bhubaneswar, January 12-13, 2015.

Pal, S.K.:
(1) Delivered Lecture, 2nd International Conference on Advanced Networking and Informatics (ICACNI-2014), Parish Hall, St. Paul's Cathedral, Kolkata, (Organized by St. Thomas Engineering College, Kolkata,) June 24, 2014; (2) Delivered Lecture, KIIT University, Bhubaneswar, June 29-30, 2014; (3) Delivered Lecture, All Indian Institute of Medical Science (AIIMS), New Delhi, August 24, 2014; (4) Delivered Lecture, Workshop on Soft Computing and Applications (SCA'14), JSS Academy of Technical Education, Noida, September 02-04, 2014; (5) Convocation Address, 4th Annual Convocation, NIT, Patna, September 28, 2014; (6) Delivered Lecture, National Institute of Technology, Patna, September 28, 2014; (7) Delivered Lecture, IEEE CALCON- 2014, Hotel Park Prime, Kolkata, November 7-8, 2014; (8) Delivered Lecture, First International Conference on Rough Sets and Knowledge Technologies (ICRSKT)-2014, JNTU, Hyderabad, November 10-11, 2014; (9) International Advisory Committee Member, International Conference on Information and Communication Technologies (ICICT-2015), Cochin University of Science and Technology (CUSAT), Kochi, India, December 03-05; (10) International Advisory Committee Member, 9th International Conference on Industrial and Information Systems (ICIIS2014), ABV-Indian Institute of Information Technology and Management, Gwalior, India (jointly organized with San Diego State University, San Diego, USA), December 15-17, 2014; (11) Convocation Address, 59th Annual Convocation, Jadavpur University, Kolkata, December 24, 2014; (12) Delivered Lecture, Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT), Gandhinagar, Gujrat, January 16, 2015; (13) Convocation Address, 11th Convocation of Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT), Gandhinagar, Gujrat, January 17, 2015; (14) Delivered Lecture, Lecture Workshop on Trans-disciplinary Areas of Research and Teaching by Shanti Swarup Bhatnagar Awardee, Deen Dayal Upadhyaya College, University of Delhi, New Delhi, January 30-31, 2015; (15) Delivered Lecture, National Institute of Technology, Patna, February 16, 2015; (18) Delivered Lecture, Science Day, CSIR-CGCRI, Kolkata, February 25, 2015; (16) Delivered Lecture, IEEE Sponsored International Conference on Cognitive Computing and Information Processing, JSSATE, Noida, March 03-04, 2015; (17) Delivered Lecture, International Workshop on Soft Computing and Applications (ISCA'15), South Asian University, New Delhi, March 25-27, 2015.

R.C. Bose Centre for Cryptology and Security, Kolkata

Barua, Rana:
(1) Delivered Lectures, Advanced Training School on Cryptography, SETS, Chennai, June 06-July 05, 2014; (2) Delivered Lectures, Short Term Course on Cryptography, IIT, Kharagpur, May 18-24, 2014.

Editorial and other Assignments

Paul, Goutam:
(1) Delivered Lectures, National Level North East Workshop on Cryptology, C.I. College, Bishnupur, Manipur, India, January 23, 2015; (2) Delivered Lecture, Theoretical Physics Division, Physical Research Laboratory (PRL), Ahmedabad, India, November 21, 2014; (3) Delivered Lecture, Department of Computer Science & Technology, Bengal Engineering and Science University, Shibpur, Howrah, India, April 17, 2014; (4) Delivered Lectures, Short Term Course on Cryptography, Department of Mathematics, Indian Institute Technology (IIT), Kharagpur, India, May 18, 2014; (5) Delivered Lecture, Course on Cryptography, Department of Computer Science & Engineering, Tripura Institute of Technology (TIT), Agartala, India, November 07-08, 2014.

Ruj, Sushmita:
(1) Delivered Lecture, India Research Network (IRN) Meeting on IoT organized by Samsung, Bangalore, December 1, 2014; (2) Delivered Lecture, Samsung Research, Bangalore, July 24, 2014; (3) Delivered Lecture, SPCOM conference, July, 2014; (4) Delivered Lecture, Short term course on Cryptology and Network Security, IIT, Kharagpur, May, 2014; (6) Delivered Lecture, Central University, Rajasthan, India, April, 2014.

9. REGIONAL MATHEMATICAL OLYMPIAD 2014 AND INDIAN NATIONAL MATHEMATICAL OLYMPIAD 2015

Regional Mathematical Olympiad (RMO) 2014: West Bengal Region

Every year, the Kolkata centre of Indian Statistical Institute organizes the Regional Mathematical Olympiad (RMO) at West Bengal. This is followed subsequently by Indian National Mathematical Olympiad (INMO) whose participants are those who have cleared the RMO test and are primarily from West Bengal. There are two Regional Co-ordinators from the Kolkata centre of Indian Statistical Institute. One of them is associated with Applied Statistics Unit, and the other with Stat-Math Unit.

On December 07, 2014, RMO-2014 in West Bengal was held in 10 different centres in the state. The numbers of participants was 761. The numbers of successful candidates was 34. INMO-2015 was held on February 01, 2015. The number of participants in INMO-2015 in West Bengal was 37.

In the period between RMO-2014 and INMO-2015, a training camp was held on January 21, 22, 23, and 27, 2015, at ISI Kolkata. It was meant for the students who had cleared RMO-2014 and a few more, to make them familiar with advanced problem-solving techniques before they appear for INMO. Several distinguished speakers, including one from outside West Bengal, were invited for this purpose. The numbers of participants in this training camp was 36.

Regional Mathematical Olympiad (RMO) 2014: *Karnataka Region*

Regional Mathematical Olympiad (RMO), Karnataka region which is conducted by ISI Bangalore center for last several years. Last year, Prof. B. Sury was the regional coordinator. In 2014, the number of students registered for the competition was 2074, from entire Karnataka. The exam was held on 7th December, 2014, in 31 centres across the state.

With the help of some faculty members at ISI Bangalore, some post-docs and research scholars, 1457 answer scripts were evaluated at ISI Bangalore. Number of students who qualified to write the national level test INMO was 30. Another 4 were selected who could attend the INMO training camp, along with the top, at ISI Bangalore.

A week long training camp was organized at ISI Bangalore, for these students, to make them familiar with advanced problem solving techniques before they appear for the national level test. Several distinguished speakers were invited for this purpose. Participants were provided with food and accommodation at ISI Bangalore.

Indian National Mathematical Olympiad (INMO) 2015

The Mathematical Olympiad Programme in India, which leads to participation of Indian students in the International Mathematical Olympiad (IMO) is organized by the Homi Bhabha Centre for Science Education (HBCSE) on behalf of the National Board for Higher Mathematics (NBHM) of the Department of Atomic Energy (DAE), Government of India. Its main purpose is to spot mathematical talent among pre-university students in the country. For the purpose of training and selection of students for the Olympiad contest, 25 regions all over the country have been designated and each assigned a Regional Coordinator. Additionally, three groups, Central Board of Secondary Education (CBSE), Navodaya Vidyalaya Samiti (NVS) and Kendriya Vidyalaya Sangathana (KVS) have a 'Regional Coordinator' each.

Mathematical Olympiad

The Kolkata centre of Indian Statistical Institute organizes both the Regional Mathematical Olympiad (RMO) at West Bengal, to be followed subsequently by Indian National Mathematical Olympiad (INMO) whose participants are those who have clearly the RMO test are primarily from West Bengal. One of the two Regional Co-coordinators from the Kolkata centre of Indian Statistical Institute is from Applied Statistics Unit. Besides this, Office of Applied Statistics Unit played the central role in organizing RMO-2014 and INMO-2015.

PART II. ADMINISTRATION AND OFFICE BEARERS

10. GENERAL ADMINISTRATION

Administrative Services Division

The Administrative Services Division at the Headquarters caters to the various needs of the Scientific Workers in all the scientific units of the Institute engaged in various scientific, research and academic activities and provides them with necessary infrastructural facilities in their pursuit of excellence. The centres at Delhi, Bangalore, Chennai and Tezpur, each having a number of science units are, by and large, getting administrative support from the administrative units/sections there. The Administrative Services Division has the following units at the Headquarters in Kolkata:

Sl. No.	Name of the Unit	Sl. No.	Name of the Unit
1.	Accounts Section	17.	Import & Travel Cell
2.	Audio-Visual Unit	18.	Internal Audit Cell
3.	Binding Unit	19.	Legal Cell
4.	Canteen	20.	Medical Expenses Reimbursement Unit
5.	Cash	21.	Medical Welfare Unit
6.	C E (A & F)'s Office	22.	Personnel Unit
7.	Central Office & Despatch Unit	23.	Provident Fund Unit
8.	Central Stores & Tailoring Unit	24.	Public Relations Unit
9.	Council Section	25.	Printing and Publication Unit
10.	Director's Office	26.	Official Language Cell
11.	Electrical Maintenance Unit	27.	Retirement Benefit Cell
12.	Engineering Unit	28.	Sankhya Office
13.	Estate Office	29.	Security Unit
14.	Guest House	30.	Telephone Unit
15.	Hostels	31.	Transport Unit
16.	House Building Advance Cell	32.	SC / ST / OBC Cell

Apart from the Units mentioned above, there are some small cells dealing with Budget, and other issues to take care of the specific needs of the Institute. The Administrative Services Division also looks after the running of hostels for students, research scholars and International Statistical Education Centre (ISEC) trainees and also the running of Canteen for the workers and students of the Institute. The other outlying Units are controlled directly by the Headquarters at Kolkata. The Administrative Services Division takes the responsibility for all new constructional activities of the Institute at its Headquarters and also at outlying centres/branches. A brief report on the constructional activity in the current year is narrated in the subsequent paragraphs.

The Administrative activities in the four Centres, namely Delhi, Bangalore, Chennai and North East Centre at Tezpur and in other outlying branches of the Institute and Giridih Office, are more or less similar to the Headquarters but on a much smaller scale.

Office bearers of the Institute Administration during the year:

Director	:	Bimal K. Roy
Professors-in-Charge of Scientific Divisions	:	Anish Sarkar (Theoretical Statistics & Mathematics)
		Anup Dewanji (Applied Statistics)

Administration

		Manoranjan Pal (Social Sciences)
		Barnana Roy (Physics & Earth Sciences)
		Saurabh Ghosh (Biological Sciences)
		Dipti Prasad Mukherjee (Computer & Communication Sciences)
Head, SQC & OR	:	Amitava Bandyopadhyay
Head, Delhi Centre	:	Rahul Roy
Head, Bangalore Centre	:	N.S.N. Sastry
Head, Chennai Centre	:	S. Ponnusamy
Head, NE Centre, Tezpur	:	S.M. Bendre
Dean of Studies	:	Pradipta Bandyopadhyay
Chief Executive (A & F)	:	S.K. Iyer

List of workers who joined/retired/voluntarily retired/resigned/terminated/died during the year

Appointments

Scientific / Technical Workers

Sl. No.	Name
1.	Amlan Banerjee
2.	Garga Chatterjee
3.	Kiranmoy Das
4.	Neena Gupta
5.	Rajat Subhra Hazra
6.	Yogeshwaran Dhandapani
7.	Holendro Singh Chungkham

Non-Scientific Workers

Sl. No.	Name		Sl. No.	Name
1.	Dhananjay Kumar Chaubey		7.	Avijit Ganguly
2.	Debasish Chakrabarti		8.	Sushil Bholanath Pakhide
3.	Sruthy T.S.		9.	Narendra Ranjan Mukerje
4.	Kunwar Singh Bisht		10.	Sibdas Sikdar
5.	Kusuma K.R.		11.	Kaisar Alam
6.	Ranjani Krishnamoorthy			

Retirement/Voluntary Retirement

Scientific & Technical Workers

Sl. No.	Name		Sl. No.	Name
1.	Krishna Majumder		12.	Jagat Jiban Saha
2.	T.S. Vasulu		13.	Aditya Bagchi
3.	Ranju Kundu		14.	G. Govinda Rajan
4.	Swati Sadhu		15.	Shankar Dihidar
5.	Pradip Kr. Das		16.	Narayan Ch. Deb
6.	Bidyut Kr. Pal		17.	Trinath Modak
7.	Sisir Roy		18.	Dilip Kr. Chaturvedi
8.	Sambhu Nath Biswas		19.	Sarajit Ray
9.	Pradip Kr. Raha		20.	Maya Dey
10.	Amar Nath SIngh		21.	Swagata Gupta
11.	Bibha Karmakar			

Non-Scientific Workers

Sl. No.	Name		Sl. No.	Name
1.	Kunal Kr. Basu		20.	Sankar Narayan Mukherjee
2.	Asit Baran Roy		21.	Gunadhar Bhowmick
3.	Niranjana Gupta		22.	Biswanath Dutta
4.	Kamal Singh		23.	Samar Kumar Ghosh
5.	Prabir Kr. Chatterjee		24.	Aloke Dey
6.	Prafulla Kr. Sarkar		25.	Rash Bihari Singh
7.	Niranjan Kr. Pal		26.	Arjun Mallick
8.	Biswajit Malakar		27.	Binod Mirdha
9.	Jagadish Sharma		28.	Biswanath Sinha
10.	Ajodhya Mukhiya		29.	V. Hema
11.	Haradhan Mondal		30.	Prabir Kumar Kundu
12.	Shibnath Paul		31.	Gopal Ch. Das
13.	Kajal Pal		32.	Rabindra Nath Paul
14.	Jiban Barua		33.	Tapan Kr. Das
15.	Ashit Nag		34.	Debabrata Mukherjee
16.	Jagjiwan Lal		35.	Ashok Kumar Saha
17.	Swapan Kr. Saha		36.	Lakhan Thakur
18.	Kalpana Banik		37.	Tushar Das
19.	Ranjana Sarkar			

Resignation/Termination

Scientific Worker

Sl. No.	Name
1.	Rajat Mazumder

Death

Non - Scientific Worker

Sl. No.	Name
1.	Hiralal Ram
2.	Ratnu Oraon
3.	Chandru Oraon
4.	Gopal Singh
5.	Rajen Orao

Number of workers in the Institute as on 31st March 2015 (A.N.)

Number of workers in the Institute as on 31st March 2015:

(i)	Scientific and Technical Workers	-	427
(ii)	Non-Scientific Workers	-	536
	Total	:	963

Breakup of manpower by Gender, Social Category and Disability group as on 31st March 2015 (A.N.)

Total Strength		Physically Handicapped (PH)	Scheduled Caste (SC)	Scheduled Tribe (ST)	Other Backward Class (OBC)	Minorities
Male	811	05	100	25	71	20
Female	152	Nil	14	01	04	02
Total	963	05	114	26	75	22

Annual Return on Cases of Sexual Harassment

Sl. No.		Autonomous Bodies
1.	Number of complaints of sexual harassment received in the year	Nil
2.	Number of complaints disposed off during the year 2014-15	03
3.	Number of cases pending for more than 90 days	Nil
4.	Number of workshops on awareness programmers against sexual harassment conducted during the year	01
5.	Nature of action	(i) Written Apology 2 Cases (ii) Withdrawing increment for one year one case

Applications received and action taken by the Institute under RTI Act, 2005

Name of the Appellate Authority: Prof. Bimal K. Roy, Director of the Institute.

Name of Central Public Information Officer: Shri S.K. Iyer, Chief Executive (Admn. & Finance) of the Institute.

A total number of 109 (One hundred and nine) applications were received by the Central Public Information Officer of the Institute during 2014-15. Central Public Information Officer provided information against 109 (One hundred and nine) applications within the stipulated date. The summary statement in this regard for the year 2014-15 is appended below:-

No. of Applications received	**No. of cases accepted**	**Decisions where requests were fully or partially rejected**		**No. of decisions from Appellate Authority**	**C I C decision**			**Amount collected (Rs.)**		
		Fully rejected	Partially rejected		No. of decisions received	Penalty imposed	Disciplinary action, if any	Fee	Other Charges	Penalty amount
109	109	Nil	Nil	9	1	NIL	NIL	920	2054	NIL

Budget and Finance

For the year 2014-2015, Section 8(1) Committee recommended Rs.20822.00 lakhs (Government Grant Rs.20372.00 lakhs and ISI internal receipt Rs.450.00 lakhs) under Non-Plan (BE) and Rs.15597.34 lakhs under Plan (BE). The Government approved a sum of Rs.13999.00 lakhs and of Rs.12500.00 lakhs for Non-Plan and Plan expenditure respectively. At the revised estimate stage, the Institute sought for a grant of Rs.18212.02 lakhs and Rs.16350.00 lakhs under Non-Plan and Plan respectively which also recommended by the Section 8(1) Committee. The Government sanctioned a grant of Rs.14891.92 lakhs (including the negative balance of Rs.1801.00 lakhs during the financial year 2013-2014) under Non-Plan and the Plan RE allocation was fixed at Rs.5853.00 lakhs (including the unutilized amount of Rs.952.91 lakhs during the financial year 2013-2014 and Rs.444.22 lakhs fund pertaining to R.C. Bose Centre of Cryptology). The plan expenditure during report was well within the budget allocation sanctioned by the Government. However, the non-plan expenditure was more by Rs. 1863.94 lakhs over the fund allotted by the Ministry. The Audited Annual Accounts of the Institute for the year 2014-2015 has been furnished in Part IV of this report.

Major Construction / Renovation works taken up by the Institute during 2014-2015

Kolkata

R C Bose Centre for Cryptology and Security

The Centre is located at the Gupta Niwas Campus of the Institute. The Planning, Design-Engineering and construction work for the project has been awarded to M/s NBCC on deposit work basis. The planning for the Centre has been done by M/s NBCC. The concept-plans of the Cryptology Centre, Hostel Building and Residential Units have been approved by the Institute. NBCC will shortly start construction activities after obtaining clearance from the local municipality.

Administration

Infrastructure Development at Baranagar Campus of the Institute

M/s Bridge & Roof Co. (India) Ltd. (A Government of India Enterprise), a Miniratna Company has been selected as Project Management Consultant through invitation of EOI for the following major construction and repairing-renovation works.

- Construction of New Academic Building and New Students' Hostel.
- Repair, renovation and restoration work of R.A. Fisher Bhavan & S.N. Bose Bhavan.
- Augmentation and distribution of electric power.

Area Development of 202, B.T. Road campus around ISEC Building

The area development work including road, drains parking space, lighting etc. around the newly constructed ISEC Building (C D Deshmukh Bhavan) has been completed.

Modernization and renovation of 3rd floor of P.N. Haksar Bhavan

The work of modernization and renovation of third floor of P.N. Haksar Bhavan for the Accounts Department is nearing completion.

Miscellaneous maintenance & Renovation work

The Institute's Engineering Unit has done miscellaneous maintenance and renovation of Labs, Offfices, hostel, staff quarters, sewerage and drainage system, internal roads, water supply and sanitary lines throughout the FY 2014-2015.

Delhi

Land and Construction

During the financial year 2014-2015, Works Advisory Committee meeting took place only once on January 23, 2015.

A write up on major civil and electrical works during the period April 01, 2014 to March 31, 2015.
Following major electrical and civil activities were carried out during 2014-2015

Miscellaneous maintenance and Renovation work:

Electrical

The Centre had undertaken during the year miscellaneous Electrical and Civil repair and maintenance works. The Electrical works included re-wiring of staff quarters, repair / maintenance and extension of street lights, re-wiring job at different buildings and making provision of solar water heater system etc.

Civil

Similarly, civil works undertaken by the Centre included painting works of Hostels and some other residential/ academic buildings, renovation of staff quarters including water proofing of some of the buildings, analyzing structural stability of P.J. Hostel building etc.

Bangalore

Major construction / renovation works completed / undertaken by the Bangalore Centre during 2014 - 2015:

1. Fire protection system and Furnishing in Research Scholar Hostel building duly approved by WAC
Fire protection works have been completed. Furnishing of suites and executive rooms of RSH building is in progress.

2. Renovation of toilets of Platinum Jubilee Building

The work has been completed in all respect.

3. Increasing height of compound wall North end point to South end point

The selection process for the appointment of Architect cum Consultant has been completed. The selected Consultant has been awarded to execute the work.

4. Renovation of two numbers of attached toilets for physically challenged personnel in old hostel

The work has already been completed and put to use.

5. Renovation of existing toilets (Gents and Ladies) on ground and second floors

The work has been fully completed and toilets have been put to use.

6. Upgrading of security guard toilet at the South gate

The work has been fully completed and toilets have been put to use.

7. Construction of New Annex Building

The selection process for suitable Government agency has been undertaken in the F.Y. 2014-15

Other Activities

We have celebrated Prof. P.C. Mahalanobis Day (as Statistics Day), Republic Day, Independence Day, Republic Day and Dr. B.R. Ambedkar's Birth Anniversary in the Centre. We have also celebrated Karnataka Rajyotsava Day with cultural programme.

Hon'ble Minister, General (Dr.) V.K. Singh visited Indian Statistical Institute, Bangalore Centre on 12.02.2015.

Tezpur

There was no new recruitment, retirement, resignation or report of death in this Centre during the financial year.

No major Construction / renovation works has been taken up by the Center during 2014-2015.

Society Type Activities

Membership: April 2014 – March 2015

1) During the period 30 persons became Ordinary Members of the Institute.
2) 15 Ordinary Members became Life Members of the Institute.

The membership position as on 31 March, 2015 is as follows:

Ordinary Members	-	295
Life Members	-	985
Institutional Members	-	03
Total	-	1283

Finance Committee Meetings: The Finance Committee met once on 9th October, 2014. Besides the decisions taken on various financial matters, the Finance Committee recommended RE 2014-15 and BE 2015-16 (both Plan and Non-Plan) in its meeting held on 9th October, 2014. The Annual Report including Audited Statement of Accounts for the year 2013-2014 was considered and recommended in the same meeting of the Finance Committee.

Council Meetings: During the period under report (2014-15), the Council met five times on 1st July, 2014, 5th September, 2014, 29th September, 2014, 13th October, 2014 and 9th January 2015 to take decisions on various academic and administrative matters of the Institute. The Budget Proposals of the Institute both for Plan and Non-Plan (RE for 2014-15 and BE for 2015-16) were considered in the meetings of the Council held on 13th October 2014, as recommended by the Finance Committee in its meeting held on 8th October, 2014. The Annual Report including the Audited Statement of Accounts for the year 2013-2014 was considered and approved by the Council in its meeting held on 13rd October, 2014.

A list containing the names of the President of the Institute, Chairman and members of the Council of the Institute and lists of members of different committees constituted by the Council are given in the Back Cover page and in Chapter 12 respectively.

Annual General Meetings: During the period under report (2014-15), the General Body of the Institute met on 14th November, 2014. The Annual Report of the Institute for the year 2013-2014 and Audited Statement of Accounts for the year 2013-2014 together with the Auditor's comments and replies of the Administration thereto were adopted in the meeting of the General Body held on 14th November, 2014.

11. LIST OF MEMBERS OF THE ACADEMIC COUNCIL AND OTHER COMMITTEES OF THE INSTITUTE AS ON 31 MARCH 2015

Academic Council

Bimal K. Roy, Director (Chairman)

Pradipta Bandyopadhyay, Dean of Studies (Convener)

Theoretical Statistics and Mathematics Division

T.S.S.R.K. Rao, B.V. Rajarama Bhat, N.S. Narasimha Sastry, Bhaskar Bagchi, S. Ramasubramanian, K. Ramamurthy, Pl. Muthuramalingam, Mohana Delampady, Sunanda Bagchi, B. Rajeev, V. Pati, B. Sury, V.R. Padmawar, Siva Athreya, C. Robinson Edward Raja, S.M. Srivastava, Probal Chaudhuri, Rana Barua, Alok Goswami, Arup Bose, Goutam Mukherjee, Ratan Dasgupta, Gopal Krishna Basak, Pradipta Bandyopadhyay, Amartya Kumar Dutta, Debashish Goswami, Rudra Pada Sarkar, Mahuya Datta, S. Pannusamy, Rajendra Bhatia, Rahul Roy, R.B. Bapat, Abhay Gopal Bhatt, Arup Kumar Pal, Isha (Bagai) Dewan, Anish Sarkar, Antar Bandyopadhyay, Jaydeb Sarkar.

Applied Statistics Division

Sushama M. Bendre, Bimal Kr. Roy, Debasis Sengupta, Anup Dewanji, Mausumi Bose, Palash Sarkar, Ashis SenGupta, Debapriya Sengupa, Tapas Samanta, Atanu Biswas, Subhamoy Maitra, Pabitra Pal Choudhury, Ayanendranath Basu, Tapas Kumar Chandra, Subir Kumar Bhandari, Smarajit Bose, Rita Saha Ray, Arun Kumar Adhikary, Sumitra Purkayastha, Arijit Chakrabarti, Sourabh Bhattacharya.

Social Sciences Division

V.K. Ramachandran, Madhura Swaminathan, Satya Ranjan Chakravarty, Amita Majumder, Abhirup Sarkar, Nityananda Sarkar, Manash Ranjan Gupta, Tarun Kabiraj, Monoranjan Pal, Manipushpak Mitra, Indraneel Dasgupta, Anjali Ghosh, Arunava Sen, Bharat Ramaswami, Satya P. Das, E. Somanathan, Prabal Roy Chowdhury, Pulakesh Maiti, Probal Dasgupta, Tridip Ray, Samarjit Das.

Biological Sciences Division

Joydev Chattopadhyay, Anjana Dewanji, Arunava Goswami, Premananda Bharati, Barun Mukhopadhyay, Subrata Kr. Roy, Parasmani Dasgupta, P.P. Majumder, Bidyut Roy, Saurabh Ghosh, Sabyasachi Bhattacharya, Indranil Mukhopadhyay.

Physics and Earth Sciences Division

Dilip Saha, Chandan Chakraborty, Dhurjati Prasad Sengupta, Soumendra Nath Sarkar, Saswati Bandyopadhyay, Pinaki Roy, Subir Ghosh, Barnana Roy, Banasri Basu, Guruprasad Kar, Parthasarathi Ghosh, Preeti Parashar, Santanu Kumar Maiti, Alan Banerjee.

Computer and Communication Sciences Division

Bhabani Prasad Sinha, Bhargab Bikram Bhattacharya, Subhas Chandra Nandy, Nabanita Das, Susmita Sur-Kolay, Krishnendu Mukhopadhyay, Sandip Das, Bidyut Baran Chowdhuri, Swapan Kr. Parui, Umapada Pal, A.R.D. Prasasd, Bhabatosh Chanda, Nikhil Ranjan Pal, Kumar Sankar Roy, Dipti Prasad Mukherjee, Srimanta Pal, Sankar Kumar Pal, C.A. Murthy, Sushmita Mitra, Ashish Ghosh, Sanghamitra Bandyopadhyay, Rajat Kumar De, Sasthi Charan Ghosh, Swagatam Ghosh.

Administration

Statistical Quality Control and Operations Research Division

Kalyan Kumar Chowdhury, P.K. Perumallu, Ashim Roy Chowdhury, U. Haridas Acharya, Surajit Pal, A. Rajagopal, Samir Kr. Neogy, B. Mohan Reddy, G.S.R. Murthy, A.L.N. Murthy, Amitava Bandyopadhyay, Dipak Kr. Manna, Arup Kumar Das, Ranjan Sett, Arup Ranjan Mukhopadhyay, Abhijit Gupta, Prasun Das, Ashis Kr. Chakraborty, Nandini Das, Susanta Kumar Gauri, Md. Zafar Anis, Ashok Sarkar, Somnath Ray, S.M. Subhani.

Library, Documentation and Information Sciences Division

Chief Librarian

Computer and Statistical Service Centre (CSSC)

Debashis Roy, Amitava Datta,

Member-Secretary, ISEC

Prasanta Pathak.

Other Committees of the Institute

A. Finance Committee

Director (Chairman), Government Representative (Ministry of Statistics & Programme Implementation), Government Representative (Ministry of Finance), Abhay Bhatt, B.V. Rajatama Bhat, Bhabatosh Chanda, Saurabh Ghosh, G.S.R. Murthy, Head, Delhi Centre, Head, Bangalore Centre, Head, Chennai Centre, Head, North-East Centre, Tezpur, Head, R.C. Bose Centre, Chief Executive (Admn. & Finance), Somnath Roy, Sudip Chakraborty (Convener).

B. Sankhya Editorial Committee

Editor-in-chief, Sankhya, Series A and Series B:

Professor B.L.S. Prakasa Rao (University of Hyderabad, Hyderabad)

Joint Editors, Sankhya, Series A:

Sourav Chatterjee (New York University, New York, USA), Subhashis Ghoshal (North Carolina State University, Raleigh, USA), Hemant Iswaran (Univesity of Miami, Miami, USA) and Alok Goswami (ISI, Kolkata).

Joint Editors, Sankhya, Series B:

Nilanjan Chatyterjee (National Cancer Institute, Washington DC, USA), Hemant Iswaran, (University of Miami, Miami, USA), Lijian Yang, (Michigan State University, East Lansing, USA) and Atanu Biswas (ISI, Kolkata).

Co-Editors, Sankhya Series A:

Barry Arnold (University of California, Riverside, CA, USA), Zhidong Bai (National University of Singapore, Singapore), Moulinath Banerjee (University of Michigan, Ann Arbor, MI, USA), Eduard Belitser (Technical University of Einhoven, Netherlands), Amarjit Budhiraja (University of North Caroline, Chapel Hill, USA), Thomas Gerds (University of Copenhagen, Denmark), Chii-Ruey Hwang (Institute of Mathematics, Academia Sinica, Taipai, Taiwan), Hannes Leeb (University Vienna, Vienna,

Austria), Ranjan Maitra (Iowa State University, Ames, IA, USA), Arnab Maity (North Carolina State University, USA), Kanchan Mukherjee (The University of Liverpool, Liverpool, UK), Debashis Paul (University of California, Davis, USA), Igor Pruenster (University of Turin, Turin, Italy), R.V. Ramamoorthi (Michigan State University, East Lansing, USA), Anindya Roy (University of Maryland-Baltimore Country, USA), Sujit K. Sahu (University of Southampton, UK), Bodhisattva Sen (Columbia University, USA), Anand Vidyashankar (George Mason University, USA), Min Yang (University of Missouri, USA), Mahmoud Zarepour (University of Ottawa, Ottawa, Canada) and S. Ramasubramanian (ISI, Bangalore).

Co-Editors, Sankhya Series B:

Tathagata Bandyopadhyay (Indian Institute of Management, Ahmedabad, India), Uttam Bandyopadhyay (University of Calcutta, Kolkata, India), Tsung-Chi Cheng (National Chengchi Universityl Taipei, Taiwan), Yi-Hau Chen (Academia Sinica, Taipei Taiwan), Holger Dette (Ruhr_Universitat, Bochum, Germany), Sarat Dass (Michigan State University, East Lansing, USA), Gauri Sankra Datta (University of Georgia, Athens, GA, USA), Jesus Fernando Lopez Fidalgo (University of Castilla-La Mancha, Spain), Jianhua Guo (Northeast Normal University, China), KyungMann Kim (University of Wisconsin, Madison, USA), Fumiyasu Komaki (University of Tokyo, Tokyo, Japan), Tatyana Krivobokova (Georg-August University, Goettingen, Germany), Partha Lahiri (University of Maryland, College Park, MD, USA), Michael Leblanc (Fred Hutchinson Cancer Research Center, USA), Maria del Carmen Pardp Llorente (Complutense University of Madrid, Spain), Arnab Maity (North Carolina State University, Raleigh, USA), Saumen Mandal (University of Manitoba, Manitoba, Canada), Thomas Metthew (University of Maryland, Baltimore, USA), Seng Huat Ong (University of Malaya, Malayasia), Shyamal D. Peddada (Research Triangle Park, NC, USA), Piercesare Secchi (Politechnico di Milano, Milan, Italy), J. Sunil Rao (University of Miami, Miami, USA), Jaya Satagopalan (Memorial Sloan-Kettering Cancer Center, USA), Mervyn Silvapulle (Monash University, Australia), Peter Song (University of Michigan, Ann Arbor, USA), Stefan A. Sperlich (Georg-August Universittat Gottingen, Switzerland), Lily Wang (University of Georgia), Lan Xue (Oregon State Unive3rsity, Oregon, USA) and Yong Zhou (Academy of Mathematics and Systems Science, Chineses Academy of Sciences, China).

C. Works Advisory Committees

Kolkata

Anandapran Gupta (Chairman), Bhabatosh Chanda (Vice-Chairman), Debaprasad Mandal, Rajkumar Roy Choudhury, Mahuya Datta, Biswabrata Pradhan, Expert (Civil), Expert (Architect), Expert (Electrical Engg.), Chief Executive (A & F), Amitava Mukherjee, Ashis Chakraborty, Rajat Kanti Chatterjee, In-Charge, E.M.U., Kuntal Ghosh, Gouri Sankar Acharya, In-charge, Engineering Unit (Convener).

Delhi

K. C. Iyer (Chairman), G.K. Taneja Expert (Electrical), R. Upadhyay (Member-Civil), Expert (Architecture-Member), Head, Delhi Centre, Abhay Bhatt, Samir K. Neogy Chetan Ghate, Sujan Dutta, M.C. Gupta (Convener).

Bangalore

Srinivas Bhogle (Chairman), M.V. Ramaswamy (Engineer-Civil), Chinnappan (Engineer-Electrical), Satyanarayana (Engineer-Architecture), Chief Engineer (C & B) Bangalore, Head, Bangalore Centre, Head, DRTC, Bangalore Centre, Head, SMU, Bangalore Centre, Head, SQC & OR, Bangalore Centre, Head, SSIU, Bangalore Centre, N. Sarvamangala, Kalyan Kumar Chowdhury, Mohan Delampady, B.S. Dayasagar, DCE (A), Bangalore Centre (Convener).

D. Ph.D. / D.Sc. Committee

Statistics

Bimal K. Roy, Director (Chairman), Dean of Studies, Isha Dewan, Gopal K. Basak, Mohan Delampady, V.R. Padamwar, Anup Dewanji, Mausumi Bose, Smarajit Bose, C.A. Murthy, Rahul Roy, (Convener).

Mathematics

Bimal K. Roy, Director (Chairman), Dean of Studies, B. Sury, Rana Barua, Mahuya Datta, Arup Pal, Anish Sarkar, Bhargab B. Bhattacharya, B.V. Rajarama Bhat (Convener).

Computer Science

Bimal K. Roy, Director (Chairman), Dean of Studies, Swapan Parui, C.A. Murthy, Sanghamitra Bandyopadhyay, Bhargab B. Bhattacharya, Susmita Sur-Kolay, Bhabatosh Chanda, Rana Barua, Palash Sarkar, (Convener).

Quantitative Economics

Bimal K. Roy, Director (Chairman), Dean of Studies, Nityananda Sarkar, Bharat Ramaswamy, E. Somanathan, Tarun Kabiraj, Anup Dewanji, Manipushpak Mitra (Convener).

SQC & OR

Bimal K. Roy, Director (Chairman), Dean of Studies, D.K. Manna, Sanghamitra Bandyopadhyaym, Anup Dewanji, S.K. Neogy, Arup K. Das, G.S.R. Murthy, (Convener).

E. Policy Planning and Evaluation Committee (PPEC)

Chairman of ISI Council (Chairman), Bimal K. Roy, Director (Vice-Chairman), Director General, C.S.O., Financial Advisor, Ministry of Statistics & P.I., Kalyan B. Sinha, Atul Sharma, Shibdas Bandyopadhyay, Partha P. Chakrabarti, S.B. Rao, T.S.S.R.K. Rao, Satya R. Chakravarty, Bhargab B. Bhattacharya (Convener).

F. Technical Advisory Committees of different Divisions

Theoretical Statistics *and Mathematics Division*

Bimal K. Roy, Director (Chairman), B.L.S. Prakasa Rao, Mythili Ramaswamy, Gadadhar Misra, B.V. Rao, Aloke Dey, Professor-in-Charge (Convener).

Applied Statistics Division

Bimal K. Roy, Director (Chairman), P. Vellaisamy, Swadheenananda Pattanayak, R. Ramanujam, Rahul Mukherjee, Uttara Naik Nimbalkar, Kalyan Das, Professor-in-Charge (Convener).

Computer and Communication Sciences Division

Bimal K. Roy, Director (Chairman), Partha P. Chakrabarti, Venkatesh Raman, Pijush Kanti Panigrahi, M. Narasimha Murty, Subhasis Chaudhuri, B.L. Deekshatulu, Soumen Chakrabarti, P. Nagabhushan, Professor-in-Charge (Convener).

Physics and Earth Sciences Division

Bimal K. Roy, Director (Chairman), Ashok Sahni, Sudipta Sengupta, Kamales Kar, R. Ramanathan, V. Kumaran, Professor-in-Charge (Convener).

Biological Sciences Division

Bimal K. Roy, Director (Chairman), D.J. Chattopadhyay, Anil P. Gore, Giriraj Chandak, A.R. Sharma, S.P. Singh, Aditya Chatterjee, Professor-in-Charge (Convener).

Social Sciences Division

Bimal K. Roy, Director (Chairman), Manoj Kumar Panda, Arvind Pandey, Sarmila Banerjee, T.J. Kamalanabhan, Tista Bagchi, Partha Nath Mukherji, Professor-in-Charge (Convener).

Statistical Quality Control and Operations Research Division

Bimal K. Roy, Director (Chairman), Sujit K. Basu, N. Ravichandran, Ramanuj Majumder, P.K. Roy, Richard Lobo, Head, SQC & OR Division (Convener).

Library, Documentation and Information Sciences Division

Bimal K. Roy, Director (Chairman), Pravakar Rath, Sudhendu Mandal, Swati Bhattacharya, Chief Librarian (Convener).

EDITORIAL BOARD

Amita Majumder	----	Chairperson
Debasish Goswami	----	Member
Amita Pal	----	Member
Dipti Prasad Mukherjee	----	Member
Preeti Parashar	----	Member
Susmita Mukhopadhyay	----	Member
Zafar Anis	----	Member
Arup Roy Choudhury	----	Member
Nibedita Ganguly	----	Member
Abhay G. Bhatt	----	Member
N.S.N. Sastry	----	Member
S. Ponnusamy	----	Member
S.M. Bendre	----	Member
S.K. Iyer	----	Member
Manoj K. Pandey	----	Member
Narendra Ranjan Mukerje	----	Member-Convener

Acknowledgements

The Editorial Board gratefully acknowledges the assistance rendered by the staff of the CE (A&F)'s Office, Public Relations Unit, Publication & Printing Unit and Reprography & Photography Unit in the preparation of this Annual Report.

Prof. Pradipta Bandyopadhyay, Dean of Studies, ISI delivering the Inaugural Address at Symposium on Business Analytics organized by SQC & OR during 17-18 December 2014

Celebration Rashtriya Ekta Dibash on Sardar Ballabhbhai Patel's Birthday on 31 October 2014

Indo-German Workshop on Algorithms organized by ACMU during 9-13 March 2015

Sri Arun Shourie, Chairman, ISI laying the foundation stone of R. C. Bose Centre for Cryptology & Security at Kolkata on 29 June 2014

Prof. Bimal K Roy, Director, ISI distributing Certificates at the 67th Convocation of the International Statistical Education Centre (ISEC) at ISI,Kolkata on 30 May 2014

Winter School on Application of Statistical Methods in Medicine, Public Health and Environment using Computer organized by ASU during 23-27 March 2015

Prof. Eric Stark Maskin, Nobel Laureate, delivering lecture at ISI on 8 January 2015

Sri Arun Shourie, Chairman, ISI, presenting medal to a student at the 49th Convocation of ISI on 9 January 2015

Prof. Sara Van de Geen delivering P C M Lecture at ISI on 8 October 2014

Published by Public Relations Unit, ISI, 203 B. T. Road, Kolkata-700108
Printed by Publication & Printing Unit, ISI, 203 B. T. Road, Kolkata-700108
Concept and Design by Reprography and Photography Unit, ISI, 203 B. T. Road, Kolkata-700108