భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్

भारतीय प्रौद्योगिकी संस्थान हैदराबाद

Indian Institute of Technology Hyderabad

DEPARTMENT OF ARTIFICIAL INTELLIGENCE

About the Department

- The Department of Artificial Intelligence (AI) at IIT-Hyderabad was established in 2019 to offer academic programs and mold students with a holistic understanding of the theory and practice of Artificial Intelligence, as well as to create a complete ecosystem for both academic practice and research in AI.
- The aim of the department is to “Enable and facilitate students to become leaders in the AI industry and academia nationally and internationally; as well as to meet the pressing demands of the country in the various subareas and applications of AI”.
- Department Website: **http://ai.iith.ac.in/**

The AI department launched the BTech in AI program in 2019, the first such initiative in India, and the third in the world (to our knowledge) after MIT and CMU.

Message from the
Head of Department

Welcome to the Department of Artificial Intelligence, IIT Hyderabad. Even until a few years back, Artificial Intelligence or AI was mostly present as a course or a few courses in the curricula of a few disciplines. However, a lot of development that has happened in this area over the past few years has shown how AI can be used to tackle problems coming from many different domains, under many different conditions. This indicates that AI deserves special attention as a separate discipline to focus on domain-agnostic as well as domain-specific techniques to transform the technology landscape. This realization triggered the establishment of the AI department at IIT Hyderabad, in 2019.

The Department of Artificial Intelligence (AI) at IIT-Hyderabad is the first such in India offering BTech, MTech and PhD programs in AI. It was built with an objective to mould students with a holistic understanding of the theory and practice of AI, as well as to create an ecosystem for pedagogy and research in AI, encompassing foundational, applied and interdisciplinary perspectives. The department currently has approximately 120 BTech, 70 MTech and 40 PhD students. The department graduated the country's first BTech batch in AI in 2023.

The Department's mission is to enable students to become leaders in the AI industry and academia nationally and internationally; as well as to meet the pressing demands of the country in various sub-areas and applications of AI. After functioning as a virtual department comprising of affiliated faculty for nearly three years, the department began recruiting its own faculty in 2022. The department currently has around 25 faculty members including the faculty members directly recruited to the department. The faculty members work on various cutting age research problems spanning from Foundational AI to Applied AI. The research flavor includes the areas of foundational aspects towards developing robust AI algorithms, Computer Vision, Natural Language Processing, Speech Processing, Robotics, Fairness in AI, Neuromorphic computing, to interdisciplinary approaches such as AI for IoT, Compilers, communication, autonomous navigation, agriculture, healthcare etc. The department runs multiple projects with funding from Government sources such as DST, SERB, MEITY, DRDO, as well as leading industries such as Google, Microsoft, Adobe, Honeywell, Sony, Qualcomm, Accenture etc. The faculty members regularly publish their research work in highly reputed conferences and journals such as AAAI, ICML, NeurIPS, AISTATS, CVPR, WACV, BMVC, ECCV, UAI, IJCNN, ACL, NAACL, IEEE Transactions on Artificial Intelligence, IEEE Transactions on Image Processing, IEEE Transactions on Green Communications and Networking, IEEE Transactions on Intelligent Transportation Systems, IEEE Transactions on Signal Processing, IEEE Transactions on Information Theory etc.

The AI department at IIT Hyderabad has strong collaborations with various government, academic and industry organizations such as DRDO, ICRISAT, Microsoft, Honeywell, Intel, Adobe, NVIDIA, etc. With growing interest in the domains from prospective students, society, industries as well as the government, the department is expected to scale greater heights in years to come. For more information, please visit https://ai.iith.ac.in/.

- Maunendra Desarkar

Programs Offered

- B.Tech in Artificial Intelligence
- B.Tech Minor in Artificial Inteliigence
- M.Tech in Artificial Intelligence - 2 years
- M.Tech in Artificial Intelligence - 3 years (August & January)
- Ph.D. in Artificial Intelligence

B. Tech in
Artificial Intelligence

Semester 1	Credits
Calculus - I MA1110	1
Calculus - II MA1220	1
Environmental Chemistry CY1017	2
Modern Physics EP1108	2
Introduction to Programming ID1063	3
English Communication LA1760	2
Discrete Math CS1010	3
Intro to AI AI1001	1
Total	**15**

Semester 2	Credits
Vector Calculus EE1203	3
Differential Equations MA1150	1
Series of Funtions MA1230	1
Artificial Intelligence AI1100	1
Probability and Random Variables AI1110	3
Digital Fabrication ID1054	2
Bioengineering BM1030	2
Programming for AI AI1104	1
LA/CA Elective LA/CAxxxx	3
Total	**15**

Semester 3	Credits
Data Structures ID2230	3
Introduction to Metric Spaces MA2150	1
Computer Architecture CS2323	2
OS - I CS3510	1
Matrix Theory EE2100	3
DBMS - I CS3550	1
Linear Systems and Signal Processing EE1206	3
LA/CA Elective LA/CAxxxx	1
Personality Development LA1770	1
Total	**16**

B. Tech in
Artificial Intelligence

Semester 4	Credits
Convex Optimization AI2101	3
Algorithms CS2443	3
Foundations of Machine Learning AI2000	3
Applied Statitics MA4240	3
Compilers - I CS3320	1
DBMS - II CS3563	3
Intro to Entrepreneurship EM3020	1
Total	**17**

Semester 5	Credits
Numerical Calculus MA5060	3
Reinforcement Learning AI3000	3
Intro to Computer Networks AI3020	1
Deep Learning AI2100	3
Advanced Topics in ML AI3001	2
Control Systems EE2101	3
LA/CA Elective LA/CAxxxx	1
Total	**16**

Semester 6	Credits
Free Electives XXxxxx	7
AI Electives*	9
Engineering Electives IDxxxx	1
Total	**17**

Semester 7	Credits
AI Electives*	9
LA/CA Elective LA/CAxxxx	1
Robotics AI4000	3
AI for Humanity AI4013	3
Total	**16**

Semester 8	Credits
AI Electives*	9
Free Elective XXxxxx	6
Ethics & Values LAxxxx	1
Total	**16**

B. Tech Minor in
Artificial Intelligence

Students have to finish a total of 12 credits, with at least one course from each of the following categories (rows). If a student has already completed some of these categories as part of the regular B.Tech Program, the student should take an equivalent number of elective credits to compensate.

Courses	Categeory
AI2000 (or) AI5000 (or) CS5590 (or) CS3390 (or) EE2802	Foundation of Machine Learning
AI2100 (or) AI5100	Deep Learning
AI3001	Advanced Topics in ML
Electives	List aside*
Total	**12**

AI and ML : Theory
Probabilistic Graphical Models
Statistical Learning Theory
Kernel Methods
Optimization Methods in Machine Leaning
Convex Optimization
Reinforcement Learning
Artificial Intelligence
Bayesian Data Analysis
Representation Learning

Applied AI or ML
Computer Vision
Natural Language Processing
Speech Systems
AI for Humanity
Robotics
Image and Video Processing
Data Analytics/Big Data
Application of AI in Healthcare
Hardware Architectures for Machine Learning
Data Mining
Information Retrieval

M. Tech in
Artificial Intelligence – 2 years

Semester 1	Credits
Probability and Stochastic Processes AI5030	3
Foundations of Machine Learning AI5000	3
Matrix Theory EE5609	3
Advanced Data Structures & Algorithms/Data Structures & Application CS6013/ID2230	3
Communication Skills (Advance) LA5180	1
Total	**13**

Semester 2	Credits
Deep Learning AI5100	3
AI Electives*	9
Industry Lecture Series AI5016	1
Total	**13**

Summer	Credits
Thesis Stage I AI6105	3
Total	**3**

Semester 3	Credits
Thesis Stage II AI6205	9
Total	**9**

Semester 4	Credits
Thesis Stage III AI6305	12
Total	**12**

Summary of Credits	
Core Theory	16
Department Core	8
Thesis	24
Total	**48**

M. Tech in
Artificial Intelligence - 3 years (August)

Semester 1	Credits
Probability and Stochastic Processes AI5030	3
Foundations of Machine Learning AI5000	3
Matrix Theory EE5609	3
Communication Skills (Advance) LA5180	1
Total	**10**

Semester 2	Credits
Deep Learning AI5100	3
AI Electives*	6
Industry Lecture Series AI5016	1
Total	**10**

Semester 3	Credits
Thesis Stage I AI6205	3
Advanced Data Structures & Algorithms/Data Structures & Application AI6205	3
AI Electives*	3
Total	**9**

Semester 4	Credits
Thesis Stage II AI6215	6
Total	**6**

Semester 5	Credits
Thesis Stage III AI6315	6
Total	**6**

Semester 6	Credits
Thesis Stage II AI6415	9
Total	**9**

M. Tech in
Artificial Intelligence – 3 years (January)

Semester 1	Credits
Probability and Stochastic Processes AI5030	3
Deep Learning AI5100	3
AI Electives*	3
Communication Skills (Advance) LA5180	1
Total	**10**

Semester 2	Credits
Foundation of Machine Learning AI5000	3
Matrix Theory EE5609	3
Advanced Data Structures & Algorithms/Data Structures & Application AI6013/ID2230	3
Industry Lecture Series AI5016	1
Total	**10**

Semester 3	Credits
Thesis Stage I AI6115	3
AI Electives*	6
Total	**9**

Semester 4	Credits
Thesis Stage II AI6215	6
AI Electives*	1
Total	**6**

Semester 5	Credits
Thesis Stage III AI6315	6
Total	**6**

Semester 6	Credits
Thesis Stage II AI6415	9
Total	**9**

Ph. D. in
Artificial Intelligence

PhD candidates joining after M.Tech or Equivalent degree

- Need to complete 12 credits of coursework in 1 year with 6 credits of mandatory courses (AI5000 and ID2230/CS6013).
- 6 credits of electives can be any course from the elective basket.

Courses(1st Year)	Credits
Basics/Foundations of Machine Learning AI5000	3 (Core)
Advanced Data Structures and Algorithms ID2230/CS6013	3 (Core)
Electives*	6
Total	**12**

PhD candidates joining after BTech/BE/MSc/Equivalent Degree in any discipline (aka Direct PhD candidates)

- Need to complete 24 credits of coursework in 1 year with 6 credits of mandatory courses (AI5000 and ID2230/CS6013).

Courses(1st Year)	Credits
Basics/Foundations of Machine Learning AI5000	3
Advanced Data Structures and Algorithms ID2230/CS6013	3
Deep Learning AI5100	3
Matrix Theory EE5609	3
Probability and Stochastic Processes AI5030	3
Electives*	10
Total	**12**

Faculty

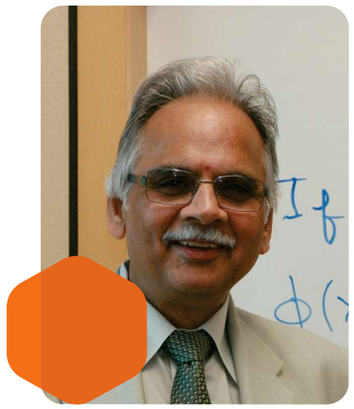
Head of Department and Distinguished Faculty Members

Maunendra Desarkar

Head of Department

Research Interests:

Natural Language Processing, Recommender Systems, Information Retrieval, Machine Learning



M. Vidyasagar

Distinguished Professor

Research Interests:

Systems and Control Theory, Reinforcement Learning

Department Faculty and Affiliated Faculty

Ganesh Ghalme

Department Faculty

Research Interests:

Game Theory, Mechanism Design, Fairness in Machine Learning, Multi-armed Bandits

Ayon Borthakur

Department Faculty

Research Interests:

Neuromorphic Computing

Konda Reddy Mopuri

Department Faculty

Research Interests:

Computer Vision, Artificial Intelligence

Nixon Patel

Affiliated faculty

Research Interests:

Wireless Communications, Applications of AI and Machine Learning

Sai Dhiraj Amuru

Affiliated Faculty

Research Interests:

Applications of AI and Machine Learning in Wireless Communications

Affiliated Faculty from other Departments

C. Krishna Mohan

Research Interests:
Video Content Analysis, Machine Learning, Sparsity Based Methods, Deep Learning

Vineeth N. Balasubramanian

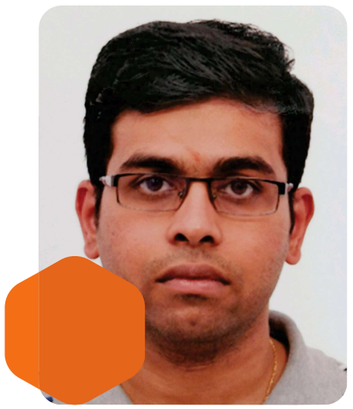
Research Interests:
Machine Learning, Computer Vision

Srijith P. K

Research Interests:
Bayesian Data Analysis, Probabilistic Machine Learning, Bayesian Non-Parametrics, Survival Analysis, and Text Analysis

Manish Singh

Research Interests:
Databases, Data Mining, HCI, Information Retrieval, Information Visualization



Sri Rama Murty Kodukula

Research Interests:
Signal Processing, Speech Analysis, Pattern Recognition

Sumohana S. Channappayya

Research Interests:
Image and Video Quality Assessment. Perceptually Optimal Algorithms, Multimedia Communication

Aditya T. Siripuram

Research Interests:
Signal Processing, Sparse Representations, Sampling Techniques, Optimization

J. Balasubramaniam

Research Interests:
Fuzzy Logic Connectives, Approximate Reasoning

Subrahmanya Sastry Challa

Research Interests:
Wavelets, Computed Tomography, Sparsity seeking optimization techniques

Amit Acharyya

Research Interests:
Signal Processing, Embedded AI, VLSI systems for next generation healthcare systems, Electronic Aspects of Pervasive Computing

P. Rajalakshmi

Research Interests:
AI for Internet of Things, Embedded Systems

Soumya Jana

Research Interests:
Multimedia Signal Processing, Information Theory, AI for Healthcare

Affiliated Faculty from other Departments

Sathya Peri

Research Interests:

Distributed Systems, Graph Analytics, Parallel Processing

R. Prasanth Kumar

Research Interests:

Dynamics, Control Robotics, Mechatronics

Shantanu Desai

Research Interests:

Machine Learning for Astrophysics

Abhinav Kumar

Research Interests:

AI in Wireless Communications, Green Cellular Networks, Device to Device Communications

S. Suryakumar

Research Interests:

Additive Manufacturing, Design

Kishalay Mitra

Research Interests:

Engineering Optimization, Machine Learning Application

Mohan Raghavan

Research Interests:

Computational Neuroscience

Ketan Detroja

Research Interests:

AI for Control Systems, Reinforcement Learning for Process Control

Rameshwar Pratap

Research Interests:

Scalable Data Analytics, Approximation Algorithms

For more details about any of the faculty. please scan the QR Code above

FOUNDATIONAL RESEARCH AREAS

Machine Learning and Deep Learning

Faculty in the department of AI are engaged in foundational research in machine learning (ML) and deep learning (DL), which are considered as the heart of AI and its success over the last decade. The branch of machine learning focuses on teaching computers to learn to perform tasks based on observed data, and deep learning forms a genre of methods in machine learning that has assumed a life of its own in recent years.

Faculty involved

1. M. Vidyasagar
2. Sumohana S. Channappayya
3. Vineeth N. Balasubramanian
4. Srijith P. K
5. J. Balasubramaniam
6. Subrahmanya Sastry Challa

01 Core Problems of Research

Deep Learning Architectures and Training

The study, design and development of new deep learning architectures, complemented by efficient methods to train such models, has been the distinctive driving force of the explosive success of AI methods in recent years. Faculty in the department actively work on newer methods in this impactful area, and have made many contributions on newer model architectures, newer methods to train them, as well as novel adaptations of such architectures to a wide range of applications. A recent focus of faculty in the department is the design and development of multimodal deep learning models that integrate modalities such as vision and language towards more holistic solutions.

Generative AI

Generative AI has captured the fascination of the world in their abilities to assimilate information, interact, assist and create new data. The department's research herein has focused on developing generative models across methods such as generative adversarial networks, variational autoencoders, normalizing flows, and more recently, diffusion models. Our past and ongoing efforts include analyzing generative models, addressing the limitations of different generative models, applications of generative models to vision and language, as well as developing generative models in parsimonious settings where data or label information may be limited.

Optimization for Machine Learning

Optimization is the engine of modern machine learning and deep learning methods. Although an interdisciplinary field, optimization for machine learning methods, in particular, has attracted significant interest across the worldwide AI community, primarily because of its unique need to achieve generalization, i.e. provide effective solutions on data that has never been observed before. Faculty in the AI department work on methods for both convex and non-convex optimization. Going beyond, efforts of the faculty have also included the study of the effectiveness of non-convex optimization methods for training deep learning models, both theoretically and empirically.

Bayesian Learning

A fundamental approach to machine learning that is widely considered to be ideal, yet difficult to implement in its truest sense, is Bayesian learning. Founded on strong principles of Bayesian theory, this family of methods can accommodate the integration of prior knowledge as well as provide estimates of uncertainty for model predictions that can be very useful in risk-sensitive applications. AI department faculty have strong interest and expertise in Bayesian deep learning as well as Bayesian non-parametric models, where past and ongoing efforts include the development of efficient inference techniques for Bayesian deep learning models, Gaussian processes and Bayesian optimization. Our efforts have also included the application of Bayesian learning to problem domains in autonomous navigation, social media analysis and astrophysics.

Reinforcement Learning and Control Theory

The need to perform sequential decision-making in many applications including gaming, navigation and robotics motivates the paradigm of reinforcement learning methods that learn policies towards an eventual goal, rather than an immediate prediction. The AI department includes faculty with strong theoretical interest in control theory and its direct relevance to reinforcement learning methods, as well as its applications to robot navigation and manipulation.

Learning and Adaptation in Evolving and Data-Scarce Environments

While supervised learning, the harbinger of machine learning settings, has evolved and matured over the last decade, learning in evolving non-stationary environments where the data distribution may not necessarily be identically independently distributed (i.i.d) or may be scarce has grown to be an important need for AI research. This includes a wide variety of settings including continual learning, domain adaptation, few/zero-shot learning and domain generalization. Faculty in the department actively work on developing deep learning models for these settings, and study both theoretical and applied aspects of newer methods in this direction.

Algorithms for Massive Datasets

In recent years, more data has been produced than ever before in the history of mankind. On one hand, such volumes of data provide a goldmine for knowledge extraction, commercial value and policy making. On the other, building reliable models on such large volumes is cumbersome and, at times, intractable, despite access to high-end computational facilities. Faculty in the department work on addressing these challenges through scalable algorithmic solutions that are both efficient and effective using data sketches (summaries), statistical variance reduction techniques, as well as building noise/outlier robust algorithms to get more accurate predictions.

Neural Differential Equations

An emerging area of deep learning methods has been the intersection of neural network models with ordinary and partial differential equations. This field is in an early stage with significant promise, and our faculty focus on developing various differential equation based neural networks for machine learning problems. Our research herein has focused on designing continuous-depth deep learning models inspired from differential equations. Treating the computation of intermediate feature representation in deep learning models as a solution to differential equations has tremendous advantages in terms of model selection and reduced number of parameters.

Causal Inference and Learning

Global leaders in AI have vocally vouched the need for the design and development of Type 2 AI systems, that can not only predict but can also reason. A critical aspect of such reasoning-based AI systems is the ability to separate causal relationships in data from spurious correlations. Understanding such causal relationships in data has a wide range of applications in risk-sensitive and safety-critical applications ranging from healthcare to economics. Faculty in the AI department have focused on integrating principles of causality into the training of deep learning models, as well as provide causal perspectives in explaining the decisions of such models.

FOUNDATIONAL RESEARCH AREAS

Computer Vision

Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from visual inputs such as digital images/ videos and to suggest recommendations based on that information. Computer vision applications range in various areas, such as surveillance, healthcare, autonomous navigation, manufacturing, agriculture, defense, etc.

Faculty involved

1. Konda Reddy Mopuri
2. Sumohana S. Channappayya
3. Vineeth N. Balasubramanian
4. Srijith P. K
5. C. Krishna Mohan

01 Applications

- **Agriculture**: Plant phenotyping using computer vision
- **Healthcare**: automated analysis of choroidal images
- **Drone-based vision**: Detection of objects from drone (low-resolution) imagery
- **Autonomous navigation**: adding levels of autonomy to driving vehicles in developing countries, focusing on India
- **Human behavior understanding**: Detection of emotions, human poses, gestures, human mobility aids etc.
- **Image and video quality assessment**: aims to quantify and measure the perceptual quality of natural images and videos

02 Core Problems of Research

- **Adversarial robustness**: developing vision models that perform consistently and reliably in the face of inputs that are deliberately crafted to mislead
- **Knowledge/Model Extraction attacks**: retrieving useful and sensitive information from the deployed models and defending against such attacks
- **Learning from limited or weak supervision**: making the learning less reliant on labeled datasets
- **Explainability**: making the models more transparent and providing human-friendly explanations for their predictions
- **Learning from long-tailed (imbalanced) datasets**: handling the imbalances in training data
- **Continual learning**: focuses on the ability of a model to learn from and adapt to new information over time without forgetting what it has previously learned
- **Causal learning**: understanding and modeling the cause-and-effect relationships between variables in a system as opposed to merely learning the correlations between them
- **Bayesian learning and uncertainty modeling** : Developing algorithms capable of modeling uncertainty and detecting out of distribution data. This is important for high risk vision applications such as autonomous driving and healthcare as they have to deal with out of distribution data.
- **Domain generalization**: Developing algorithms which can generalize to unseen domains and deal with distribution shift.

FOUNDATIONAL RESEARCH AREAS

Robotics and Industry 4.0

From its inception, the primary goal of artificial intelligence (AI) was to forge entities capable of both cognitive reasoning and physical action reminiscent of human abilities. As the demands of the industrial revolution took hold, however, this unified goal diverged into two distinct paths. In one direction, the field of robotics evolved, prioritizing the development of reprogrammable machines adept at performing repetitive, precision tasks to cater to manufacturing needs. Simultaneously, the pursuit of human-like thinking continued within AI, focusing on cognitive modeling, decision-making processes, and intelligent problem-solving. Now, in the present era, these once-divergent paths have converged, giving rise to advanced AI systems that seamlessly integrate human-like cognition with autonomous physical capabilities. At the same time, application of AI techniques to specific robotic tasks which need not necessarily require human-like cognition is also expanding.

Faculty involved

1. R. Prasanth Kumar
2. S. Suryakumar

01 Core Problems of Research

Reinforcement Learning

Reinforcement learning (RL) in robotics enables robots to learn tasks through trial and error, guided by rewards or penalties. By iteratively optimizing their actions, robots can develop complex behaviors and decision-making processes. RL's integration with robotics represents a leap towards adaptive, autonomous systems in dynamic environments. We develop neural controllers trained by reinforcement learning for legged robots such as quadruped robots, biped/humanoid robots, and multirotor UAVs. Specific focus is on systems which are underactuated and hard to control using conventional control systems.

Industry 4.0

With the advent of “smart” and “intelligent” machines, we are looking at onset of the fourth industrial revolution, also referred as Industry 4.0. The next generation factories will depend of various technology verticals to make this happen. The research at IITH works circles around the enabling technologies for the same including additive manufacturing/3D printing and digital twins.

FOUNDATIONAL RESEARCH AREAS

Natural Language Processing

Language is a ubiquitous mode of communication. Understanding such communications and acting on them to create an impact thus requires understanding the natural language content, and further processing based on these understanding. The NLP research at the Department of AI, IIT Hyderabad focuses on multiple problems from a foundational as well as functional perspective.

Faculty involved

1. Manish Singh
2. Srijith P. K
3. Maunendra Desarkar
4. Sri Rama Murty Kodukula

01 Core Problems of Research

Multilinguality

Multilingual Natural Language Processing (NLP) involves the development of NLP systems capable of handling multiple languages. Among the notable challenges in this domain is addressing low-resource languages (LRLs), characterized by limited available data or resources. We work towards the advancement of modeling frameworks that facilitate cross-lingual/multilingual transfer across various NLP tasks, specifically focusing on LRLs. Our primary objective is to create efficient and effective solutions that can be practically applied in real-world multilingual scenarios. We have achieved notable progress in enabling zero-shot technologies for several LRLs by employing methodologies such as language structure analysis, cross-lingual transfer learning, meta-learning, and other innovative approaches.

Conversational AI

The domain of Conversational AI tries to enable computers or automated agents to understand, process, and respond to human language in a natural and personalized way. It encompasses voice assistants, chatbots, and other AI-powered systems that can carry out meaningful conversations with users. In this research space we have undertaken problems like These include building chat-bot systems for traffic control, creating conversational agents, and developing dialogue state tracking systems, among others.

Controllable Text Generation

With the growing capabilities of Natural Language Generation models, it has become imperative to ensure that the generated text is clean and free from unwanted attributes such as racial-bias, discrimination, hate etc. We work towards developing methods that can generate texts in a controlled manner, to avoid certain types of attributes (say, non-toxicity) in the generated text.

Exploring Product Reviews

Due to the massive volume of products and sellers available in e-commerce sites, users take help of customer reviews to make an informed decision about selecting the products and the sellers. Although reviews contain very valuable information, almost all e-commerce sites provide very simple navigation mechanisms for exploring the reviews. To aid review exploration we have built two review exploration systems, one based on product aspects and another one based on opinionated tags. We have also worked on detecting stance in comparative reviews using unsupervised algorithms. We have also built a context based review recommendation system, where the context is a combination of user preference and product aspects.

Continual and Lifelong Learning

We develop algorithms which can learn continuously across multiple NLP tasks arriving in some sequence and transfer knowledge across them for improved learning and performance from limited data.

Multi-Modal Learning

We work in the intersection of vision, language and other modalities, developing algorithms to process multi-modal data and problems involving vision and language such as image captioning, visual question answering etc.

Temporal Textual Data

We work in the intersection of vision, language and other modalities, developing algorithms to process multi-modal data and problems involving vision and language such as image captioning, visual question answering etc.

FOUNDATIONAL RESEARCH AREAS

AI and Ethics

AI algorithms are increasingly used to make decisions pertaining to societal and economic value. For instance, healthcare indicators data, bank credit scores, and criminal risk scores are increasingly used by algorithms to decide health premiums, loan decisions and bail decisions across the world. While the algorithmic decisions are more accurate, they are not inherently immune from ethical scrutiny.
This vertical studies ways to formalize relevant parameters such as fairness, privacy and explainability and evaluate AI algorithms, models and AI based decision frameworks. These studies include tradeoffs between efficiency and desired social parameters, interventions, suggestions and guidelines for practitioners to quantify and mitigate problems with the AI based decision-making frameworks.

Faculty involved

1. Ganesh Ghalme

01 Core Problems of Research

Fairness in AI

The fairness requirements encapsulates how the AI based decisions treat individuals or groups of the society. Some of the relevant research questions we ask are; Are the marginalized groups given sufficient representation? Are AI based decisions discriminatory towards one group/community? Are similar individuals treated similarly? If there are biases, where do they emerge from and is there a way to intervene and mitigate bias and what is the cost of doing so in terms of loss in efficiency? Finally, we seek to propose socially aware AI algorithms.

Applications: Recommendation systems, crowdsourcing, banking, sequential resource allocation, sponsored search, internet content creation

Explainability in AI

AI powered decision frameworks often appear as blackbox solutions. A complex machine learning or deep learning/neural network based models power these decisions with the help of a large amount of data. These decisions, often, are not self explanatory. For instance, an ML model is often unable to explain why a certain fraction of individuals were denied loan or in the education sector denied admission while others were accepted. Explainable AI strives to seek such explanations from ML models and furthermore provide recourse i.e. suggestions to applicants on what should they do to improve.

Applications: Healthcare, Banking and insurance, education

Strategic AI

AI algorithms, for all their efficiency and speed, are still vulnerable to strategic manipulation. As most AI based algorithms work on score based systems (such as likes/shares in online content, health parameters and CIBIL scores in healthcare and banking, QS scores in institute rankings), it is only natural that strategic players “game” the system by performing well on these parameters without improving on the true underlying quality. There have been instances where AI algorithms have been manipulated by individuals to get a loan (by increasing credit score by for instance, buying multiple credit cards) or lower health premiums etc. How can we make our AI algorithms robust to manipulation?

Applications: Banking and insurance, education, healthcare, social networks

Security and Privacy

The leakage of private information and its subsequent exploitation is a major concern when one uses human data in sectors such as healthcare and banking. While one needs data to be able to make more efficient models, one should also ensure the privacy and security of an individual's confidentiality.

Applications: Banking, online platforms

APPLIED/INTERDISCIPLINARY RESEARCH AREAS

Manufacturing Processes

Faculty involved

1. Kishalay Mitra

01 Core Problems of Research

Recent improvements in state-of-the-art experimental and computational infrastructures, affordability, automation, ubiquitous connectivity through IoT, global push towards meeting environmental constraints to ensure safety and sustainability resulted in generation, processing and management of enormous amounts of heterogeneous data in the domain of Manufacturing. Process Systems Engineering (PSE), which deals with the manufacturing process design for the purpose of converting raw goods to usable end products, focuses on the design, operation, control, optimization and intensification of chemical, physical, and biological processes.
Aim of research in this domain at IITH is to develop state-of-the-art AI/ML tools that can analyze vast amounts of highly complex data generated by the manufacturing process community and suggest optimization of performance under various sources of uncertainty.

Potential areas in PSE are targeted and how the applications of deep supervised / unsupervised learning methods can be useful to devise novel ways of finding solutions to existing issues is investigated through AI research. Some of the focussed areas are

(i) modeling steady and unsteady behavior of the process.
(ii) replacing computationally expensive high fidelity models with ML surrogates to enable optimization using them
(iii) accurate system identification and data based model predictive control of extremely nonlinear industrial processes
(iv) image based sensing for better optimization of the process
(v) uncertainty quantifications using global sensitivity analysis as well as generative modeling
(vi) ML based single and multi-objective optimal control.

APPLIED/INTERDISCIPLINARY RESEARCH AREAS

Sustainability

Faculty involved

1. Kishalay Mitra

01 Core Problems of Research

To maintain economic development, often the aspects of environmental care and social well-being are neglected, which eventually triggered the world wide demand to make systems sustainable. Tackling the dual issues of dwindling reserve and greenhouse gas emissions while using fossil fuels as energy sources, usage of renewables is the new trend that can make the energy generation sustainable. Even though state-of-the-art technologies are developed across the world to harness renewable energy, the efficiency remains low due to the uncertain and nonlinear nature of such resources. Additionally, a common problem faced in the domain of windfarm modeling is the computational expense related to simulating the entire study. Thus, wind farm layout optimization, wake modeling, uncertainty handling and control studies during energy harnessing from wind are certain areas of research which need a lot of focus. Novel methodologies to design optimal wind farms by combining the fields of deep learning, Computational Fluid Dynamics, combinatorial & evolutionary optimization and uncertainty analysis are bearing fruits.

One of the ways towards sustainable energy generation is to go for green biofuels from bio-waste. India is yet to tap the full potential of the bioenergy sector despite its 70% of population depends on forest and agriculture. The national initiatives towards blending 20% biofuels with fossil fuels is a catalyzing fact in this direction. Though significant progress in research has been achieved while devising novel routes for bio-energy conversion from different biomass sources, a novel approach has been adopted in our research to attack these problems holistically from the vantage point of a supply chain network designer. Similarly, another research direction towards waste to wealth creation by us is to design smart cities through optimal e-Waste management, which talks about utilization of electronics waste to the best extent possible before disposal leading to minimization of pollution to mother nature and optimum utilization of usage of otherwise very scarce resources (circular economy).

APPLIED/INTERDISCIPLINARY RESEARCH AREAS

Autonomous Navigation

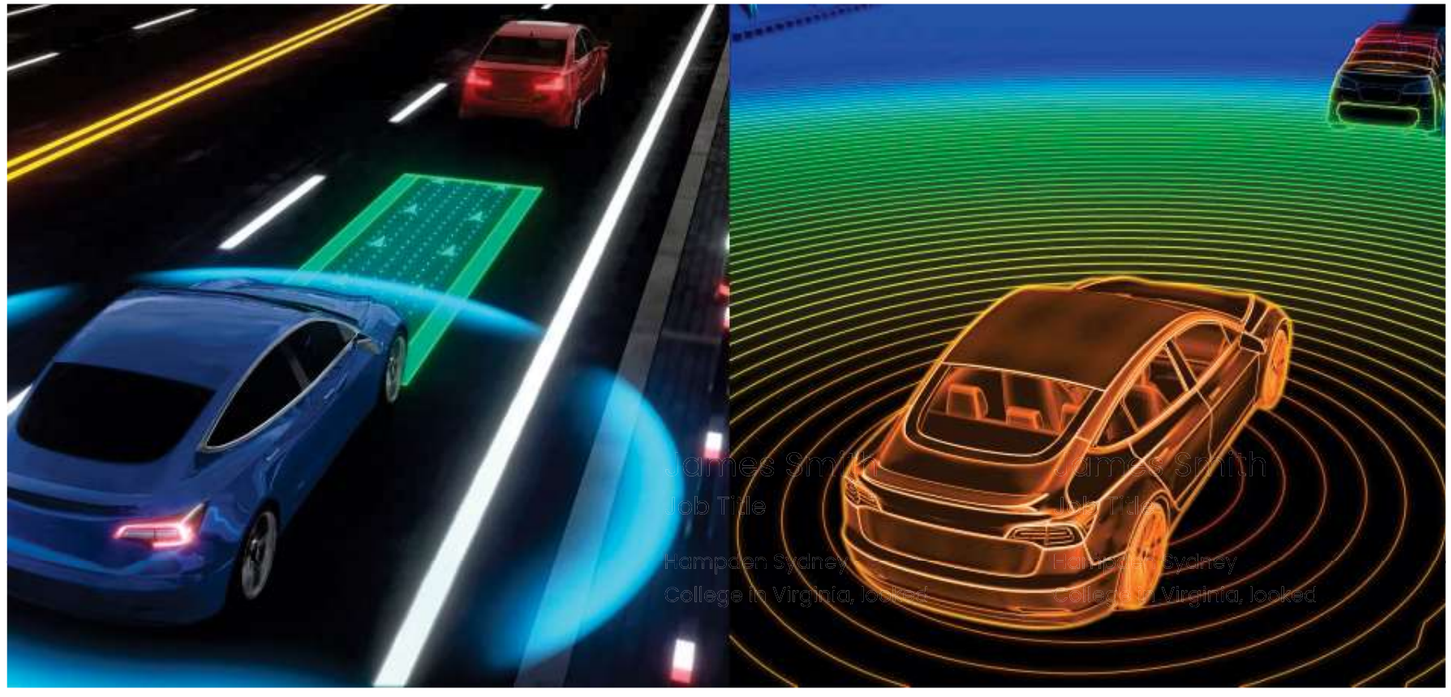
Faculty involved

1. P. Rajalakshmi
2. Vineeth N. Balasubramanian

01 Core Problems of Research

Autonomous navigation is a crucial aspect of modern robotics and is applied to a wide range of vehicles, including aerial, ground, surface, and underwater vehicles. Each of these vehicle types presents unique challenges and solutions when it comes to autonomous navigation. Common technologies and concepts that span all these types of autonomous navigation include: Machine Learning and Artificial Intelligence (AI), Communication Systems, Energy Management and Fail-Safe Mechanisms.

Some of the areas that are being actively researched at IITH include Swarms of autonomous aerial and ground vehicles, GPS based and Map based navigations, Path planning, GPS denied navigations, Multi-modal sensor data synchronisation and fusion, Perception algorithms on the sensor fusion data, real-time control and actuation algorithms. The field of autonomous navigation continues to advance, with ongoing research and development focused on improving the reliability and capabilities of these vehicles across various domains or modes of transportation.



APPLIED/INTERDISCIPLINARY RESEARCH AREAS

Social Media

Social media are web-based services that allow users to connect and share information. Due to the huge size of social network graphs and the plethora of generated content, it has various challenges, such as information diffusion, information overload, information organization, information categorization, etc. Here at IITH, we have been looking into all these aspects in different social media. We have also worked on problems like rumor detection, disaster management, and topic detection and tracking in social media. We also work on analyzing and solving problems arising in community question answering sites such as stack exchange. Due to differences in the way information is shared in various social media, and user privacy and security requirements, we need specific solutions to address the above listed problems. We have developed several solutions including models based on point processes such as Hawkes process and graph neural networks to address these problems.

Faculty involved

1. Manish Singh
2. Srijith P. K
3. Maunendra Desarkar

01 Core Problems of Research

Information Diffusion

Information diffusion is a process by which information about new opinions, behaviors, conventions, practices, and technologies flow from person-to-person in a social network. Studies on information diffusion primarily focus on how information diffuses in networks and how to enhance information diffusion. Our work has been on enhancing the information diffusion in social networks. We have analyzed the effect of various important factors of information diffusion, such as network connectivity, location, posting timestamp, post content. For example, we can find influential users for marketing a given information, find content that is likely to generate high user interaction, and find time to post information that will give high visibility.

Information Overload

Social media services generate a huge volume of data every day, which is difficult to search or comprehend. We have proposed information summarization and semantic grouping methods to create a concise readable summary of huge volumes of unstructured information. We also extract tags from the data so that users can get a quick summary using the tags and also use them for the purpose of content navigation.

Information Organization

Data is often organized in social media using tags. Tags are used to segregate information and also to route posts between users. Since each social media has a huge number of tags, we are looking at how to mine the semantic relationship between these tags and organize them in the form of ontology. Tag frequency and text corpus can be used to mine such relationships for popular tags. However for new and rarely used tags these approaches cannot be used, so we propose use of topological features derived from the tag network to extract the relationship of rare/new tags with popular tags.

Information Categorization

Mostly all social media allow all users to post messages and replies. As a result, social media has a variety of information, such as spam information, fake information, relevant and irrelevant responses to posts, low and high quality posts, etc. NLP and social network analysis is often used to identify the above categories of information. Due to variation in social network structure, type of social interactions and post content, we propose specific algorithms to categorize information for each social media.

APPLIED/INTERDISCIPLINARY RESEARCH AREAS

Astrophysics

Astrophysics has now become a ``big data" science. Many astrophysical surveys (mainly in optical and also radio) designed to obtain precise estimates of cosmological parameters as well as to map out the distant universe produce terabytes of data per night. Extracting the best science out of this data requires expertise in data mining, machine learning and astrostatistics. At IITH, we have been working on problems in this interface since 2016.

Faculty involved

1. Shantanu Desai
2. Srijith P. K
3. Sumohana S. Channappayya

01 Core Problems of Research

Bayesian Regression using novel methods

SD is part of some of multiple collaborations such as Dark Energy Survey and Indian Pulsar Timing Array Consortium. Any inference in astrophysics is obtained using parametric regression analysis involving 10s to hundreds of free parameters. Usually this is done using Bayesian inference using MCMC techniques. Similarly, in order to decide which theoretical model best fits the data ,one usual Bayesian model comparison, usually done using Nested sampling. With a master's student (from CSE who had joined prior to the inception of the AI department), PKS and SD investigated the use of Variational inference (VI) for both parameter estimation and Bayesian model comparison. We demonstrated using multiple examples in different areas of Astronomy that VI is much faster than the frequently used MCMC methods (for Bayesian regression) and nested sampling (for Bayesian model selection). We are also investigating alternate techniques such as Normalizing flows.

Star-Galaxy separation using deep learning

As optical surveys probe the distant reaches of the universe, the distinction between stars and distant galaxies gets blurred using traditional techniques. Therefore, an EE student (along with SC,SD,PKS) has been investigating the use of DL techniques to test the efficacy of star/galaxy separation using SDSS data.

Masking of artifacts in astronomical images using Deep Learning

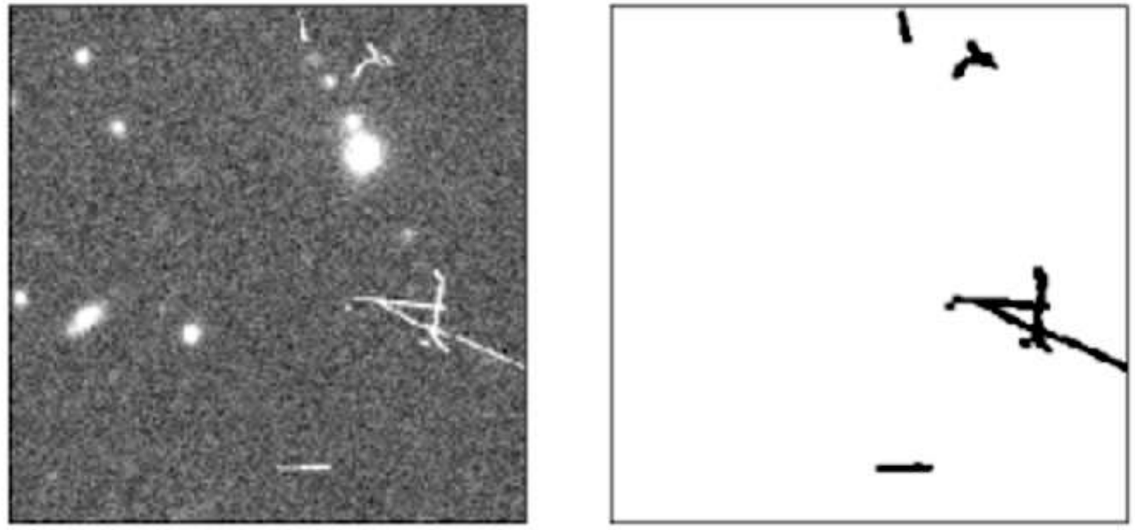
Optical photometric imaging data from surveys such as DES with thick CCDs and long exposures contain transient artificial defects such as cosmic rays and satellite trails which could masquerade as transient astronomical sources and also degrade the sensitivity to detect faint sources if not accounted for Along with a PhD student in EE, we (SC, SD and PKS) have investigated a number of deep learning based methods to identify and interpolate over transient defects such as cosmic rays. We have tested this algorithm on both ground-based imaging data from DECam and LCOGT and also space-based telescopes such as Hubble space telescope and have shown that they outperform the traditional techniques for cosmic ray identification using Laplace transform.

Galaxy morphology classification using Deep Learning techniques

A large number of photometric surveys such as SDSS, DES, Pan-starrs, LSST, Euclid have started or will soon start mapping out large contiguous regions of the sky with unprecedented image quality and with very deep exposures. Consequently they have generated an avalanche of data for galaxies with a lot more diversity than seen with the previous telescopes. Detailed characterization of this morphology is important for a variety of topics from galaxy evolution to cosmology. With a Master student from CSE, PKS and SD investigated the use of Neural ordinary differential equations and showed that its performance is similar to the widely used ResNet technique with much less computational complexity. With a current ID ph.D student we are exploring explainability of the deep techniques with Galaxy Zoo data.

Miscellaneous Topics

SD and PKS have also applied unsupervised classification/clustering techniques for classification of a whole bunch of astronomical sources such as GRBs, pulsars, pulsar glitches using Gaussian Mixture Model and also Extreme Deconvolution (which is an extension of GMM, that incorporates the uncertainties in the data). SD has also started some exploratory work (along with students) to investigate Symbolic regression, which tries to do an ab-initio parametric regression analysis between the input and output variables.



(a) Image with CR hits

(b) Groundtruth CR mask

An example of Cosmic- Ray hits in DECam data

APPLIED/INTERDISCIPLINARY RESEARCH AREAS

Communications

5G and beyond networks have stringents requirements in terms of latency, reliability, throughput, user experience and others. Dynamic optimization of the network to achieve these parameters is a complex process. Artificial Intelligence and Machine Learning (AI/ML) is increasingly being looked upon as a key technology to address these problems at multiple levels in the network. In recent times, several works have looked upon joint communication and sensing using already deployed wireless networks. Technologies like mmWave, LTE, WiFi, etc. have shown promise in both classification and localization of objects like humans, cars, and drones. The heterogeneity of communication use-cases like machine type communications (MTC), Internet-of-Things (IoT), vehicle-to-vehicle communication (V2V), unmanned aerial vehicles (UAVs), etc. further necessitates the usage of AI/ML in 5G and beyond networks.

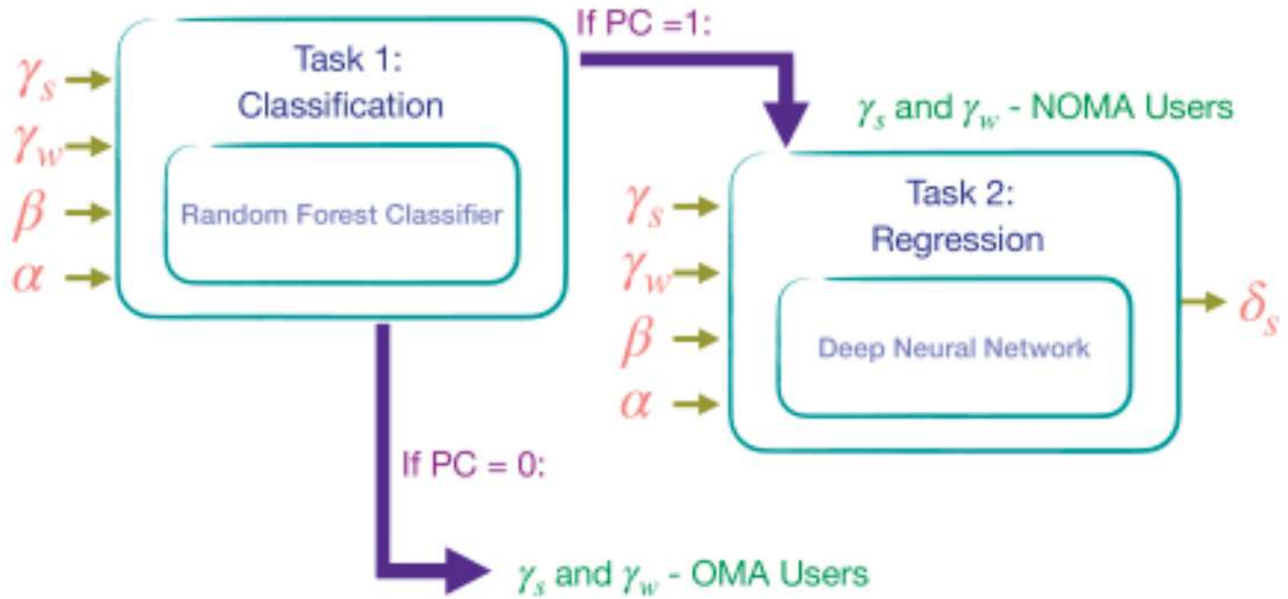
Faculty involved

1. Abhinav Kumar
2. Sai Dhiraj Amuru

01 Core Problems of Research

The existing efforts in AI/ML for 5G and beyond networks at IITH can be broadly classified into the following.

1. **Enhanced Radio Access Network (RAN):** This includes works like supervised deep learning based MIMO precoding, double deep reinforcement learning based handover mechanism, DNN based Adaptive User Pairing and Power Allocation to achieve Fairness in NOMA Systems with Imperfections in SIC.
2. **Object classification and localization**: Several works in the group have considered using mmWave FMCW RADAR for UAV/Car/Human classification and localization. The work on Fingerprint Image-Based Multi-Building 3D Indoor Wi-Fi Localization Using Convolutional Neural Network received recognition in NCC 2022.
3. **Internet-of-Things**: Application of Deep Learning and Blockchain for Secure Communication in Digital Twin Empowered Industrial IoT Network.



DNN based Adaptive User Pairing and Power Allocation to achieve Fairness in NOMA Systems with Imperfections in SIC.

APPLIED/INTERDISCIPLINARY RESEARCH AREAS

Systems for AI

Faculty involved

1. Sathya Peri

01 Core Problems of Research

In general, AI systems consider large amounts of training data, analyzing the data for correlations and patterns, and using these patterns to make predictions about future states. So, to be effective at this, the AI systems will have to efficiently work on the Systems aspect for efficient processing of training data and learn from them.

In fact, GPUs have become very popular and have helped AI/ML systems immensely to learn at a faster rate. In this context, our team has been working with efficient algorithms to process large amounts of data efficiently on CPUs. We are currently working with CPUs and later extend these ideas to GPU systems.

A brief summary of our work on the area of graph analytics is here:
Graph algorithms are applicable has several diverse applications, including social networks, communication networks, VLSI design, graphics etc. Many of these applications require dynamic modifications -- addition and removal of vertices and/or edges -- in the graph. Our team has recently developed algorithms for Concurrent Graphs which I will explain in this talk. In this work, we developed a novel concurrent non-blocking algorithm to implement a dynamic unbounded directed graph in a shared-memory machine. The addition and removal operations of vertices and edges are lock-free. For a finite sized graph, the lookup operations are wait-free.

In addition to these point operations, we then considered a set method which is the most significant component of the presented algorithm: reachability query in a concurrent graph which identifies if there is a path between two vertices in such a dynamic network. The solution to the reachability query in our algorithm is obstruction-free and thus impose minimal additional synchronization cost over other operations. We showed that each of the data structure operations are linearizable. We did some extensive evaluations on the C++ implementation of the algorithm through various micro-benchmarks. Our implementation results have also been very good. On an average, we perform around 5x times better than sequential graph implementation.

Research
Infrastructure

As the Department of Artificial Intelligence at IIT Hyderabad continues to grow by leaps and bounds, the department has recently procured new state-of-the-art technology and infrastructure. This includes an AI center, funded by the support of Honeywell and the Japan International Cooperation Agency, consisting of various GPU- based servers for carrying out cutting-edge research. In addition, the department also recently entered into close collaboration with NVIDIA to establish an NVIDIA Artificial Intelligence Technology Centre (NVAITC), the first of its kind in India.

The newly established AI center consists of computing facilities such as NVIDIA DGX-1s and DGX-2s, which are widely reputed AI supercomputers. The DGX-1 comprises 8 NVIDIA Tesla V100 GPUs and provides GPU computing power of 1 PetaFLOPS. On the other hand, DGX-2 is the world's first 2 PetaFLOPS system integrating 16 NVIDIA V100 Tensor Core GPUs, enabling one to work with large training datasets. This center would focus on accelerating research in AI at the institute. For reference visit Nvidia DGX

India's first NVAITC, a center of collaboration between researchers at IIT-Hyderabad and NVIDIA, was inaugurated on 9th July 2020. The institute has already procured three NVIDIA DGX-1TM systems and two NVIDIA DGX-2TM systems and would soon procure more such servers. The establishment of the center has led researchers to pursue research projects of importance to societal needs. Research and projects related to agriculture in AI, smart cities, intelligent transport, and Indian language understanding are underway, and have already led to the publication of some jointly authored papers. Projects that will be taken up soon include increasing crop yield using AI algorithms and applying AI-based solutions to support safer transportation systems and better ways of managing traffic, among others.

"IIT Hyderabad's AI department, supported by Honeywell, JICA, and NVIDIA, leads the way in AI research and innovation in India"

AI Research Center

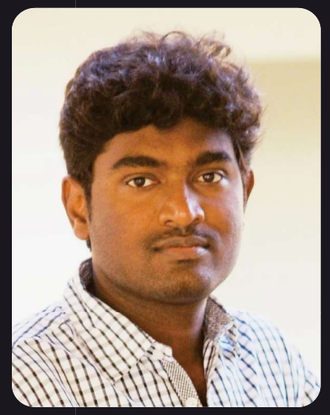
The AI department at IIT-Hyderabad has been recognized for pioneering efforts in AI pedagogy and research, including its BTech, MTech and PhD programs in AI, as well as interdisciplinary AI research. This effort has inspired many other institutions across the country to launch similar programs. To support the research activities of the AI department, a Centre for Research and Innovation in AI (क्रयिा) has now been established with the support of JICA (Japan International Cooperation Agency) and Honeywell. This AI क्रयिा Centre -- in addition to seating areas, classrooms and conference rooms for researchers -- houses a mini-data centre with high-end computational facilities to meet the ever-increasing demand of researchers associated with the AI department at IIT Hyderabad. With various GPU servers and the deep learning supercomputers NVIDIA DGX1 and DGX2, the data centre supports upto 250 TFlops of GPU computing power. This centre will be used by faculty, research staff and students at IIT Hyderabad to carry out state-of-the art AI research in-house, as well as in partnership with its collaborators in government and the industry.

Related articles

- Honeywell Sets up Ai Research Center ait IITH
- Research Collab of Honeywell with IITH
- Tie up of lab between Honeywell and IITH
- Honeywell establishes AI Lab at IIT Hyderabad
- Lab of Honeywell in IIT Hyderabad

AWARDS AND ACCOLADES

Konda Reddy Mopuri

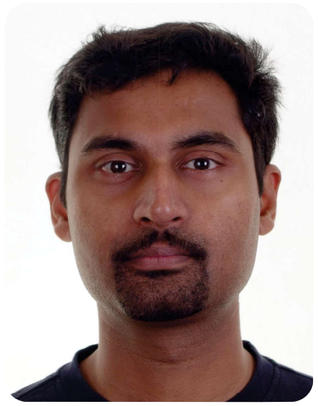


Dr. Konda Reddy Mopuri received the Young Alumni Achiever Award for 2022, by the Department of Computational and Data Sciences, Indian Institute of Science (IISc).

Abhinav Kumar

1. Best Poster award in the COMSNETS 2023.
2. Best Paper (runner up) award in the Communications track, NCC 2022.
3. “Recognition for Best Supervisor” in PhD category at IEEE ComSoc GraTE-7, 2021.
4. Team Mentor of Team SNAAPP, Winners of Smart India Hackathon 2019.
5. Best paper award at the first conference on Deployable AI (DAI), IIT Madras (2022)

Srijith P. K



1. Dr. Srijith P. K. received the Sony Research Award 2021.
2. Sahil Yerawar, Sagar Jinde, P. K. Srijith, Maunendra Sankar Desarkar, K. M. Annervaz, Shubhashis Sengupta. “Predicting Reputation Score of Users in Stack-Overflow with Alternate Data”. KDIR 2022. (Nominated for best poster award)

Maunendra Desarkar

1. Sahil Yerawar, Sagar Jinde, P. K. Srijith, Maunendra Sankar Desarkar, K. M. Annervaz, Shubhashis Sengupta. “Predicting Reputation Score of Users in Stack-Overflow with Alternate Data”. KDIR 2022. (Nominated for best poster award)
2. Selected as IEEE Member

Vineeth N. Balasubramanian

1. K J Joseph, Sujoy Paul, Gaurav Aggarwal, Soma Biswas, Piyush Rai, Kai Han, V N Balasubramanian, Spacing Loss for Discovering Novel Categories, Workshop on Continual Learning in Vision, CVPR’22 (Best Paper Runner-Up Award)
2. Senior Member, AAAI, Class of 2023
3. ACM IKDD Doctoral Dissertation in Data Science Award for thesis of PhD student Anirban Sarkar, 2022
4. Listed in World's Top 2% scientists, 2022
5. Fulbright-Nehru Academic and Professional Excellence Fellowship, 2022-23
6. NASSCOM AI Gamechanger Award, AI Research (DL Algorithms and Architecture) category (Winner and Runner-up), 2022 (Announcement Link)
7. Best Paper Award Honorable Mention, Continual Learning (CLVISION) workshop at CVPR, 2022
8. Best Paper Award, Research track, CODS-COMAD 2022
9. Google exploreCSR grant award, 2022
10. Teaching Excellence Award, IIT Hyderabad, 2021
11. Best Paper Award, Causality in Vision workshop at CVPR, 2021

AWARDS AND ACCOLADES

P. Rajalakshmi

1. Awarded ‘Cyient Chair Professor’ under Cyient Chair in Future Communication from April 2021 for a period of 3 years
2. Member of CII Telangana Digital Transformation and IT Panel since August 2018.
3. "Best Oral Presentetion Award" for "Solutions based on image processing for precision agriculture,during Plant Science Symposium-2018,Themed "Climate is Changing, Agriculture Must Too". to her students Mr. Ajay Yadav and Mr. Mahesh taparia.
4. "Outstanding Paper Award" for "A Novel Computer-aided diagnosis framework for Deep Learning for classification of Fatty Liver Disease in Ultrasound Imaging”in IEEE Healthcom 2018.
5. "Outstanding Paper Award" for “A Novel classification framework for EEG Based Four class motor imagery using Kullback-Leibler Regularised Riemannian Manifold”in IEEE Healthcom 2018.

Kishalay Mitra

1. Named among World's Top 2% Scientists, according to the latest profile review (2022 & 2021) conducted by Stanford University / Elsevier.
2. Best Project Award, 2021 (B. Tech category) awarded to Ms. Sakshi Naik by Indian National Academy of Engineering (INAE) working under Prof. Kishalay Mitra.
3. BATTERY 2030+, a long-term roadmap for forward-looking battery research in Europe, prepared by the EU Horizon 2020 initiative mentions Prof. Kishalay’s work in the Li+ Battery space can open up new opportunities to explore new cell formats and designs.
4. Selected as an academic partner by IBM Research, India under Open Science Collaboration Program.
5. Associate Editor, Journal of The Institution of Engineers (India): Series E, Springer.

PROJECTS

- Deep Learning for Long- Tailed Computer vision Tasks: Dr Konda Redddy M. Funding Agency: SERB. 2023-2025
- Development of Real-time Video perception Capabilities for an Autonomous Robot: Dr. Sumohana Channappayya, Dr. Vineeth N.Balasubramanian. Funding Agency: DRDO. 2022-2026
- Development of Real-time audio and speech processing modules for robot audition: Dr.Sri Rama Murthy K, Dr.Aditya Siripuram. Funding Agency: DRDO. 2022-2026
- Learning in the Presence of Strategic Agents: Dr. Ganesh Ghalme, Dr. Vineeth Balasubramanian, Dr.Shweta Jain(IIT Ropar). Funding Agency: SERB-CRG. 2022-2025
- Earthquake Early Warning System (EEWS) Using Deep Learning Approaches: Prof. C Krishna Mohan. Funding Agency: Ministry of Earth Sciences. 2022-2025
- Development of Digital Scene Matching Area Correlation (DSMAC) Algorithms and Prototype System: Dr Sumohana Channappayya, Dr. Amit Acharyya. Funding Agency: DRDO. 2021-2023
- Generating Autosuggests for Search Queries: Dr. Maunendra Sankar Desarkar. Funding Agent: Microsoft. 2021-2023
- Getting better business insights with Alternative Data Sources: Dr. Srijith PK, Dr. Maunendra Sankar Desarkar. Funding Agent: Accenture Advanced Technology Labs. 2020-2022
- Advanced vision Technologies for Road Mobility and safety: Dr. Vineeth Balasubramiam, Dr. Srijith P K. Funding Agency: SERB. 2019-2023.
- Learning in the presence of Strategic Agents: SERB CRG Feb-2023
- DFAT Australia-India Council grant 2020 for “Workshops to establish India-Australia Internet of Things (IoT) Training Academy” with Swinburne University Of Technology, Australia.
- DST project titled “Low-Altitude UAV Communicationand Tracking (LUCAT)” .
- JICA for CKP project titled “Privacy preserving framework for location based services”
- DST project titled “Energy Efficient Lighting with VLC and PLC based Communications” .
- SERB for project titled “Performance evaluation of cellular networks in unlicensed spectrum co-existing with WiFi”
- Spintronics based Digital Logic Architecture Design for AI Applications, Science and Engineering research Board (SERB), 2023-2026.
- An Efficient Non-Blocking Framework for Large-Scale Graph Analytics. DST (CRG), GoI.
- Power optimization and modelling for the prospective Hyundai EV Infotainment systems, Hyundai Mobis, 2022-2023 (6 Months),.
- Run-time optimized PeRformance and pOwer Management solutions for SMC sYStem on chip (R-PROMYS), Suzuki Motor Corporation, Japan, 2021-2024,.
- Machine-Learning model development for Hyundai Vehicle’s speed prediction on various road surfaces and subsequent implementation on resource constraint embedded platform, Hyundai Mobis, 2022-2023,.
- Reconfigurable Machine Learning Hardware Design for Defence Applications (RMLA), ER-IPR, DRDO, 2021-2024,.
- Indigenous Intelligent and Scalable Neuromorphic Multichip for AI Training and Inference Solutions, MEITY, 2021-2024.
- Intelligent and Proactive RTL Assessment Tool Design (IP-RAT), TSMC, 2021-2024.
- Intelligent IoT enabled Autonomous Structural Health Monitoring System for Ships, Aeroplanes, Trains and Automobiles, IMPRINT, 2019-2022.
- Iot based deMonstrator design using proposed methOdology with CNN and BSS for RehabIlitated ParaLYZEd Patients (i-MOBILYZE)”, AMD XILINX, 2019-2022.
- Affordable deep learning based point of care cardiac monitoring for heart attack survivors powered by lab on-chip technology, MEITY, 4/20-23. Soumya Jana
- Development of Robust Algorithms for detection & classification of ships based on ultra sound wake signature. Naval Research Board, 8/17-10/20. Soumya Jana
- Development of Computational Software integrating Multilevel Image Data Analysis: Towards efficient clinical practices and advanced biomolecular research in ophthalmology. DBT, 4/17-4/20. Soumya Jana

COLLABORATIONS WITH ACADEMIA

IIT Madras

IIT Ropar

Tata Institute of Fundamental Research

Kumamoto University

University of Tokyo

Keio University

The Norwegian University of Science & Technology

COLLABORATIONS WITH INDUSTRY

DRDO

AMD Xilinx

Department of Posts

Suzuki Motor Cooperation

Hyundai

Ministry of Earth Science

Carrier Research

NTT Research

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Intel

Tata Consultancy Services

National Astronomical Observatory of Japan

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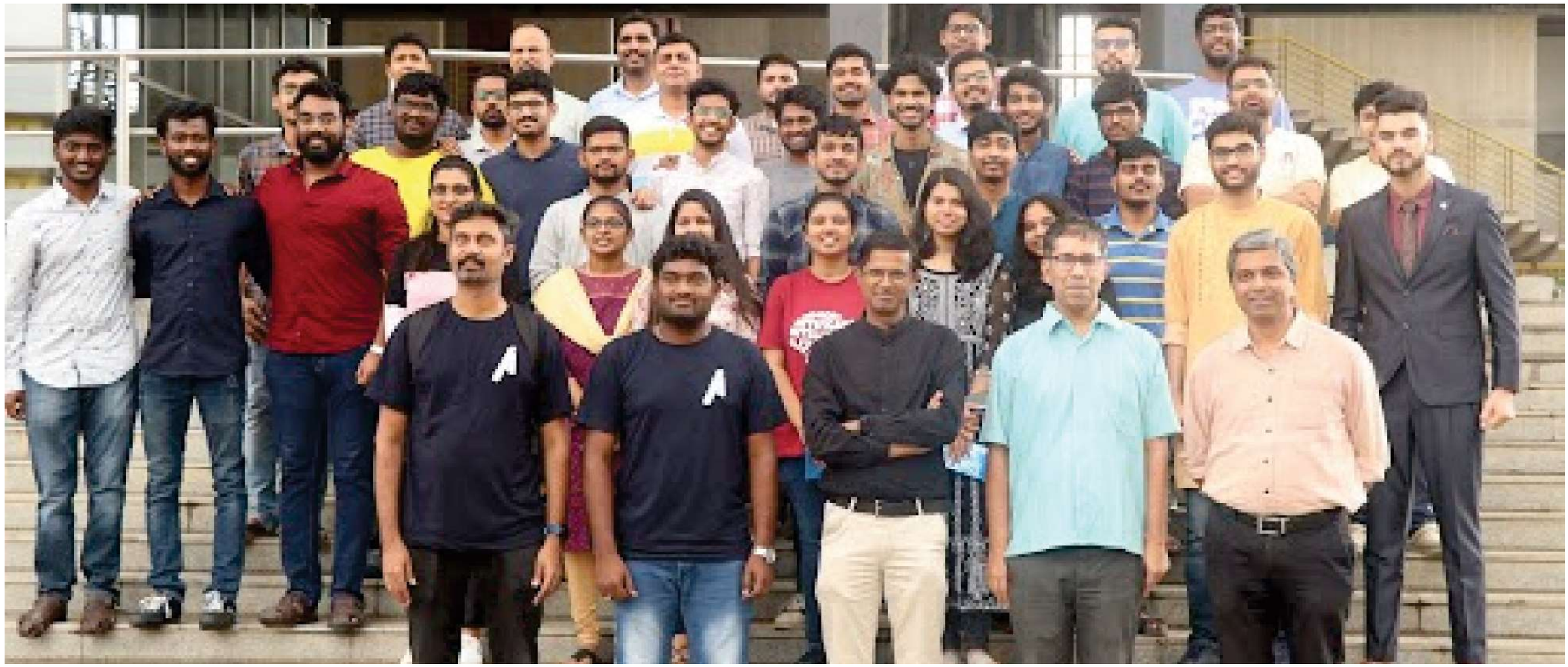

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