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IIITD IRD Newsletter

INDRAPRASTHA INSTITUTE of
INFORMATION TECHNOLOGY DELHI

IIIT-D IRD NEWSLETTER

Volume 4 | Feb 2022

Director's Message

Dear readers,

Firstly, I wish you a very Happy New Year, full of possibilities!

IIIT-D, a research-led teaching institute, has been focussing on various possibilities for advancing knowledge through ground-breaking, high-impact research. In IIIT-D, collaboration is valued and recognized at all levels - between academic units, between research institutions, with partners in the community, and most importantly, with industry. IIIT-D has recently signed an MOU with TCS to collaborate on research areas of mutual interest and explore a new concept of 'flipped internship' where the student will stay at the Institute working on their internship in close interaction with industry collaborators. We are also setting up an Innovation Lab at IIIT-D with support from Samsung. This unique collaboration with Samsung will not only provide support for equipment but also for student fellowships. I am also happy to share that the technology innovation hubs of IIIT-D and IITD have together set up a Medical Robotics Center at IIIT-D. This Center will be a technology-enabled medical simulation & training facility for young resident doctors, besides acting as a validation center for the research outcomes in healthcare robotics and digital health. This newsletter contains more information and exciting news about our current research, development, and innovation activities.

This New Year, we look forward to pursuing novel research ideas, developing innovative technologies, and forging new partnerships. As always, your feedback and suggestions are most welcome. Stay safe! Stay connected!
Best wishes,
Ranjan

Dean IRD's Message

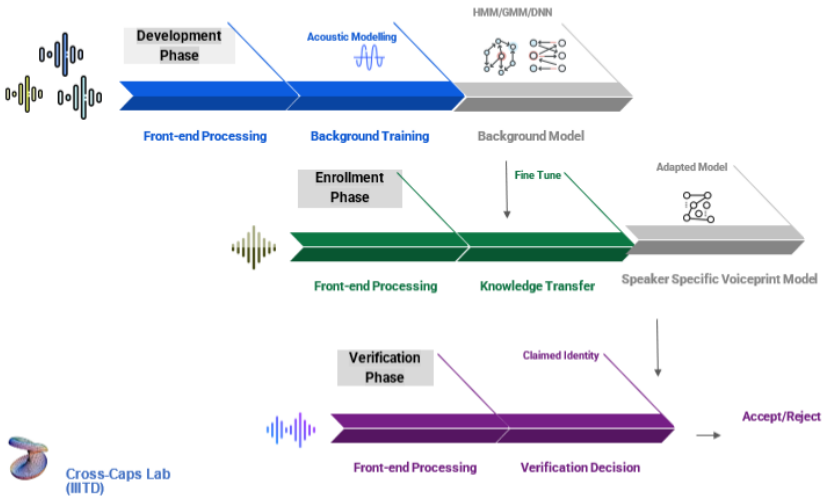
Greetings from IIIT Delhi!
I hope you all are doing well. Many of us have started going to the office and hope we will be back to pre-covid days soon.
We are happy to bring out the fourth edition of the IIIT-Delhi IRD Newsletter. Since our last newsletter, there have been several visible research activities 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 50 quality research papers in top Transactions and Conferences, filed four patents, signed 16 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 knowing more about our research activities.

RESEARCH HIGHLIGHTS

Key Research Project

LEAD-SV: Low-footprint, Efficient and Adaptive Deep Models for Speaker Verification in Smart Home Devices

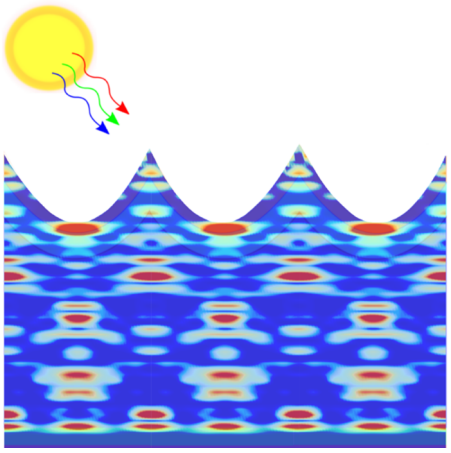
Over the last decade, Deep neural networks (DNNs) have demonstrated excellent generalization performance in a wide range of applications, including speech and audio domains. In parallel, innovations in approaches for the design of efficient architectures and hardware accelerators have prompted commercial interest in deploying such systems on IoT and mobile computing devices. In the Indian context, the field of home automation has seen quite a surge over the last few years. As a result of the superior inference quality of DNNs, various voice-enabled intelligent home devices have started to permeate our everyday lives with redefined user experiences. However, such devices are still incapable of distinguishing between different users. This is important from user-specific personalization and security or privacy perspective. For instance, we do not want someone else to read our emails using a smart speaker connected to a mobile phone. This calls for research in Speaker Verification (SV) systems that



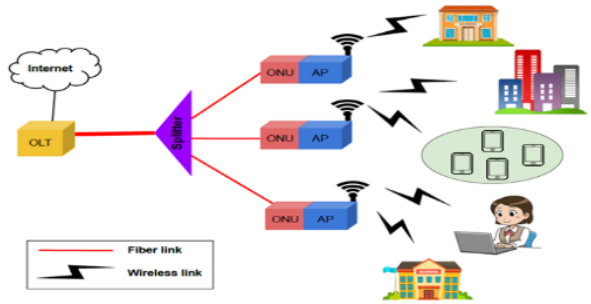
aim to verify a speaker's identity given an audio recording. Deployment of SV systems in smart devices brings various challenges such as performance degradation due to distance speech and noisy conditions, limited availability of user-specific enrolment data, and mismatch between training and practical usage scenarios.
Another existing SV technology is mainly available through cloud infrastructure, which is prone to another kind of privacy concern arising from malicious attacks using Text-To-Speech synthesis (TTS) or Voice Conversion (VC) system. This project addresses the challenges mentioned above by developing a novel methodology for training high-performance deep neural network models for on-device SV, tailored to the user requirements and hardware on smart target devices. In addition, the aim is not only to highlight the vulnerability of such audio models but to study the behavior of compressed on-device audio models in the context of robustness and what is being modeled during the learning process. This project is funded by SERB and led by Dr. Vinayak Abrol.

Flexible, ultra-high efficiency photonic crystal solar cells

Earth is illuminated with 173,000 TeraWatts of power from the sun. While this amounts to approximately 10,000 times the global power consumption, this enormous energy reservoir remains untapped primarily due to the lack of efficient, cost-effective photovoltaic technology. The efficiency of silicon solar cells has inched only by 1.7% over the past 25 years and is currently stuck at 26.7%. The project aims to harness the unprecedented light-trapping capability of photonic crystals to boost the efficiency in silicon solar cells beyond 30%, a long-standing goal of the photovoltaics community. This new class of cells would be more efficient, flexible, cheaper, and amenable to mass fabrication than any existing cell. This project is funded by SERB and led by Dr. Sayak Bhattacharya.



Multi-Institutional Faculty Interdisciplinary Research Project (MFIRP)



The joint MFIRP proposals have been invited for collaborative, basic, applied or translational research projects in interdisciplinary areas of Computer Science and Engineering, AI/ML, Electronics and Communication Engineering, Computational Biology, Social Sciences, Humanities, Mathematics, and Quantum Computing from IIITD and IITD. The submission deadline was September 30, 2021.

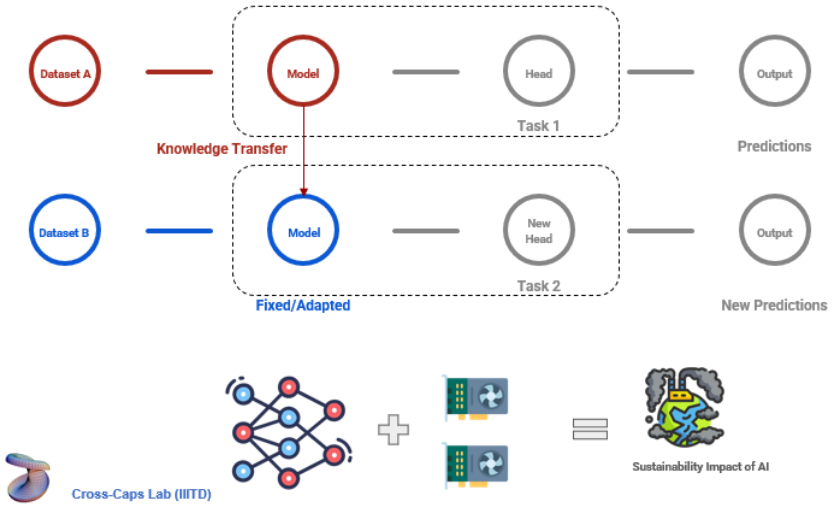
Out of 19 proposals, 5 proposals got selected. The proposal of the following faculties members got selected:

1. Dr. R.K. Ghosh
2. Dr. Paro Mishra
3. Dr. Mrinmoy Chakraborty
4. Dr. Sneha Chaubey
5. Dr. Vinayak Abrol

Model agnostic evaluation of transferability of pre-trained deep model

This project aims to develop mathematical tools to measure and evaluate the transferability of deep neural network (DNN) based models for a target task. To this aim, various time-frequency (TF) and topology-based methods will be explored to develop an empirically easy to compute metric. Such a metric aims to practical assessment of a variety of different pre-trained acoustic models by running just a single pass through target data.

In particular, we will analyze the trajectory growth of simple geometric objects (lying on a manifold of test data) passing through DNNs as a metric to link expressivity and generalization error in such deep models. In addition, the aim is to study how such models flexibly integrate spectral and temporal task-dependent information. We analyze the properties of our methods theoretically and also demonstrate its effectiveness empirically for diverse pre-trained models (supervised/unsupervised), downstream tasks (classification/regression), and modalities (vision/speech/audio). This project is led by Dr. Vinayak Abrol



Unexceptional Neoliberalism and the Future Work - The Political Economy of Platform Work in India

A grant from the Southern Centre for Inequality Studies, University of Witwatersrand, Johannesburg, South Africa has been granted to Dr. Gayatri Nair for a project titled Unexceptional Neoliberalism and the Future Work - The Political Economy of Platform Work in India. The significant amount is 8362 USD and the grant period is for six months.

As part of the five-country project, this research is to analyze the impact of gig work in India on its workers and understand the changes if any the entry of such work has been introduced in the political economy of India. To address this question, PI examines digital technology experiences at work through interviews with gig workers and shifts in law and policy. This project is funded by the University of Witwatersrand.

FACULTY FOCUS

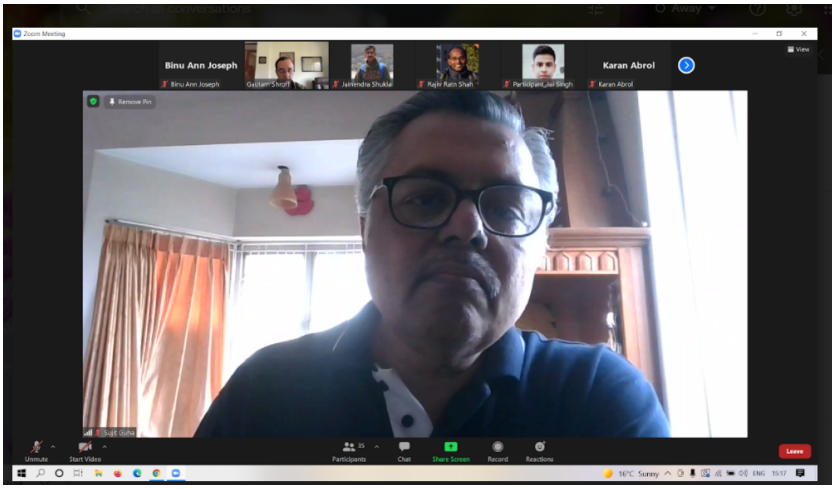
Dr. Paro Mishra is an assistant professor at IIITD. She received her Ph.D from the Department of Humanities and Social Sciences, Indian Institute of Technology, Delhi, in 2017. Her core research interests lie at the intersection of Gender and Technology – New Reproductive Technologies (NRTs) and Information/ Digital Technologies. She has published on intimate migrations, masculinity, aging, care circulation, care work, and gendered surveillance. Paro has received several fellowships and grants from the Netherlands Institute for Advanced Studies, University Grants Commission, IIT Delhi, and the Indian Council of Social Science Research. She has recently finished a project on sex-selective technologies, male marriage squeeze, and cross-cultural intimacies funded by the Indian Council of Social Science Research (2018). Her current research examines the intersections of ICTs and Aging, particularly questions around the 'Smart' Aging landscape in India. Select publications include special issue co-editorship for Asian Bioethics Review (2021; 13(1)) and in Journals like Anthropology and Aging, The Sociological Review, Economic & Political Weekly, and Society and Culture in South Asia.

Dr. Vinayak Abrol currently works as an assistant professor in the Computer Science and Engineering at IIIT-Delhi. Before this, he held Oxford-Emirates data science fellowship at Mathematical Institute, University of Oxford (10/2018-12/2020), position of Academic Advisor at Kellogg college Oxford (7/2019-12/2020) and SNSF funded postdoctoral position at IDIAP research Institute, Switzerland (2/2018-10/2018). He received his TCS Innovation Labs funded Ph.D from School of Computing and Electrical Engineering, IIT Mandi, India in 2018; following M.E and B.E in Electronics and Communication Engineering from Panjab University Chandigarh, India in 2013 and 2011, respectively. His research focuses on the design, and analysis of numerical algorithms for information inspired applications, which is multi-disciplinary and lies at an intersection of Engineering, Maths and Computer Science. On the theoretical front he is currently working on developing theories of deep learning using tools from random matrix theory, and information theory, where as on the applied front his research interest is in area of speech/audio analytics on problem such as acoustic modelling and coding, voice biometrics, pathological speech and audio categorization. His research has been disseminated in several internationally reputed journals and conferences, including JASA, IEEE TASLP/TMM, Elsevier Speech Communication/CSL/PRL, ICML, NIPS, INTERSPEECH, and ICASSP, etc.

INDUSTRY COLLABORATION

IIITD has made various collaborations with many Industrial and Academic Organizations, few of them are:

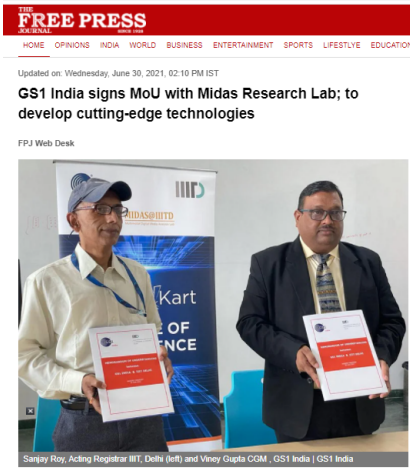
1. Tata Consultancy Services Ltd.
2. Linkquest Technologies Ltd.
3. Federation of Indian Chambers of Commerce and Industry (FICCI)
4. Yulu Bikes Pvt. Ltd.



Collaboration meeting with TCS

INTERNATIONAL COLLABORATION

1. WiseCode
2. Population Council Organization
3. D.Kraft Learning
4. GS1
5. Sony AI


THE FREE PRESS JOURNAL

HOME OPINIONS INDIA WORLD BUSINESS ENTERTAINMENT SPORTS LIFESTYLE EDUCATION

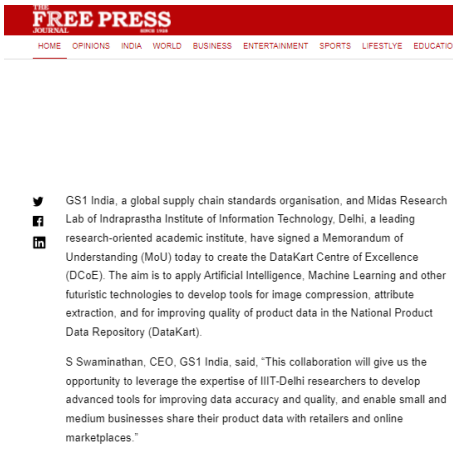
Updated on: Wednesday, June 30, 2021, 02:10 PM IST

GS1 India signs MoU with Midas Research Lab; to develop cutting-edge technologies

FPJ Web Desk

Sanjay Roy, Acting Registrar IIIT, Delhi (left) and Viney Gupta CGM , GS1 India | GS1 India

Advertisement


THE FREE PRESS JOURNAL

HOME OPINIONS INDIA WORLD BUSINESS ENTERTAINMENT SPORTS LIFESTYLE EDUCATIO

GS1 India, a global supply chain standards organisation, and Midas Research Lab of Indraprastha Institute of Information Technology, Delhi, a leading research-oriented academic institute, have signed a Memorandum of Understanding (MoU) today to create the DataKart Centre of Excellence (DCoE). The aim is to apply Artificial Intelligence, Machine Learning and other futuristic technologies to develop tools for image compression, attribute extraction, and for improving quality of product data in the National Product Data Repository (DataKart).

S Swaminathan, CEO, GS1 India, said, "This collaboration will give us the opportunity to leverage the expertise of IIIT-Delhi researchers to develop advanced tools for improving data accuracy and quality, and enable small and medium businesses share their product data with retailers and online marketplaces."

MoUs SIGNED

1. J.K. Laxmipat University
2. School of Information and Data Science Nagasaki University

16

MoU Signed

PATENTS:

The details of patents can be found at *https://ird.iiitd.edu.in/filedpatents.html*

33

TOTAL NUMBER OF PROJECTS

Rs. 4.22 Cr.

TOTAL VALUE OF PROJECTS

4

TOTAL NUMBER OF PATENTS FILED

14 PhD

28 RA

EMPLOYMENT GENERATED

Duration : Oct'21 - Feb'22

AWARDS, HONORS, AND RECOGNITION

1. Best paper award (Application-oriented Research Track) in AIMLSystems 2021 Conference ($1000) : P. R. Sahoo, R. Rajoria, S. Chandhok, S. J. Darak, D. Pau and H. D. Dabral, “Resource-Constrained Neural Networks for 5G Direction-of-Arrival Estimation in Micro-controllers,” AIMLSystems 2021 conference, Bangalore, India, Sept. 2021.
2. NEILOM PRIZE 2020-21 Dr. Richa Gupta has been awarded this year’s Neilom Prize of Rs. 50,000 for her work on Assistive Technology. This prize instituted by Neilom Foundation, Maryland, USA, aims to inspire and empower recipients, who are Neilom Fellows, to become the leaders of tomorrow and create impactful solutions to reach humanity. The Neilom Foundation was established by Prof. Davinder K. Anand in honor of his son Dilip “Neil” Anand. The Foundation’s vision is to support activities to improve the lives of young people working at the intersection of Education and Technology.
3. Mr. Venktesh V and Ms. Prashasti received the Prime Minister’s Fellowship for Doctoral Research on projects titled ‘AI in Education’ and "On-chip Sensors to monitor Device Variability and Reliability for Automotive and Space Applications," respectively. The Prime Minister Fellowship Scheme for Doctoral Research is an initiative by the Science and Engineering Research Board - SERB and Confederation of Indian Industry to encourage young, talented, enthusiastic, and result-oriented scholars to take up industry-relevant research. His project is focused on applying AI for personalized education. The work is being done with Extramarks (Educational Technology Company) Prashasti's project aims to provide On-chip Aging, Voltage, and Speed sensors to enable adaptive process and aging compensation. In collaboration with ST Micro, the researchers propose to design sensors in the 18nm FD-SOI technology for low power and highly reliable circuits to address the most demanding applications in automotive, industrial, or aerospace markets.

CENTRE ACTIVITIES:

DataKart Centre of Excellence (DCoE)

It’s the age of disruptions, and information technology is the driver for the transformations. With the rise of Big Data, AI, and myriad applications, IT has to be recognized as a source of immense social and economic power. At the same time, technologists and computer scientists must understand the world they are helping to build.

GS1 India signed a Memorandum of Understanding (MoU) with MIDAS Research Lab of Indraprastha Institute of Information Technology (IIIT) Delhi, a leading premier research-oriented academic institute, to create the DataKart Centre of Excellence (DCoE).

The creation of DCoE aims to apply Artificial Intelligence, Machine Learning, and other futuristic technologies to develop tools for image compression, attribute extraction, and improving the qualityof product data in DataKart (National Product Data Repository).

The collaboration will enable the development of cutting-edge technologies for making the DataKart more robust and dependable. This will benefit Businesses (retailers, online marketplaces, point-of-sale providers, and aggregators) and end-consumers access to quality product data.

This collaboration will allow GS1 to leverage the expertise of IIIT-Delhi researchers to develop advanced tools for collecting the data, improving data accuracy and quality, and enabling small and medium businesses to share their product data with retailers and online marketplaces.

The collaboration will bring together research professionals and academic scholars to develop cutting-edge technologies for making the National Product Data Repository more robust and dependable. The DCoE will ensure that data is published in the repository is of the highest standards and is available for businesses and consumers for validation. Dr. Rajiv Ratn Shah leads the centre.

Achievement of Centre for Sustainable Mobility

The centre team led by Dr. Pravesh Biyani has initiated a pilot project with OSRTC on a comprehensive ticketing system -- real-time using hardware in buses and the contactless and online system. The data collected from this system will be used to optimize their operations and provide better connectivity to the citizens of Odisha. The team will be testing the solution in March and April.

The Centre team led by Richa Gupta is in talks with the DTC to initiate a project on inclusive transportation. This is for disabled citizens as well as less tech-savvy passengers.

Establishment of Centre Of Excellence (CoE) In Human-Centered Computing

A new Centre of Excellence (CoE) in Human-Centered Computing has been established. The CoE will focus on teaching relevant courses on Human-Centered Computing and facilitating research collaborations, capacity building, and exchange of researchers and experts between the European Union (EU) and India. The CoE is established as part of the EU Erasmus+ Design and Innovation Capacity Building (DESINNO) project that brings together IIITD, World University Of Design (WUD), and Regional Institute of Management and Technology (RIMT) from India; and University of Aegean, Greece, Brunel University, UK, and Politecnico di Milano, Italy, and CREATHIDEV from Europe which are anchoring the activities under this project from India and the EU respectively. Prof. Pushpendra Singh will lead this center.

Achievement of Centre for Design and New Media

Hackathon: Anveshan was conducted from 8-11th Jan 2022. The four research centers: Center for Design and New Media (sponsored by Tata Consultancy Services, A TCS Foundation Initiative), Center of Excellence in Healthcare, Centre of Sustainable Mobility, and Infosys Center for Artificial Intelligence, came together for Anveshan. All research centers contributed with the different problem statements concerning their focus areas.

Center for Design and New Media was the overall coordinator for the Hackathon: Anveshan.

A Student-Driven Hackathon presents an opportunity to exchange knowledge and get valuable mentorship support from the center members. A platform to employ problem-solving skills in real-life problems.

Teams Presented
First Round 33

Teams Qualified
Second Round 14

Support for each team 25k

Prize Pool for awardees 1.5L

UG, PG, and PhD
Students from IIITD 125+

Dr. Jainendra Shukla has been appointed as the new Head for the Centre for Design and New Media

Some ongoing research work of CDNM:

1. Studying the Role of Human Movement In the Metaverse:

The project aims to study the role of human movement in the Metaverse from an applied perspective. Firstly, we would synthesize and analyze the existing approaches of body movement detection. Secondly, the study would involve building prototypes of social, work, or play experiences using contemporary motion detection methods. Thirdly, we would draw out the guidelines a designer must follow when designing with a specific implementation technique. Lastly, we would come up with recommendations for tools and APIs to be built to democratize the use of human motion in Metaverse experiences. We believe that through this effort, we will be able to push the boundary of the relevant knowledge and consideration for human body movement as an interaction mechanism. Dr. Aman Parnami is taking care of this project.

2. Improving Mental Health Through Continuous Objective Measurement and Personalized Intervention:

Under stress, we experience an increased heart rate, reduced Heart Rate Variability (HRV), and excessive sweating, leading to an increase in skin conductance. Hence these physiological signals can be used as a biomarker to identify stress in an individual. EDA indicates emotional arousal by measuring skin conductivity, while HRV captures variation in time elapsed between successive heartbeats. PPG is used to understand the heart's activity by measuring blood flow. PPG signals can be used to calculate HRV. However, studies have shown that EDA is a motion-sensitive signal; even the process of digestion and increased sweating at high temperatures and humidity can change the EDA measurements [2].
Moreover, skin conductivity also increases during sleep. Hence, EDA alone might not give reliable predictions, and we rely on both EDA and HRV to predict stress. Dr. Jainendra Shukla is leading this project.

3.VERTIGLOBAL: A Global Telehealth Solution for Vertigo:

The expected outcomes of the proposed study are:

1. Designing and building of low-cost, easy to use, portable, robust, and effective device for nystagmus eye tracking.
2. Building mobile application / web portal for generating different reports automatically based on nystagmus eye-tracking
3. Building machine learning models to automatically perform vHIT in vertigo diagnosis

Dr. Rajiv Ratn Shah is heading the project.

4. Exploring the Design of XR Enabled Accessible Learning Experiences:

This project will address this gap and try to explore XR elements such as marked audio captioning, 3D sound, contrast, customizable fonts, etc., in the design of engaging, accessible, immersive, and interactive resources for persons with sensory impairments. Dr. Richa Gupta is leading the project.

5. Smart Camera for Enforcing Social Distancing and Face Mask Detection

We propose developing a plug-and-play extension for existing CCTV cameras in public places to enforce social distancing and face mask detection. The solution incorporates computer vision techniques and uses the frame-by-frame information of CCTV to detect people and classify violations of social distancing norms. The solution will also perform real-time face mask detection. The techniques will be robust and can function without any calibration, and will be capable of detecting varying geometries of face masks and performing under degrees of natural illumination. In case of a detected violation, a voice alert can be issued. Further, the timestamp of violation with the snapshot of the frame highlighting the associated subjects will be sent to a central database and emailed to the authorities for further action. Dr. Sujay Deb is leading the project.

Infosys Centre for

Artificial Intelligence

Achievements of Centre of Artificial Intelligence

The Infosys Center for Artificial Intelligence (CAI) has grown to 23 regular faculty members from IIIT-Delhi. It draws direct involvement of about 100 students at the UG, Masters, and Ph.D. levels via the educational programs supported by the Center (B. Tech. CSAI & M. Tech. CSAI), research thesis, and capstone projects. This increasing engagement with IIITD faculty members and students has directly impacted the research outcomes of the Center, which is demonstrated by the publications and funded research being executed at CAI. The Center has expanded its reach and is initiating collaborative ties with external entities, e.g., the recent MoU between Infosys CAI and the AI Institute of University of South California (AIISC).

Dr. Tanmoy Chakraborty has been appointed as the new Head for the Center for Artificial Intelligence.

Publications: In FY 2021-2022, the faculty members of CAI published a total of 82 papers, of which 43 were in reputed peer-reviewed conference proceedings (AAAI, NeurIPS, ACL, SIGCHI, SIGKDD, ICSE, WACV, WSDM, etc.), 39 were in reputed peer-reviewed journals (ACM and IEEE Transactions).

Sponsored Research Projects (SRP): The faculty members were actively involved in acquiring sponsored research projects.
In FY 2021-22, 17 newly sanctioned sponsored/ consultancy research projects were attributed to CAI by the PIs. The total funding amount was approx. Rs. 4.63 Crores, of which about Rs. 1.3 Crores of funds are from corporate sources and about Rs. 3.3 Crores is govt. funding. Apart from the new SRPs, the seven ongoing projects associated with the Centre have a total budget of Rs. 4.67 Crores, of which Rs. 0.69 Crores was corporate funding, and the remaining was government funding.

Events and Outreach: The visual data contest was co-hosted with the ICVGIP conference, India's premier conference for computer vision, graphics, and image processing. The contest had three visual data competitions, intending to stimulate the students to tackle large-scale applied learning problems for computer vision. The contest attracted applicants from 38 teams, most of which were from various Indian colleges and a few from US universities. Recently, an MoU was signed with AIISC to enable close research collaborations between the two Centers. CAI members are organizing workshops with reputed international conferences such as ACL'22 and AAAI'21.

Research News

News Article [Health Column]: By Prof. Anubha Gupta, SBILab, Indraprastha Institute of Information Technology, Delhi and Manukumar Shetty MD. Maulana Azad Medical College has been published in ETHealthworld.com by Economic Times.
Students of SBILab (headed by Prof. Anubha Gupta) at IIIT-D, Rohith Rajesh, Soham Das, Paras Mehan, and Adwit Singh Kochar have received iHub Anubhuti's Chanakya UG Fellowship for research work in the area of Healthcare.

Research Groups:

1. Program Analysis Group
2. Graphic Research Group
3. High-Speed Electronics Group
4. Visual Conception Group