Kotak IISc AI-ML Centre
Annual Report
April 2023-March 2024

KOTAK IISc AI–ML CENTRE

The Kotak IISc AI–ML Centre (KIAC) was conceived of with the vision of creating a state-of-the-art artificial intelligence–machine learning Centre at the Indian Institute of Science (IISc). The Centre was established at IISc with financial support from the Kotak Mahindra Bank Limited (KMBL) through a corporate social responsibility grant.

The KIAC office was inaugurated on 18 January 2023 by Prakash Apte (Chairman, Non-Executive, KMBL) and Rajesh Sundaresan (Dean, Division of Electrical, Electronics, and Computer Sciences, IISc) in the Department of Computational and Data Sciences, IISc. The proposed building for KIAC is under construction and is expected to be completed by December 2024. The Centre will be housed in the East Wing of the Undergraduate Complex. The four-floor building will have conference halls, seminar and lecture halls, a computer lab, and library among other facilities to support collaborative research, education, and innovation in artificial intelligence (AI) and machine learning (ML). These facilities will be used to create high-quality online courses.

The Centre is anchored by a group of faculty members at IISc who work in the areas of computer science, computational and data sciences, and artificial intelligence. KIAC is a research, education, and innovation hub. It hosts key programmes utilising the existing programmes in AI and ML at IISc. It enables additional courses to be offered in AI and ML at the postgraduate level. The Centre also hosts the Institute's outreach programmes, including skill development programmes in AI/ML and data science. KIAC provides support for the students and faculty of IISc and also collaborates with industry on projects of common interest.

VISION

The main objectives of the Centre are:

i. to develop rigorously-trained human resources who will become future leaders in artificial intelligence–machine learning and champion India's surge in this area,

ii. to conduct cutting-edge research in this area, leading to international visibility of the highest order, and

iii. to develop innovative, deep-tech solutions to meet the current and emerging requirements of the industry.

ORGANISATION OF THE CENTRE

The governance of the Centre is overseen by the following structure. The Convenor and Co-convenor are responsible for creating technical programmes that are in-line with the memorandum of understanding (MoU) between KMBL and IISc. These programmes are presented to the Scientific Advisory Board (SAB) to ensure that the conceived programmes are compatible with the MoU. The SAB reports to the Governing Board (GB). The Project Review Committee (PRC) also reports to the GB and reviews the overall functioning of the Centre.

The members of the three boards/committees have representatives from both IISc and KMBL and meet frequently to review the progress of the Centre and plan future initiatives. The current members are portrayed in the next few pages. The Centre is grateful for the guidance and support from previous members of these boards/committees: Chetan Savla, Jaimin Bhatt, Devendra Sharnagat, and Amit Dhalwade from KMBL and Sashikumaar Ganesan from IISc. KIAC also welcomes Rajiv Soundararajan from IISc who will take over as Convenor from 1 April 2024. The Centre thanks Chiranjib Bhattacharyya (the current Convenor) and Venkatesh Babu Radhakrishnan (the current Co-convenor), who have contributed immensely to the growth of the Centre and will step down from their roles on 31 March 2024.

GOVERNING BOARD

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Rajesh Sundaresan
IISc

P S Anil Kumar
IISc

Himanshu Nivsarkar
KMBL

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KMBL

KIAC TEAM

Chiranjib Bhattacharyya (Convenor)

Venkatesh Babu Radhakrishnan (Co-convenor)

Chandrasekaran Pandu Rangan (Chair Visiting Professor)

Viraj Kumar (Visiting Professor)

Grace Mathew Abraham (Program Manager)

Geethanjali Monto (Senior Editorial Assistant)

Neetha Ashtakar (Systems Administrator)

Sudha Aithal (Secretary)

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EXECUTIVE SUMMARY

The Kotak IISc AI-ML Centre (KIAC) was established at the Indian Institute of Science (IISc) with the vision to become one of the leading Centres in the world in artificial intelligence and machine learning. Since its inception in September 2022, it has been striving towards this vision with the support of the Kotak Mahindra Bank Limited (KMBL). Not only has KMBL provided financial support to the Centre, but also played an active role in decision making on the way forward.

During the financial year 2023–24, the Centre organised and supported various lectures, events, and workshops related to artificial intelligence (AI) and machine learning (ML). The research activities of many students were supported through the Kotak scholarship, the PhD top-up scholarship, and the scholarships for IISc MTech and PhD students from the empowered category. Interns and predoctoral fellows were onboarded to work on cutting-edge topics under the guidance of IISc faculty. The calls for postdoctoral fellows and international chair visiting professors were released.

A Computation Lab was set up for the benefit of the undergraduate students of the BTech (Mathematics and Computing) programme at IISc and this Lab is serving as a practical workshop for the undergraduate courses offered by IISc as well as courses initiated by KIAC, conducted by professionals in the field.

Distinguished KIAC professors conducted courses for students of the BTech (Mathematics and Computing) and MTech (AI) programmes. AI-ML talks were organised primarily for IISc students. In addition, lectures, courses, training sessions, and workshops were organised and supported to enhance the knowledge base and build skills of different target groups. Workshops/technical meetings were arranged with industry counterparts to explore collaboration.

Faculty members and students of IISc were given financial support to attend leading AI conferences abroad. KIAC professors were provided travel support to present their work in international conferences.

To inform various target audiences about the opportunities and activities at the Centre, a dedicated webpage and social media handles are regularly updated. The Centre also broadcasts through the Institute emailing system and puts up posters at prominent places within the campus.

A BIRD'S EYE VIEW OF ACTIVITIES

The following tables give a picture of the Centre's activities during April 2023–March 2024.

Activity	Number of occurrences	Number of participants/ beneficiaries	Output indicators
Kotak IISc AI-ML talk series	15	733	education, collaboration, outreach
Events	4	355	skill development, education, teaching, outreach
Courses* and training sessions	7	597	skill development, education, teaching
Workshops	14	1495	skill development, education, capacity building
Undergraduate education	1	50	developing computing infrastructure for undergraduate education
Kotak scholarship	2	2	support for students
PhD top-up scholarship	2	2	support for students
MTech and PhD scholarships	1	68	support for students from empowered categories
Internships	1	4	support for research, training human resources, developing solutions for current requirements
Predoctoral fellowships	1	7	support for research, training human resources, developing solutions for current requirements
Attending leading international AI conferences	1	5	skill development, visibility, enabling publications in prestigious journals and participation in top-level conferences
Travel support for KIAC faculty	2	2	skill development, education, visibility
Collaborations with academia/industry	3	71	development of innovative, deep-tech solutions to meet the current and emerging requirements of the industry
Total number of activities 53		**Total number of participants/beneficiaries 3342**	

*Excluding the courses offered by KIAC distinguished faculty for the MTech (AI), MTech (Online, AI), and BTech (Mathematics and Computing) programmes.

APRIL–JUNE 2023

Date	Activity	Number of participants/ beneficiaries	Output indicators
Feb–Apr 2023	The Art of Communication for Leaders (course)	84	skill development, education, teaching
Apr–Jun 2023	Continuation of Kotak scholarship to Sasmita Harini S	1	support for students
Apr–Jun 2023	Continuation of PhD top-up scholarship to Aditya Subramanian	1	support for students
Apr–Jun 2023	Setting up the KIAC UG Computation Lab	50	developing computing infrastructure for undergraduate education
Apr 2023	Travel support for KIAC faculty	1	skill development, education, visibility
6 Apr 2023	Computer Proofs and Artificial Intelligence in Mathematics (event)	40	skill development, education, teaching, outreach
13–16 Apr 2023	ACM India Bootcamp on Responsible Computing (workshop)	28	skill development, education, capacity building
25 Apr 2023	Helping Students Develop a Critical Eye with Refute Questions (training session)	46	skill development, education, teaching
14 May 2023	Paradox Fest (event)	51	skill development, education, teaching, outreach
12 Jun 2023	Diffusers for Democratising Diffusion Models (Kotak IISc AI-ML talk)	71	education, collaboration, outreach
10–11 and 17–18 Jun 2023	Leveraging Generative AI for Teaching Programming Courses (training session)	200	skill development, education, teaching

JULY–SEPTEMBER 2023

Date	Activity	Number of participants/ beneficiaries	Output indicators
Jul 2023	Continuation of PhD top-up scholarship to Aditya Subramanian	1	support for students
Jul–Sep 2023	Continuation of Kotak scholarship to Sasmita Harini S	1	support for students
Jul–Sep 2023	Setting up the KIAC UG Computation Lab	50	developing computing infrastructure for undergraduate education
3−7 Jul 2023	Electrical Engineering Summer School 2023 (workshop)	117	skill development, education, capacity building
4 Jul 2023	On Dynamics-Informed Blending of Machine Learning and Microeconomics (Kotak IISc AI-ML talk)	120	education, collaboration, outreach
12 Jul 2023	AI/ML and Robotics for Space Technology (workshop)	200	skill development, education, capacity building
12−15 Jul 2023	36th Annual Conference on Learning Theory (COLT 2023) (workshop)	300	skill development, education, capacity building
16 Jul 2023	One-day workshop on Learning Theory (workshop)	50	skill development, education, capacity building
24−28 Jul 2023	New Approaches and Machine learning Methods for Ab initio calculations (NAMMA 2023): Psi-K India Workshop (workshop)	60	skill development, education, capacity building

JULY–SEPTEMBER 2023

Date	Activity	Number of participants/ beneficiaries	Output indicators
28 Jul 2023	Cyclically Adjusted Price/Earnings Ratio (CAPE) as a Predictor of Long-Term Equity Returns (event)	20	skill development, education, teaching, outreach
1 Aug 2023	Start of Kotak scholarship for Shivey Ravi Guttal	1	support for students
1 Aug 2023	Start of PhD top-up scholarship for Shubhankar Gupta	1	support for students
23 Aug 2023	Inauguration of the KIAC UG Computation Lab	25	developing computing infrastructure for undergraduate education
28 Aug 2023	Global Trends in 5G Communication (Kotak IISc AI-ML talk)	15	education, collaboration, outreach
12 Sep 2023	Algorithmic Governance: Auditing Search and Recommendation Algorithms for Problematic Content (Kotak IISc AI-ML talk)	10	education, collaboration, outreach
23 Sep 2023	Computer Science workshop (training session)	49	skill development, education, teaching
30 Sep and 8 Oct 2023	A Very Short Course on Large Language Models (course)	31	skill development, education, teaching
Sep–Oct 2023	Leveraging Generative AI for Teaching Programming Courses (training session)	141	skill development, education, teaching

OCTOBER–DECEMBER 2023

Date	Activity	Number of participants/ beneficiaries	Output indicators
30 Sep and 8 Oct 2023	A Very Short Course on Large Language Models (course)	31	skill development, education, teaching
Sep–Oct 2023	Leveraging Generative AI for Teaching Programming Courses (training session)	141	skill development, education, teaching
Oct 2023	Support to attend leading international AI conferences	4	skill development, visibility, enabling publications in prestigious journals and participation in top-level conferences
Oct–Dec 2023	Continuation of Kotak scholarship to Sasmita Harini S and Shivey Ravi Guttal	2	support for students
Oct–Dec 2023	Continuation of PhD top-up scholarship to Shubhankar Gupta	1	support for students
Oct–Dec 2023	Internships	4	support for research, training human resources, developing solutions for current requirements
Oct–Dec 2023	Predoctoral fellowships	5	support for research, training human resources, developing solutions for current requirements
18 Oct 2023	The Promise of 3D Representation for Controllable Content Generation (Kotak IISc AI-ML talk)	45	education, collaboration, outreach

OCTOBER–DECEMBER 2023

Date	Activity	Number of participants/ beneficiaries	Output indicators
25–28 Oct 2023	AI-ML Systems 2023 (workshop)	269	skill development, education, capacity building
Nov 2023	Travel support for KIAC faculty	1	skill development, education, visibility
17–18 Nov 2023	Tensor Computation and Machine Learning (workshop)	41	skill development, education, capacity building
20 Nov 2023	Adobe–IISc GenAI workshop (collaborations with academia/industry)	51	development of innovative, deep-tech solutions to meet the current and emerging requirements of the industry
21 Nov 2023	SMaLL: A Framework for Rapidly Generating ML Libraries (Kotak IISc AI-ML talk)	19	education, collaboration, outreach
5 Dec 2023	Advancing Visual Intelligence: Innovation Across Images, Videos, and Point Clouds (Kotak IISc AI-ML talk)	33	education, collaboration, outreach
7 Dec 2023	Artificial Intelligence in Oral Cancer (workshop)	32	skill development, education, capacity building

JANUARY–MARCH 2024

Date	Activity	Number of participants/ beneficiaries	Output indicators
Jan–Mar 2024	Continuation of Kotak scholarship to Sasmita Harini S and Shivey Ravi Guttal	2	support for students
Jan–Mar 2024	Continuation of PhD top-up scholarship to Shubhankar Gupta	1	support for students
Jan–Mar 2024	Internships	4	support for research, training human resources, developing solutions for current requirements
Jan–Mar 2024	Predoctoral fellowships	7	support for research, training human resources, developing solutions for current requirements
Mar 2024	Support to attend leading international AI conferences	1	skill development, visibility, enabling publications in prestigious journals and participation in top-level conferences
8 Jan 2024	Multimodal Generative LLMs: Unification, Interpretability, Evaluation (Kotak IISc AI-ML talk)	45	education, collaboration, outreach
11 Jan 2024	Object-centric 3D Scene Understanding from Videos (Kotak IISc AI-ML talk)	45	education, collaboration, outreach
12 Jan 2024	LLMs for Everybody: How Inclusive are the LLMs Today and Why Should we Care? (Kotak IISc AI-ML talk)	71	education, collaboration, outreach
12–15 Jan 2024	Present and Future Computing Systems (workshop)	79	skill development, education, capacity building
19–20 Jan 2024	Neuromorphic Sensing and Computing Architecture for Next-Gen AI Hardware (workshop)	85	skill development, education, capacity building

JANUARY–MARCH 2024

Date	Activity	Number of participants/ beneficiaries	Output indicators
30 Jan 2024	KIAC–AICTE Discussion on Faculty Development Programmes (collaborations with academia/industry)	4	development of innovative, deep-tech solutions to meet the current and emerging requirements of the industry
2 Feb 2024	Teaching LLMs the Value of Cooperation (Kotak IISc AI-ML talk)	20	education, collaboration, outreach
5, 7, and 8 Feb 2024	Three Lectures on Optimisation and Data Science (event)	95, 97, 52	skill development, education, teaching, outreach
13 Feb 2024	Recent Trends in Quantitative Finance (workshop)	90	skill development, education, capacity building
20 Feb 2024	KMBL Technical Meeting (collaborations with academia/industry)	16	development of innovative, deep-tech solutions to meet the current and emerging requirements of the industry
21 Feb 2024	AI–CoE Stage 1 PoC: Workshop to Finalise Oral Cancer Study Design (workshop)	44	skill development, education, capacity building
24 Feb 2024	Leveraging Computing using Generative AI (training session)	46	skill development, education, teaching
26 Feb 2024	Domain Adaptation for Fair and Robust Computer Vision (Kotak IISc AI-ML talk)	47	education, collaboration, outreach
26 Feb 2024	AlphaGeometry and Friends: AI for Mathematics (Kotak IISc AI-ML talk)	120	education, collaboration, outreach
18 Mar 2024	Making an Impact? A Tale of Two Projects (Kotak IISc AI-ML talk)	34	education, collaboration, outreach
18 Mar 2024	Efficient Language Model Inference using Statistical Tools (Kotak IISc AI-ML talk)	38	education, collaboration, outreach

REPORT OF ACTIVITIES

The Kotak IISc AI-ML Centre organised multiple activities during the last financial year 2023–24. These activities have been organised in the following pages under four heads: (i) education and skill development, (ii) support, (iii) industry–academia collaborations, and (iv) outreach.

EDUCATION AND SKILL DEVELOPMENT

The Centre contributed to enhancing the knowledge and skill of a plethora of participants from academia and industry, from India and abroad, across a range of age, educational, cultural, and socio-economic backgrounds. This was done through the Kotak IISc AI–ML talk series, events, courses and training sessions, and workshops. Some of the programmes aimed at introducing teachers to generative artificial intelligence technologies for programming.

Kotak IISc AI-ML talk series

The Kotak IISc AI–ML talk series facilitates exposure of students to the research work and state-of-the-art in their respective fields of expertise. It includes talks by eminent scientists and researchers from academia and industry from all over the world, with whom IISc students and faculty can interact and collaborate on various projects. The talks are held at IISc and open to all; non-IIScians can attend upon request.
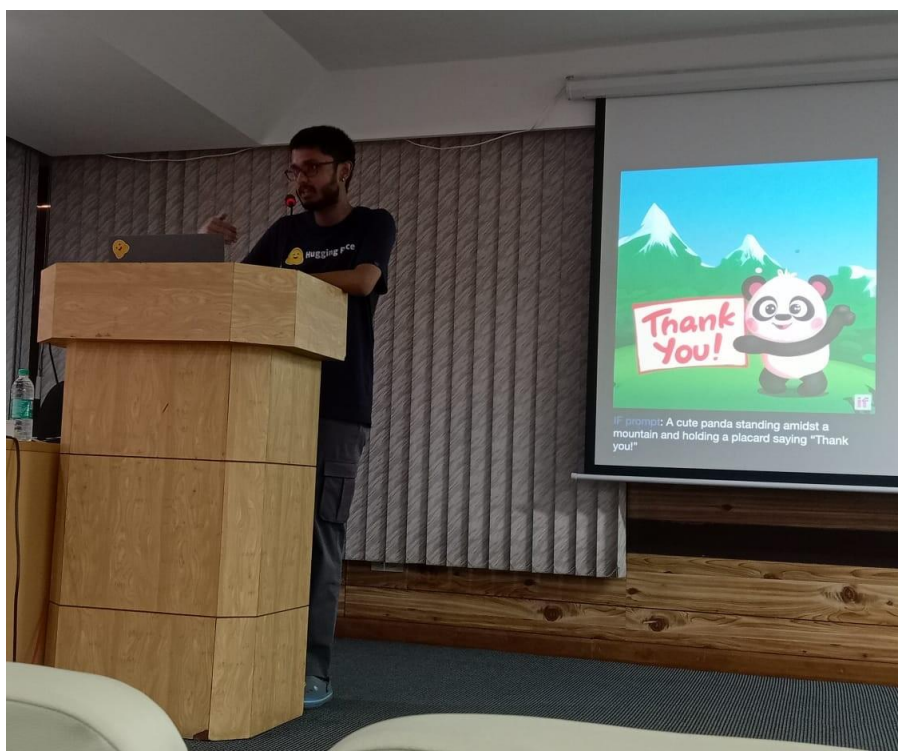
KIAC organised 15 talks between April 2023–March 2024, a brief summary of which is provided in the following pages.

Diffusers for Democratising Diffusion Models

Sayak Paul, Developer Advocate Engineer, Hugging Face
12 June 2023; Department of Computational and Data Sciences, IISc
Attendees: 71

In diffusion models, noise vectors are continuously refined to create realistic images. However, diffusers are used for applications beyond image generation. At Hugging Face, diffusers are used in image translation, text to video generation, latent space manipulation, image editing with human-readable instructions, and semantic guidance. These diffusers have practical applications in the comics industry and in marketing, to name a few.

Not all diffusion models are open source. Why do we need to make them open source? This is important to study risk factors and failure cases, evaluate safety measures, build, and improve on them. The Hugging Face team makes diffusers as accessible as possible to researchers. The Python library maintained at https://lnkd.in/dCj9ubbv provides open and responsible access to pre-trained diffusion models. The aim is to democratise the ecosystem of diffusion models by making them easy to use. Sayak Paul emphasised that the Hugging Face team is open to collaborations.

On Dynamics - Informed Blending of Machine Learning and Microeconomics

Micheal I Jordan, Pehong Chen Distinguished Professor, University of California, Berkeley
4 July 2023; Department of Computer Science and Automation, IISc
Attendees: 120

Statistical decisions are often given meaning in the context of other decisions, particularly when there are scarce resources to be shared. Managing such sharing is one of the classical goals of microeconomics, and it is given new relevance in the modern setting of large, human-focussed datasets and in data-analytic contexts such as classifiers and recommendation systems. Michael I Jordan discussed several recent projects that aimed to explore the interface between machine learning and microeconomics, including leader/follower dynamics in strategic classification, a Lyapunov theory for matching markets with transfers, and the use of contract theory as a way to design mechanisms that perform statistical inference.

Global Trends in 5G Communication

Nirlay Kundu, Distinguished Engineer, Verizon Innovation Labs
28 August 2023; Online
Attendees: 15

The talk by Nirlay Kundu addressed the 5G technology landscape, its deployment in a Tier 1 telco environment, the challenges of network planning, the role of standards in advancing the adoption of open interfaces, and the business challenges that network operators face.

Algorithmic Governance: Auditing Search and Recommendation Algorithms for Problematic Content

Tanushree Mitra, Assistant Professor, University of Washington, Information School
12 September 2023; Department of Computational and Data Sciences, IISc
Attendees: 10

Today, online social systems have become integral to our daily lives. Yet, these systems and the algorithms driving them surface problematic content, whether they be harmful misinformation or damaging conspiracy theories. Left unchecked, these problems can negatively impact our democracy. How do we systematically investigate algorithmic misinformation? How do we govern algorithmic systems to safeguard against problematic content? In her talk, Tanushree Mitra presented the results of algorithmic audits for misinformation conducted on the search and recommendation algorithms driving two platforms: 1) YouTube, the most popular video search platform and 2) Amazon, the world's leading e-commerce platform. She presented ideas on how we can develop effective long-term algorithmic governance, the challenges in doing so and the new governance challenges and opportunities that are emerging with the recent advances in the field of large language models.

The Promise of 3D Representation for Controllable Content Generation

Amit Raj, Research Scientist, Google Research
18 October 2023; Department of Computational and Data Sciences, IISc
Attendees: 45

Neural image synthesis has seen enormous advances in recent years, led by innovations in generative adversarial networks (GANs) that generate high-resolution, photo-realistic images. However, a major limitation of these methods is that they tend to capture texture statistics of an image with no explicit understanding of geometry. Additionally, GAN-only pipelines are notoriously hard to train. In contrast, recent trends in neural and volumetric rendering have demonstrated compelling results by incorporating three-dimensional (3D) information into the synthesis pipeline using classical rendering techniques. Additionally, diffusion models represent another class of generative models that have recently seen great success in high-quality image generation.

Amit Raj leverages ideas from both classical graphics rendering and neural image synthesis to design 3D guided image generation pipelines that are photo-realistic, controllable, and easy to train.

SMaLL: A Framework for Rapidly Generating ML Libraries

Upasana Sridhar, PhD student, Department of Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh
21 November 2023; Department of Computer Science and Automation, IISc
Attendees: 19
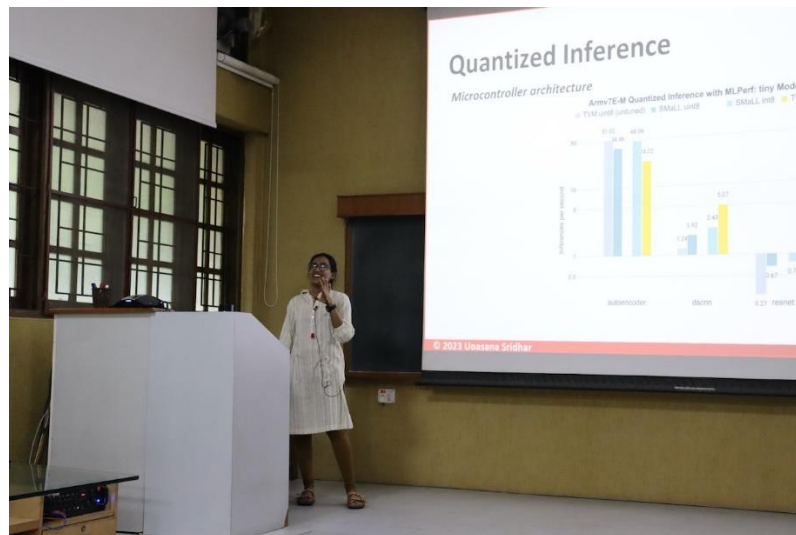
There is much interest in deploying deep neural networks (DNNs) on edge devices such as microcontrollers, Raspberry Pis, and smartphones. However, embedded devices are often resource constrained, making high-performance machine learning (ML) libraries critical to enable DNN deployment. These high-performance libraries are typically hand-tuned for very specific hardware features and are difficult to port across even generations of the same hardware architecture. The rapid development of new edge devices, combined with the high implementation effort required by high performance libraries, leads to sparse support for the high-performance libraries required.

The SMaLL framework is an open-source solution to rapidly port high-performance machine learning libraries to new CPU (central processing unit) architectures. The key insight is that the operations used in DNNs can be expressed using a shared abstraction. This allows performance-specific optimisations to be isolated to a small section of code, called a kernel, with support for a new architecture requiring only a few hundred lines of new code. Further, the resulting libraries frequently have better performance than the state-of-the-art ML framework on each target hardware.

In this talk, Upasana Sridhar focussed on the specific problems of developing libraries for edge devices and highlighted the lessons learnt from constructing abstractions for performance.

Advancing Visual Intelligence: Innovations Across Images, Videos, and Point Clouds

Mrigank Rochan, Assistant Professor, Department of Computer Science, University of Saskatchewan, Canada
5 December 2023; Department of Computational and Data Sciences, IISc
Attendees: 33

As the demand for advanced computer vision applications continues to grow, there is a pressing need to improve the understanding and interpretation of visual data. In this talk, Mrigank Rochan presented his group's efforts to push the boundaries of visual intelligence across multiple modalities, including images, videos, and point clouds, enabling more accurate and efficient analysis of diverse visual content. Firstly, he introduced their method, which can automatically localise the object in an image associated with a user-generated textual tag. Secondly, he described their work towards the automatic creation of a short visual summary or highlight of a long input video, allowing users to easily preview, search, and edit ever-growing video data. Thirdly, he discussed their research on robust visual perception systems in autonomous driving, focusing specifically on LiDAR point cloud semantic segmentation. Finally, he concluded with some interesting future directions.

Multimodal Generative LLMs: Unification, Interpretability, Evaluation

Mohit Bansal, John R & Louise S Parker Professor and Director of the MURGe-Lab (UNC-NLP Group), Department of Computer Science, UNC Chapel Hill

8 January 2024; Department of Computational and Data Sciences, IISc

Attendees: 45

In this talk, Mohit Bansal presented his team's journey on large-scale multimodal pretrained (generative) models across various modalities (text, images, videos, audio, layouts), enhancing important aspects such as unification (for generalisability, shared knowledge, and efficiency), interpretable programming/planning (for controllability and faithfulness) and evaluation (of fine-grained skills, faithfulness, and social biases). He started by discussing early cross-modal vision-and-language pretraining models (LXMERT). He then looked at early unified models (VL-T5) to combine several multimodal tasks (such as visual QA, referring expression comprehension, visual entailment, visual common sense reasoning, captioning, and multimodal translation) by treating all tasks as text generation. Next, he looked at recent progressively more unified models (with joint objectives and architecture, as well as newer unified modalities during encoding and decoding) such as textless video-audio transformers (TVLT), vision-text-layout transformers for universal document processing (UDOP), and composable any-to-any text-audio-image-video multimodal generation (CoDi).

He also discussed interpretable and controllable multimodal generation (to improve faithfulness) via large language model (LLM)-based planning and programming, such as layout-controllable image generation via visual programming (VPGen), consistent multi-scene video generation via LLM-guided planning (VideoDirectorGPT), and open-domain, open-platform diagram generation (DiagrammerGPT). He concluded with important faithfulness and bias evaluation aspects of multimodal generation models, based on fine-grained skill and social bias evaluation (DALL-Eval), interpretable and explainable visual

programs (VPEval), as well as reliable fine-grained evaluation via Davidsonian Semantics (DSG).

Object-centric 3d Scene Understanding from Videos

Yash Bhalgat

11 January 2024; Department of Computational and Data Sciences, IISc

Attendees: 45

The growing demand for immersive, interactive experiences has underscored the importance of three-dimensional (3D) data in understanding our surroundings. Traditional methods for capturing 3D data are often complex and equipment-intensive. In contrast, Yash Bhalgat's research aims to utilise unconstrained videos, such as those from augmented reality glasses, to effortlessly capture scenes and objects in their full 3D complexity. As a first step, he described a method to incorporate epipolar geometry priors in multi-view transformer models to enable identifying objects across extreme pose variations. Next, he discussed his recent work on 3D object segmentation using two-dimensional pre-trained foundation models. Finally, he touched upon his ongoing work on object-centric dynamic scene representations.

LLMs for Everybody: How Inclusive are the LLMs Today and Why Should we Care?

Monojit Choudhury, Professor of Natural Language Processing, Mohamed bin Zayed University of Artificial Intelligence (MBZUAI), Abu Dhabi

12 January 2024; Department of Computer Science and Automation, IISc
Attendees: 71
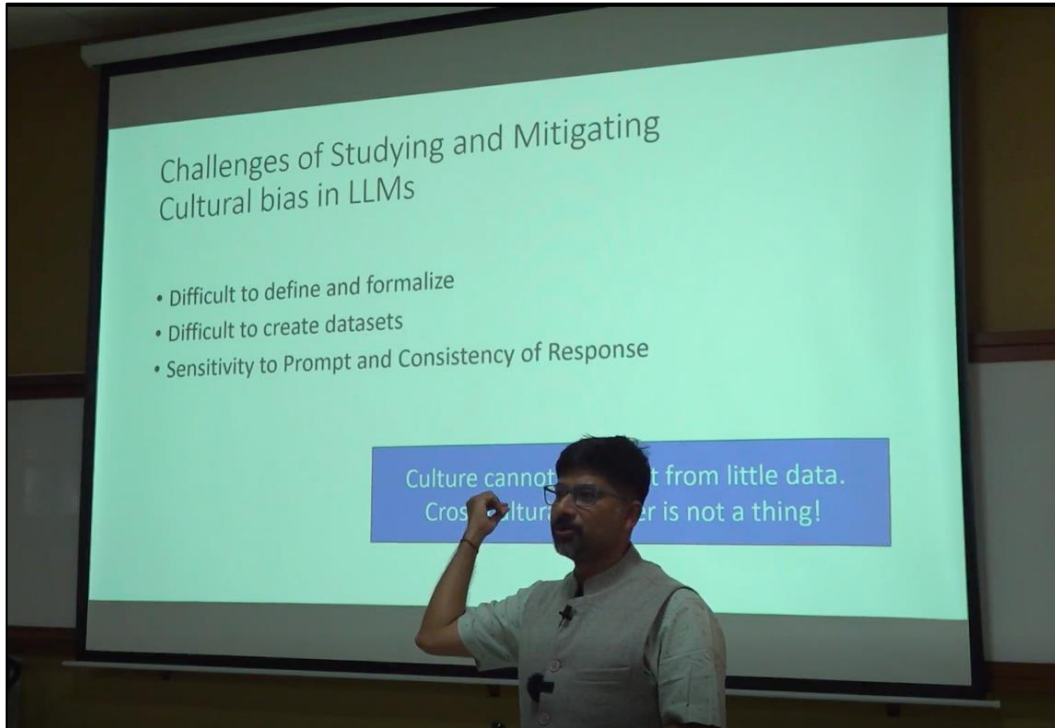
Large language models (LLMs) have revolutionised the field of natural language processing (NLP) and natural human–computer interactions. They hold a lot of promise, but are these promises equitable across countries, languages, and other demographic groups? Research from Monojit Choudhury's group as well as from around the world is constantly revealing that LLMs are biased in terms of their language processing abilities in most but a few of the world's languages, cultural awareness (or lack thereof), and value alignment. In this talk, Choudhury highlighted some of his group's recent findings around value alignment bias in the models and argued why we need models that can reason generically across moral values and cultural conventions.

He also discussed some of the opportunities for students at the postgraduate, PhD, and postdoctoral levels at the newly-founded Mohamed bin Zayed University of Artificial Intelligence in Abu Dhabi.

Teaching LLMS the Value of Cooperation

Tanmoy Chakraborty, Associate Professor of Electrical Engineering and Associate Faculty Member, Yardi School of AI, Indian Institute of Technology Delhi.
2 February 2024; Department of Computer Science and Automation, IISc
Attendees: 20
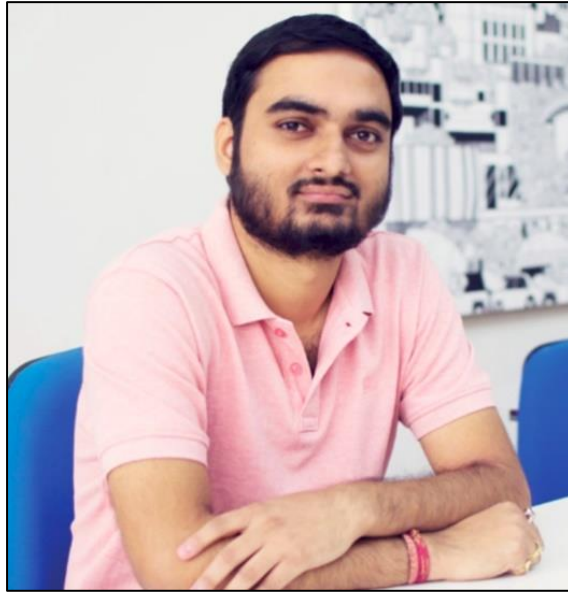
Large language models, despite their astounding reasoning abilities, are not faithful problem solvers. While their abilities are strongly correlated with scale, even humongous models like GPT-3.5 or GPT-4 can become inconsistent reasoners. Recent advances in verbose prompting techniques like chain-of-thought try to elicit step-by-step decomposition so that the model can solve a sequence of simpler problems to finally reach the goal. Augmenting external tools like web search or calculators has also been proposed to offload deterministic tasks. However, foundational language models learn neither problem decomposition nor tool-usage.

In this talk, Tanmoy Chakraborty presented potent solutions towards offloading reasoning subtasks in the case of mathematical problem solving: how does one teach an auxiliary (and potentially frugal) language model to coordinate with black-box solvers, symbolic or language model-based, to successfully answer mathematical problems? This talk focussed on successfully teaching language models to perform reasoning from non-human feedback and how rewards beyond just the correctness of the final answer are essential for better learning.

Domain Adaptation for Fair and Robust Computer Vision

Tarun Kalluri, PhD student, Visual Computing Group, UC San Diego
26 February 2024; Department of Computational and Data Sciences, IISc
Attendees: 47

While recent progress significantly advances the state-of-the-art in computer vision across several tasks, the poor ability of these models to generalise to domains and categories under-represented in the training set remains a problem, posing a direct challenge to fair and inclusive computer vision. In his talk, Tarun Kalluri talked about his recent efforts towards improving generalisability and robustness in computer vision using domain adaptation. First, he spoke about work on scaling domain adaptation to large scale datasets using metric learning. Next, he introduced a new dataset effort called GeoNet aimed at benchmarking and developing novel algorithms towards geographical robustness in various vision tasks. Finally, he talked about the latest research studying the role of language supervision to improve adaptation of visual models to new domains.

AlphaGeometry and Friends: AI for Mathematics

Siddhartha Gadgil, Professor, Department of Mathematics, IISc
26 February 2024; Faculty Hall, IISc

Attendees: 120
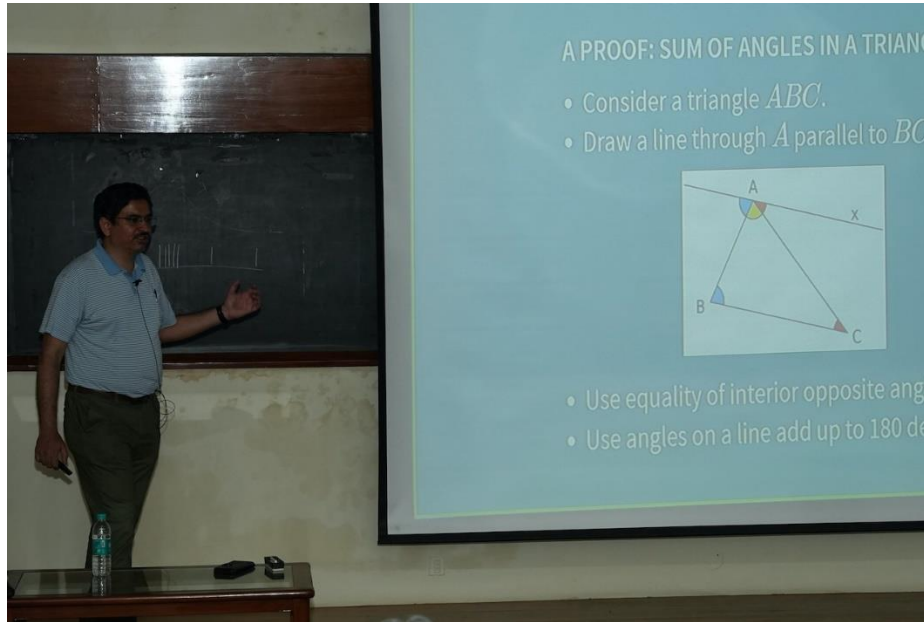
Recently, researchers at Google developed a system, AlphaGeometry, which can solve geometry problems from the International Mathematical Olympiad (IMO) at close to Gold Medal level. This was based on algorithmic (i.e., rule based) deduction together with a language model (Generative AI) to generate auxiliary constructions. To train the language model, 'synthetic data' was generated.

This work follows what are becoming common patterns for the use of artificial intelligence in mathematics, in particular using Generative AI to obtain useful candidates paired with deductive systems, including interactive theorem provers (ITPs), to check correctness, complete proofs, and evaluate results. Essentially, Generative AI is used for 'intuitive' aspects of reasoning and algorithms/symbolic AI/ITPs are used for the 'logical' aspects of reasoning.

In this talk, Siddhartha Gadgil began by discussing AlphaGeometry. He then discussed a few other systems for AI for mathematics, including 'FunSearch' which proved a result giving an improved bound for the so-called CapSet problem. He also discussed the design of possible systems for going beyond the present systems and experiments with GPT-4 showing its powers and its limitations relevant to this quest.

Making an Impact? A Tale of Two Projects

Kevin Leyton-Brown, Professor of Computer Science and a Distinguished University Scholar at the University of British Columbia

18 March 2024; Department of Computational and Data Sciences, IISc

Attendees: 34

How can AI researchers leverage their specialised knowledge to make a social impact? The notion is beguiling but the reality is complicated. Kevin Leyton-Brown's talk contrasted two strategies that are often employed—loosely described as write a paper and be an entrepreneur—gained via two, very different projects in electronic market design. The first project focussed on developing new theoretical ideas for incentivising local food pantries to honestly report demand to a centralised food bank. The second project was more practical; it aimed to design an electronic market for agricultural commodities in Uganda that could operate over low-end SMS phones. After discussing technical innovations, lessons learned, and lingering disappointments from both projects, the talk concluded with some overall thoughts about strategies that researchers might employ in pursuit of successful 'AI for Social Impact projects' and how these can be taught in our courses.

Efficient Language Model Inference Using Statistical Tools

Ananda Theertha Suresh, Research Scientist at Google Research, New York

18 March 2024; Department of Computer Science and Automation, IISc

Attendees: 38

Autoregressive sampling from large language models has led to state-of-the-art results in several natural language tasks. However, autoregressive sampling generates tokens one at a time making it slow, and even prohibitive in certain tasks. One way to speed up sampling is speculative decoding: use a small model to sample a draft (block or sequence of tokens), and then score all tokens in the draft by the large language model in parallel. A subset of the tokens in the draft are accepted (and the rest rejected) based on a statistical method to guarantee that the final output follows the distribution of the large model.

In this talk, Ananda Theertha Suresh provided a principled understanding of speculative decoding through the lens of distribution coupling and optimal transport theory. This new formulation enables an improvement in speculative decoding in two ways: first, he proposed an optimal draft acceptance algorithm that provides additional wall-clock speedup without incurring additional computation cost. Next, he asked if the latency can be improved further with extra parallel computations? He answered this question affirmatively by showing that if we have multiple drafts from the small model, we can use them to improve the speedup further albeit using extra parallel computations. He provided theoretical guarantees on the proposed algorithms and characterised the expected speedup. He further empirically demonstrated the practicality of the new algorithms on standard datasets.

Events

A variety of events are being organised, utilising various modes of interaction such as lectures, discussions, and panel discussions, to disseminate information and encourage discussions among peer groups and to highlight the work of experts in various fields.

Computer Proofs and Artificial Intelligence in Mathematics

6 April 2023

Department of Mathematics, IISc

Participants: 40

An informal discussion on the topic, 'Computer Proofs and Artificial Intelligence in Mathematics', took place in the Department of Mathematics, IISc, with Kevin Buzzard (Professor, Imperial College, London), Viraj Kumar (Visiting Professor, KIAC), Siddhartha Gadgil (Professor, Department of Mathematics, IISc), faculty, and students from IISc. The theme of the discussion was 'How would artificial intelligence impact mathematics, research, and teaching?'

Paradox Fest

14 May 2023

Department of Computer Science and Automation, IISc

Participants: 51

While learning about the foundations of set theory, axiomatic approach, and formal proof of correctness in the course 'Discrete Mathematics', offered by Chandrasekaran Pandu Rangan (Chair Visiting Professor, KIAC), the undergraduate students of the BTech (Mathematics and Computing) programme at IISc were excited about paradoxes. They teamed up to put up a delightful show with presentations on world-famous paradoxes. The Fest was organised by Databased, ACM−W IISc Student Chapter, and KIAC.

Talk on 'Cyclically Adjusted Price/Earnings Ratio (CAPE) as a Predictor of Long-Term Equity Returns'

Thomas K Philips, Adjunct Faculty, Department of Finance and Risk Engineering, Tandon School of Engineering, NYU
28 July 2023; Department of Management Studies, IISc
Attendees: 20

Robert Shiller's cyclically adjusted price/earnings ratio (CAPE) has proven to be a powerful descriptor, as well as a useful predictor, of long-term equity returns in the United States and many global markets. CAPE uses a 10-year average of real earnings to simultaneously filter noise in earnings and to estimate corporate profitability over a business cycle.

In this talk, Thomas K Philips explained CAPE's theoretical underpinnings and simplified its methodology by separating the filtering of noise from the detection of cyclicality in earnings. In addition, he accounted for an empirical nonlinearity in the relationship between valuation ratios and equity market returns and combined two robust non-linear forecasts to create an improved forecast of the 10-year forward returns of the S&P 500. He also explained why robust estimators are of particular importance in finance, and why so many predictive models perform poorly out-of-sample.

Three Lectures on Optimisation and Data Science

Venkat Chandrasekaran, Professor, Department of Computing and Mathematical Sciences & Electrical Engineering, California Institute of Technology, USA
5, 7, 8 February 2024; Department of Computer Science and Automation, IISc
Attendees: 95, 97, 52

Venkat Chandrasekaran gave three lectures on optimisation and data science. His first lecture was on 'Optimisation and Creativity', the second on 'Convex Graph Invariants and Their Applications', and the third on 'Fitting Convex Sets to Data'. The lectures were attended by many students from IISc.

Courses and training sessions

To enhance the knowledge base and build skills of different target groups, courses and training sessions are organised for students and faculty (schools and colleges).

The Art of Communication for Leaders

Rakesh Godhwani, Founder and Chief Executive Officer, School of Meaningful Experiences Pvt. Ltd

February–April 2023; Hybrid mode: Office of Communications, IISc/Online

Participants: 84

A course on 'The Art of Communication for Leaders' was conducted for the second time in 2023 during February–April, with financial support from KIAC. The need for such a course has been felt for a long time in IISc as students find it difficult to communicate their research, whether it is to a peer group or a general audience.

The course had a mix of in-person and online sessions topics such as understanding confidence, self-esteem, and self-doubt; overcoming glossophobia; understanding audiences; persuasion; depth of an argument and conveying a point of view; speech writing; managing social interactions; and job interviews. The students were also given three assignments.

Students from various programmes—undergraduate, master's, and doctoral—were encouraged to enrol for the two-credits course, to enable them to break barriers and talk to each other.

Helping Students Develop a Critical Eye with Refute Questions

Viraj Kumar, Visiting Professor, KIAC

25 April 2023; Goa

Participants: 46

Viraj Kumar (Visiting Professor, KIAC), conducted a hands-on workshop for 46 faculty as part of the 'National Level Faculty Development Program on Effective Pedagogical Strategies for Computer Science Education', organised jointly by the Directorate of Higher Education, Goa State Higher Education Council, and the ACM India Special Interest Group on Computer Science Education (ACM iSIGCSE).

The workshop was entitled 'Helping Students Develop a Critical Eye with Refute Questions', which was a refinement of a previous workshop presented by Viraj Kumar at the SIGCSE TS 2023 conference in Toronto, Canada (March 2023).

The participants were experienced faculty in various undergraduate and postgraduate computing disciplines. The workshop provided them with a hands-on introduction to a recently proposed, auto-gradable type of question that simultaneously tests student understanding of the *task* and the *code for that task*.

Leveraging Generative AI for Teaching Programming Courses

Viraj Kumar, Visiting Professor, KIAC

June 10–11 and June 17–18, 2023; Online

Participants: 200
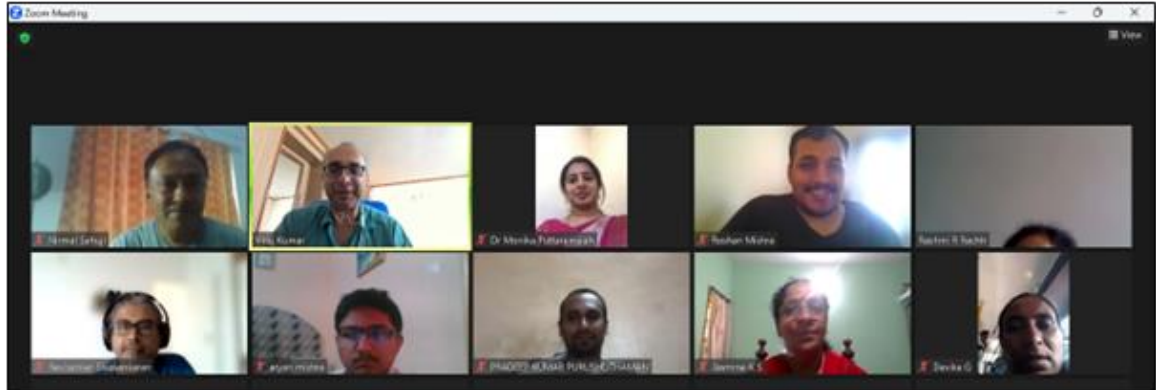
Viraj Kumar (Visiting Professor, KIAC) conducted an NPTEL (National Programme of Technology Enhanced Learning) workshop on 'Leveraging Generative AI for Teaching Programming Courses'. The ten-hour workshop was conducted online on two consecutive weekends: June 10–11 and June 17–18, 2023.

The workshop targeted both current faculty from computing domains across a range of higher education programmes (including BTech/BE/BCA/MCA/MTech/ME, and BCA/MCA) as well as prospective faculty (including Master's students, PhD scholars, and even some undergraduate students who were keen to pursue an academic career). About 50% of the 200 workshop registrants were current faculty, including 40 faculty from Karnataka who were sponsored by the Board of IT Education Standards (BITES).

The participants were introduced to several generative artificial intelligence (AI) technologies for programming and provided with a variety of hands-on exercises so that they could (a) understand how students can use these technologies to solve traditional programming problems trivially, and (b) understand how to design new types of assessments (and associated pedagogical strategies) to help students develop key competencies despite access to these powerful tools.

The participants found the material challenging; however, several reported that the workshop served its key purpose: getting them to think about how to leverage generative AI technologies in their own classrooms.

Computer Science workshop

Viraj Kumar, Visiting Professor, KIAC

23 September 2023; Human Resource Development Centre, Delhi Public School Society

Participants: 49

Viraj Kumar conducted a session for computer science teachers of classes 9-12 on 23 September 2023. The session was part of a residential Computer Science workshop organised by the Human Resource Development Centre of the Delhi Public School Society between 21-24 September 2023. The objective of the workshop was to acquaint teachers with teaching strategies and the latest developments in the field.

Viraj's session was in two parts: (i) Implications of Generative AI on Programming. This two-hour session provided teachers with a high-level understanding of Generative AI, why it is effective for writing code (especially code for students), and where the current school Computer Science curriculum must be changed due to the emergence of (and easy access to) Generative AI tools. The session included some hands-on components and a vibrant question–answer session. (ii) Questions for Assessing the Ability to Critique. This largely hands-on two-hour session introduced teachers to a new style of questions, namely Refute questions, that explicitly develop the ability of students to critically analyse artefacts such as AI-

generated code. The teachers were provided resources to effectively create and evaluate such questions and provide students with formative feedback.

A Very Short Course on Large Language Models

Monojit Choudhury (Principal Applied Scientist) and Aditi Khandelwal, Kumar Tanmay, Utkarsh Agarwal (research scholars), Microsoft Corporation

Date: 30 September and 8 October, 2023

Participants: 31

The course aimed to provide students with an accelerated understanding of building practical engineering natural language processing (NLP) systems and prompt engineering using the most advanced large language models (LLMs).

Leveraging Generative AI for Teaching Programming Courses

Viraj Kumar, Visiting Professor, KIAC

September–October 2023; Online

Participants: 141

The workshop had registrations from current and prospective Computer Science faculty. Among these participants, 63 participated actively enough to earn certificates. At a high level, this workshop was similar to the training session for the Delhi Public School Society school teachers. However, since this was targeted at college faculty, it was substantially more in-depth. Further, it provided faculty with hands-on exposure to a new style of code-writing problems that cannot be solved by merely copy-pasting solutions produced by Generative AI tools. The workshop provided faculty with both the student perspective (solving these problems) and the faculty perspective (evaluating student solutions).

Faculty Training in 'Leveraging Computing using Generative AI'

Viraj Kumar, Visiting Professor, KIAC

24 February 2024; MVJ College of Engineering

Participants: 46
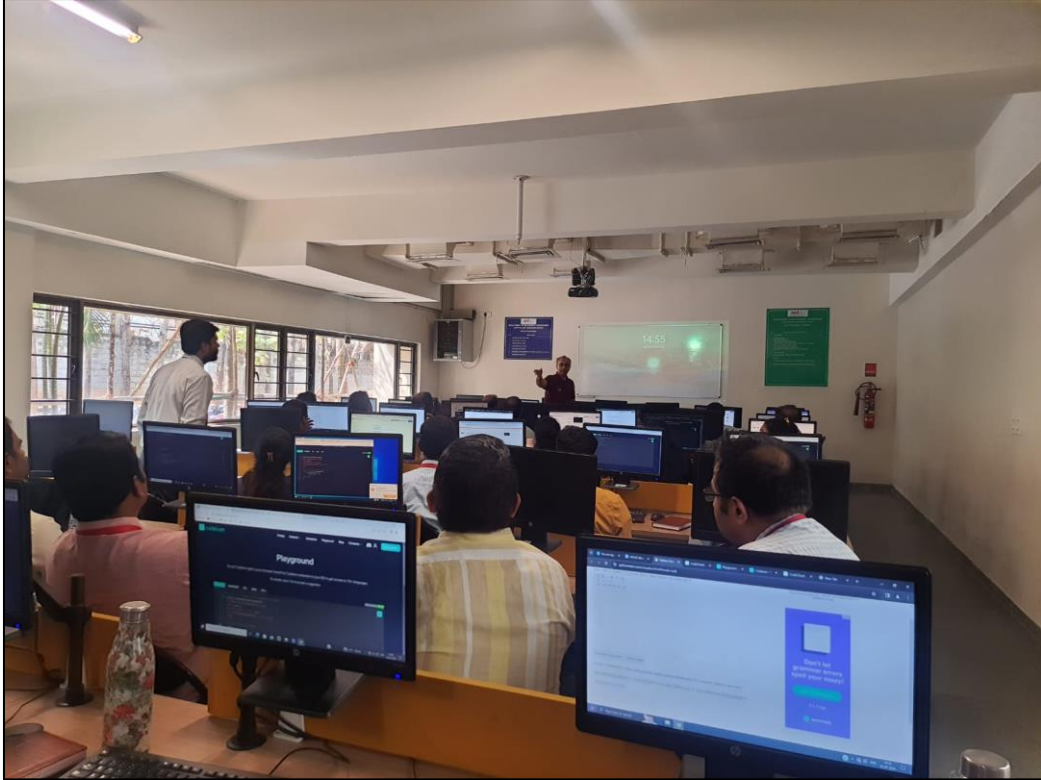
As a follow-up initiative of KIAC's discussion with officials from the All India Council for Technical Education on 30 January 2024, the Centre explored the possibility of conducting faculty training programmes in 'Computing for Non-CS Faculty'. The workshop at MVJ College of Engineering was a pilot study to test the feasibility of and enthusiasm for this idea.

Workshops

The Kotak IISc AI–ML Centre extends financial and/or organisational support to faculty members of IISc to organise and conduct workshops on a wide range of themes such as artificial intelligence in oral cancer, robotics and space exploration, responsible computing, learning theory, tensor computation and machine learning, and quantitative finance. Fourteen workshops were supported in this financial year.

ACM India Bootcamp on Responsible Computing

13–16 April 2023; IISc

Participants: 28

The Kotak IISc AI-ML Centre and the Association for Computing Machinery India conducted a 'Bootcamp on Responsible Computing' for professionals and senior researchers, to enable them to obtain an in-depth perspective of different aspects of responsible computing. As Hemant Pande, Executive Director of ACM India, said "A dream is something that keeps you awake", the dream of conducting this bootcamp came true after three years, after the scheduled in-person event was cancelled due to the COVID pandemic.

Responsible Computing implies a consideration of the environment, fairness, equal opportunities, responsible use of data, models, and resources, among others. During the Bootcamp, various aspects of responsible computing were covered by eminent speakers, with discussions and hands-on exercises with the participants. Shweta Agrawal (IIT Madras) highlighted the privacy/security aspects of responsible computing,; Hima Lakkaraju (Harvard University) gave a brief history

of explainable artificial intelligence (AI) and her team's work in this area; Divy Thakkar (Google) spoke on AI for social good; Nandana Sengupta (IIT Delhi) covered public policy and AI; Prateek Jain (Google) explained the pitfalls of deep learning; Hari Subramonyam (Stanford University) focussed on human-centred ethical AI, and Abhijnan Chakraborty (IIT Delhi) on fairness in AI.

Electrical Engineering Summer School 2023

3–7 July 2023; IISc

Participants: 117

The Electrical Engineering Summer School 2023 was held during 3-7 July 2023 in the Department of Electrical Engineering in IISc. A total of 117 undergraduate and postgraduate students from many top colleges and institutes across India attended the event. The event consisted of talks by faculty, industry experts, students; lab visits and demonstrations, poster session, open discussions with faculty and student panels; tutorials; and quizzes. These sessions covered a variety of topics such as technical introductions to different areas, career opportunities and challenges, research highlights, and student life in IISc.

The subject areas covered included power systems, high voltage engineering, power electronics, signal processing, computer vision, AI/ML, and controls. There were two days of dedicated AI/ML sessions sponsored by KIAC on Day 3 and Day 4.

Workshop on Role of AI/ML, Robotics and extended Reality (XR) for Space Exploration

12 July 2023; IISc

Participants: 200

The aim of this workshop was to (i) congregate artificial intelligence (AI) researchers and space scientists from ISRO, (ii) discuss applications of AI/ML (machine learning) and robotics for future space missions, (iii) explore XR technology for cockpit design of crewed missions, and (iv) plan a similar workshop at a reputed venue like ICRA 2024.

The workshop started with a welcome address from Chiranjib Bhattacharyya, Convenor of KIAC. The Director of ISRO Human Space Flight Program graced the occasion with a detailed presentation on the upcoming Gaganyaan mission. An opening plenary was delivered by S K Ghosh (Professor, IIT Kharagpur) on spatial data science and its relevance for planetary exploration. It was followed by two interesting talks on space robotics and the Chandrayaan mission. Students from IISc demonstrated XR-based robot control and simulation of Martian habitat, during the lunch break.

The afternoon session started with a panel discussion on the role of AI and robotics in space exploration. Participants from the Aeronautical Development Agency, Council of Scientific & Industrial Research-National Aerospace Laboratories, and Jawaharlal Nehru Centre for Advanced Scientific Research presented developments in XR-based cockpit development and digital twins. Delegates from the University of Akron, USA and Brunel University, UK presented work on using

XR technology for space exploration and training crew for an international space station.

Overall, the workshop was a grand success with more than 200 registrations and physical attendance by colleagues from the British Deputy High Commission, Ingersoll Rand, Shell, British Telecom, Tata Consultancy Services, and many other industries and academic institutes.

36th Annual Conference on Learning Theory (COLT 2023)

12-15 July 2023; The LaLiT Ashok, Bengaluru
Participants: 300
One-day workshop on Learning Theory
16 July 2023; IISc
Participants: 50

The 36th Annual Conference on Learning Theory (COLT 2023) was held at The LaLiT Ashok, Bengaluru from 12–15 July 2023. COLT, formerly known as the conference on Computational Learning Theory, has been held annually since 1988 and for the first time in India this year. It has become the leading international conference on learning theory by maintaining a highly selective process for

submissions. It is committed to high-quality articles in all the theoretical aspects of machine learning and related topics. The Proceedings of COLT are automatically accepted in the Proceedings of Machine Learning Research if the authors desire to publish a conference paper.

This year's conference programme featured 2 plenary speakers – Professors Tong Zhang from The Hong Kong University of Science and Technology and Asu Ozdaglar from the Massachusetts Institute of Technology, a total of 165 scientific paper presentations, and a panel discussion on finding new research connections and growing one's research sphere effectively. The conference was well attended, with over 275 registered participants from all over the globe.

The conference was followed by a one-day workshop on Learning Theory at the J N Tata auditorium, IISc. The workshop featured many world-renowned experts in the field of online learning and optimisation, giving talks about their pioneering work in the area. The event was well-attended with approximately 50 participants in all.

The distinguished guest at the workshop was Nicolò Cesa-Bianchi, Professor of Computer Science, Università degli Studi di Milano, Italy, who has written influential articles and books on online learning algorithms. The workshop celebrated his 60th birthday in the presence of his students—current and past—and his collaborators.

The workshop was also graced by other eminent scientists including Manfred Warmuth, Yoav Freund, Sebastien Bubeck, Yishay Mansour, and Claudio Gentile, who spoke on a range of topics from forecasting algorithms to multi-armed bandit optimisation methods. The presentations and discussions significantly enriched understanding and opened new avenues for future research and collaboration.

COLT and the associated workshop successfully facilitated the creation of a conducive platform for Indian students, early-career scientists and researchers to interact with and learn from seasoned experts in the field. This, it is hoped, not only bolstered their knowledge and expertise but also created potential opportunities for collaborative research projects in the future.

New Approaches and Machine learning Methods for Ab initio calculations (NAMMA 2023): Psi-K India Workshop

24–28 July 2023; IISc

Participants: 160

The NAMMA 2023 workshop, organised jointly by IISc, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru, and the Chatterjee Group-Centres of Research and Education in Science and Technology (TCG-CREST), Kolkata was held in Bengaluru from 24–28 July 2023. This is the first such meeting organised in India, sponsored by the Psi-K European Network, augmented by generous support from various funding agencies such as the Kotak IISc AI-ML Centre at IISc, Sheikh Saqr Lab at JNCASR, Shell India Pvt Ltd, Netweb Technologies, Micropoint Computers, Gaussian Inc, apart from the three organizing institutes (IISc, JNCASR, Shell).

The first two days of this five-day workshop were devoted to pedagogic level workshops with hands-on sessions covering the details of density-functional theory (DFT), density functional perturbation theory (DFPT) and AI/ML techniques used for materials discovery. There were four resource persons and about 60 participants. Three days were devoted to invited talks covering a wide canvas of DFT and AI/ML.

There were 60 speakers (from different parts of India, taking into account the geographical diversity as well as gender balance), six overseas speakers from Europe, USA and Israel, 30 outstation student participants, and 60 student participants from Bengaluru. The lectures in the workshop, as well as the talks at

the conference, were streamed live to about 500 researchers, to reach as much of the Indian electronic structure community as possible.

AI–ML Systems 2023

25–28 October 2023; Chancery Pavilion, Bengaluru

Participants: 269

The aim of this conference was to examine how immense strides in AI/ML techniques are made possible through advances in computational systems; how the use of AI/ML can help in data-driven explorations of the design space of the computational systems; and how new breeds of AI/ML Systems enable new forms of socio-techno-economic systems and they in turn generate new requirements for research in AI/ML techniques.

Tensor Computation and Machine Learning

17–18 November 2023; IISc

Participants: 41

The aim of this workshop was to provide a platform for researchers from academia and industry to present their original work and exchange ideas, information, techniques, and applications in the field of machine learning and tensor computing, including, but not limited to artificial neural network, applied linear and multilinear algebra, parallel and distributed deep learning, scientific machine learning, soft computing, data security, image processing, and other emerging areas of research.

Artificial Intelligence in Oral Cancer

7 December 2023; IISc

Participants: 32

The objective of this workshop was to bring together partners and stakeholders who could contribute to the call from the Ministry of Education for consortium-based proposals from higher education institutions on Artificial Intelligence (AI) for Healthcare, and to identify tangible, demonstrable improvements and targets for a successful proof-of-concept on oral cancer.

The workshop was hosted in the Department of Electrical Communication Engineering, IISc on 7 December 2023. The event was attended by 32 persons, including the main collaborators from IISc, the Oral Cancer Task Force, Bengaluru, and oral cancer researchers from across India. During the discussion after the presentations, the attendees identified a focus area on which the consortium proposal would be based.

Present and Future Computing Systems

12–15 January 2024; IISc

Participants: 79

Computing systems (e.g., mobile phones, desktops, laptops) are integrated parts of our lives nowadays. While we want our computing systems to be cheap, we also want them to be fast and energy efficient. Moreover, we also want our computing systems to be safe and secure so that we can use them without risking our privacy. Several new applications have emerged recently that are being extensively executed on different computing systems. Specifically, the emergence of machine learning applications (e.g., deep neural networks, and ChatGPT) has called for more efficient and more secure computing systems than ever before. In this workshop, several scholars with extensive research experience in the domain of computing systems talked about various aspects of present computing systems as well as how future computing systems will look like. Attendees got a unique opportunity to interact with professionals from leading industries in this domain. Moreover, a team from C-DAC provided a hands-on demonstration of DIR–V VEGA Processor, which is India's indigenous microcontroller development board.

Neuromorphic Sensing and Computing Architecture for Next-Gen AI Hardware

19−20 January 2024; IISc

Participants: 85
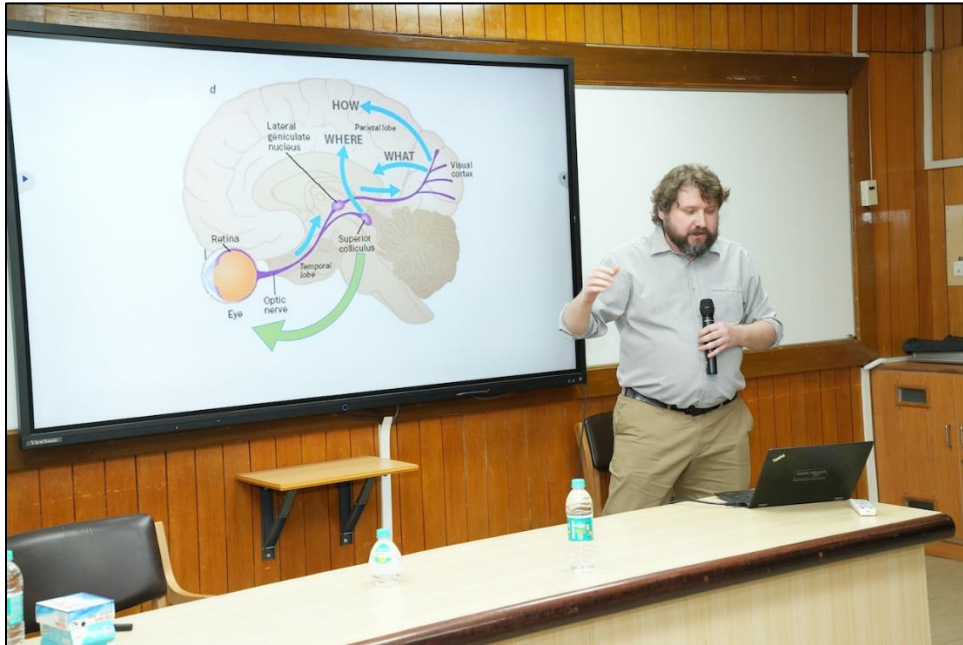
The workshop was a hub for exploring neuromorphic engineering and brain-inspired systems shaping artificial intelligence hardware. Scholars, researchers, and industry leaders delved into discussions on large-scale neuromorphic computing through talks and tutorial sessions. Both theory and practical applications reshaping artificial intelligence hardware were covered from algorithm to hardware design with practical demos.

The different talks delivered were on (i) Neuromorphic Sensing and Computing at the International Centre for Neuromorphic Systems, (ii) Continual Learning Systems with Neural Plasticity, (iii) A Sampling Theoretic Framework for Neuromorphic Sensing, (iv) Quantum Tunneling, Synaptic Intelligence and Learning-in-Memory, (v) On-Sensor Computer Vision with Pixel-Parallel Processor Arrays, (vi) A distributional approach to Datafree pruning, and (vii) Processing in interconnect inspired by dendritic computation. The tutorial on the second day delved into an in-depth look at the SCAMP chip architecture, instruction set, microarchitecture and circuit implementation, following by its programming and familiarisation on the simulator and GUI.

The workshop on neuromorphic engineering and brain-inspired systems brought together scholars, researchers, and industry leaders for a fruitful exploration of the future of AI hardware. Through a series of talks, tutorials, and practical demonstrations, participants delved into the theoretical foundations and real-world applications of large-scale neuromorphic computing. The second day offered a practical component through a tutorial on the SCAMP chip architecture. Overall, the workshop fostered a collaborative environment for exploring the exciting possibilities of neuromorphic engineering. By bridging theory and practice, the event equipped participants with the knowledge and tools to shape the future of AI hardware.

Recent Trends in Quantitative Finance

13 February 2024; IISc

Participants: 90

The first edition of the workshop on 'Recent Trends in Quantitative Finance' (RTQF 2024) was conducted on 13 February 2024. The mini-symposium aimed to bring together academicians, industry experts, and research scholars working on quantitative methods in finance. The talks by the experts touched upon the exciting developments in the field.

Cornelis Oosterlee (Utrecht University) presented the inaugural talk on 'Deep time-inconsistent Portfolio Optimization with Stocks and Options', while Sankarshan

Basu (IIM Bangalore) spoke on application of quantitative techniques in finance. Arjun Beri (Wells Fargo) gave an overview of the challenges in counterparty credit risk modelling and discussed some methodological solutions employed in the industry to tackle such problems. Anshul Jain (SSGA) talked about leveraging Gen AI techniques for investments and provided an outline of the work happening at his organisation.

Srikanth Iyer (IISc) talked about his work 'Asymmetric Super-Heston-rough Volatility Model with Zumbach effect as a Scaling Limit of Quadratic Hawkes Processes'. Arjun K M (J P Morgan) explained the need to ensure that any AI (artificial intelligence) & ML (machine learning) model used in decision-making follows the principles of fairness, ethics, accountability, explainability, privacy, security, and governance. Aditya Nittoor (SigmaQuant) talked about 'Estimation and Minimization of Execution Cost for Quoting Strategies'.

Non-Parametric estimation of ulti-dimensional Marked Hawkes processes was the theme of the talk by Sobin Joseph (IISc). The last talk for the day was delivered by Sumanjay Dutta (IISc) on low sample factor modelling for asset pricing.

AI–CoE Stage 1 PoC: Workshop to Finalise Oral Cancer Study Design

21 February 2024, Hybrid mode (IISc, Online)

Participants: 44
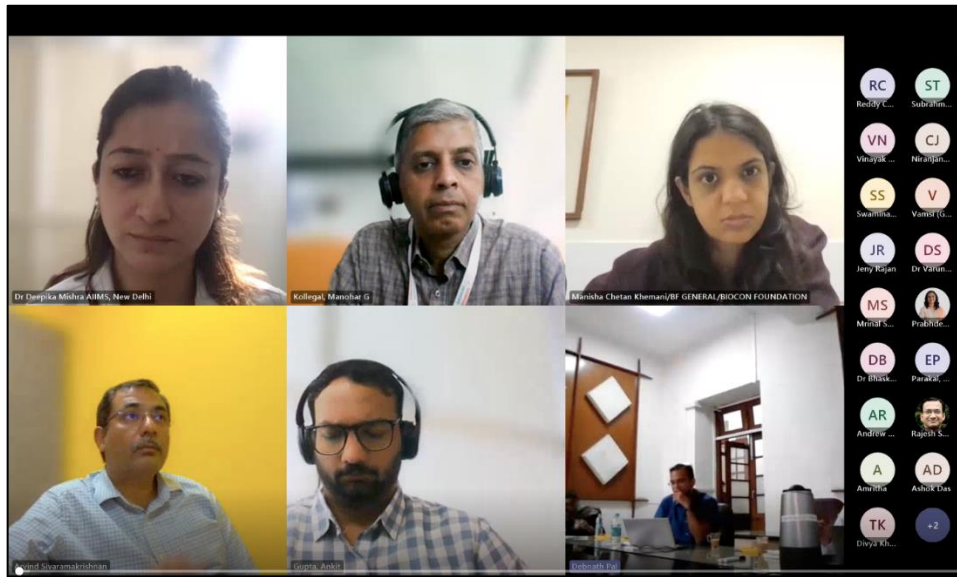
This workshop was the second to be conducted in IISc in the context of the call from the Ministry of Education for consortium-based proposals from higher education institutions on Artificial Intelligence (AI) for Healthcare. The first workshop was held on 7 December 2023, which was also supported by KIAC.

The current workshop was primarily to discuss the objectives, implementation challenges, capabilities of the consortium partners, and arrive at a suitable design for the implementation of the proof-of-concept, which is an oral cancer screening tool. The classifications for the remote specialist as well as the histopathologist, based on the guidelines of the World Health Organisation, were discussed. The data sharing policies for Phase 1 were discussed.

Two sharpened objectives were arrived at. The first one was to assess whether the oral cancer screening tool could match the remote specialist in identifying high-risk participants. The second objective was to gather data to assess whether AI-enabled cytology could assist the histopathologist. The study designs for enabling the above assessments and the partner sites where the trials would be conducted were discussed.

It is now known that the IISc led consortium is one of the four selected for support during the proof-of-concept Phase 1. The funding will be given by the Ministry of Education.

Undergraduate education

A fully-networked instructional lab with 50 desktops and 2 servers was set up to cater to the computational needs of the undergraduate students of the BTech (Mathematics and Computing) programme at IISc. The lab was inaugurated on 23 August 2023 by Milind Nagnur, Chief Technology Officer, KMBL and Govindan Rangarajan, Director, IISc. Senior delegates from KMBL and IISc were present.

The lab is used to conduct two IISc UG courses, namely, 'Data structures and algorithms' and 'Introduction to numerical methods'. A course was organised during September–October 2023 by KIAC on large language models, taught by Monojit Choudhury and his team from the Microsoft Corporation. The course aimed to provide students with an accelerated understanding of building practical engineering natural language processing (NLP) systems and prompt engineering using the most advanced large language models (LLMs).

Scholarships for IISc students

Kotak scholarship

The Kotak Scholarship is awarded to the woman student with the highest JEE Advanced Rank joining the undergraduate BTech (Mathematics and Computing) programme at IISc. This scholarship covers the tuition fees and other fees for the entire programme. Sasmita Harini S received the award for the academic year 2022–23, and Shivey Ravi Guttal received the award for the academic year 2023–24.

Sasmita Harini S receiving the scholarship certificate from Prakash Apte (Chairman (Non-Executive), KMBL) on 18 January 2023.

Shivey Ravi Guttal receiving the scholarship certificate from Milind Nagnur (Chief Technology Officer, KMBL) on 23 August 2023.

PhD top-up scholarship

The KIAC PhD top-up scholarship is a 100% top-up fellowship from KIAC. This award is for registered PhD students of IISc who fulfil the following criteria:

(i) who have not completed five years,

(ii) who are currently not availing any PhD fellowship other than the MHRD stipend from IISc, and

(iii) who have at least one regular paper published/accepted in the indicated fora (AAAI, IJCAI, CVPR, ECCV, ICCV, ICLR, ICML, NeurIPS, KDD, ACL, EMNLP, NAACL, SIGIR, WWW) in the indicated time period.In the first round, scholarship was awarded to Aditya Subramanian, a PhD student from the Department of Computer Science and Automation, and in the second round, Shubhankar Gupta, a PhD student from the Department of Aerospace Engineering received the scholarship.

SHUBHANKAR GUPTA   ADITYA SUBRAMANIAN

In the first round, the scholarship was awarded to Aditya Subramanian, a PhD student from the Department of Computer Science and Automation, and in the second round, Shubhankar Gupta, a PhD student from the Department of Aerospace Engineering received the scholarship.

Scholarships for MTech and PhD students from the empowered category

Fifty six MTech students and 12 PhD students from the empowered category were given scholarships.

Internships

The one-year KIAC internships are for students pursuing any relevant branch of Engineering. The call was released on 25 September 2023, and four interns are on board.

TUSHAR OJHA   NAVANEETH SIVAKUMAR   ADITYA GANDHAMAL   SAI HARSHA MUPPARAJU

Predoctoral fellowships

The one-year predoctoral fellowships are for students who have recently completed their undergraduate/postgraduate degree in any relevant branch of Engineering and would like to pursue research in artificial intelligence–machine learning. The call was released on 25 September 2023, and seven predoctoral fellows are on board.
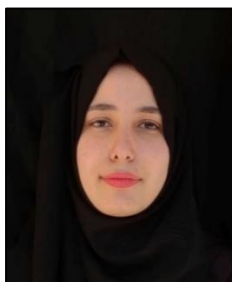
AYMAN UN NISA   RANKIT KACHROO   SAKSHAM BHUTANI   VENKATESH T

ASHISH RAMAYEE ASHOKAN   SUNNY BHATI   JINAL VYAS

Postdoctoral fellowships

The postdoctoral fellowships are offered to candidates who have recently completed their doctorates and wish to pursue cutting-edge research in artificial intelligence. He/she should have a good research record evidenced by publications in top-tier premier conferences (such as A* ranked conferences) in artificial intelligence/machine learning.

The call was released on 5 October 2023, and some applications have been received. The selection of candidates will be done, if found suitable.

# International visiting chair professorships

The international visiting chair professorships are offered to distinguished researchers every year to enable them to visit IISc for a minimum period of three weeks each, to engage in research interactions with IISc faculty members and graduate students. The candidate is expected to be working in core AI-ML related areas and publishing impactful works in top AI-ML venues.

The call was released on 1 December 2023, and applications have been received. The selection of candidates will be done, if found suitable.

Attending leading international AI conferences

The objective of this initiative is to encourage and support researchers (faculty members and students from IISc) to attend premier conferences related to artificial intelligence and to publish their work in leading venues.

The support can be used for registration, travel, hotel stay, and per diem. The presented papers are displayed on the KIAC website along with the photo of the beneficiary. KIAC supported three students and two faculty members in this financial year.
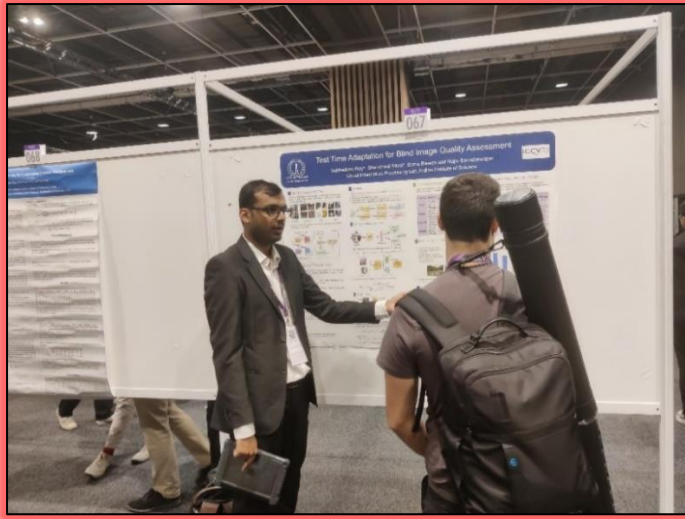
Shankhanil Mitra
PhD student,
Department of Electrical
Communication
Engineering,
Indian Institute of Science,
Bengaluru

Title of paper
Test Time Adaptation for
Blind Image Quality
Assessment
International Conference
on Computer Vision
(ICCV) 2023

Harsh Rangwani
PhD student,
Department of Computational
and Data Sciences,
Indian Institute of Science,
Bengaluru

Title of paper
Strata-NeRF: Neural Radiance
Fields for Stratified Scenes
International Conference on
Computer Vision (ICCV) 2023

Aditya Gopalan
Associate Professor,
Department of Electrical
Communication
Engineering, Indian
Institute of Science,
Bengaluru

Title of tutorial
Do you Prefer Learning
with Preferences:
Foundations of Human
Aligned Prediction Models
with Relative Feedback
Thirty-seventh Annual
Conference on Neural
Information Processing
Systems (NeurIPS 2023)

Venkatesh Babu Radhakrishnan
Professor and Chair,
Department of Computational
& Data Sciences,
Indian Institute of Science,
Bengaluru

Title of paper
Domain-Specificity Inducing
Transformers for Source-Free
Domain Adaptation
International Conference on
Computer Vision (ICCV) 2023
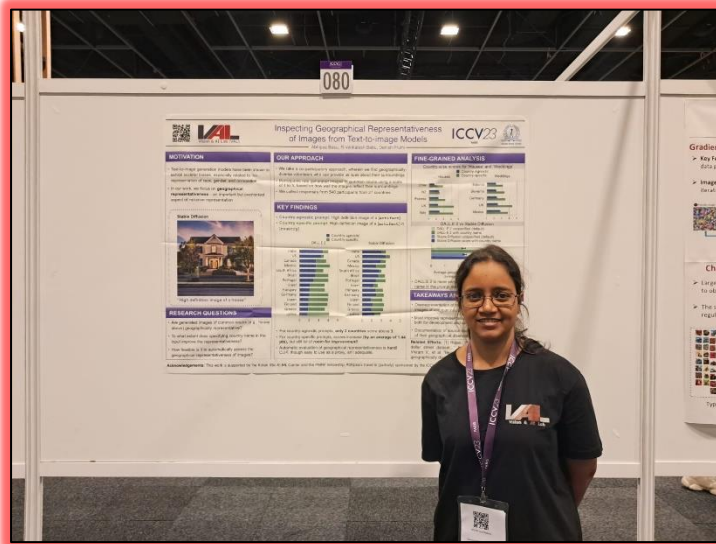
Abhipsa Basu
PhD student,
Department of
Computational and Data
Sciences,
Indian Institute of
Science, Bengaluru

Title of paper
Inspecting the
Geographical
Representativeness of
Images from Text-to-
Image Models
International Conference
on Computer Vision
(ICCV) 2023

Travel support for KIAC faculty

The Centre extends travel support for its distinguished faculty to present their work at international venues.

Chandrasekaran Pandu Rangan

Viraj Kumar

Viraj Kumar (Visiting Professor, KIAC) attended the 54th ACM Technical Symposium on Computer Science Education (SIGCSE'23) in Toronto, Canada from 15–18 March 2023. Chandrasekaran Pandu Rangan (Chair Visiting Professor, KIAC) attended the 22nd International Conference on Cryptology and Network Security in Augusta, Georgia from 31 October–2 November 2023.

Organising workshops

The Kotak IISc AI–ML Centre extended financial and/or organisational support to faculty members of IISc to organise and conduct workshops on a wide range of themes including artificial intelligence in oral cancer, robotics and space exploration, responsible computing, learning theory, tensor computation and machine learning, and quantitative finance. A total of fourteen workshops were supported, with 1495 beneficiaries.

COLLABORATIONS

KIAC has been actively involved in establishing collaborations with academia/industry with the aim of working together on projects of mutual interest, utilising the expertise of both the parties.

Adobe-IISc GenAI workshop

20 November 2023, IISc

Participants: 51

The objective of this workshop was to understand the work done by Adobe Research and IISc, to foster new collaborations and partnerships, and to find PhD students from IISc who could intern with Adobe Research over the summer.

KIAC–AICTE Discussion on Faculty Development Programmes

30 January 2024, IISc

Participants: 4

A discussion was organised to find ways in which KIAC and the All India Council for Technical Education (AICTE) can collaborate on conducting high-quality faculty development programmes at scale. The target was engineering faculty in non-computing disciplines. The aim was to enable faculty members to develop innovative teaching methodologies, establish collaborative research projects, and contribute significantly to the advancement of their respective fields.

The detailed discussion between delegates from KIAC and AICTE dealt with an overview of IISc's faculty training initiatives and available resources, at both the Bengaluru campus and the Challakere campus, KIAC's objectives and its expertise in training faculty to leverage artificial intelligence for pedagogy and assessment, and AICTE's schemes for faculty training.

IISc will be coordinating with AICTE on the AICTE-QIP-PG Certificate Program in 11 emerging areas, namely, artificial intelligence, machine learning, blockchain, semiconductor, Internet of Things, robotics, quantum computing, data science, cyber security, 3D printing and design, and virtual reality. A detailed proposal is to be finalised soon.

KMBL Technical Meeting

20 February 2024, IISc
Participants: 16

The goal of this meeting between representatives from IISc and KMBL, Bengaluru was to go beyond the ambit of corporate social responsibility (CSR) and explore the myriad ways in which IISc and KMBL can collaborate on areas of common interest in the arena of applications of artificial intelligence in the finance/banking sector. The objective was also to engage IISc students as interns with KMBL as part of their BTech/MTech/PhD internship/industry projects.

OUTREACH

The talks and events organised by the Kotak IISc AI-ML Centre are open to the
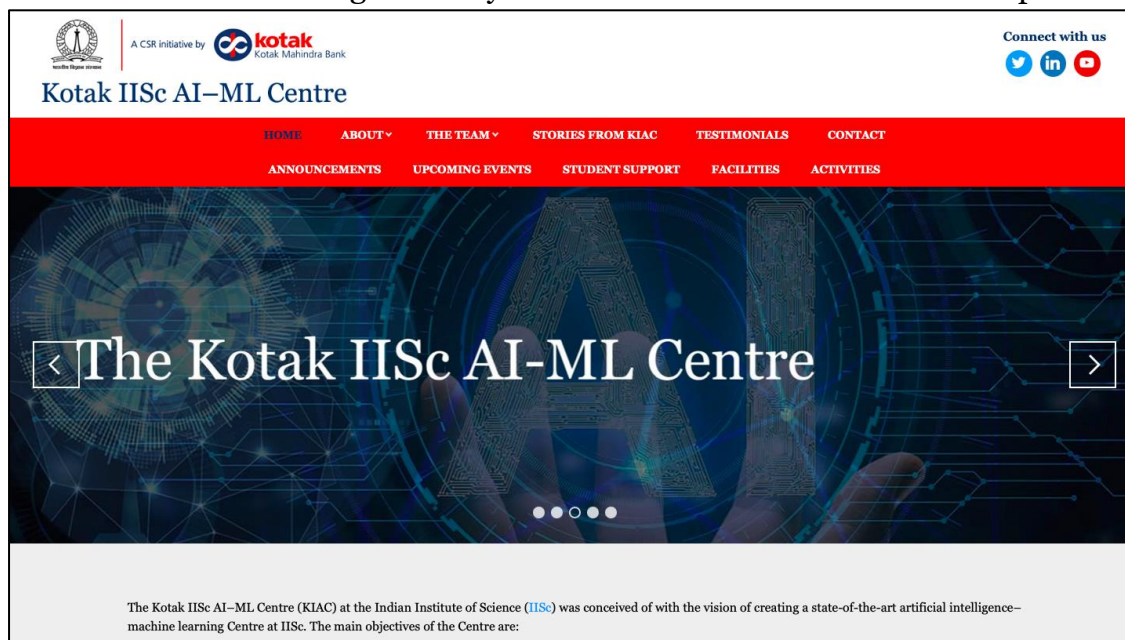

public, and they can attend upon prior permission. The information is posted on KIAC's social media handles and the webpage. A summary of these events and also of the workshops organised/funded by the Centre are available on the KIAC webpage. The recordings of lectures are uploaded on the KIAC YouTube channel for the benefit of those interested but unable to attend the events in person. Recently, interviews were conducted with two women faculty members of IISc, Soma Biswas and Vaanathi Sundaresan, who do cutting-edge research in artificial intelligence. These conversations were in the context of the International Women's Day (8 March 2024) and uploaded on the YouTube channel with the aim of inspiring young women to pursue a career in STEM.

TESTIMONIALS

"The travel grant allowed me to participate in one of the top conferences in computer vision and machine learning. The experience that I gained by interacting with fellow researchers around the world is unparallel. I thank KIAC for giving opportunity to Indian students like me to present our work at such an esteemed venue."

Shankhanil Mitra
PhD student,
Department of Electrical Communication Engineering,
Indian Institute of Science, Bengaluru
International Conference on Computer Vision (ICCV) 2023
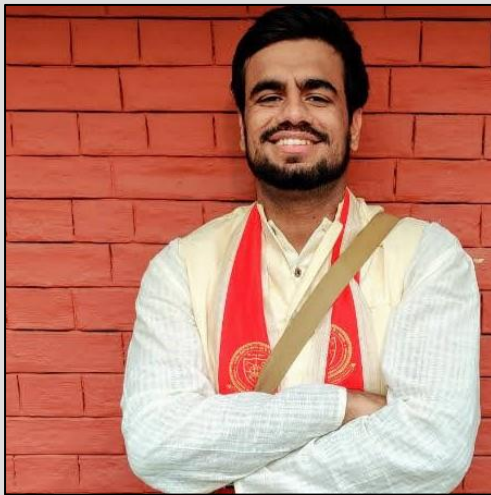
"Kotak AI Centre support for travel grants is a blessing for AI researchers, as the students don't have to worry about external funding sources if the paper gets accepted in top-tier AI conferences. The AI Centre has provided funding for only the top AI conferences, which encourages students to publish research papers of top-notch quality at these conferences. The Centre has had a positive impact on the AI research landscape in IISc."

Harsh Rangwani
PhD student,
Department of Computational and Data Sciences,
Indian Institute of Science, Bengaluru
International Conference on Computer Vision (ICCV) 2023

"I am highly grateful to KIAC for helping me attend the conference and present my paper. It would not have been possible without their support."

Abhipsa Basu
PhD student,
Department of Computational and Data Sciences,
Indian Institute of Science, Bengaluru
International Conference on Computer

"ICCV is one of the top tier conferences and a highly competitive venue to publish. Very few papers from India were published at ICCV. This year, only 16 papers were from India among 2300 papers presented at ICCV. KIAC 's travel support immensely helped the researchers to travel and present their papers. Also, the acknowledgement given to KIAC in these papers gives visibility to KIAC at international level and will help in getting Visiting Professors to IISc through KIAC. This great initiative of KIAC should be continued."

Venkatesh Babu Radhakrishnan
Professor and Chair, Department of Computational and Data Sciences,
Indian Institute of Science, Bengaluru
International Conference on Computer Vision (ICCV) 2023

"NeurIPS is among the premier machine learning/AI conferences in the world and being chosen to deliver a tutorial at the meeting is a unique opportunity. KIAC stepped up in a time of need to generously offer financial support for my travel to the conference in USA. Such support goes a long way in meeting the needs of Indian researchers to stay updated on cutting-edge research advances, as well as helping to improve the perception of Indian science and technology on the global stage. I appreciate KIAC for its commitment to supporting the Indian AI research ecosystem through its grants programme."

Aditya Gopalan
Associate Professor, Department of Electrical Communication Engineering,
Indian Institute of Science, Bengaluru
Thirty-seventh Annual Conference on Neural Information Processing Systems (NeurIPS 2023)