PLAKSHA UNIVERSITY

NEWSLETTER
1729
VOL 01 - ISSUE 03 —— JAN 2024

Christened ‘1729’, after Ramanujan - Hardy number, the Plaksha newsletter is a window into our thriving, interconnected, and learner centered environment where Plakshans look beyond the obvious, just like Srinivas Ramanujan did with the seemingly dull number '1729'.
Through this newsletter we share the contribution of each member of our vibrant community of learners, researchers, leaders, innovators and problem solvers to reimagining technology education.

REFLECTIONS: FROM THE VICE CHANCELLOR’s DESK

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Prof. Rudra Pratap
FOUNDING VICE CHANCELLOR

PLAKSHA THINK TANK

Data Science and Intelligence: Seeing through the “eyes" of history and science

The Bastille fell in 1789, 13 years after the American Declaration of Independence, a period marked by war and upheaval on both sides of the Atlantic, one that demanded technological advantages to win the war. Among the two areas that Napoleon sought to overcome the British were steel and the conversion of heat to work/motion. He tasked a young Sadi Carnot to build these capabilities in a small military school that gave us the polytechnic legacy, a precursor to engineering as a discipline perfected in the United States, leading to the peacetime dividend of the 1840s, a period also marked as the European Spring before we entered the next phase of upheaval between the two world wars. Our engineering legacy defined a century of enormous progress. It raised a talent pool trained to be engineers from the beginning, for no amount of scientific knowledge alone would make an engineer.

A century after the rise of the first engineering schools in America, we saw the emergence of computing as a discipline with its roots in engineering and math and an early glimpse into computation and computing machines. Almost immediately, it gave a glimpse into how human thought could be emulated and the vision of "thinking machines." Thus, the first forays into artificial intelligence rose in the early 1950s. In the six decades since, AI has seen three generations of technological advances, each with its own “winters” as the early excitement eventually lead to disappointments in putting these advances to meaningful use, at least in competition to more targeted domain knowledge. The vision of intelligent machines was contrasted by the reality of failures: machine translation, speech recognition, expert systems.

Yet, progress was being made, slowly and steadily. Optical character recognition was being put into practical use, and it became a driver for limited image classification efforts such as handwriting recognition on a network of “neurons” as multiplicative weight elements that updated their weights based on known outputs by back-propagation of error correction, a version of chain rule that efficiently computed gradient of a loss function. In the meantime, driven by discoveries by neuroscientists in how the optical nervous system was organized, the single-layer network of neurons in neural networks transitioned to alternating layers of complex/simple neural networks interspersed with normalization/non-linear functions. Modeled after the visual cortex, the resulting convolutional neural networks provided a systematic means of optimization that automatically identified spatial “features” in images. By early 2000, advances in computing hardware demonstrated measurable progress in the ability of convolutional neural networks to classify images and handwritten text.

Driven by a standard set of benchmark challenges, the progress in automatic image classification was rapid and dramatic. While it is still not very clear as to why these networks — the so-called deep neural networks — worked, a combination of happy coincidences, including the availability of large amounts of labeled images over the internet, cloud computing, and significant parallel processing using graphical computing co-processors enabled advances in pattern recognition that will soon expand beyond recognizing images to speech

and text. In its latest incarnation, AI had literally and metaphorically become synonymous with the ability to see or the eyes of the machine. In our attempt to understand images, mankind had walked into replicating the processes by which we understood images. Another branch of research in neural networks put these into the feedback loop, and challenged the network to generate an image given the feature/label, the outcome of this network was then feed to another neural network that tried to classify it. Thus, modeled as an adversarial game between a generation and a discrimination network, the roots of generative AI took place. It was only a matter of time before the attention shifted from two-dimensional images to one-dimensional input of text, speech. Machine translation was, for instance, was the task of transforming one such serial input into a serial output, the so-called, pre-trained transformer. A significant result about six years ago pointed out that convolution was not needed for such transformation on text, and a simpler mechanism provided the necessary capability to identify semantically relevant text pieces regardless of their distance in the source text. These advances are now at the root of the continuing evolution of neuromorphic computing architectures in “generative AI”.

As we close the circle from images to text, we also make another important transition from engineering, which was all about numbers, to text and symbolic processing. While numbers had important niceness — fully ordered and continuous — language provides a bigger challenge and flexibility in knowledge representation. Language is also the ultimate sensor cross-modality, it captures experience seen or heard or felt in another form, arguably the source of human intelligence.

While it is early to tell exactly how the recent and continuing advances will find practical use, there is no question that technology we have arrived at a new junction, just like the engineering of two hundred years ago, where no amount of computing or math will be sufficient for the new scientist, the data scientist of tomorrow. The new curriculum is the Data Science, at the intersection of pedagogy in computer science, engineering, math and statistics, with innovations in how we teach the practical and thinking skills to the talent needed in this emerging field.

Prof. Rajesh Gupta

Professor and Qualcomm Endowed Chair,
Department of Computer Science and Engineering,
University of California, San Diego

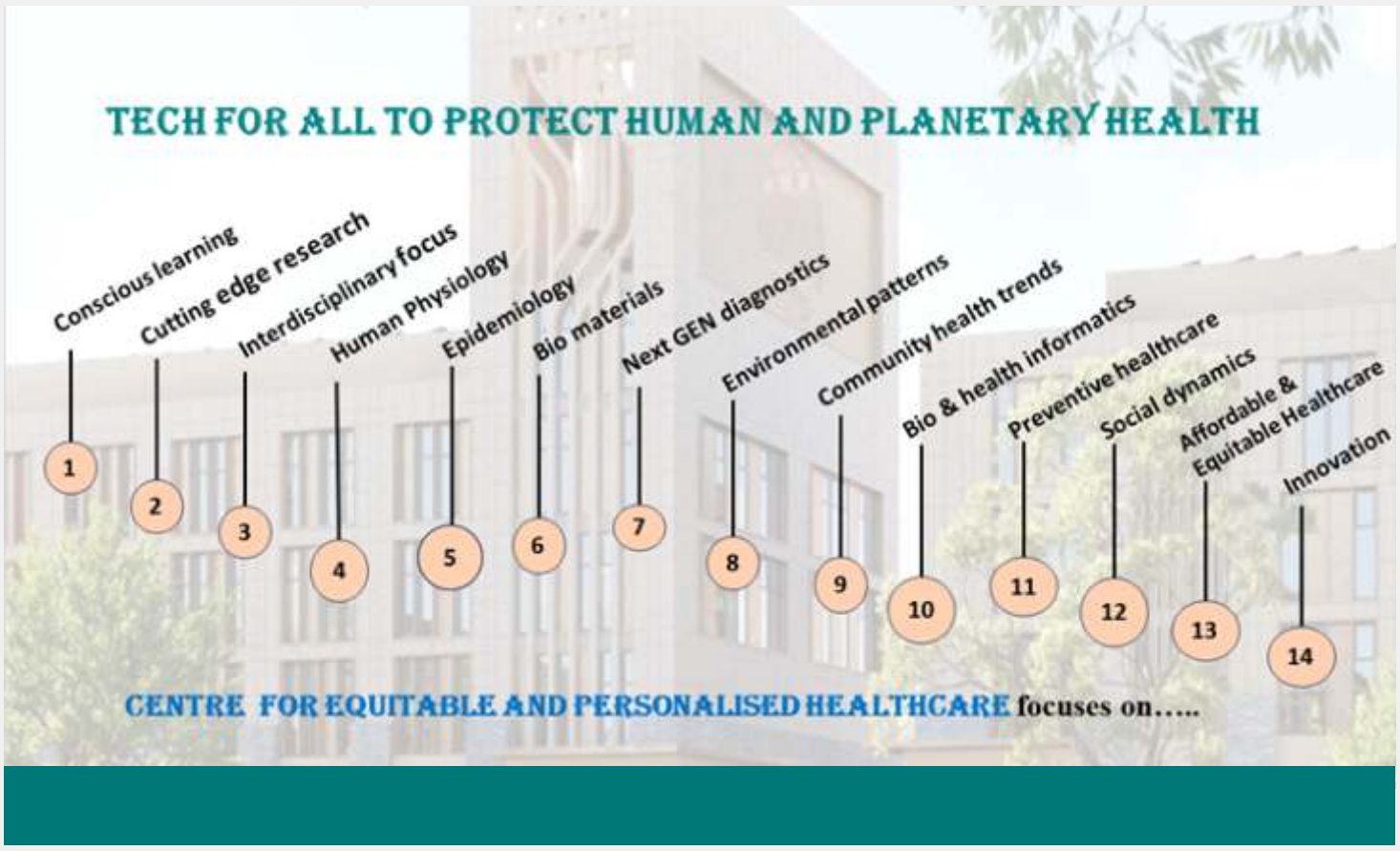
REIMAGINE RESEARCH

Highlited line:
How innovation, education and research come together to create a world that is inclusive and/or focussed on improving human and planetary health? How do we build on our foundation by leveraging technology to empower our community?

In a world that is highly diverse in life situations, perceptions and awareness, a well-crafted and holistic higher education alone can build the culture of conscious learning that should pave way for an all-inclusive and sustainable human growth, and planetary health. The Centre for Equitable and Personalised Healthcare (CEPH) at Plaksha aims to contribute via intersection of cutting-edge research in molecular biology, bioinformatics, epidemiology, biomaterials, next generation medical diagnostics and health informatics, for a deep understanding of human physiology in the Indian context, and cater towards preventive healthcare & sustainable practices. Such interdisciplinary research will help to gain insights into health trends, environmental patterns, social dynamics, and enable evidence-based decision-making to address early on, the root causes of human health and the complex challenges.

The collaboration across disciplines is also promoted to come up with innovative technology solutions for affordable and equitable healthcare, and advocate policy changes where necessary. CEPH will design centre specific courses to promote research backed STEM learning in aspiring students with a view for skill development, and periodically conduct technical and awareness workshops that will be open to public. Partnership with prominent Indian academic institutes, industries, and eminent international collaborations are also highly sought after at the centre, to spearhead the cause.

Chaitanya Lekshmi Indira
Associate Professor



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Article headline:

Wastewater from daily domestic activities (sewage) is around 99.9% water with the remaining 0.1% containing suspended and dissolved components, including emerging contaminants such as pharmaceuticals. Sewage is a major source of pollution in India with around two-third of the urban municipal wastewater remaining untreated, either due to lack of sufficient sewage treatment plants (STPs) or inadequate operation of the existing centralized plants. A potential solution could be community-level decentralized sewage treatment, covering treatment options that are either mechanized (e.g., sequencing batch reactors or SBRs), natural (e.g., constructed wetlands) or hybrid (integrating mechanized and natural systems). The technology should be fit-for-purpose and compatible with location requirements. While natural treatment systems are typically aesthetically pleasing and incur low capital cost, the cost of engagement with multiple stakeholders (urban local bodies, other government agencies, local community, research institutions, technology supplier etc.) often makes these systems socio-economically unattractive. Furthermore, though there have been technological advances in wastewater reclamation, recycle and recovery systems, suitable business models are required to scale, operate and maintain these technologies in a given setting. At Centre for Water Security (CWS), one of our focus themes is translational research covering development and implementation of efficient and customised sewage treatment solutions. We particularly encourage students at Plaksha to actively engage in this work.

Malini Balakrishnan, PhD
Director
Center for Water Security

STORIES OF IMPACT

Headline:

In India, where STEM education for visually impaired (VI) students often relies on rote learning, we address the challenge of making science, particularly optics, more inclusive. Our work describes the creation and preliminary testing of an auditory-tactile prototype to teach optics to VI students. Using a 3-D printed light detector that signals with sound and tactile feedback, we engaged VI students in hands-on experiments. Initial observations and future plans for video analysis and concept mapping aim to assess the prototype's effectiveness and the students' conceptual grasp. This research signifies a step towards inclusive STEM education, offering VI students a more interactive learning experience.

Prof Rucha Joshi
Associate Professor

Headline:

At the CTLC we have three key objectives. Firstly, to teach our engineering students to think about technology and innovation from a broader planetary perspective through a philosophical lens. In the process, we train them to ask the tough questions and interrogate our assumptions about technology and its relationship to society. We call this human-centred engineering. Secondly, we develop their communication skills, both verbal and writing skills, so that the engineering fraternity can communicate the technicalities of engineering to the public at large and to non-technical stakeholders. Finally, we creatively use technology to increase the efficacy of engineering education. A recent course was on helping our engineering students to do research and write academic scripts. This requires a skill set that is new for engineers and therefore can evoke a variety of emotions while doing this course. We installed a trained AI model on their laptops which was able to detect the emotional state of the students by capturing their facial

expressions. This enabled the students to know how they were feeling and their emotional state even as they did their research and writing. Students gave feedback that this self-knowledge of their emotional state was helpful for them to move past the hurdles, and they were able to considerably increase the efficacy of their research and writing in their own perception. The CTLC team wrote a research paper on this initiative which has been accepted at the 21st International Conference on Smart Technologies & Education (STE) and will be presented in the Spring of 2024 at the Arcada University of Applied Sciences in Helsinki, Finland.

Dr. Brainerd Prince
Director, Centre for Thinking, Language and Communication

Dr. S Siddharth
Assistant Professor

Headline:

Building a curriculum from scratch for a new university is by no means a small task. But building a curriculum that possibly no one or at any rate very few institutions have attempted is an even more challenging prospect. Especially when it comes to combining or rather integrating the academic and disciplinary perspectives offered by the humanities, social sciences together with science and technology. At the outset one might ask why even venture into doing something like this? What is the value of an 'integrated', 'multi' or even 'trans-disciplinary' curriculum? Is claiming that it is 'unique' sufficient reason for designing it? Perhaps not on its own, however, to claim that it is original because it begins to address and respond to new and unique - in the sense of unprecedented - circumstances that humanity finds itself in today is what furnishes an integrated curriculum with its deep, enduring, social and educational value. Part of the process of designing or inventing a distinctive curriculum lies in the recognition that human and non-human species, organic and non-organic substances, natural and technological occurrences all exist together on the Earth in a state of profound interdependency. Understanding the nature of this interdependency is one of the central concerns, for example, of the Freshmore course

Dr. Aditya Malik
Professor

SUCCESS SPOTLIGHT

Headline:

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Dr. Anupam Sobti
Assistant Professor

STUDENTS SPEAK

Headline:

One of the foundational goals of Plaksha University is to leverage technology for improving our quality of life and empower our community. To this end, a number of innovations were introduced in the Machine Learning and Pattern Recognition course taught by Professor Siddharth to third year undergraduate students. These innovations were nurtured with the vision to take a more experiential approach to learning. First, in every lecture, the presentation component was followed by a real-time demo exposing students to practical applications of the concept. This enabled students to connect the dots between theoretical concepts and their use in solving real-world problems. Second, students were taught to implement related solutions every week in the lab to gain hands-on learning experience. Finally, having gained practical skills in the lab, student groups worked on utilizing machine learning to solve problems that they face around themselves. This brought about 28 wonderful projects from the class for diverse applications such as indoor navigation, reducing mess food wastage, job recommender system,

As students of the Machine Learning & Pattern Recognition course taught by Professor Siddharth, our project involved the optimization of the food menu at Plaksha University through demand forecasting.
While existing literature relies on conventional models and computer vision to address the problem through a supply-side outlook, it finds itself unable to answer any uncorrelated surge in demands. We instead utilize a demand-side approach to address this problem by providing recommendations based on demand forecasting for footfall while addressing varying preferences.

Alli Ajagbe, Divith Narendra, Soham Petkar

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Noyonica Chatterjee, Ankit Kumar and Surabhi Tannu

PLAKSHA UPDATES

Headline:
A one-day workshop on "Emerging Frontiers of Indian Knowledge Systems" was conducted at Plaksha on Nov 2 to bring attention to some of the interesting contributions of Indic thinking. There were 5 talks, each covering an interdisciplinary area. In addition to internal audience from Plaksha (students, VC, faculty, Plaksha founders), there were attendees from a few academic institutes.

Prof. RN Iyengar (Jain Univ, Banglalore) spoke on how the effect of axial procession of earth has given rise to many textual references to circumpolar stars in Sanskrit astronomical texts that can be used for a chronological analysis. Using references to the Dhruva star in Sanskrit texts, he presented its stratigraphy as a fixed pole star over close to atleast 5 millennia.

Prof. MD Srinivas (Center of Policy Research, Chennai) spoke on the foundational methodology of Indic sciences. The talk discussed a pragmatic and open-ended approach to scientific theorisation as expounded in the major source-works of Nyāya (Logic and Epistemology), Vyākara a (Grammar), Ga ita (Mathematics) and Jyoti a (Astronomy). The Indian approach to scientific knowledge is very different from the quest for inviolable, absolutely-true universal laws which has dominated the Greek and the modern European scientific traditions.

Sri Raghu Anantanarayanan (Rtambhara Ashram, Kotagiri) discussed Citta Vaidya as psychology in the light of Yogic wisdom. After defining Citta Vaidya as a confluence of the Yoga Sūtra-s, Itihāsa-purā a, Theatre and Dance, he observed that Citta Vidya emphasizes introspection and sādhanā as the key to personal transformation, while Euro-American Psychology emphasizes outside-in therapy as the key to transformation.

Prof. Sampadananda Misra (Rishihood Univ, Sonipat) discussed how Sanskrit is not just a medium of communication but a profound repository of ancient wisdom, culture, and philosophy. The talk discussed unique qualities of Sanskrit, highlighting its role in shaping human consciousness and understanding underlying principles of creation, natural laws, and the science of living.

Prof. Deepti Navaratna (NIAS, Bangalore) discussed the topic of "Raga Engineering" and the role of neuroscience in understanding the insights of Indic thinking in the music and in art domains in general. After the 5 formal presentations, she also conducted an interactive session with live music on the same topics with the students of the Plaksha Music club.

There was a panel discussion, anchored by one of the founders (Ashish Gupta), on how to take forward high quality research in IKS and its role in engineering education.

The feedback on the workshop has been positive and clearly indicates that further explorations are necessary. The organizers of the workshop were Dr. Sumita Ambasta (a Plaksha founder) and K. Gopinath (Plaksha), using high-level inputs from the VC (Prof. Rudra Pratap) and a Plaksha founder (Ashish Gupta).

Prof. Gopinath
Professor

PLAKSHA AT A GLANCE

36
Full-time Faculty

20
Visiting Faculty

362
Students

154
Executives

19
Research Fellows

Collaborate with Plaksha: We are keen to collaborate with faculty members and researchers from both within and outside Plaksha to leverage our collective expertise and push the boundaries of knowledge.

Virtual Tour: Explore the vibrant campus of Plaksha from the comfort of your homes. Take a virtual tour to see our state-of-the-art facilities and collaborative learning spaces.

Plaksha University
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