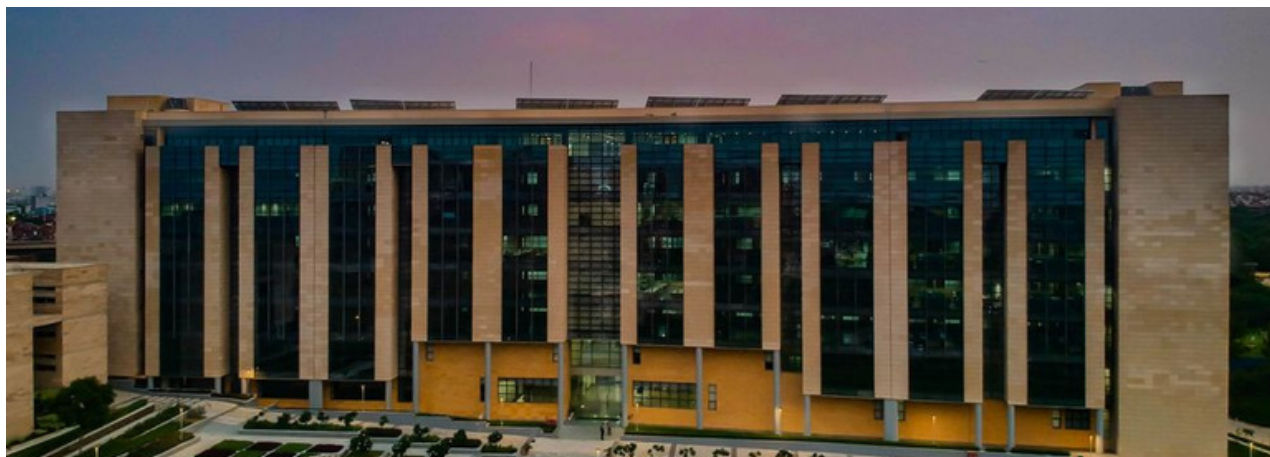


IIIT-D IRD NEWSLETTER

Volume 5 | Dec 2022



Director's Message



Dear Readers,

I hope that you are safe and doing great! Niels Bohr, the Nobel laureate in Physics said, "Prediction is very difficult, especially if it's about the future!" Without making any predictions, we hope the pandemic is now in the rear-view mirror.

From the perspective of urban vehicular mobility, we are gradually moving towards an increasingly connected, autonomous, electrified, and shared future. I am delighted to inform you that the Centre of Excellence on Sustainable Mobility at IIIT-Delhi was formally inaugurated on 12 July 2022. The Centre is working on projects like the contactless ticketing that will help improve the ease of living for the common citizens of Delhi. An MoU was also signed with the transport department for collaboration on the problems related to urban transportation in Delhi.

We signed an MoU for setting up an Electropreneur Park (EP) at IIIT-Delhi. This is envisioned as a unique entity focused on promoting innovation and creating start-ups in electronic design and fabrication. The idea is to create a holistic ecosystem where the faculty members and students of IIIT-Delhi can actively engage with 'electronics' start-ups. The EP is planned to work in tandem with iHub Anubhuti, the Technology Innovation Hub at IIIT-Delhi.

The Institute has started an internal grand-challenges program (Discovery Track Investigator) to give impetus to specific research areas where we can bring about a 'seismic shift' and indeed 'move the needle'. The Institute also organized a Quantum Technology workshop, the outcome of which is new "Minor in Quantum Technologies" which is being offered at the institute now.

These are just some of the recent activities and you will find more information about our current initiatives related to research, development, and innovation in this issue. As always, your feedback and suggestions are most welcome.

Happy reading!

Best wishes,

Ranjan Bose



Dean IRD's Message

Greetings from IIIT-Delhi!

I hope you all are doing well. Many of us have started going to the office and expect we will be back to pre-covid days soon. We are happy to bring out the Fifth edition of the IIIT-Delhi IRD Newsletter. Since our last newsletter, there have been several visible research activities and accomplishments received by our faculty members and you will find some glimpses in this newsletter. We have established a new 'Centre of Human-Centered Computing' focusing on next-generation technologies for HCI and adaptive visualization. Our faculty members have published more than 33 quality research papers in top Transactions and Conferences filed two patents, signed 21 MoUs with various Government organizations and Industries, and transferred research technologies to Industry. As always, we welcome your feedback. Enjoy reading this new edition of the newsletter and learn more about our research activities.

RESEARCH HIGHLIGHTS

Key Research Project

DCM Nouvelle Ltd. (DCMNVL)

This research project will carry out CSR Activity to promote research and development to enable special education through the generation of new technologies, significant technical know-how, Data, and Confidential Information that has immense commercial potential and is of substantial economic value to society.

Identification of network pathways for drug targeting in Multiple Myeloma from NGS data using deep Learning

Objectives as stated in the project proposal:

Objective-1: Design a novel bio-inspired deep learning architecture from signaling pathways (BDL-SP).

Objective-2: Identification of altered biological signaling pathways from the WES data of MM and MGUS based on BDL-SP of objective-1, and its comparison to human reference networks.

Objective-3: Identification of network motifs a) at subject-level and b) for intra- and inter-group analysis of MM and MGUS subjects using altered pathways discovered in objective-2 and subsequent identification of driver and passenger mutation genes.

Objective-4: Development of an automated pipeline with software for the above objectives that will be made freely available to research labs/hospitals within India.

Comment: Since the Ph.D. student had earned the M.Tech in Electrical Engineering, he had to be trained to handle the genomics data. Hence, initially, we trained the student with Objective-0 as below:

Objective-5: Learning to handle the genomics data, build its preprocessing pipelines, and learn the ge-nomics data handling tools and software in R package and Python.



FACULTY FOCUS



Dr. Arun Balaji Buduru is an assistant professor at Indraprastha Institute of Information Technology Delhi. He received his Ph.D. in Computer Science, specializing in Information Assurance, at Arizona State University in 2016. His research interests include cyber security, reinforcement learning and stochastic planning. He received his B.E. degree in Computer Science in 2011 from Anna University at Chennai, India. He has worked as a research intern as part of Cisco IoT Architecture Group. His current research focuses on adaptive user re-authentication on touch-based devices, predicting security breaches in critical cyber infrastructures, and user behavior based adaptive IoT device reconfiguration.

Dr. Arani Bhattacharya earned his Ph.D. degree holder from Stony Brook University in Computer Science in 2019. His research experience is in the general areas of wireless networks, with a focus on applying algorithms, formal verification, and machine learning to different emerging applications. He has co-authored over 20 publications in different reputed venues. Before joining IIIT-Delhi, Arani has worked as a postdoctoral researcher at KTH Royal Institute of Technology, Stockholm and as a research intern at IMDEA Networks Institute, Madrid. He regularly serves as a reviewer for several top-tier journals such as IEEE/ ACM Transactions on Networking, IEEE Transactions on Wireless Communications and IEEE Transactions on Mobile Computing.



Dr. Koteswar Rao Jerripothula is currently working as an Assistant Professor at IIIT-Delhi in the CSE Department. He received his B.Tech degree from IIT Roorkee, India, in 2012, and PhD degree from Nanyang Technological University (NTU), Singapore, in 2017. In 2016, he did a research internship at Advanced Digital Sciences Center (ADSC), Singapore. He has also worked with Graphic Era and Lenskart earlier.

His research interests are Computer Vision and Machine Learning. He is currently focusing primarily on object co-segmentation, saliency detection, semi-supervised learning and weakly supervised learning. Some of his works have been published in top/popular venues like CVPR, ECCV, TMM, TCSVT, etc.



COLLABORATION

IIIT-Delhi has made various collaborations with Industrial and Academic Organizations, a few of them are:

- CEFIPRA,DST
- Transport Department, Govt. of NCT of Delhi
- ICMR
- DRIIV Foundation
- Rajiv Gandhi Cancer Institute & Research Centre
- Vehant Tech Pvt Ltd
- DCM Nouvelle Ltd.
- OSRTC
- National Language Translation Mission (NLTM)
- Applied Solar Technologies
- (India) Pvt. Ltd.
- Information and Library
- Network Center, Gandhinagar
- ALTZ Technologies Pvt. Ltd.
- EDCIL India Pvt. Ltd
- Enord Pvt. Ltd.

INTERNATIONAL COLLABORATION

- University of Naples Federico II
- Namibia University of Science and Technology
- Adeia Media Holdings LLC
- The Harvard College Project for Asian and International Relations (HPAIR)



PATENTS:

The detail of patents can be found at:
<https://ird.iiitd.edu.in/filedpatents.html>



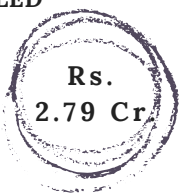
**TOTAL NUMBER OF
PATENTS FILED**



**PATENTS
PUBLISHED**



**TOTAL NUMBER OF
PROJECTS**



**TOTAL VALUE OF
PROJECTS**



MoU SIGNED



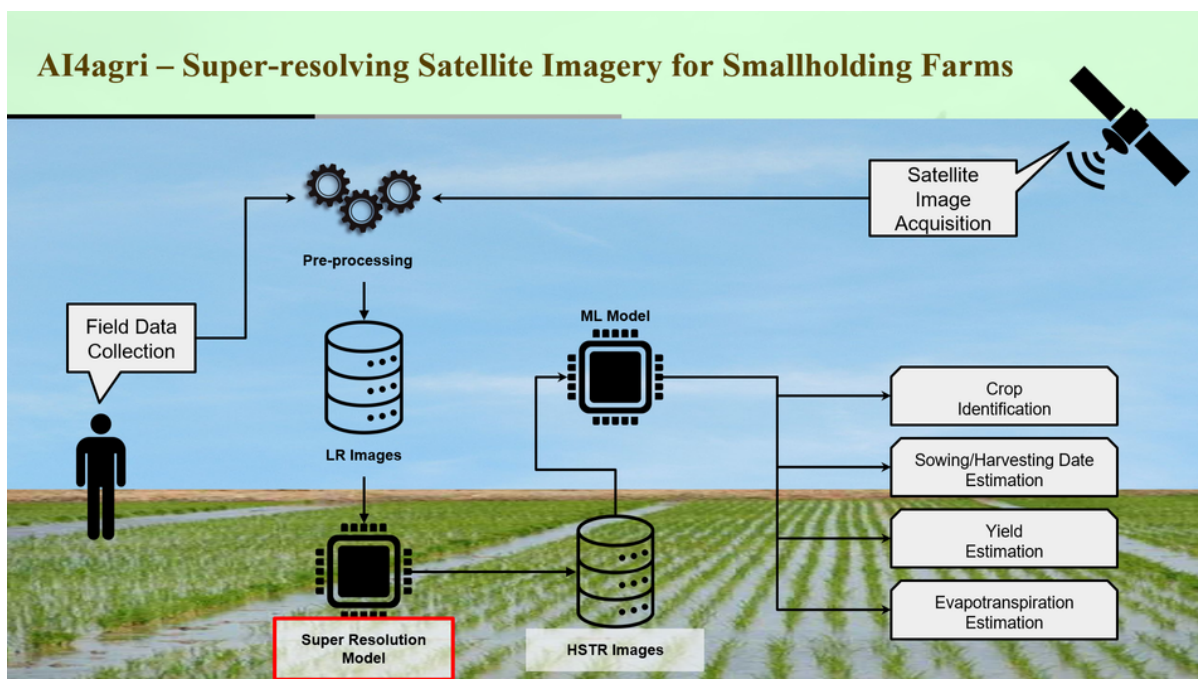
**EMPLOYMENT
GENERATED**



AWARDS, HONORS, AND RECOGNITIONS



1. Dr. Saket Anand and his team have been recognized by the Google AI for Social Good workshop team under the "Methods Recognition" category. The project on AI for Agriculture, titled "High-Resolution Satellite Imagery for Modeling the Impact of Aridification on Crop Production", in collaboration with M. S. Swaminathan Research Foundation, was selected for support by the Google AI for Social Good workshop team in the 2021-2022 cycle.



2. Dr. Sanat K. Biswas has been selected for the 2020 Harry Rowe Mimno Award for the paper titled "State Estimation Methods in Navigation: Overview and Application" by the IEEE Aerospace and Electronics Society. It was notified on April 6 2022. Established in 1979, this award is to recognize and foster excellence in clear communication of technical material of widespread interest to AESS members and in doing so, to honor the contributions of AES Transactions Editor-in-Chief Emeritus Dr. Harry Rowe Mimno to the AESS and IEEE for over 50 years. The award is to the author of a paper that is either tutorial in nature (including surveys), speculative, or advocates new ideas or principles tending to promote debate.
3. Dr. Debarka Sengupta has been selected for the INAE Young Innovator & Entrepreneur Award 2022 for the development of Blood-based detection of cancers using gene expression profiles and machine learning. The INAE Young Innovator & Entrepreneur Award is instituted to encourage and recognize innovation and entrepreneurship among Young Engineers. The engineering innovations/inventions/concepts realized and implemented in the industry are either in new processes or products.

CENTRE ACTIVITIES

Achievement of Centre for Design and New Media

Publications and conferences:

Publications and conference papers in top avenues like IJSR, DIS, COMSNETS, IEEE, ICMM ETC

- Ghosh, S., Kumar, S., Singla, Y. K., Shah, R. R., & Umesh, S. (2022). Span Classification with Structured Information for Dis_luency Detection in Spoken Utterances
- Mahata, Debanjan, Naveen Agarwal, Dibya Gautam, Amardeep Kumar, Swapnil Parekh, Yaman Kumar Singla, Anish Acharya, and Rajiv Ratn Shah. "LDKP: A Dataset for Identifying Keyphrases from Long Scienti_ic Documents"
- Anubha Kabra, Mehar Bhatia, Yaman Kumar Singla, Junyi Jessy Li, and Rajiv Ratn Shah. 2022. Evaluation Toolkit For Robustness Testing Of Automatic Essay Scoring Systems. In 5th Joint International Conference on Data Science & Management of Data (9th ACM IKDD CODS and 27th COMAD) (CODSCOMAD 2022), January 8-10, 2022, Bangalore, India. ACM, New York, NY, USA, 10 pages
- D. Sethia, T. Kamlesh, M. Singh and S. B. Ray, "Short Term Effect of Physical Exercise on Selective Attention using Eeg and Stroop Task," 2022 14th International Conference on COMMunication Systems & NETworkS (COMSNETS), 2022, pp. 789-793
- D. Sethia, T. Kamlesh, M. Singh and S. B. Ray, "Short Term Effect of Physical Exercise on Selective Attention using EEG and Stroop Task," 2022 14th International Conference on COMMunication Systems & NETworkS (COMSNETS), 2022, pp. 789-793
- Singh, D.K., Kumar, M., Fosch-Villaronga, E., Singh, Deepa, Shukla, J. (2022, April). Ethical Considerations from Child-Robot Interactions in Under-Resourced Communities. International Journal of Social Robotics (2022).
- Bamdev, P., Grover, M. S., Singla, Y. K., Vafaee, P., Hama, M., & Shah, R. R. (2022). Automated Speech Scoring System Under The Lens. International Journal of Artificial Intelligence in Education, 1-36
- The paper of Dr. Richa Gupta titled "StoryBox: Independent Multi-modal Interactive Storytelling for Children with Visual Impairment" has been accepted at the Conference on Human Factors in Computing Systems in LBW track
- The paper of Dr. Richa Gupta titled "Perceiving Sequences and Layouts through Touch" has been accepted at IEEE Eurohaptics Conference 2022

A short animated film by student (Mayank Jain), "Trapped in Search", was selected by First-Time Filmmaker Sessions by Lift-Off Global Network, UK.

A short animated film by student (Smera Goel), "Growing Pains", was selected by First-Time Filmmaker Sessions by Lift-Off Global Network, UK.





Achievement of Centre for Sustainable Mobility

Work Done:

- Portal and APIs to collect and display data of street lights in Delhi are in the advanced stage
- The work is part of a project monitored by LG and coordinated by the Principal Secretary (home)

We combine this data with the bus data to let a person know

- What is the lighting at bus stands
- The time of arrival of the Bus and the expected crowd
- Lighting from Bus stand to home

A Roadmap Towards Smarter Transportation System: Challenges and Solution Approaches:

Motivation: India is facing several challenges related to traffic safety due to the increase in road surface area and the number of vehicles. India currently has the highest fatalities at around 1.5 lakh per year. The number of fatalities has largely remained stagnant over the past decade, indicating that further measures are needed to improve traffic safety. Second, the average speed of traffic in cities like New Delhi and Bangalore has fallen to as low as 20 km/h due to extreme traffic congestion. This leads to a loss of productivity among urban residents. It further increases air pollution as repeated acceleration and deceleration leads to higher emission from vehicles.

Goal: Our research aims to introduce smarter traffic management technologies to mitigate these problems. We elucidate some of the technologies we are looking to introduce :

Leveraging Public WiFi to Send Streams of Traffic Cameras. Although traffic cameras are widely deployed, they currently depend on wired connectivity to send the video streams for either manual or automated processing. Extending ubiquitous wired connectivity is known to be expensive. A number of modern cities have now rolled out public WiFi access. We look at utilizing such publicly deployed WiFi to send the video streams for further processing. Our first strategy is to identify the newer standards of WiFi, such as WiFi 6 and 7 (802.11ax/be), to ensure that the data from multiple cameras can be transmitted reliably at acceptable and predictable latency.

A second strategy for using such traffic cameras is to filter out irrelevant data. A large proportion of the space and time of the video feeds collected do not have any relevant information which can be readily filtered out. However, current techniques of filtering such data tend to utilize computer vision techniques that leverage deep neural networks (DNNs). Executing DNNs is computationally expensive and requires specialized processors to run in real time. We study lightweight methods of identifying relevant portions of the video so that executing compute-intensive DNNs on the cameras may be avoided. Efficient Automated Processing of Traffic Video Streams A major goal of today's traffic management systems is to enforce better driving habits. This can be achieved by (i) automated enforcement of traffic rules, (ii) More dynamic traffic management, as well as (iii) using an automated alert system to alert drivers of road obstructions. Each of these techniques requires the real-time computation of the traffic video streams. We propose to utilize computing devices installed close to the cell towers, known as edge compute devices, to provide such services. Our goal is to mathematically model the capabilities of such edge compute devices to provide real-time inference with minimum wastage of compute resources.

Energy-Efficient Traffic Management A major challenge that has been currently overlooked is that processing the video feeds of lakhs of cameras on servers would lead to enormous energy consumption. This would lead to an increase in carbon emissions, leading to further global warming. Thus, it is crucial to ensure more energy-efficient traffic management, via judicious utilization of computing resources. Recent advances in computer architecture have led to the rise of heterogeneous computing devices for specialized workloads. We want to utilize the power of such compute devices for specialized workloads, such as FPGAs and neural processing units, to increase the energy efficiency of traffic management.

Achievement of Centre for Artificial Intelligence

CAI Webinar Series

2nd Feb : Talk on "AI for social impact: Results from deployments for public health" in the Seminar series of CAI by Prof. Milind Tambe (Harvard University)

March 14th: Talk on "Machine Learning and Logic: Fast and Slow Thinking" in the Seminar series of CAI by Prof. Moshe Vardi, Rice University

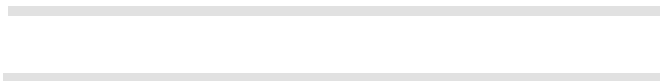
May 3: Talk on "Making Invisible Visible with Data, ML and Devices" in the Seminar series of CAI by Prof. Ramesh Raskar from MIT Media Lab

Jun 21: Talk on "Guaranteed adversarially robust training of neural networks" by Dr. Raman Arora, from Johns Hopkins University

July 11: Talk on " New Opportunities in Automating AI" in the Seminar series of CAI by Dr. Lisa Amini, Director of IBM Research Cambridge

Workshop

April 20th: CAI-AIISC Online Workshop



Research News

Prof. Anubha Gupta's interview for the AI-based free tool MERC, a Novel Machine Learning Extra Tree Model for Risk Prediction After ST-Elevation Myocardial Infarction, created by the SBILab, IIIT-D, and GB Pant Hospital has been featured in Prime Time Shows of ZeeNews and News24 on June 1, 2022.

SBILab is organizing the FDP Programme / IEEE SPS Summer Seasonal School in collaboration with IEEE SPS, CAI IIITD and Centre of Excellence in Healthcare, IIITD, between June 6-10, 2022 in virtual mode. .

An article on "Understanding the difference between automation and AI is important for AI development" by Dr. Vinayak Abrol in India

Collaboration of Dr. Paro Mishra on Queer Marriage/ Relationship Project.

Collaborators include:

D'Lane Compton, Professor and Chair of Sociology, University of New Orleans ; Gayle Kaufman, Professor of Sociology and Gender & Sexuality Studies, Davidson College ; Tannistha Samanta, Associate Professor, Sociology, Flames University, Pune

Our PhD. alumni, Mitali Sinha (student of Dr. Sujay Deb) has been awarded the "Best Student Research Forum Award" at the 35th International conference on VLSI design and 21st international conference on embedded systems (VLSID 2022) for her thesis titled "Performance-aware Design-space Optimization and Attack mitigation for Emerging Heterogeneous Architectures".

Other Activities

The One IRD portal was introduced to the system and the same is working fine as all the requests are being furnished through it only.

Notable Publications

"Optical IRS Aided B5G V2V Solution for Road Safety Applications" received the best paper award in the IEEE ANTS 2022 conference.

"ANROL: Autonomous Navigation based on ROS and Laser Odometry" demo presented in 15th International Conference on COMMunication Systems & NETWORKS (COMSNETS2023).

"H-AES: Towards Automated Essay Scoring for Hindi" presented at the Thirteenth AAAI Symposium on Educational Advances in Artificial Intelligence.

"An Energy-efficient Ge-based Leaky Integrate and Fire Neuron: Proposal and Analysis" is published in IEEE Transactions on Nanotechnology.

"A Process and Data Variations Tolerant Capacitive Coupled 10T1C SRAM for In-Memory Compute (IMC) in Deep Neural Network Accelerators" published in 4th IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS) held in Incheon South Korea.

"Wasserstein Metric Attack on Person Re-identification" published in IEEE 5th International Conference on Multimedia Information Processing and Retrieval (MIPR).

"Contextual Active Learning for Person Re-Identification" published in IEEE 5th International Conference on Multimedia Information Processing and Retrieval (IEEE MIPR 2022).

"Strategies for teaching design prototyping in virtual mode" presented at the EDDE Design Education Conference 2022.

"DEC-aided SM-OFDM: A Spatial Modulation System with Deep Learning based Error Correction", presented at the International Conference on AI-ML Systems, 2022.