Indian Institute of Science

Kotak IISc AI-ML Centre

A report of activities
April to June 2023

Contents

Executive summary

The Kotak IISc AI-ML Centre conducted various activities during April–June 2023 in keeping with the Centre's objectives. The initiatives and events were targeted towards various beneficiary groups such as undergraduate students, postgraduate students, doctoral students, faculty, and professionals.

• For undergraduate (UG) students of the BTech (Mathematics and Computing) programme at IISc, KIAC supported the setting up of a Computation Lab to address all their computational needs. The Centre also supported a Paradox Fest, in which the UG students undertaking the 'Discrete Mathematics' course presented world-famous paradoxes to a diverse audience.

• For postgraduate and doctoral students of IISc, a Kotak IISc AI-ML talk was arranged. These talks aim at exposing the students to the work being conducted by eminent scientists and researchers in academia and industry, as well as opportunities in the areas of artificial intelligence (AI) and machine learning (ML). A discussion, led by outstanding experts, was also arranged on the role of computer proofs and artificial intelligence in mathematics.

• For all the students of IISc, including undergraduate, postgraduate, and doctoral, KIAC supported a course on 'The Art of Communication for Leaders'. The course was aimed at helping students communicate better with various audiences.

• For students and current faculty (participants from outside IISc), Viraj Kumar, Visiting Professor at KIAC, conducted an online NPTEL workshop on 'Leveraging Generative AI for Teaching Programming Courses'. He also conducted a workshop in Goa on 'Helping Students Develop a Critical Eye with Refute Questions'.

• For senior researchers, academicians, and professionals, KIAC co-organised a Bootcamp on Responsible Computing. This event was aimed at making them aware of the different aspects of responsible computing.

• Financial support was provided to IISc students through two programmes: (1) the Kotak Scholarship, and (2) the Research Support for IISc PhD students.

• Travel support was provided to KIAC faculty to participate in an international conference as part of the outreach activities of the Centre.

• Calls for support for IISc faculty members and students to attend and present their work in premier conferences related to artificial intelligence have been released. Support has been extended to IISc faculty to host workshops and conferences related to artificial intelligence, machine learning, and their interdisciplinary applications. Financial assistance has also been offered to external stakeholders to host conferences/workshops.

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

In the following pages, we describe these events in detail. We also reiterate the Centre's objectives, and provide an update on the KIAC administration team.

Objective of KIAC

The Kotak IISc AI-ML Centre (KIAC) at the Indian Institute of Science (IISc) was conceived of with the objective of creating a state-of-the-art AI-ML and Fintech Centre at IISc to (a) develop rigorously-trained human resources who will become future leaders of this technology and champion India's surge in this area, (b) conduct cutting edge research in this area leading to international visibility of the highest order, and (c) develop innovative, deep-tech solutions to meet the current and emerging requirements of the industry.

Governance

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). These programmes are presented to the Scientific Advisory Committee (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.

Updates about the KIAC administration team

KIAC thanks Professor Sashikumaar Ganesan for his contributions as Co-convenor from 1 January 2023 till 31 May 2023. The Centre welcomes Professor Venkatesh Babu Radhakrishnan as Co-convenor of KIAC from 1 June 2023.

Members of the Governing Board

Govindan Rangarajan, IISc (Chair)
Navakanta Bhat, IISc
Yadati Narahari, IISc
Kaushal Verma, IISc
Chetan Savla, KMBL
Jaimin Bhatt, KMBL

Members of the Scientific Advisory Committee

Rajesh Sundaresan, IISc (Chair)
Chiranjib Bhattacharyya, IISc
Venkatesh Babu Radhakrishnan, IISc
Srikanth Krishnan Iyer, IISc
Devendra Sharnagat, KMBL

Members of the Project Review Committee

S K Satheesh, IISc (Chair)
P S Anil Kumar, IISc
Rajesh Sundaresan, IISc
Himanshu Nivsarkar, KMBL
Amit Dhalwade, KMBL

The new KIAC Team

Convenor: Chiranjib Bhattacharyya
Co-convenor: Venkatesh Babu Radhakrishnan
Chair Visiting Professor: C Pandu Rangan
Visiting Professor: Viraj Kumar
Systems Administrator: Neetha Ashtakar
Secretary: Sudha Aithal
Senior Editorial Assistant: Geethanjali Monto

KEY ACHIEVEMENTS AT KIAC

The Kotak IISc AI-ML Centre undertook multiple activities during April–June 2023 in keeping with its objectives. The initiatives and events were targeted towards various beneficiary groups such as undergraduate students, postgraduate students, doctoral students, faculty, and professionals. We provide a description of these activities here.

1 | Setting up instructional laboratories

KIAC UG Computation Lab

Beneficiaries:
IISc undergraduate students of the BTech Mathematics and Computing programme

Requirement:
A computation lab to cater to the computational needs of UG students, including the work they will do as part of the artificial intelligence–machine learning course and other projects.

Result:
A fully-functional instructional lab with 50 desktops and 2 servers.

Details:
An instructional lab for UG students is being set up in the old Physics building, IISc. Nineteen desktops and two servers (with the following configurations) have been procured so far with financial support from the Kotak IISc AI-ML Centre. The plan is to buy around 31 more desktops to meet the student requirements. The students will be using these systems for all their computational needs, including the work they will do as part of the artificial intelligence–machine learning course and other projects. The desktops and servers have been set up temporarily in the Supercomputer Education and Research Centre, IISc until the UG lab is ready.

2 | Kotak IISc AI-ML talk series

Beneficiaries:

IISc students

Requirement:

Exposure of students to the research work and the state-of-the-art in their respective fields of expertise.

Result:

Talks by eminent scientists and researchers (academia and industry) from all over the world, with whom students can interact and collaborate on various projects.

Details:

In June 2023, Sayak Paul gave the third lecture in this series.

Diffusers for democratising diffusion models

[Sayak Paul](#), Developer Advocate Engineer, [Hugging Face](#)
12 June 2023
Department of Computational and Data Sciences, IISc
Number of attendees: 71

The third Kotak IISc AI-ML talk was organised on 12 June 2023 in collaboration with the Department of Computational and Data Sciences (CDS), IISc. Sayak Paul, Developer Advocate Engineer at Hugging Face, spoke on 'Diffusers for democratising diffusion models'.

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 emphasised that the Hugging Face team is open to collaborations.

3 | Events

Beneficiaries:
    Students, researchers, professionals, general public, depending on the event.
Requirement:
    A platform to encourage debates and discussions among peer groups, to inform the general public, and to highlight the work of experts in various fields related to artificial intelligence.
Result:
    Events, utilising various modes of interaction such as panel discussions and presentations, facilitating interdisciplinary collaboration.
Details:
    Two events were conducted during April–June, as described below.

Paradox Fest
14 May 2023
Department of Computer Science and Automation, IISc
Number of participants: 51

While learning about the foundations of set theory, axiomatic approach, and formal proof of correctness in the course 'Discrete Mathematics', offered by Professor C Pandu Rangan (Chair Visiting Professor at 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 on 14 May 2023. The Fest was organised by Databased, ACM–W IISc Student Chapter, and KIAC.

During the Fest, the students presented eleven paradoxes.

S. No.	Title	Team Members
1	Grelling-Nelson Paradox	Naman Mishra, Indrayudh Das
2	Just One More Paradox	Sahil Chaudhary, Mrigank Pawagi
3	Two Envelopes Paradox	Mehul Darak, Sanika Amol Borade
4	Boy or Girl Paradox	Savyasachi Deval, Sacchit Kale, Aditya Manjunatha
5	Gödel Paradox of Incompleteness	Anushka Dassi, Pinakin Choudhary
6	Cramer's Paradox	Sannidhi V Hebbar, Varivashya Poladi, Anishka Vaitla
7	Unexpected Hanging Paradox	Aditya Gupta, R K Shishir,
8	Berry Paradox	Pratyush Kant, Sirjan Hansda, Hridam Majumdar
9	Sierpinski-Mazurkiewicz Paradox	Maitreya Bhaduri, Ishaq Hamza
10	Gabriel's Horn Paradox	Ayush Raina, Arnav Bhatt, Sanidhya Kaushik
11	Banach-Tarski Paradox	Armaan Khetarpaul

PARADOX FEST

PRESENTATIONS

Computer Proofs and Artificial Intelligence in Mathematics
6 April 2023
Department of Mathematics, IISc
Number of participants: 40

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

4 | Courses and training sessions

Beneficiaries:
    Students and faculty, from within IISc and outside, depending on the requirements.

Requirement:
    Education and skill development of students and faculty.

Result:
    Lectures by experts from KIAC, IISc, other academic institutions, and industry, facilitating brainstorming and idea generation.

Details:
    A course was conducted during April–June, as described below.

The Art of Communication for Leaders
February–April 2023
Hybrid mode: Office of Communications, IISc/Online
Number of participants: 84

A course on 'The Art of Communication for Leaders' is being hosted once a year by the Office of Communications (OoC), IISc. The course was conducted for the second time this year (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. However, it has been difficult to find an instructor for the course.

In 2022, IISc signed a memorandum of understanding (MoU) with the School of Meaningful Experiences (SoME) Pvt. Ltd, to conduct 'The Art of Communication for Leaders' programme developed by SoME. Accordingly, the first course was conducted by Rakesh Godhwani, Founder and Chief Executive Officer of SoME during the January–April semester, with excellent feedback from the 93 participants.

As Rakesh Godhwani explains, "The whole objective of the course was to make IISc students who are very good in their scientific research work understand the importance of communicating their research with their audiences." Godhwani uses the six Cs framework—confidence, communication, curiosity, creativity, collaboration, and competence—to help the students learn how to communicate with confidence, achieve the desired impact on the audience, and convince job recruiters to give them jobs! The aim of the course was to prepare the students for the next stage after IISc, whether they plan to join the industry or pursue higher studies.

The course had a mix of in-person and online sessions on 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. A total of 84 students completed the course this year.

5 | Workshops

Beneficiaries:
    Students, researchers, and professionals, depending on the workshop.
Requirement:
    Education, skill development, capacity building.
Result:
    Lectures by experts from IISc, other academic institutions, and industry, facilitating discussions and interdisciplinary collaborations.
Details:
    KIAC has supported three workshops between April and June 2023. The nature of support ranged from teaching to organisation to financial assistance.

Leveraging Generative AI for Teaching Programming Courses
**10–11 June and 17–18 June 2023**
Organisers: National Programme of Technology Enhanced Learning
Online
Number of 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: 10–11 June and 17–18 June 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).
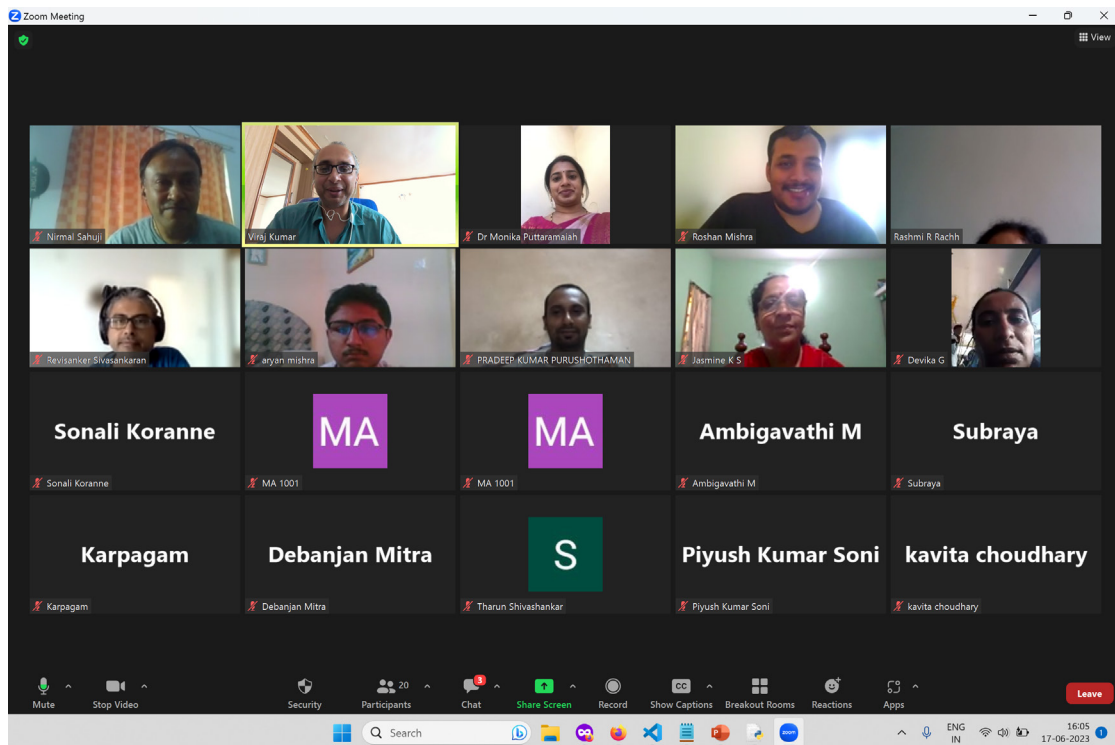
The participants were introduced to several generative artificial intelligence (AI) technologies for programming and provided with a variety of hands-on exercises so that they can (a) understand how students can use these technologies to solve traditional programming problems trivially, and (b) understand 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, but several reported that the workshop served its key purpose: getting them to think about how to leverage generative AI technologies in their own classrooms.

Helping Students Develop a Critical Eye with Refute Questions

25 April 2023
Organisers: Directorate of Higher Education, Goa State Higher Education Council and the ACM India Special Interest Group on Computer Science Education (ACM iSIGCSE)
Number of participants: 46

On 25 April 2023, Viraj Kumar, Visiting Professor at KIAC, conducted a hands-on workshop for forty-six 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'23 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.

ACM India Bootcamp on Responsible Computing
13–16 April 2023
Organisers: Kotak IISc AI-ML Centre and the Association for Computing Machinery India
Number of participants: 28

The Kotak IISc AI-ML Centre (KIAC) and the Association for Computing Machinery (ACM) 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.

6 | Student support

Beneficiaries:
IISc students.
Requirement:
Financial assistance to enhance the facilities available for study and research work.
Result:
Monthly scholarship and payment of course fees/top-up fellowship.
Details:
KIAC is supporting one BTech student and one PhD student, as described below.

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. The members of the standing selection committee to decide on scholarship awards for the BTech programme selected Ms Sasmita Harini S for the award in the academic year 2022–23.

Research Support for IISc PhD students

The Research Support for IISc PhD students includes a 100% top up fellowship from KIAC. In the first round, Mr Aditya Subramanian (PhD Engineering, Department of Computer Science and Automation (CSA), IISc) was selected.

7 | Travel support

Name of beneficiary:
Professor Viraj Kumar (Visiting Professor, KIAC)
Name of conference: 54th ACM Technical Symposium on Computer Science Education (SIGCSE'23)
Venue: Toronto, Canada
Date: 15–18 March 2023

KIAC extended travel support to Professor Viraj Kumar (Visiting Professor, KIAC) to attend the 54th ACM Technical Symposium on Computer Science Education (SIGCSE'23) in Toronto, Canada from 15–18 March 2023. At the conference, Professor Viraj:

• Co-presented a research paper entitled 'Conversing with Copilot: Exploring Prompt Engineering for Solving CS1 Problems using Natural Language'.

• Served as a co-lead for the Birds of a Feather session entitled 'The Implications of Large Language Models for CS Teachers and Students'.

• Presented a demonstration of an IISc student project entitled 'Bug-eecha: A Gamified Approach to Programming Problem Comprehension and Testing'.

• Presented a workshop entitled 'Helping Students Develop a Critical Eye with Refute Questions'.

8 | Sponsoring conferences/workshops

Beneficiaries:
   Students, researchers, and professionals, depending on the workshop.
Requirement:
   Financial support to external stakeholders to host conferences/workshops.
Result:
   Enabling education, skill development, and capacity building of the beneficiaries through financially supporting conferences/workshops.
Details:
   KIAC received requests to partially sponsor international workshops with high impact and outreach possibilities. The Centre has committed to partially sponsor two workshops.

9 | Calls for support from KIAC

Beneficiaries:
   Students, researchers, faculty, and professionals, depending on the call for support.
Requirement:
   Financial support for IISc faculty and students to attend leading conferences related to artificial intelligence, and for IISc faculty to conduct workshops.
Result:
   Enabling outreach, publications in reputed conference proceedings, education, skill development, and capacity building of the beneficiaries.
Details:
   KIAC has sent out emails to IISc faculty members from the Division of Electrical, Electronics, and Computer Sciences (EECS), the Department of Computational and Data Sciences (CDS), and the Robert Bosch Centre for Cyber-Physical Systems (CPS) encouraging them to apply for financial support from KIAC to:
(1) attend AI conferences (2) conduct workshops.

(1) Attending AI conferences

The objective is to encourage and support researchers (faculty members and students) to attend premier conferences related to artificial intelligence.

The support (registration, travel, hotel stay, per diem) will be a maximum of Rs 1.5 lakhs per paper for presenting regular papers in the main conference in any one of the indicated conferences. The paper will be displayed on the KIAC website along with the photo of the beneficiary.

KIAC expects the beneficiaries to acknowledge the Centre in the camera ready version. In case the camera ready version has already been submitted, KIAC has to be acknowledged in any one forthcoming publication in the venues mentioned.

(2) Conducting workshops

The objective is to encourage and support IISc faculty members to host workshops related to artificial intelligence and machine learning. The nature of workshops can be instructional schools or research workshops. This is part of the outreach activity of KIAC.

The maximum support extendable per workshop is Rs 5 lakhs. All expenses (such as workshop venue rental, travel, and local hospitality) will be reimbursed against the submitted bills.

KIAC has received requests from IISc faculty members and has committed to support five workshops.

10 | Publicity

Beneficiaries:
Students, researchers, faculty, professionals, and the general public.

Requirement:
Creating awareness among the students, researchers, and general public about the activities and opportunities at the Kotak IISc AI-ML Centre

Result:
The KIAC website, and the KIAC social media handles (Twitter and LinkedIn).

Details:
The KIAC team is continuously updating the KIAC website, posting on KIAC social media handles, broadcasting talks and events through the IISc campus bulletin, and putting up posters at prominent locations.

A summary of activities undertaken by KIAC during April–June 2023

Sl. No.	Category	Activities	Number of participants/ beneficiaries	Output indicators
1	Setting up instructional laboratories	KIAC UG Computation Lab	46	skill development, education, teaching
2	Kotak IISc AI-ML talk series	Diffusers for democratising diffusion models	71	education
3	Events	Paradox Fest	51	education, teaching
		Computer Proofs and Artificial Intelligence in Mathematics	40	education, teaching
4	Courses and training sessions	Leveraging Generative AI for Teaching Programming Courses	200	skill development, education, teaching
		The Art of Communication for Leaders	84	skill development, education, teaching
5	Workshops	Helping Students Develop a Critical Eye with Refute Questions	46	skill development, education, capacity building
		ACM India Bootcamp on Responsible Computing	28	skill development, education, capacity building
6	Student Support	Kotak scholarship	1	education
		Research Support for IISc	1	education
7	Travel support	Beneficiary: Professor Viraj Kumar	1	skill development, education
8	Sponsoring conferences/ workshops	Committed to support 2 events (details in the Plan for July–September 2023)	2	skill development, education
9	Calls for support from KIAC	(1) attend AI conferences	(yet to receive response)	publications in prestigious journals
		(2) conduct workshops	5	skill development, education, external stakeholders,
10	Publicity	KIAC webpage		
		Social media handles: Twitter and LinkedIn		
		IISc broadcast		outreach
		Posters at prominent places		

A CSR Initiative by

Compiled with inputs from