cepstrum

INPHASE

Annual Magazine of EEE Department

‘Controlling Machines with your mind’

‘From idea to victory- Hackathon triumph!’

‘Cold fusion: Revolution or myth?’

The city where history, myth, and identity merge.

‘Goodbyes:More than just Words.’

Edition 21

May 2025

FOREWORD

With great pleasure and pride, I present the 21st edition of **InPhase** magazine, published by **Cepstrum** — the student society of the Department of Electronics and Electrical Engineering, IIT Guwahati. I deeply appreciate the diversity of ideas showcased in this edition. The vibrant range of thoughts captured across these pages reflects the enthusiasm and creativity of the brilliant minds within our department. Notably, the articles extend beyond the domains of science and technology, and explore into social and interdisciplinary themes as well. The editorial and design teams have done a commendable job, and their collective effort and dedication are evident in the quality of this edition. I wholeheartedly congratulate the Cepstrum team and extend my sincere gratitude to all the contributors for their thoughtful and engaging articles. I am confident that every reader will thoroughly enjoy each article.

With best wishes
Harshal B. Nemade

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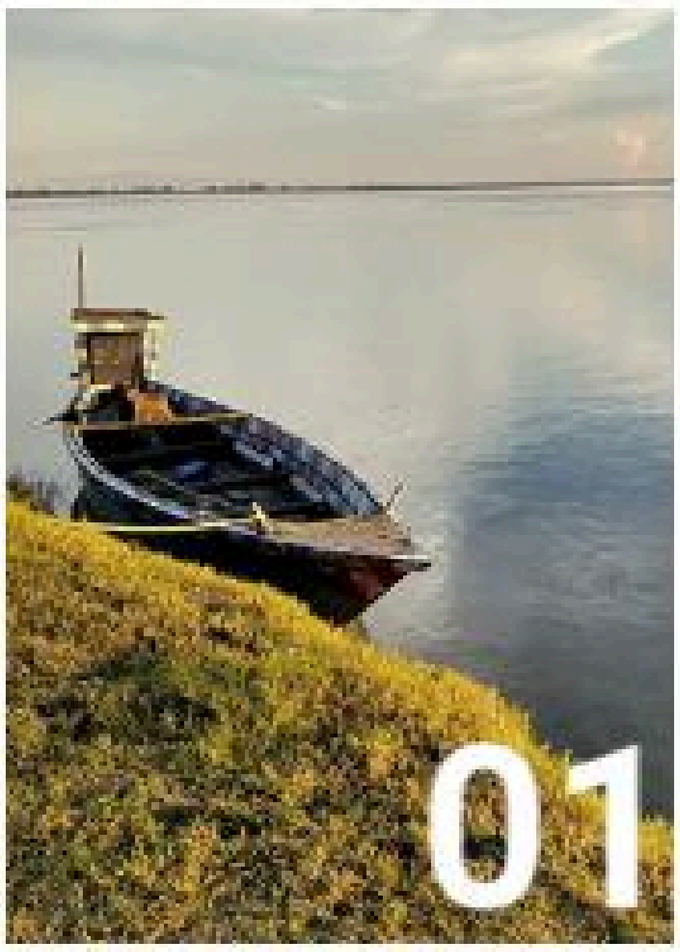

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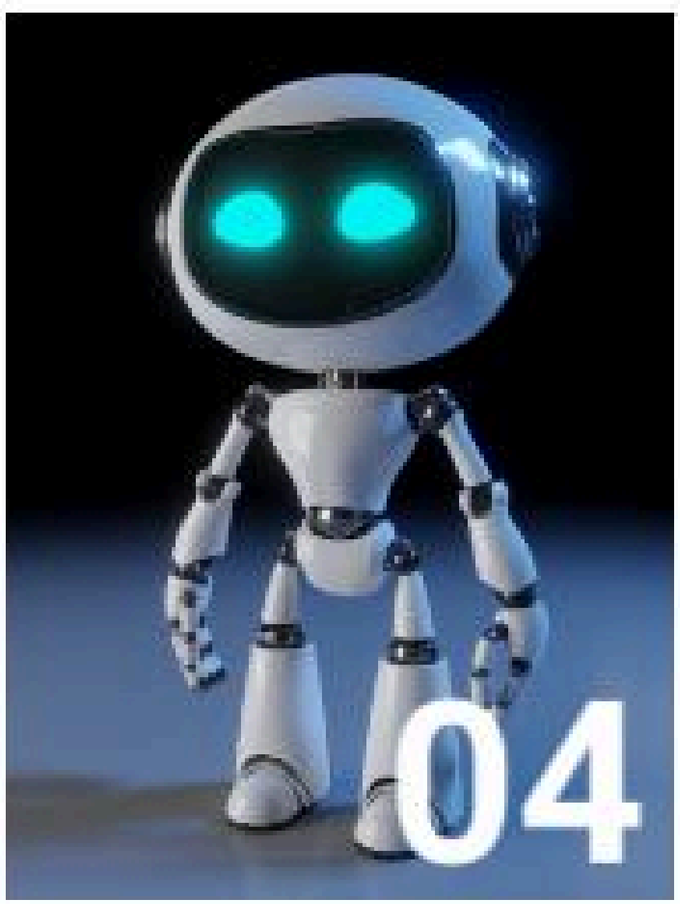

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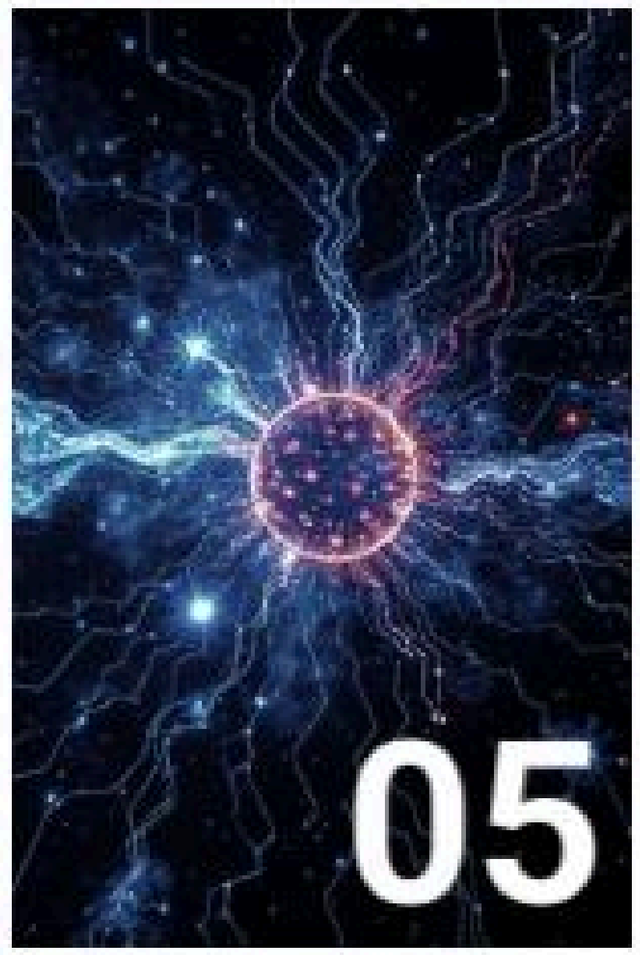

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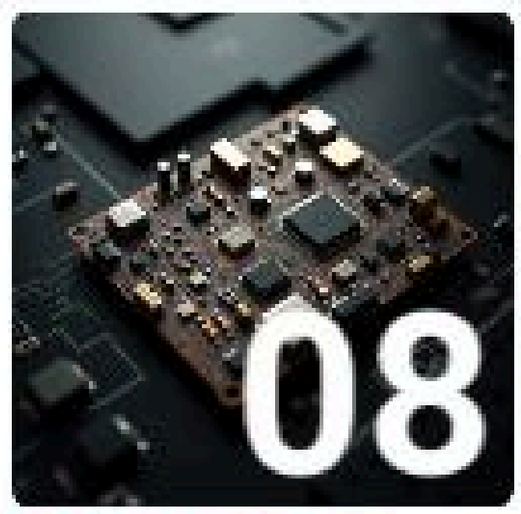

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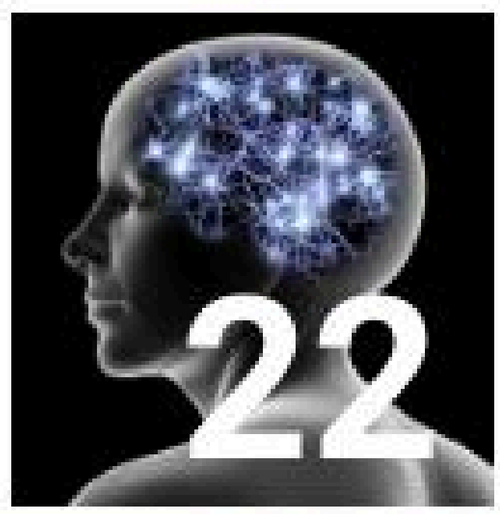

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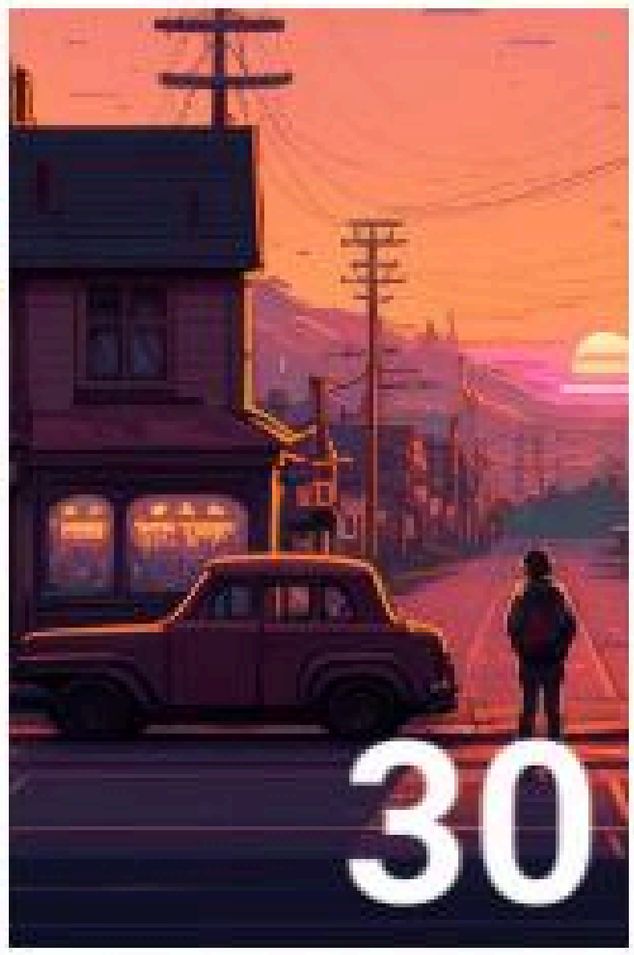

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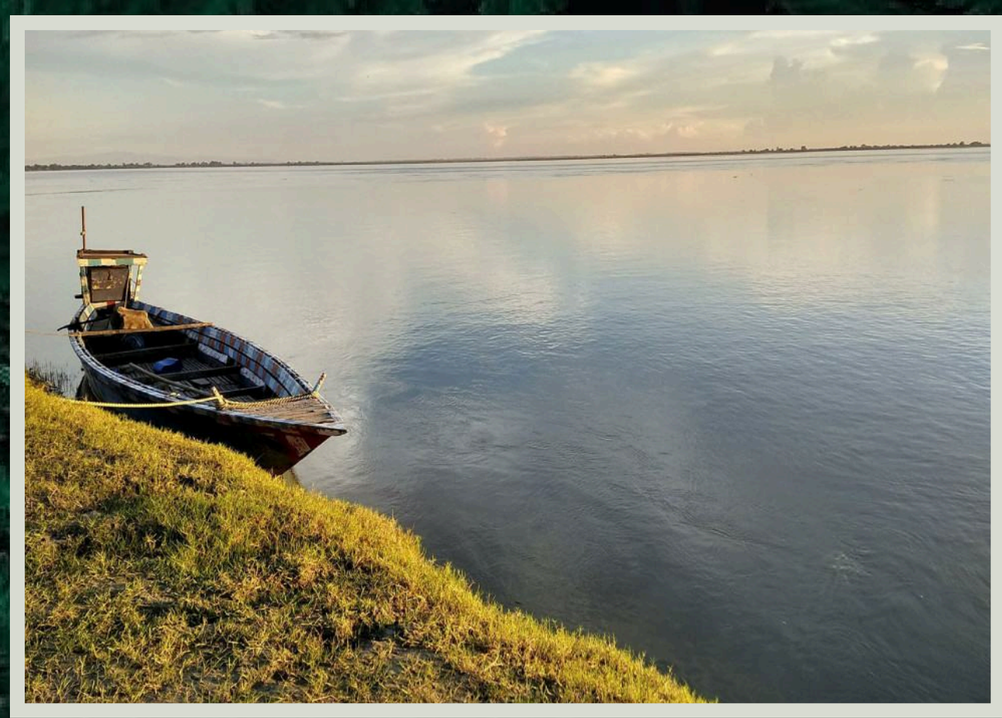
A PERSONAL JOURNEY THROUGH TEZPUR

-Harsha Borah

Located on the banks of the mighty Brahmaputra, seated peacefully, is my hometown, the “cultural capital” of Assam, Tezpur. I have lived in this city for 22 years and have formed a deep connection with its numerous tales and turns. Placed in the background of mythological tales and filled with ancient sculptures and cultural markers, the city invigorates historical significance through and through. As I grew up, this rich history that lies in the roots of this city became more than just a backdrop—it became an important part of who I am. My story with this historic city started on a winter evening in 2002 when I was born in EMM Hospital, one of the oldest hospitals in Tezpur. I acquired my formal education from St. Joseph’s Convent H.S. School, the only all-girls school in the city, established in 1936 by missionaries.

My Sundays were marked by visits to the district museum, the erstwhile Dak Bungalow, a British-era building hosting around 600 artifacts. But the larger histories of this city and its highlights weren’t something I came to know in a day. It was mostly my mother, with a comb and oil in hand, rendering these countless realities of this beautiful town while I sat peeling oranges with the winter air tingling my nostrils. Her stories of larger-than-life battles, mythological tales, and freedom struggles brought the history of this place to life in my young imagination and became a part of who I am. Through her narratives, I began to see my city as a rich repository passed down through generations.



Mythological Origins: The City of Blood

Etymologically, Tezpur means “Full of Blood” (Tez = Blood, Pur = Full). The name originated from an ancient Hindu Puranic lore. It is said that the King of the Asuras, Banasura, resided here. He had a daughter named Usha, who fell in love with Aniruddha, the nephew of Lord Krishna, after seeing him in a dream. Her friend Chitralekha, using her powers, stole Aniruddha from Krishna’s palace. Enraged, Banasura locked Usha in a fortress, Agnigarh, which was set ablaze from all sides to prevent trespassers.

Hari-Hara Yuddha

A great war ensued, with Lord Krishna siding with his nephew and Lord Shiva supporting his devotee, Banasura. This war, known as the Harihar war, flooded the streets of the city with blood, giving rise to the name Tezpur. Ultimately, Krishna emerged victorious, and Usha and Aniruddha were wed, earning Tezpur the title “City of Eternal Romance.”

This mythological history fascinated my 5-year-old mind. I used to look at Agnigarh from my school building, hoping to spot the rumored ring of fire. Though I never saw it, this story became essential to my childhood, woven into every narrative I shared about my city. These stories, passed down through generations, form the identity of Tezpur and its people.

Tezpur and Freedom Struggle: A Cradle of Nationalism

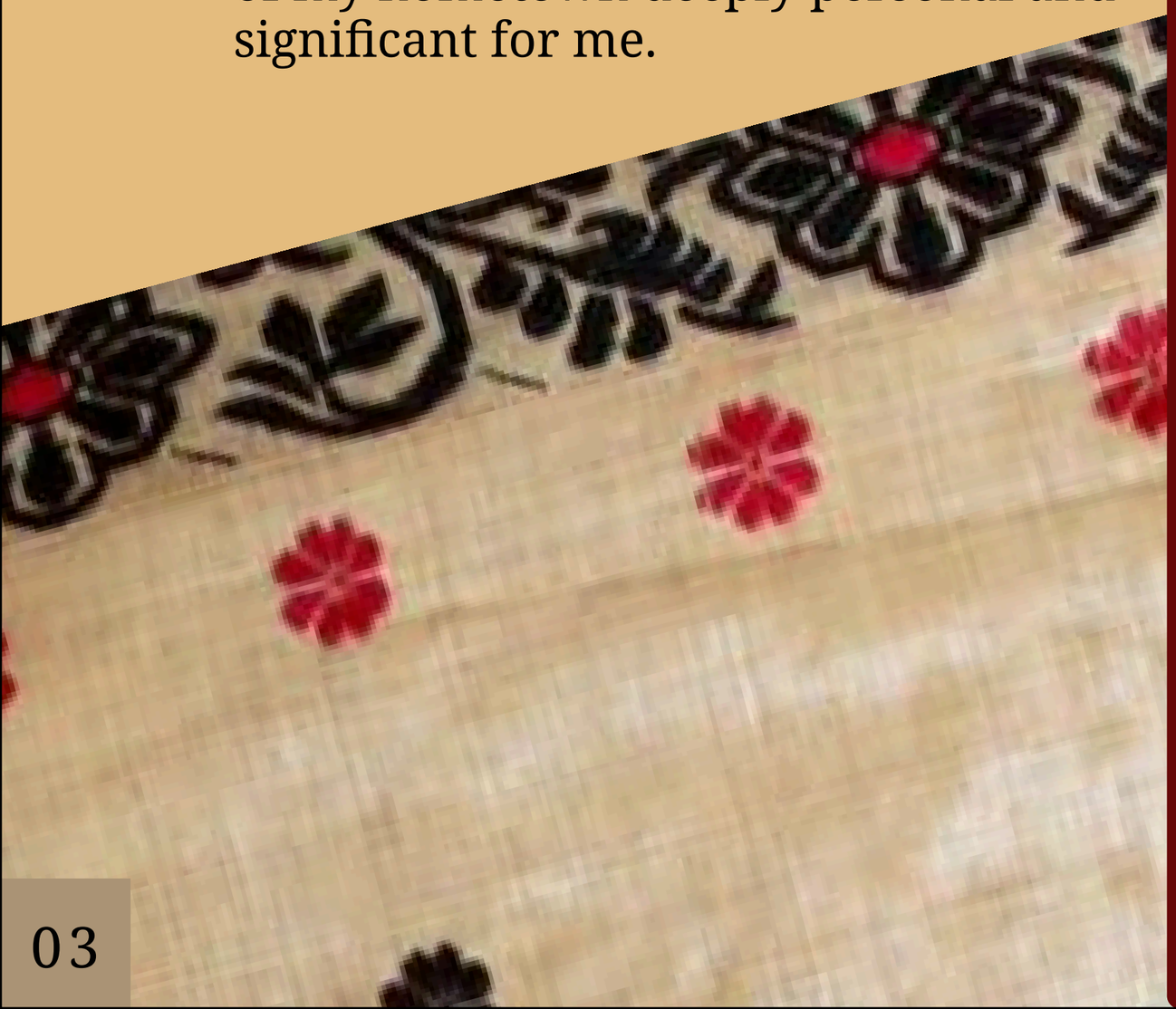
From a young age, I was fascinated by the tales of freedom fighters’ struggles. I was confused when none of my school history textbooks mentioned the freedom struggle in Assam. It was my mother who recounted the countless tales of brave men and women who fought religiously for India’s freedom.

Da-Parbatia

Tezpur was the hub of political activity. Many leaders gathered at Jyoti Prasad Agarwala's ancestral house, known as Poki, to discuss Assam's political stance. This house hosted Gandhiji in 1921 and 1934, along with leaders like Lala Lajpat Rai and Jawaharlal Nehru. After Agarwala's death, the house was converted into a memorial museum.

During the Quit India Movement, espite sensitive circumstances due to Myanmar's invasion by Japanese forces, leaders like Jyoti Prasad Agarwala and Pushpalata Das gathered in Tezpur to plan protests against the British. The city witnessed numerous demonstrations and protests. Freedom fighters like Kamakhya Tripathi and Mahikanta Das were arrested, while groups like Mrityu Bahinis (willing to die for freedom) and Shanti Sena (peaceful protesters) took center stage.

These stories of bravery, narrated by my mother, filled the gaps left by formal education, making the history of my hometown deeply personal and significant for me.



Preserving the Legacy

By writing this history, I aim to stress the importance of Assam's often-overlooked contributions. These stories must be remembered and celebrated not merely as historical events but as the foundation of our identity. The history of this city is not just dates and events but the living, breathing people who make it what it is.

Tezpur's history, encompassing mythological tales and colonial encounters, is a testament to the strength and resilience of its people. Writing about it is not only a documentation of the past but also a preservation of its essence for future generations. Tezpur is a living, breathing entity, deeply rooted in its origins yet continuing to grow and shape the lives of those who call it home.

ROBOTICS

-Robotics Club IITG

We had the privilege of competing in an international Robotics competition in Japan. The experience was transformative, exposing our team to cutting-edge technology and pushing us to our limits.

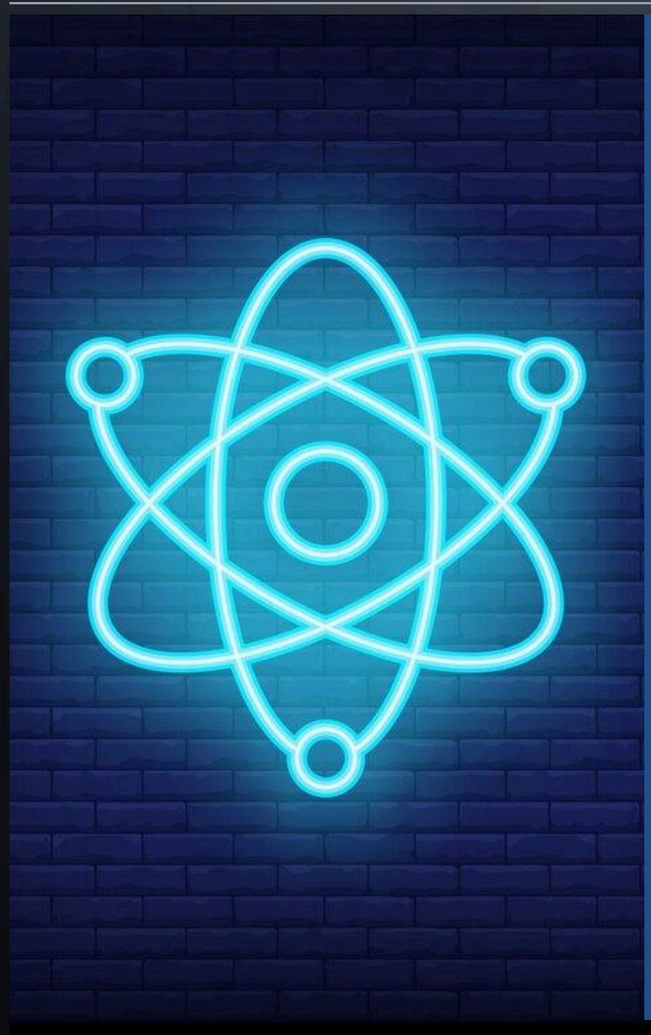
The competition brought together the brightest minds in robotics, and the level of innovation on display was staggering. Meeting with global experts was a highlight, giving us invaluable insights into the future of robotics and new directions for our work.

Despite fierce competition, placing in the top six was a proud achievement

It took teamwork, creativity, and persistence to stand out among such strong contenders.

Beyond the competition, Japan itself was an eye-opener. Immersing in the culture and exploring Tokyo's tech-driven streets inspired us to think beyond the technical and appreciate the role of collaboration and curiosity in innovation.

This experience reaffirmed our passion for robotics and left us with a renewed drive to push boundaries in our work. Japan was more than a competition—it was a launchpad for our future.



Cold Fusion

Fleischmann-Pons' claim of nuclear fusion at room temperature

-Kushal Dornahalli

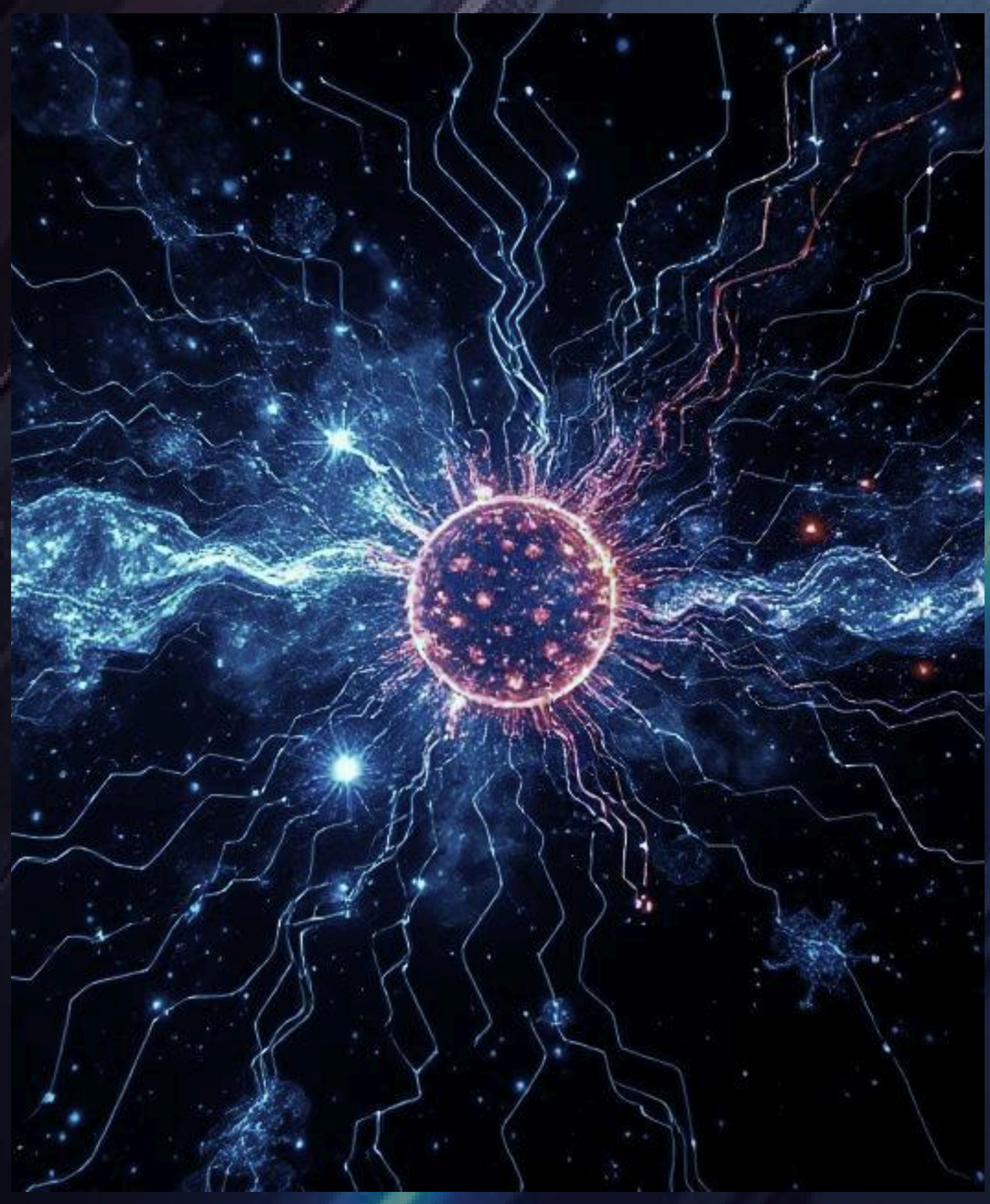
Cold fusion is a hypothesised type of nuclear reaction that occurs at around room temperature. It contrasts starkly with 'hot fusion' that is known to take place naturally within stars and artificially in hydrogen bombs or prototype fusion reactors under immense pressure and at temperatures of millions of degrees.

In 1989, two electrochemists at the University of Utah, Martin Fleischmann and Stanley Pons, reported that their apparatus had produced anomalous heat of magnitude that would defy any explanations unless in terms of nuclear processes. They reported measuring small amounts of nuclear reaction byproducts such as neutrons and tritiums.The small tabletop experiment involved electrolysis of heavy water on surface of palladium electrode.

The reported result received wide media attention and raised hopes of cheap and abundant source of energy.

Many scientists tried to replicate this experiment with the few details available. Expectations diminished as a result of numerous failed replications, the retraction of several previously reported positive replications, the identification of methodological flaws and experimental errors in the original study, and ultimately, the confirmation that Fleischmann and Pons had not observed the expected nuclear reaction byproducts. By late 1989, most scientists considered cold fusion claims dead and it gained a reputation as pathological science.

In 1989 and further in 2004, the United States Department of Energy (DOE) concluded that the reported results of excess heat did not present convincing evidence of a useful source of energy and decided against allocating funding specifically for cold fusion.



Proposed Mechanisms & Their Flaws

Researchers in the field do not agree on a theory for cold fusion. One proposal considers that hydrogen and its isotopes can be absorbed in certain solids, including palladium hydride, at high densities. This creates a high partial pressure, reducing the average separation of hydrogen isotopes. However the reduction in separation is not enough to create the fusion rates claimed in the original experiment, by a factor of ten.

It was also proposed that a higher density of hydrogen inside the palladium and a lower potential barrier could raise the possibility of fusion at lower temperatures than expected form a simple application of Coulomb's law. Electron screening of the positive hydrogen nuclei by the negative electrons in palladium lattice was suggested to the 2004 DOE commission but the panel found the theoretical explanations not convincing and inconsistent with current physics theories.

Conventionally deuteron fusion is a two-step process in which unstable high energy intermediate is formed:

$$^{2}H + {}^{2}H \rightarrow {}^{4}He^{*} + 24\ MeV$$

Experiments have shown only three decay pathways for this excited-state nucleus, with the branching ratio showing the probability that any given intermediate follows a particular pathway:

$^4He^* \rightarrow {}^3He + n + 3.3$ MeV (50%)
$^4He^* \rightarrow {}^3H + p + 4.0$ MeV (50%)
$^4He^* \rightarrow {}^4He + \gamma + 3.3$ MeV (0.0001%)

Only about 1 in a million of the intermediaries take the third pathway, making its products very rare compared to other parts. This result is consistent with the predictions of the Bohr model.

Some researchers reported detecting but without the expected neutron or tritium production. Such a result would require branching ratios strongly favouring the third pathway, with the actual rates of the first two lower by at least five orders of magnitude than observations from other experiments, directly contradicting both theoretically predicted & observed branching probabilities.

Those reports did not include production of gamma rays which would require the third pathway to have changed somehow so that gamma rays are no longer emitted.

The known rate of decay process together with the inter-atomic spacing in a metallic crystal makes heat transfer of 24 MeV excess energy into the host metal lattice prior to the intermediary's decay inexplicably by conventional understanding of momentum and energy transfer, and even then there would be measurable levels of radiation.

Also experiments indicate that the ratios of deuterium fusion remain constant at different energies. In general, pressure and chemical environment cause only small changes to fusion ratios. An early explanation invoked the Oppenheimer-Phillips process at low energies, but its magnitude was too small to explain the altered ratios.

Before the Defense

A memoire

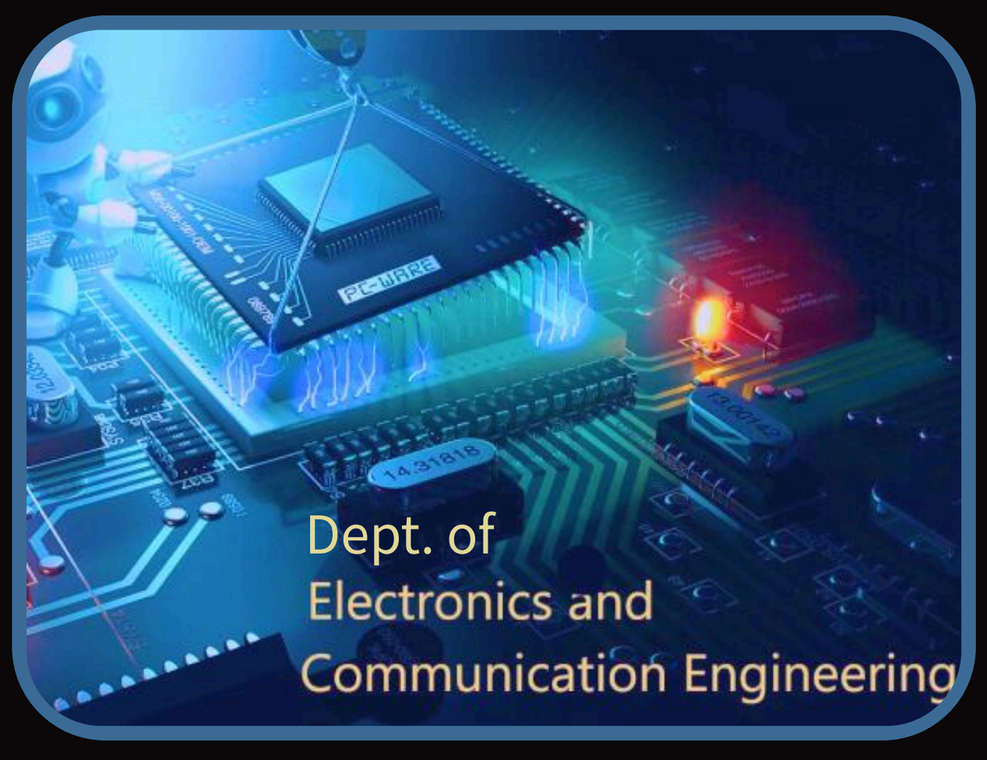
-Dedicated to the memory of Prof. S. Chakravorty (1949-2025), former member of faculty at the Department of Electronics and Communication Engineering, IIT Roorkee.

Notes:
1. This is a slightly fictionalized and summarized version of the conversations that | had with Prof Chakravorty over almost fifteen years.
2. Some of the points discussed here were made by Dr. Kumar Appaiah, Associate Professor, Department of EE, IIT Bombay, but have been attributed to other people for consistency of the narrative.

-Prof. Ribhu Chopra

It was well past 6:30, I was alone in the lab. Still there was no sign of him. Had he missed class today? No, it could not have been. The lights in his room were switched on- he was in the department, which means he was taking an extended class.
“Naturally,” I thought. “It is almost the end of April, the last few days of the semester. It is when he will cover everything that he wanted to cover in the course. Speed be dammed.” I involuntarily sniggered at the memory of him finishing our Digital communication syllabus, and then adding with a theatrical flourish. “This covers everything that will be in your final exams. But I have also checked your mid semester exam copies, and looking at them, if there is a God, only he can help you now.” With that he had exited the classroom, slightly coughing and lighting a cigarette on his way out. Of course, Roorkee was an IIT, and smoking was banned inside the campus. But then, no polite words could be used to convey his regard for the said rule.

My train of thought was interrupted by the sound of a latch tuming and a door opening somewhere in the corridor. “It must be him.” I told myself and picked up a copy of my freshly printed PhD thesis.



I was right, the door was ajar and a faint smell of Gold Flake Kings was drifting through the corridor. It seemed to be the right time to show off my thesis, and the last-minute changes that I was feeling quite excited about. I knocked.

"Yes." He growled.

I entered. His back was facing the door, he was busy, putting something on a bookshelf. I waited for my turn.

"Speak" he growled again. "Do not wait for me to face you and make eye contact." "Sir, I got the printouts ready." I spoke, unsure of whether I was disturbing him. "What printouts?" "The final version of the Thesis, my defense is tomorrow at 11"

"Huh?" this was not his usual angry grunt. "Achcha Ribhu!" he exclaimed. "You should have told me it was you. Sit, sit, just wait a minute. Let me get this done and I will be with you."

Two minutes later, he was sitting at his usual comfy chair lighting a Gold Flake. "So."

His eyes twinkled, as he opened a copy. "you got the hard bound copies."

"Yes sir. I will Keep this copy with me so I have made certain modifications." "Modifications?"

"look at the beginning of the chapter."

"Ah. This looks like the end of Chapter 1. Wait, let me first look at Chapter 2, and then will look at the other chapters." He turned the pages.

"Weapons cleave it not, fire burns it not, water wets it not and wind dries it not. Why have you put this just in your copy, Prof Mehra (My PhD Supervisor) will be delighted to have these in his copy as well."

"I did not know that sir"

"But how have you chosen these verses? Arbitrarily, or do these follow any order?" He scratched his beard with his free hand. At times, I had wondered how such a dense beard could be compatible with his habit of chain smoking. Would it not catch fire? As if sensing my thoughts, he stubbed his cigarette before it reached a critical point.

"In order sir, for example, this is the chapter verse for the chapter on cyclostationarity, the second order correlation that remains unaffected by AWGN...."

“and hence the chapter on collaborative sensing has Sangchhadvam from the Rig Veda, nice”, he said while turning the pages. “Hiranmaye na patrena, Purnamada purnaidma for the conclusion. Wait, what is this? I have never seen it.” He paused, and read out aloud

“The Vedas with their six limbs and the knowledge of all sciences may be on one’s lips; one may possess the poetic gift and may compose fine prose and poetry; yet if one’s mind be not centred upon the lotus feet of the Guru, what then, what then, what then?”

“Achcha, this is an Adi Shankara composition, nice. Let me ask Google. Guru Ashtakam, he mumbled while typing on his ancient office desktop.” “Here it is, eight verses to the Guru.

He pointed to the screen. Alas, this is a much-misused term these days.

Everyone is everyone else’s guru. Which reminds me, what became of your job applications?”

“Am yet to apply properly sir. Most IITs require a defended thesis.”

“Ah yes.” He said thoughtfully. “So fingers crossed.” I added.

“No need to cross, the question isn’t whether you will land a teaching position, the question is, when will you land one.:

“Yes sir.” I nodded slyly. “Dekho, he continued, ek to job dhoondh lo jaldi se, aur ek shaadi kar lo. Ek hi shaadi karne ko bol raha hoon.” He added, smiling.

“But” his tone took a slightly serious note. “Do remember the professional hazards of teaching.”

“Yes sir, I know, you have reminded me quite often of the adage, “He who can, does; he who cannot, teaches.” It was my turn to smile back.

“No.” His smile grew wider. “That along with the fact that you get paid to lecture and judge others are actually perks of the job.”

“Yes, that is why I am so eager to join. Then what is the problem.”

“The problem is that in your eagerness to join, you are overlooking the demographic that will form a vast majority of your future students, and that demographic is not so enthused for teaching.”

“Sir, I am sorry I do not see the problem there.”

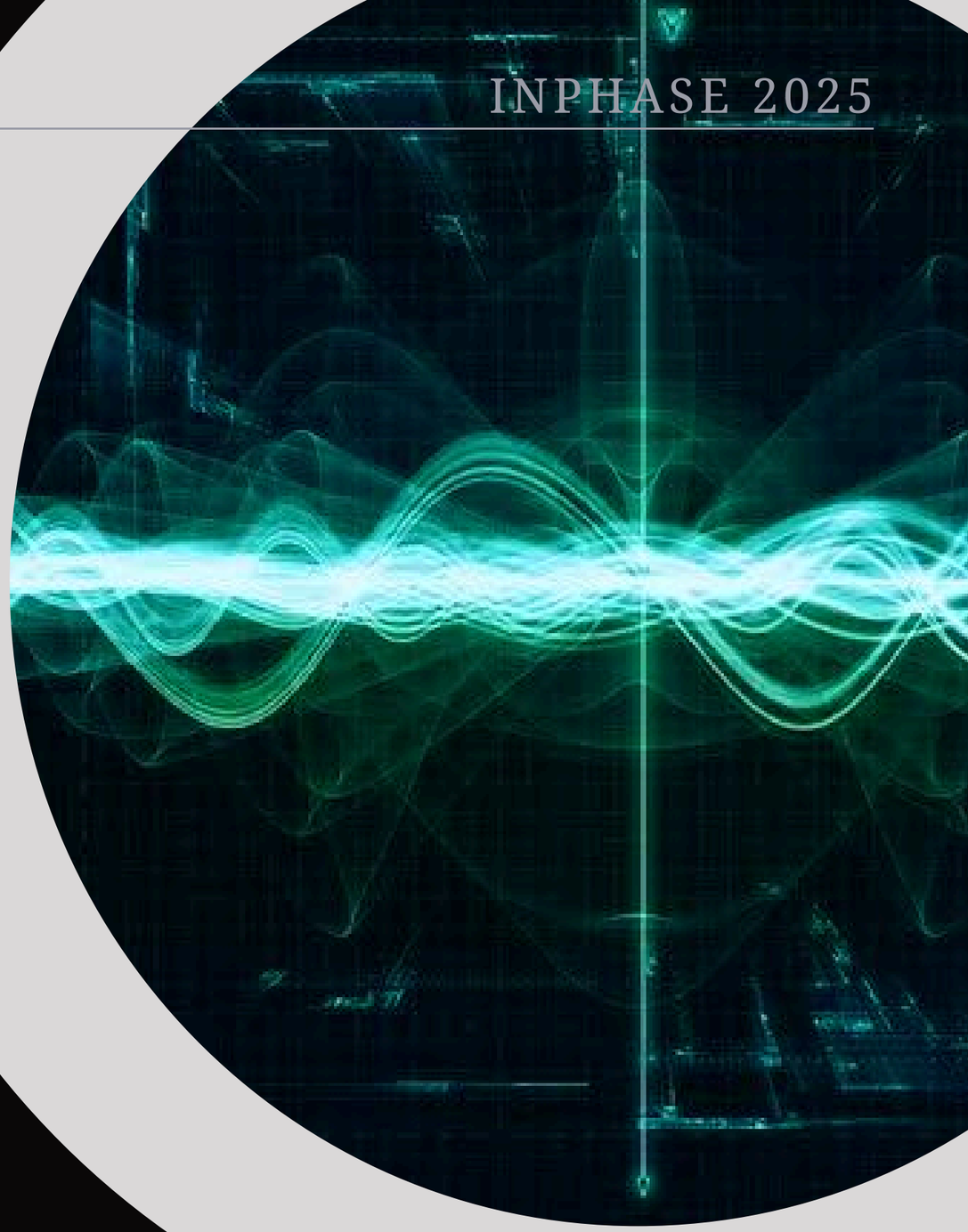
“Ah. So, let me put it this way. Why do you want to teach at an IIT?”

“Because the proportion of interested students is higher here”

“Yes. You are looking for interested students. Now, another question, why did you drop my wireless networks course in your second semester, and took up that other course?”

“Sir, you are slightly tight fisted with grading” I smiled slyly.

“Exactly, but you would define these interested students to be interested in the content of your course and not the grades, right?”



I was silent

“See, I am not telling you to grade loosely or tightly, I am just telling you to not take students’ career decisions or course choices personally.”

“I nodded, and there is this other thing about the Guru Ashtakam verse that you wrote, people interested in teaching jobs generally tend to have a highly inflated view of the respect that teachers get.”

“Don't they?” I was getting slightly uncomfortable about my career choices.

“Some coaching teachers with good marketing skills do, but college teachers don’t, and I believe you are interested in becoming the latter.” He replied, the last few words slightly distorted by the next cigarette clenched between his teeth.

“Yes sir. But coaching is all about marketing.”

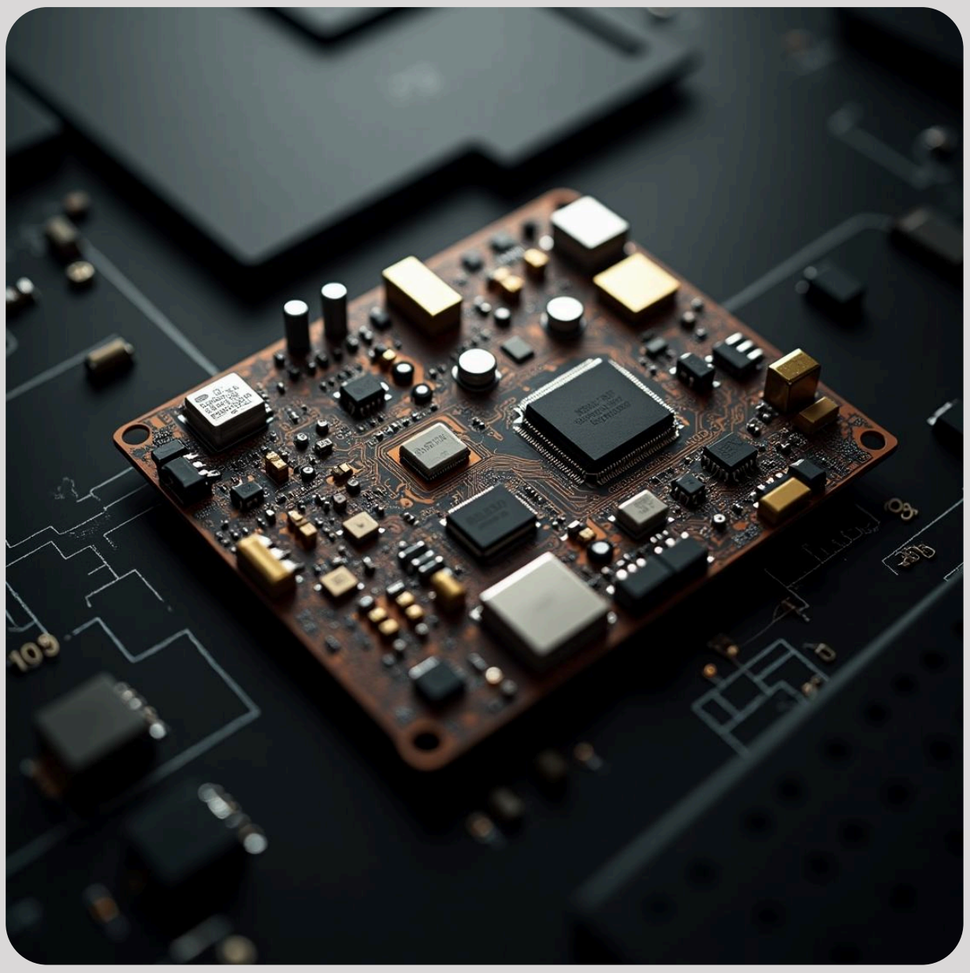
“All of it is about marketing. See a coaching teacher covering difficult topics in class and being strict with grading is appreciated and if I use Gallagher’s book for digital communications, I will perhaps be hated even more”

I nodded.

“Why do you think that is?” He asked, blowing smoke like a dragon.

I shrugged.

“See, when I am teaching, I am training them to fight against me, in an exam that I will conduct and I will grade, so according to them I always have the option of making life easy for them.



On the other hand, coaching waale sir, bhaiya or whatever they choose to call themselves, he is preparing them to fight against a nameless, faceless enemy. So there the adage the more you sweat in training, the less you bleed in battle is applicable. But here you and I are the enemies, and we are making them sweat in classes and bleed in grade sheets."

"But, sir, just handing out grades- won't that be unfair to the students who are actually working hard."

"It sure will be." "So, what i am saying is, handing out grades is the popular solution, and teaching and grading honestly is the right solution. | never said that the right solution was the popular solution." Ah. "Chalo". He said, stubbing his cigarette again. "It is quite late. Time for me to shut shop, and time for you to possibly have one of your last meals at your hostel mess. By the way, did | tell you about the achaar waale aaloo ke paranthe that were served at Sunday breakfast when we were students?"

LOST IN TIME

A SPACE-TIME ODYSSEY

~Harsha Borah

Gregory's chrono-dial flashed 23:24, marking the 'Daystar down' on a date: the 23rd of the winter month, year 2997. His location, according to his apparatus, was the starkly named "Post Extinction Planet Life. " The ship, tilting precariously on some colossal structure, had its windshield shattered and was losing vital gas, making him lightheaded. He'd taken his anti-toxin pills before leaving the station, but the desolate, brown landscape made him uneasy. Thankful for his mother's foresight, he was wearing his "Safe Human" suit.

He ejected from the damaged vessel, landing hard on the sandy terrain. The suit absorbed most of the impact, but he still needed a moment to regain his footing. His ship was completely wrecked, its chances of getting him to Solar Year 3000 nil. He reached for the tail of his backpack, a bucket-shaped transmitter, and dialed three numbers on the interlocutor.

The robotic voice repeated, "Miss Karoll will promptly pick up your call" three times before her quick voice finally answered.
"Ave Gregory. Where are you?
"Ave Miss Karoll. I am in Planet Life, 2997." Her tone was incredulous.
"What?! The entire class is in a panic trying to find you. How many times have I told you not to stray off our space-time routes?"
"Oh, sweet Rungcakes, I didn't, Miss. I was going down to 2990 just like you taught us, when the space-time police stopped me for a toll payment. I think they messed up the system and forgot to add a 10-year leap over my account. I took the next jump, and here I am."
"Oh, my God, Gregory, are you hurt?"
"I'm fine, Miss, but what should I do?"
"First, make sure you are wearing your suit. The Lethal Dose on that planet is high. The pills will help, but it's better to be safe. I'm sending you 90kw of energy through the time tunnel.

"He touched the video and a gruff voice began to narrate. The video showed the planet from space, once a vibrant blue-green sphere. The narrator spoke of a paradise abundant with life, but also of how it was destroyed by its own cleverest beings: men. He recounted their evolution from primitive mammals, the development of tools and agriculture, and the rise of societies. He spoke of competition, battles, kingdoms, and eventually, nations. The video showed how these nations became obsessed with power, developing weapons that led to mass destruction. Toxic fumes and ash filled the atmosphere, killing the vegetation and animal life. In the end, men died, after exhausting the planet's every resource, and the planet was left a lifeless, sandy terrain. A sudden spark caught Gregory's attention. The storm clouds had multiplied and a massive wall of sand was approaching. Fear gripped him. His suit was strong, but he was unsure of its limits against an extraterrestrial storm.

"Miss Karoll, where are you?" he thought desperately. Then, a blue light enveloped him. He felt himself lifted, being pulled into the bright alleyway of a watcher's ship.
"You okay, Gregie boy?" the watcher said, with a chuckle. It was Uncle Berry, his mother's friend. Gregory had never seen him with his huge binocular headgear.
"Oh, Uncle Berry, perfect timing!" Gregory said, trying to catch his breath,
"This place is eerie. Men were monsters, it seems."
"Yeah, they were. Men. Our ancestors. Amazing what they had and what they did."
"Our ancestors?" Gregory asked looking at the watcher.
"Oh, Gregie, we are the descendants of those monsters. We lived on Planet Life, but after years of war, the wisest thought we should move. We found Planet Helio. Can't imagine life anywhere else now. Home - a powerful word. How could they do that to their home?" he said, looking at Planet Life.
Gregory sighed and stared out the window. The glinting silver wrappers looked like stars. He squinted, and in his mind, he could almost read, "Roffer Chocolate: There is no place like home."

“Space is expanding—and it’s still getting bigger every second!”

You can jump back with that. We'll look at the ship after you get here, okay?" "Okay, Miss, but the ship's a mess. It crashed into a big stone and is stuck out here in the middle of nowhere." Miss Karoll’s usually bright voice wavered, she sounded genuinely worried "Oh, dear. How did that happen?" She had been vigilant for weeks, trying to keep her space-time study class safe. Now, one of her students was stranded on another planet. "I don't know, Miss. The dial just changed to 2997 and the ship crashed into something. I blacked out and woke up to a completely wrecked front. So, I put on my suit and ejected." "Okay, you did good. I'll send a watcher to fetch you back with your ship, but Planet Life is congested today. It’s a Monday, and every elementary school is visiting for history. It may take some time, but don’t worry you'll be alright, okay Gregory?" "Okay, Miss." "Stay put. We’ll see you in 3000, Planet Helio.” "Ave, Miss, " Gregory replied, and the interlocutor retreated into his backpack. He slowly surveyed his surroundings. Black and blue sand stretched in all directions.

There were a few dilapidated structures jutting out of the sand, but otherwise the landscape was bleak. An enormous orange sun dominated the sky. His wrist meter showed a 75°C jump in temperature. A glint near his feet caught his eye - a crumpled silver thing. He picked it up, recognizing it as a discarded wrapper. Ancient text was scribbled on it, which, when scanned with his Dialect specs, read, "Roffer Chocolate: There is no place like home. " He chuckled at the irony of the wrapper in this lifeless place. Five centuries had passed since the planet was inhabited, yet, the planet was littered with such discarded remnants. Violence can only remove so much. He glanced at the swollen sky, noticing a storm cloud forming in the distance. The eye of the storm was dark and sandy, whirling and pulling sand towards itself.
“At least it’s far away.
Miss Karoll better be quick,
” he thought. He retrieved his Pastime encyclopedia, a small tablet containing the timelines of all planets. He typed in "Planet Life" and only one 23-minute video appeared.
"Wow, such empty,
" he mused.
"This planet must have done something horrible for the Time Keepers to leave out data.

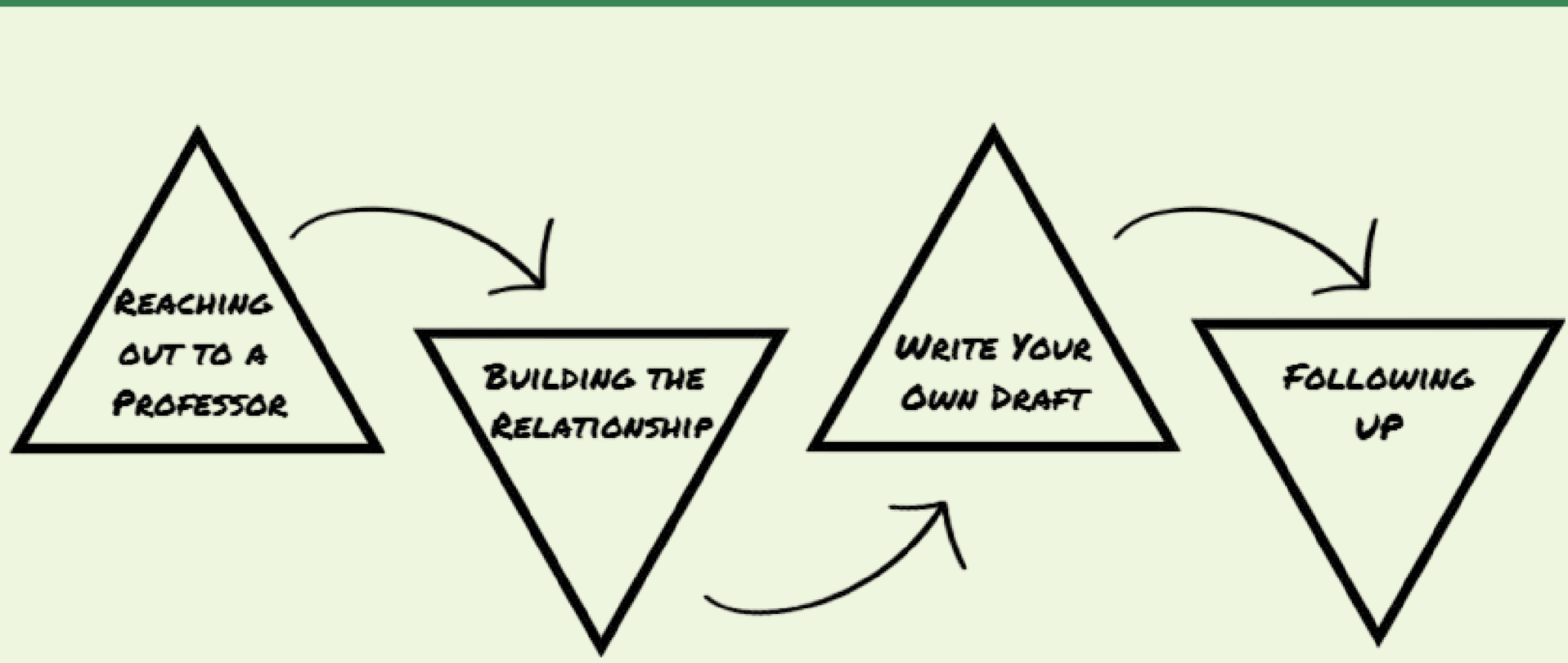
How to Secure a Strong Letter of Recommendation:
Guide for Undergraduates

~Manish Bhatt

Since joining IIT Guwahati, I've been consistently impressed by the intellectual curiosity and potential of our students. Many of you exhibit the dedication and capability necessary for academic success. However, I've also noticed that while most students excel academically, many struggle with the subtleties of communication and respectful interaction in academia. It's important to remember that our department is not just a place to study; it is also a professional workspace. The way you engage with faculty can have a profound impact on building relationships — and ultimately, securing a letter of recommendation.

It's not uncommon for professors to receive requests for letters from students they've never met. What students don't realize is that if we don't know them, it is incredibly difficult for us to write a strong letter.

After all, what can we say? What personal experiences can we mention? Without a connection, we may end up writing a generic letter, which won't help much with the application. So, how can you avoid this pitfall? Maybe developing an understanding of academic professionalism early can be useful. However, professionalism in academia isn't just a set of rules—it's a mindset that helps you build meaningful relationships, unlock career opportunities, and ensure academic success. My advice to students aiming for graduate studies is to focus on cultivating these connections early, so that when the time comes to request a letter, your professors have plenty of positive examples to draw from. A strong letter of recommendation plays a crucial role in applications for internships, scholarships, and graduate programs.



Reaching out to a Professor:

The first step in securing a letter of recommendation is to reach out to a professor. Email is the most effective way to do this, but keep in mind that professors receive numerous emails daily, and it’s impossible to respond to each one. To ensure you get a reply, follow the best practices of professional communication: clear, respectful, and purposeful emails are key.

A typical email should have three parts:

1. The Greeting: Always begin with a formal salutation, addressing the professor by their correct title (e.g., "Dear Prof. X").
2. The Body: State the purpose of your email clearly. If you're requesting a letter of recommendation, for example, you could start with: "Dear Prof. X, I am writing to request a letter of recommendation..." If you're inquiring about a project or internship, emphasize why you are interested in the professor’s work. For example: "Dear Prof. X, I thoroughly enjoyed your research on image reconstruction in photoacoustic tomography and would like to work with you on related inverse problems."
3. The Closing: Maintain a polite tone throughout, proofread for clarity and grammar, and end with a respectful closing such as "Sincerely" or "Best regards," followed by your full name.

Building the Relationship:

When requesting a letter of recommendation, it's essential to choose a professor who knows you well and is familiar with your academic achievements. To make this possible, you should begin connecting with potential professors early in your program. I recommend that B.Tech students should start reaching out after their 3rd or 4th semester. An early connection gives you ample time to work on projects and perhaps publish research by the time you apply for graduate admissions in your final year.

Once you've started working with a professor, maintain the highest standards of academic conduct. Be punctual, well-prepared for meetings, and engaged in discussions. Professors value students who demonstrate genuine curiosity, initiative, and responsibility. In class (or during office hours), ask questions, even if they seem small. Your engagement shows your intellectual curiosity and eagerness to learn.

Writing your own Draft:

Typically, professors prefer to write letters themselves if you've spent enough time working with them. However, this isn't always the case. In such instances, it’s common for professors to ask students to write a draft, which they then edit and personalize. While writing the draft can feel uncomfortable, it’s a valuable opportunity to present your achievements in a structured and focused way. Begin by providing context for the professor, explaining how they know you and highlighting your academic accomplishments, skills, and key projects that align with the opportunity you're applying for.
Be confident but objective in your self-presentation, and include specific examples that demonstrate your potential. If needed, address any challenges you've overcome during your academic journey. Students should understand that typically the admission committee receives only positive letters of recommendation, so a generic one may not stand out. What truly makes a letter exceptional is personalization. For example, consider the following questions:
1.How did the student approach a research problem?
2.How was the student's work received by peers?
3.Did your professor have an interaction with you that reflects the student’s future goals?
4.What is the professor’s view on the student’s personality and academic conduct?
5.How well did the student prepare for meetings, presentations, and deliver high-quality work?

These personalized insights give depth to a letter and can make a significant difference. When you provide your professor with a draft, make sure to include these points, ensuring they have a clear picture of your academic journey and accomplishments. Remember, your letter of recommendation should not be a mere reflection of your CV. You are already submitting your CV as part of your application. The letter should tell a story about your professionalism, conduct, and achievements from the professor’s perspective.
Avoid generic statements like "She is a hardworking student" without providing specific examples to back them up.
Once your draft is ready, share it with your professor, who can then verify, refine, and add their personal insights before signing the letter.

Following Up:

Always give your professor ample time to write the letter—at least a few weeks in advance.
Be clear about the purpose of the letter and any points you'd like emphasized. Preparing a list of universities, their deadlines, and any specific instructions can be helpful.
Remember to follow up if necessary and express your appreciation both when making the request and after the letter is submitted. Finally, when you receive your offer letters, let your professors know—they will be just as excited about your success as you are.

Arts & Creatives

By Shreya Mandal

By Sutheertha

INTER IIT TECHNICAL MEET

~P Aashrith Ram

The Inter-IIT Technical Meet is one of the most prestigious intercollegiate competitions in the country, bringing together the brightest technical minds from IITs across India. Hosted annually by one of the IITs, the event challenges participants with real-world problem statements (PS) provided by leading companies, research organizations, and startups. These problem statements, categorized into high, mid, and low-prep levels, demand expertise in domains such as hardware, software, game development, AI, and robotics. Teams rigorously work on their solutions over weeks, culminating in an intense, high-stakes showdown at the host institute.
The 13th edition of the Tech Meet, held at IIT Bombay from December 11th to 14th, 2023, lived up to its legacy. This year's problem statements were provided by ISRO, Adobe, Zelta, Bharat Forge, FedEx, Dream11, and many more, pushing teams to innovate and solve real-world challenges. IIT Guwahati, with its determined contingent, took on the challenge head-on, demonstrating strategic planning, technical excellence, and unwavering commitment.

An Unforgettable Journey

The road to Inter-IIT was not just about problem-solving; it was an experience of camaraderie and perseverance. With problem statements released in mid-October, the teams delved deep into research, prototyping, and testing, refining their solutions through continuous iterations. The sleepless nights, intense brainstorming sessions, and countless debugging marathons were all part of the journey.

The final showdown in Mumbai was an adventure in itself. Traveling together as a contingent strengthened the bond among team members, making the trip more than just a competition—it became a collection of unforgettable memories. Upon reaching the iconic IIT Bombay campus, the energy was electrifying. The next few days were a whirlwind of technical presentations, product showcases, and rigorous evaluations by expert judges. The Pan-IIT Expo was another highlight, offering insights into cutting-edge technology and fostering interactions with industry leaders. Beyond the competition, the

contingent made sure to . experience the best of Mumbai—exploring its vibrant streets, savoring local delicacies, and visiting some of its famous landmarks. These moments added a unique flavor to their Inter-IIT journey, making it as much about personal growth as technical excellence

A Historic Win for IIT Guwahati

As the final results were announced, emotions ran high—IIT Guwahati had secured an overall 3rd position, marking its best-ever performance in Inter-IIT Tech Meet history. The contingent's relentless efforts bore fruit as they achieved multiple podium finishes across key problem statements:

🏆 Gold – Zelta, IGDC
🥈 Silver – Bharat Forge, FedEx
🥉 Bronze – Dream11, Insolation

This incredible achievement was a testament to the innovation, perseverance, and teamwork of the contingent. Every member played a crucial role, from brainstorming solutions to executing them flawlessly under pressure. The hard work of students, mentors, and coordinators shone through, solidifying IIT Guwahati's reputation as a formidable force in the technical domain.

Looking Ahead

The success at Inter-IIT Tech Meet 13.0 is not just a milestone but a stepping stone for even greater accomplishments in the future. With passion, dedication, and technical brilliance, IIT Guwahati continues to push boundaries and set new benchmarks in innovation.

Congratulations to the entire contingent for making IIT Guwahati proud! Here's to more victories in the years to come!

#GoldForGuwahati 🚀

NEURAL INTERFACES

~Sutheertha

Imagine being able to control a computer without lifting a finger or speaking a word. With neural interfaces, this is no longer just science fiction—it's a reality. By connecting the nervous system directly to machines, these interfaces can read electrical signals from the body and translate them into commands, allowing users to interact with technology in entirely new ways. Whether it's moving a cursor with a thought or operating a robotic limb, neural interfaces bridge the gap between the human brain and digital devices.

This groundbreaking technology is transforming industries, from healthcare to entertainment. For individuals with disabilities, neural interfaces oUer life-changing solutions, enabling them to control prosthetic limbs, communicate through brain signals, and regain independence. In gaming and virtual reality, these interfaces create immersive experiences by allowing players to interact using their minds alone. While terms like "neural interfaces," "brain-computer interfaces" (BCIs), and "human-machine interfaces" (HMIs) are often used interchangeably, they each have unique distinctions, shaping the future of how humans and machines collaborate.

•Neural Interfaces: This is the broadest term, encompassing any system that interacts with the nervous system, including the brain, spinal cord, and peripheral nerves. They can be used for a wide range of applications, from medical devices like cochlear implants to advanced prosthetics and even consumer electronics.

•Brain-Computer Interfaces (BCIs): Also known as brain-machine interfaces (BMIs), these specifically refer to systems that establish a direct communication pathway between the brain's electrical activity and an external device, most commonly a computer or robotic limb. BCIs are primarily focused on interpreting brain signals to control external devices.

•Human-Machine Interfaces (HMIs): This is a more general term that can include neural interfaces and BCIs but also encompasses other forms of interaction between humans and machines, such as traditional input devices like keyboards and touchscreens.

The main diUerence? Neural interfaces work with the entire nervous system, BCIs focus on the brain, and HMIs include all human-machine interactions. Neural interfaces are grouped into three types based on how they interact with the brain:

1. Invasive Interfaces
• Require surgery to implant electrodes inside the brain.
• Provide the best signal quality but have higher risks.
• Example: Neuralink's brain chip, used to help paralyzed patients control devices.

2. Semi-Invasive Interfaces
• Electrodes are placed on the brain's surface or inside the skull, but not deep in the brain.
• Balance signal quality and safety.
• Example: NeuroPace RNS System, which helps treat epilepsy.
3. Non-Invasive Interfaces
• Use external sensors (like EEG headsets) to read brain signals without surgery.
• Safer but less precise.
• Example: OpenBCI's EEG headsets and Wisear's neural earphones for hands-free device control.

Brain-Computer Interfaces (BCIs), also sometimes called brain-machine interfaces, are often used for researching, mapping, and assisting human cognitive and sensory-motor functions. The first neuro-prosthetic devices were implanted in humans in the mid-1990s. The whole idea of BCIs started with Hans Berger's discovery of the brain's electrical activity and the development of electroencephalography (EEG). Since then, several laboratories have managed to read signals from the cerebral cortex of monkeys and rats to operate BCIs to produce movement. Monkeys have moved computer sensors and commanded robotic arms to perform tasks just by thinking about them and seeing the results, without any motor output. In 2020, Elon Musk's Neuralink was successfully implanted in a pig. In 2021, Musk announced that the company had successfully enabled a monkey to play video games using Neuralink's device.

A Brain-Computer Interface (BCI) system consists of three key components: signal acquisition, signal processing, and application. These components work together to capture, interpret, and apply brain signals for various purposes, such as controlling a robotic arm or assisting individuals with disabilities. Signal acquisition involves detecting brain activity through methods like EEG, ECoG, or implanted electrodes. The acquired signals then undergo signal processing, which includes feature extraction to identify relevant patterns, feature classification to assign these patterns to specific commands, and feature translation to convert them into actionable
outputs. Finally, the BCI application executes these commands, enabling users to interact with external devices. In some cases, BCIs can also provide feedback signals to the brain, potentially
restoring functions like vision and hearing.

Despite their potential, BCI clinical trials face significant challenges. Many people, especially in developing countries, lack awareness of BCIs, making it diUicult to recruit participants. Current trials often have small sample sizes and lack cultural diversity, limiting the generalizability of findings. Another major issue is the lack of research on user acceptance and public perception. Addressing these challenges by increasing awareness, expanding participant diversity, and understanding social acceptance will be essential for the successful integration of BCI technology into everyday life.

SOCIO SCOPE

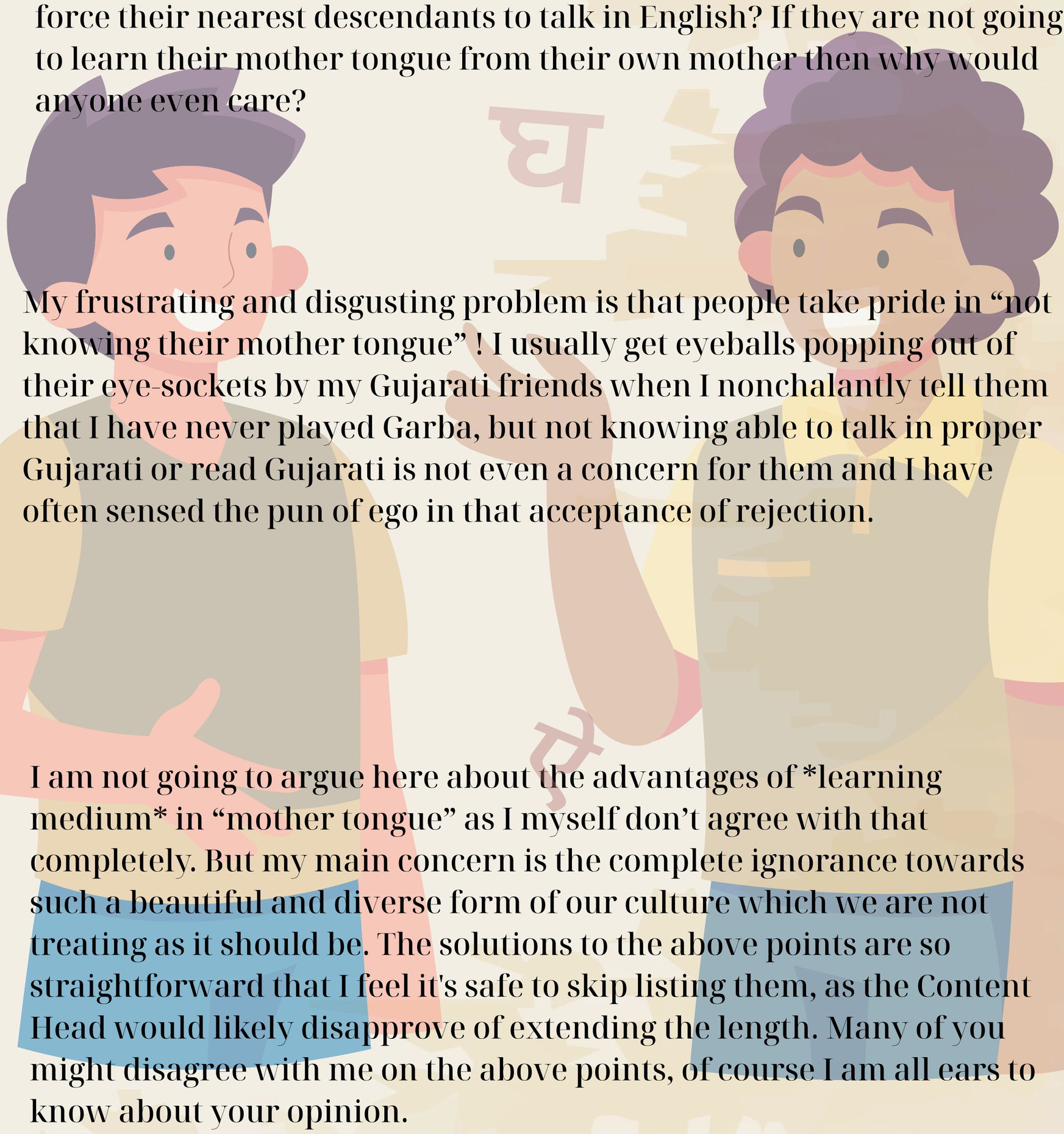
MRITAH BHASHA

~Devarsh Bhandari

Before I start this article, I want to ask you a few questions. When was the last time you wrote anything in your mother tongue? How difficult is it for you to read a language other than English, especially if it is the language you were raised in? When was the last time you read a paragraph from that language? Even if you have a conversation with your friends or family in that language, how often do you replace words with their English counterparts, even when suitable modern words exist in your language? Can you count from 1 to 100 in that? From my experiences, your answers to the above question do not reflect your connection with your mother tongue.

The blind horse race of learning English while sacrificing the mother tongue is beyond my tolerance. Here my problem is not learning English or any other language, but simple rejection of one of the most prestigious heritage forms. That's another case that we are so proud of other forms such as folk dance, traditional dress, and delicious dishes, so it's clear that it is not the situation of us joining the campaign for destruction of Heritage. Then why are languages suffering from complete forfeiture?

From my perspective, the child speaking in English is the achievement and necessity for many parents to prove their educational status in the society. The kid is encouraged to talk in English at home! Isn't it enough for a five year old to learn English at the school that the parents would force their nearest descendants to talk in English? If they are not going to learn their mother tongue from their own mother then why would anyone even care?



My frustrating and disgusting problem is that people take pride in "not knowing their mother tongue" ! I usually get eyeballs popping out of their eye-sockets by my Gujarati friends when I nonchalantly tell them that I have never played Garba, but not knowing able to talk in proper Gujarati or read Gujarati is not even a concern for them and I have often sensed the pun of ego in that acceptance of rejection.

I am not going to argue here about the advantages of *learning medium* in "mother tongue" as I myself don't agree with that completely. But my main concern is the complete ignorance towards such a beautiful and diverse form of our culture which we are not treating as it should be. The solutions to the above points are so straightforward that I feel it's safe to skip listing them, as the Content Head would likely disapprove of extending the length. Many of you might disagree with me on the above points, of course I am all ears to know about your opinion.

PRAYATNA CHRONICLES

My Journey as the Convener of Prayatna 2025

~Himanshu Agarwal

Prayatna, the annual socio-welfare fest of IIT Guwahati, has always held a special place in my heart. I had the opportunity to witness Prayatna 2023, which was successfully organized under the leadership of Ankit Bhaiya. Having worked across various domains in diUerent fests, I had gained substantial experience in event management. However, I had never considered applying for the highest position due to a lack of confidence. But when the application for the Convener of Prayatna 2025 was announced, I felt an irresistible urge to step up and take on the challenge. I prepared diligently for the role, seeking guidance from past conveners of diUerent fests to understand the responsibilities that came with it. By the end of April, I was honoured to be selected as the Convener of Prayatna 2025.

Building the Team

One of the first and most crucial tasks was to form a strong team to revive the fest, especially since Prayatna 2024 had not taken place due to administrative challenges. I initiated the recruitment process for key positions, including Finance Head, Events Head, PR Head, Marketing Head, Web Head, Media Head, and Design Head. The selection process was rigorous, involving multiple rounds of interviews, and it took nearly a month to finalize the team.

Overcoming Challenges

We organized our first event on August 15, which received a great response. However, as the academic semester progressed, challenges began to emerge. Many of our final-year members were caught up in placement season, while third-year members were deeply engaged in their internships. Balancing fest responsibilities alongside academics became a demanding task. The real test began during the peak preparation period when my Events Head resigned, followed shortly by the PR Head and then the Design Head. Managing these key key roles simultaneously

was daunting, but with the support of Ujjwal Chhajer (General Secretary, Welfare Board) and Dhwanii (Girl Representative, Welfare Board), we managed to rebuild our team. Together, we restructured the fest to ensure it remained true to its core vision—serving both social welfare and student engagement.

Last-Minute Setbacks and Resilience

As we neared the fest, unforeseen obstacles arose. Our keynote speakers had to withdraw due to health issues, requiring us to make significant structural changes just a week before the event. A day before the fest, multiple setbacks occurred—vendors backed out, speakers cancelled and uncertainty loomed over whether the fest would take place as planned. The stress levels were high, as the entire team had worked tirelessly for a year to bring Prayatna 2025 to life. At this critical juncture, our team came together, reassessed the situation, and quickly secured new vendors, speakers, and artists. With determination and teamwork, we brought the fest back on track.

The Fest Days and the Grand Finale

Despite all the challenges, Prayatna 2025 was a resounding success. Day 1 and Day 2 ran smoothly, setting the stage for an electrifying Day 3. The highlight of the fest was the Screening of the Cricket Finals, where India’s victory added an unforgettable moment of celebration. After the match, I visited the participants to gather feedback on how we could improve the fest. Most of them were very happy with the structure and execution. With the strong foundation we have built, we now have well-defined planning for the next year's fest, ensuring that we remain independent and not reliant on external influences.

Final Thoughts

This journey has been one of the most transformative experiences of my life. Leading Prayatna 2025 taught me invaluable lessons in leadership, crisis management, and teamwork. There are many behind-the-scene stories that shaped this experience-ones I’d love to share in person. I want to thank everyone who stood by me through this journey. Prayatna 2025 was not just a fest; it was a testament to perseverance, dedication, and the power of collaboration.

The Anatomy of Goodbye

-Harshita Mudgal

It starts with an ache in my chest. I am 15, and I have never really known the meaning of seeing someone leave. Nobody has a choice or a say in it, but these are just circumstances. I am on my way back to town from the nearby city, and today is the day she leaves. The sky is clear, and it's warm, but the harsh sunlight on my face does not bother me like before. Nor can I hear the deafening roar of the bus engine. One thought drowns out everything else: Will I make it in time?

It's strange to think I only met her three years ago. When we first interacted, my feelings were anything but kind. I hated her-the day she joined school and walked into my class. Although there's an odd symmetry between that day and this one: the ache in my chest, the heaviness. The sorrow of her exiting my life and the discomfort of her entering, why does it have to feel the same?

Our first year together was uneventful, mostly a blur of polite indifference. We stayed in our own comfort zones, barely exchanging words. She was confident, bold, and unapologetically herself, the kind of person I aspired to be but didn't dare to emulate. I, in contrast, was quiet, my voice barely louder than a whisper. Maybe I envied her freedom, or maybe I feared her honesty. Whatever it was, it kept me at a distance-until ninth grade.

Ninth grade was when it all changed. I don't remember what pushed me to step outside my self-imposed boundary and speak to her, but I remember how it felt-like stepping into the sunlight after hiding in the shadows. One incident stands out vividly: the science project. There was only one spot left in the team, and we both wanted it. Yet, neither of us argued or fought for it. Instead, we ended up working together on something entirely separate,building a makeshift project that ended up being more fun than the original plan. It wasn't about winning; it was about how effortlessly we clicked. That day, I saw the real her-unfiltered, genuine, and refreshingly honest.

From that point on, everything shifted. We were on the same page about so many things, from school assignments to random conversations about life. She had this ability to make even the mundane feel meaningful. The classroom became our world, and though we never met outside of it, the bonds we formed there were unforgettable. I learned to laugh louder, speak more freely, and most importantly, be unapologetically myself.

But good things never last, do they? The final year of school arrived, and so did the news I dreaded. Her dad, a high court judge, was being transferred far away. It was sudden, like a thunderstorm on a sunny day. One moment, everything was normal; the next, the countdown to goodbye began. I didn't know how to

process it. I clung to every moment we had left, every shared joke, every fleeting smile, knowing it could be the last.

And now, here I am, on this bus, clutching a photo frame of the only picture we ever took together and a scrapbook filled with memories. The scrapbook was a labor of love, each page a testament to the friendship that changed my life. The photo frame, simple and unassuming, felt monumental in its significance-a reminder of a bond that survived despite the odds.

As the bus halts, I step out and take a deep breath. The air smells of dust and sunlight, with a faint hint of blossoms carried by the breeze. The trees sway gently, their shadows stretching across the road like they're reaching out to comfort me. Even nature seems to mourn this parting.

She's there, waiting near the school gate, her familiar smile lighting up her face despite the sadness in her eyes. I hand her the gifts, my voice barely above a whisper as I wish her the best for her new journey. She looks at the scrapbook, running her fingers over the cover, and then at the photo frame. "You didn't have to," she says, but I can see how much it means to her.

And then, unexpectedly, she pulls out a small envelope and a little box. "This is for you," she says. I open the envelope first. It's a handwritten letter. The sight of her neat handwriting makes my heart ache. Every word feels like a piece of her soul laid bare, her honesty and warmth pouring out in ink. She tells me how much our friendship meant to her, how I taught her things she never knew she needed to learn, and how she hopes I never lose the spark she admires in me.

I'm already tearing up when I open the box. Inside is a heart-shaped pendant with a blue crystal. It's the exact shade of blue I've always loved, though I've never mentioned it to anyone. How did she know? Or was it just a coincidence? Either way, she stole my heart all over again.

The bus arrives, and I know this is it. The final goodbye. She waves, her hand lingering in the air as if she doesn't want to let go. I watch as the bus pulls away, shrinking her silhouette until she disappears entirely. The ache in my chest deepens, but so does the warmth. She's gone, but she's not. Not really. Even though we don't talk much now, whenever we do, it feels like no time has passed. She's still the same-perfect in her honesty, her kindness, her unwavering authenticity. I've changed, though. My personality, my mindset, my entire outlook on life-so much of it is shaped by people like her. She taught me how to be brave, how to be real, and how to cherish the fleeting moments that make life worth living.

This is how a goodbye looks. It's messy and bittersweet, full of pain and gratitude all at once. It's the ache of losing someone and the joy of having known them. It's the promise of forever wrapped in the uncertainty of tomorrow. It's a pendant, a letter, and a lifetime of memories tucked into a scrapbook. It's her. It's us.

It's everything.

Remembering Prof . Anup Kumar Gogoi

Professor Anup Kumar Gogoi was one of the pioneering faculty members of the Department of Electronics and Electrical Engineering. Sadly, he passed away last year. Cepstrum deeply mourns his loss. A dedicated educator, mentor, and innovator, he left a lasting impact on students and colleagues alike. He was very passionate about research, entrepreneurship, and the development of technical education in the Northeast. In this tribute, his colleagues, Prof. Chitralekha Mahanta and Prof. P.K. Bora, share their cherished memories of him.

I vividly remember the day when I first met Prof. Anup Kumar Gogoi in the year 2000 as I joined IIT Guwahati in erstwhile Electronics and Communication Engineering (ECE) Department as a faculty member. IIT Guwahati was functioning from the Transit Complex where I was allotted a faculty room which was shared by Prof. Gogoi. From the very first day, he made me comfortable by offering me help and guidance in my new workplace. In fact, he was my immediate guide in IIT Guwahati for any issue that I faced. His simple and unassuming nature put me at ease while I was starting to adjust to my life in IIT Guwahati. As a colleague, he was always supportive and ever ready to offer his assistance as and when needed. Professionally, his emphasis was in finding technical solutions to challenging practical problems. His innovative zeal shaped many interesting BTech Projects in the EEE Department. As a teacher, he was always approachable and inspiring to students. He was passionate about creating entrepreneurs from among our students. Yellow Fourier, the first start-up venture in IIT Guwahati was incubated in ECE Department under the mentorship of Prof. Gogoi.He nurtured some brilliant ideas which he tried to realize for benefit of the society. Throughout his career in IIT Guwahati, I found him often engaged in a variety of projects which were aimed for upliftment of the entire North East. His dream of making the North East resourceful in technically skilled manpower resulted in the birth of NETES Institute of Technology and Science (NITS) Mirza, a

private Engineering College under his tutelage. Unconditional love for his motherland and its people was the driving force which pioneered such difficult endeavours. His indomitable spirit could not be defeated by many a hurdles he faced on his path towards his goal. Modesty and honesty were core to his nature. Humility is a quality he was rooted to. Although being a younger brother to Late Tarun Gogoi, the then Chief Minister of Assam for three consecutive terms, Prof. Gogoi never dropped any hint of it in his act or word. I admire him for these virtues which are so rare in today's world. I pay my respectful homage to Prof. Anup Kumar Gogoi who guided me with affection and care in my formative years in ECE Department of IIT Guwahati.

- Prof. Chitralekha Mahanta EEE Department

Professor Anup Kumar Gogoi was one of the pioneering faculty members of the Department of Electronics and Electrical Engineering. He joined the department as an Associate Professor in 1997, two years after its inception as the Department of Electronics and Communication Engineering. He was promoted to Professor in 2003 and retired from the department in 2018. Prof. Gogoi was born into an illustrious Assamese family in Jorhat on March 1, 1953. His eldest brother, Tarun Gogoi, served as the Chief Minister of Assam for many years. Anup completed his early education in Jorhat and earned a Bachelor's degree in Electrical Engineering from Assam Engineering College in 1976. He later pursued his Master's and PhD degrees in Electrical Engineering from IIT Kanpur. Prof. Gogoi began his professional career faculty member in the Department of Electrical Engineering at Assam Engineering College. He also mentored the establishment of the Department of Electronics and Telecommunication Engineering at the same institution, playing a pivotal role in promoting electronics education in the region. Additionally, he served as the General Manager of Research and Development at the Assam Electronics Development Corporation (AMTRON). During his tenure at IIT Guwahati, Prof. Gogoi held several important positions, including Head of the Department, Chairman of GATE, and Dean of the Outreach Education Programme. He played a significant role in shaping the department into a centre of academic excellence during its early years. He inspired students to explore R&D and entrepreneurship, and under his mentorship, Yellow Fourier Technologies Pvt. Ltd. – the first startup founded by IIT Guwahati alumni – was incubated. Initially focusing on electronics laboratory products, the company later relocated to Hyderabad. Prof. Gogoi also mentored another successful startup by IITG alumni, Brigosha Technologies, which now thrives in Bangalore. IIT Guwahati was a key player in the development of virtual labs under an

initiative by the Ministry of Education, as part of the National Mission on Education through ICT. Prof. Gogoi, along with his colleagues Dr. LN Sharma and Dr. Sanjib Das, contributed to the design of remote communication engineering experiments accessible over the internet. Beyond academics, Prof. Gogoi was passionate about fostering innovation in Assam. He established private laboratories, designed scientific experiments for school students, and encouraged traditional craftsmen. His vision was always centred on providing quality education to the masses, and he remained a dreamer until the end of his life. Prof. Gogoi had a love for exploration and connecting with people from all walks of life. He participated in international car rallies, and just months before his passing, he completed the BBIN (Bhutan, Bangladesh, India, Nepal) Friendship Car Rally. I cherish my long association with Prof.Gogoi, both as a teacher and colleague. His brilliant teaching of electrical engineering, along with his guidance in laboratory and computational methods, will always be remembered.

- P. K. Bora EEE Department

TO YOU & ME & ALL

Appearance you say
Makes thou sway
Mistaken you are
A lie from afar

The beauty is indeed
The beholder's eyes
But take heed
The body comprise

It's all flesh n bones
In control of none's
When it burn
Or when it turn (old)

Left is nothing
Yourself and nothing
What you've made
Is only your name
Your pals will have you (in memories)
Situations be blamed.

The riches you say
Makes thou pray
Worthless they are
Never at par

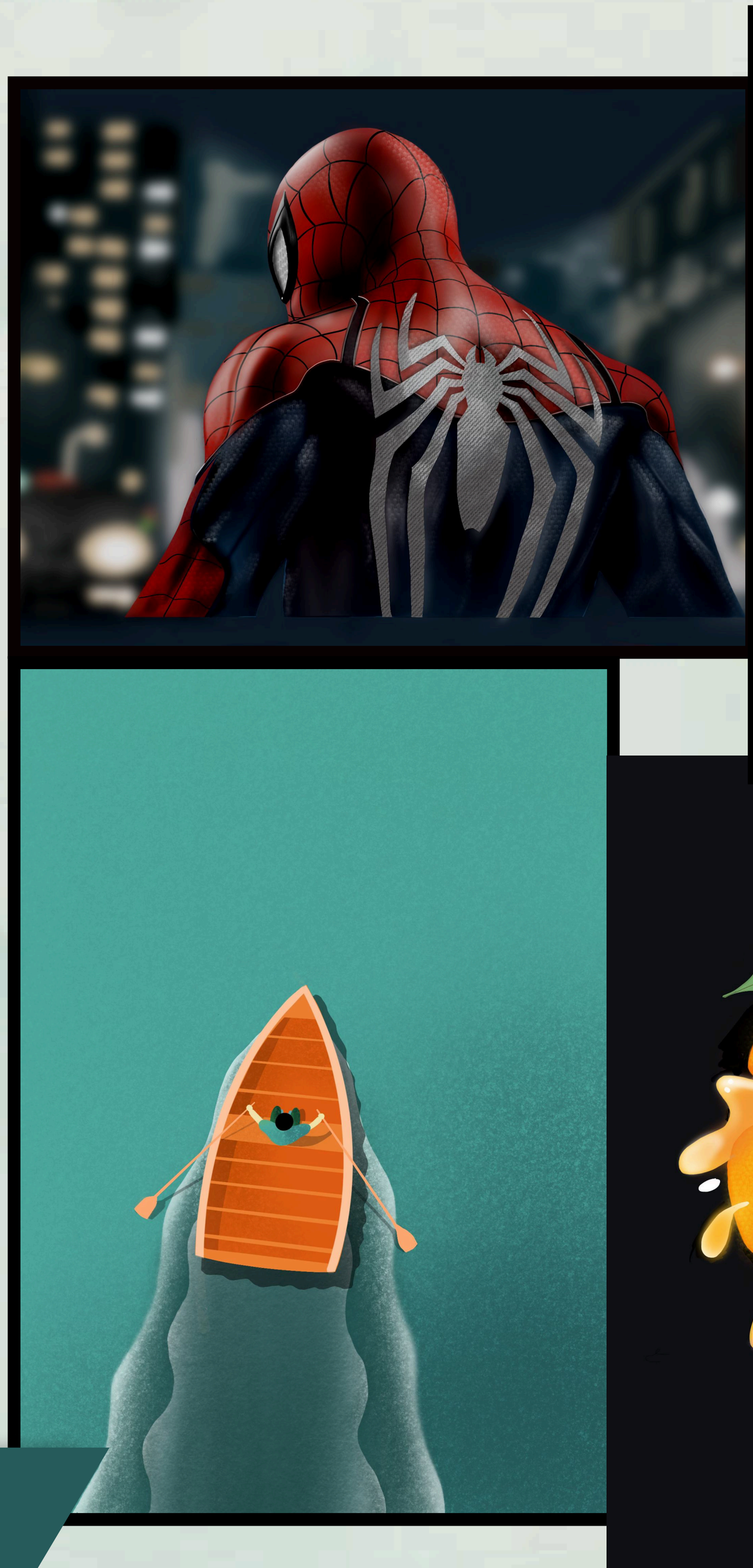
What is earned
Is not that terminates
What is earned
Is what that stays

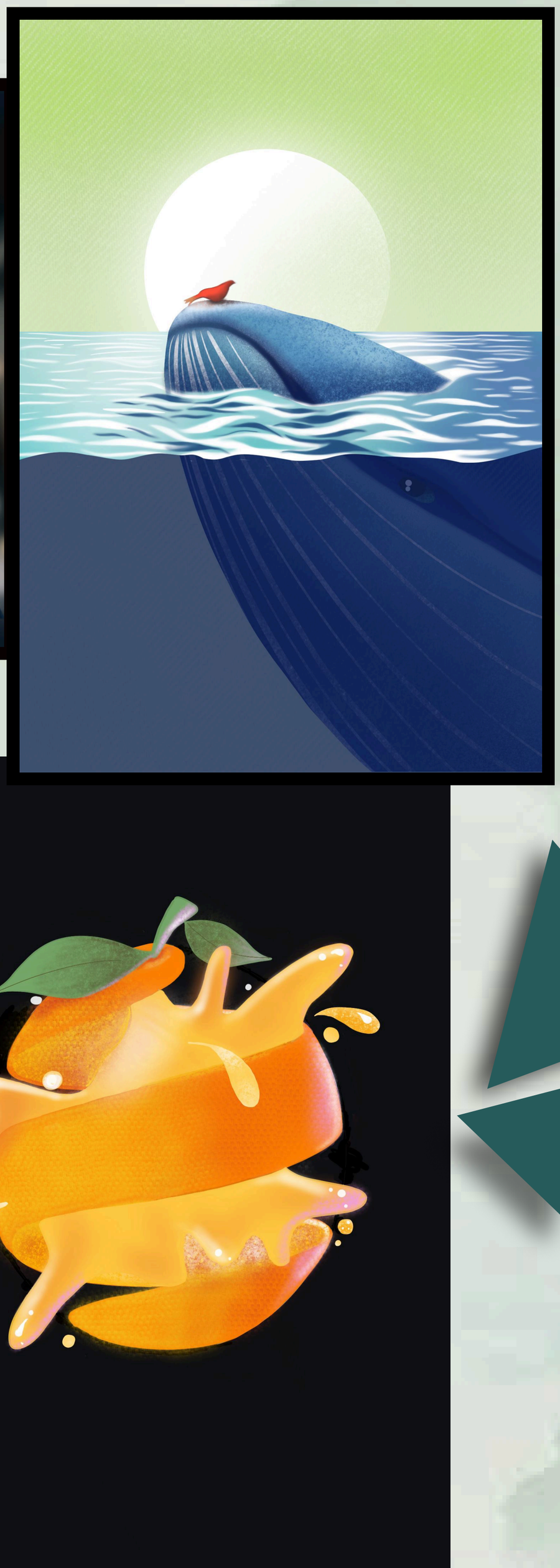
Neither its commodities
Nor the worldly oh please
But the precious trails
Of moments you sail

And precious the trails
Only the love prevails
Beware of what you wish
And change what you cherish
For it may stay for long
Or may leave vanish (for others to belong)

-Abhishek Burman

Arts & Creatives





-By Ankit KumarSingh

Will AI-based EduTech eliminate the traditional classroom?

~Prof. Prabir Barooah

"This technology will revolutionize education!" has been said many times in the past, when the TV was introduced, and when the computer was introduced, when the Internet became widespread, and then when hi bandwidth wireless communication became ubiquitous. The last time it was proclaimed was when massive online open courses (MOOCs) were introduced. Now that the age of AI has dawned, it is no surprise that there are people proclaiming with equal enthusiasm that AI is going to revolutionize education.

Every single time in the past, the prediction has been proven false. Education is still mostly imparted in a physical classroom by a teacher. Especially high-quality education for which people are willing to pay money. Yes, I know many of you use instructional videos in YouTube. I do too, sometimes profitably. If you can read through this article in its entirety, you will realize that that is not a counterexample.

But, is it different this time? Can AI, coupled with the Internet's ability to make information available at your fingertips instantly, really revolutionize education? Eliminate those pesky teachers that the taxpayer has to pay for, and still provide high quality education to large number of students at a vastly lower cost? AI can already do a lot that seemed unimaginable just a few years ago. Some people are claiming AGI – artificial general intelligence - is just round the corner. If that happens, AI can truly think like a human being. So, perhaps the upcoming "advanced AI" can really teach students better than the current crop of human teachers?

How advanced does AI have to be before all teaching can be done by AI, without the need for traditional classrooms manned by teachers? Or is it unlikely to happen, ever?

I believe the answer is, yes, it can happen, but only when AI becomes advanced enough that human beings easily develop emotional connection with AI. That requires AI to have a physical embodiment as well, such as a humanoid robot, that we can see and touch, not just talk with. A ChatGPT

style AI agent that remains entirely in a software form, no matter how advanced, will not lead to emotional connections barring one or two outlying cases[1].

To provide argument in support of the claim, I have to analyze what makes high-quality education hard, and what role do teachers actually play.

First things first. The previous claims about new technologies going to revolutionize education did not come true because they were based on a false premise. That premise was that the key hurdle in providing education is information availability. And that teachers provide information to students in a classroom. It is easy enough to make that mistake. If you observe what a teacher does, it does look like she is making information available to the students on the board. The students simply copy that information onto their notebooks. But that is a highly superficial observation. Even before the Internet, one could argue that the information is all there in the textbooks, so why did we need teachers at that time? Perhaps the textbooks were expensive and students could not afford them? That was certainly the case for the IITs decades ago.

Consider a 20-year-old boy in a small town in USA, in the 1970s. He is not financially well-off enough to be able to enroll in a university as a full-time student. The United States has an extensive and high-quality public library system with a solid interlibrary loan program. It was easy for our 20-year-old to go to the nearest public library and borrow all the engineering textbooks that are needed during a 4-year degree, free of cost. Perhaps the nearest public library is another town, so he has to take a bus. U.S. universities are far less rigid compared to those in India in their rules and regulations. Our intrepid 20-year-old can easily register as a part time student in the nearest university, study on his own, take the exams and get his degree[2] . After the Internet, our 20-year-old does not need to take the bus, but can order e-books from the same library system over the internet. Or he can order physical copies of the books from Amazon from his

[1] There are cases of teens getting emotionally attached to AI agents, sometimes with disastrous results: https://www.indiatoday.in/technology/news/story/teen-commits-suicide-after-forming-attachment-with-characterai-chatbot-mother-holds-company-responsible-2622389-2024-10-24

[2] OK, I am ignoring a few technical details here, like labs. But those technical details do not blunt the main thrust of the argument.

residence. *So, all that the internet has done for education is that it has eliminated the need for the bus ride*. If information availability were truly the main bottleneck, lots of students in the US would have gotten college degrees after the Internet made "..information available at their fingertips". But that did not happen.

The fact that information availability was never the bottleneck is often missed in discussions on education. It is a forgivable error in India since so many things changed simultaneously in India in the 90's that it is difficult to assess what factor affected what outcome. But since things changed one at a time in the West, it is far easier to see – as I have described above – that information availability is not – and never was - the main hurdle in providing high-quality education.

What, then, is the key hurdle?

Discipline.

Learning is hard, and requires discipline, which is hard to develop on one's own. Often, this discipline has to be externally imposed. Sometimes fear is a good motivator, such as fear of failing the class and not getting the degree. But that alone won't lead to learning. It will at most lead to barely passing an exam. The right kind of discipline comes only from respect for the teacher, which motivates students to work hard. The word teacher is a misnomer, since no one can teach you anything. You have to learn, yourself. The best a teacher can do is to act as a guide, and to inspire students to learn. All the learning that a student does occurs due to her own effort, and hers alone. You may protest, "but wait, I have had a really good math teacher in high school. He really taught me math." Allow me to counter-argue. I will give you two specific examples from my own student days. The first is Prof. Petar Kokotovic in the University of California Santa Barbara who we used to call PK. He was a highly energetic lecturer and enthusiastic teacher; that increased our own enthusiasm for the subjects he taught. Second, his office hours – in which we would have one-on-one discussions - were highly valuable. If I did not know better, I would have said he taught me a lot. But with the benefit of hindsight, now I realize that most of the learning happened the night before the office hours, when I

knew the following morning, I would have to ask him about a concept I was struggling with. Why? Because I knew that if he were to find out that I did not know something I was supposed to, it would be embarrassing. It would be embarrassing because I respected him highly, and I would feel that I disappointed him if I did not go fully prepared. So, I would study very hard on the night before, desperately trying to understand whatever I was struggling with first, eliminating all doubt that it not something simple that I should have figured out already. Sometimes, that studying did precisely that, it eliminated the need to talk to PK. Sometimes, I still could not understand and therefore had to go to him the following morning. But by that time, I was as well prepared as I could ever be. When PK explained what was going on, I was able to grasp it. So, you see, I did all the work required for me to learn, the teacher only gave me a little nudge. But more importantly, he inspired me to put in the work needed so that I could benefit from that nudge. Let us review why was I so inspired; for it is critical to my argument. I was afraid of disappointing him. It was my respect for him that led to this fear of disappointing him, and that is what led to study hard. That is what caused me to learn, not PK teaching me. Every good teacher I have encountered, it was always the same. One of the best teachers I have encountered was Prof. Jadu Siddhanta, who taught us English poetry in J.B. College, Jorhat, in class XI and XII. While my friends and I in those years were often rowdy in nearly every other class, we would listen to him in rapt attention. There was literally pin-drop silence in his class. And this was a person who was the most mild-mannered among all of our teachers in JB College; who rarely raised his voice to any student. Because of his high level of professional competence that was immediately obvious the moment he started lecturing, though at that age I did not even the phrase ‘professional competence’, we all developed a strong respect for him. That is what led us to work hard in his class and listen to him in silence. Your favorite math teacher? I suspect that same thing happened there. You put in the work needed to learn; he merely inspired you to do so.

For lack of a better word, shame is a key ingredient in learning. Shame for appearing unprepared. Shame for disappointing another human being who

has earned your respect. That shame is what inspires a student to work hard, which leads to learning. All else is incidental.

Can AI engender shame in humans? Science fiction provides a qualified affirmative as an answer: yes, when robots become nearly indistinguishable from us in nearly every respect, so much so that we start thinking of them as beings deserving of our emotional energy. The 2001 Spielberg movie “A.I. Artificial Intelligence” is a great case in point. A humanoid robot child is created for a couple to fill in for their son who is in a comma due to a then incurable disease. The robot child is so indistinguishable from the real son that the mother unavoidably develops - if not love - at least a high degree of emotional attachment to him (it?). When situation changes the robot child needs to be “retired”, it breaks her heart. Watch the movie to see what that potent combo of guilt and love inspires her to do; I don’t want to give you the spoiler here.

An app powered by an LLM that can converse with us via a screen may sound like a human being for some time, but we will not develop emotional attachment with that app. Not widely, at any rate. If such an AI agent is used as a teacher, a human student will not feel ashamed to disappoint “it”. Even if the app is an AGI agent. How many of us are ashamed that we cannot reply to a question asked by ChatGPT? But when that AI comes in the physical form of a humanoid robot that is nearly indistinguishable from a human teacher, we may very well develop an emotional attachment to it. Shame is a short distance away. Maybe then the AI teacher will inspire us to put in the work needed.

Or, maybe, because we would know that the AI has acquired its knowledge and competency not by working hard but from an aggregation of data collected from other humans, maybe we still would not respect it. We still would not feel that we have let our (robot) teacher down if we cannot answer its questions. In that case, there will never be a replacement for human teachers. Potential Edtech startup founders, anyone?

-Siddharth Sivapuram

It all started for me on 12th August, 2024. I got a text message from Pranjal Soni - THE LEADER of the team, asking me to join the team. I knew Pranjal since the winter semester and thought of saying YES. And boy oh boy, saying YES turned out to be one of the best decisions of my life.

Let me introduce you to my team first. It consisted of the four Brahma boys and the one from Siang, which is me. The Brahma boys included Kahaan, Pulkit, Utkarsh, and Akash. I already knew Kahaan and Utkarsh; I met Pulkit and Akash in Techniche 2024, and I can definitely tell you that the way our team bonded was so amazing that I was genuinely myself with these people; cracking jokes all around in the team meets.

For our initial round in college and submission of the idea online, we worked really hard, especially around the mid-semester. All of us being new to ML actually learned a lot of stuff doing this. Again, it was our exceptional presentation that helped us stand first in our campus internal hackathon. I still remember days spent by us in the Lohit canteen, not waiting for the rain to stop so that we could spend even more time together in the library, learning more about Utkarsh's love story and many, many more moments.

When the submission of the idea was done, it was a long time before the results actually came. September and October were dead. And then came the results in November. I still remember I somehow met Pranjal

every time at the library whenever she had some important news, and news it was! WE GOT SELECTED FOR THE FINALS!

I was genuinely, extremely, and completely happy, but being an Aquarius, I'm supposedly emotionally distant and hence couldn't fully express my happiness to the fullest (which will happen in the future as well). But I WAS HAPPY :)

Then came the end sems, and I went through them somehow. It was scheduled in an ad-hoc manner, or at least my preparation was ad-hoc. Anyway, back to our story—SIH.

We had actually planned on staying during the holidays till the first week of December so that we could get the model ready and sort out the remaining things during the holidays. I won't explain much of the work we did, but after literally zero progress in the first four days, we finally got a direction to work on and capitalized on that. Our model consisted of the usage of APIs, Markov Chains, Kalman Filters, and a lot of other fancy stuff.

After preparing an intense ML model, a crazy website to deploy the model on, and an exhausive financial report prepared by Akash, we were ready to fly to Ahmedabad!

We reached Ahmedabad on 10th December, and our hackathon started on the next day. I still remember that we were supposed to be sleeping in the hostel that night, being anxious, excited, and feeling all the other emotions someone actually experiences before such a BIG DAY. But nah, we were drinking Irish latte at a coffee shop in Ahmedabad at 11:13 pm in the night. None of us were actually guilty, but then suddenly a feeling of guilt struck at 11:14 pm, and all of us were packing bags.

Having Kahaan from Ahmedabad actually helped since he had a car and was a trustable driver, at least beΣer than Pulkit. Let me tell you the story behind this. The last time we went out, Pulkit was driving, and he had actually almost smooched a car (slid past it), but thankfully nothing much had happened since it was Guwahati.

Let’s wake up now to the 11th of December...Oh no, it had already started! We were discussing what needed to be done in our room, where all the Brahma boys and I stayed. The team knew that I was a cuddle sleeper and nobody wanted to sleep beside me. But somehow, I managed to find some place on the bed.

Anyways, we woke up early the next day to reach the centre. It was a huge hall with a lot of tables where the teams could work. It was similar to a science exhibition that I had seen during my school time. And the format was similar too. The judges came to us for three rounds of mentorship and three rounds of evaluation.

In the final round of evaluation, we were provided with five datasets which we used to train the model. In the first round, we were given a new dataset and solved it with ease. Then came the nightmare at the end of the day of the hackathon in the second round—a new dataset that had a lot of problems.

Before getng onto this, let me explain to you simply the problem we were trying to solve. We were making an ML model which uses GNSS data collected from satellites to predict whether the point on the map was on a service road or on a highway. Basically, it was a binary classification problem. Now, the dataset that had been given to us in the second round demanded us to classify the road into three types—service road, non-flyover, and a flyover. This required us to make changes to our model, forcing us to find a new API to use. By some wonder, we actually solved the problem, and it was 100% accurate (thanks to Google Earth).

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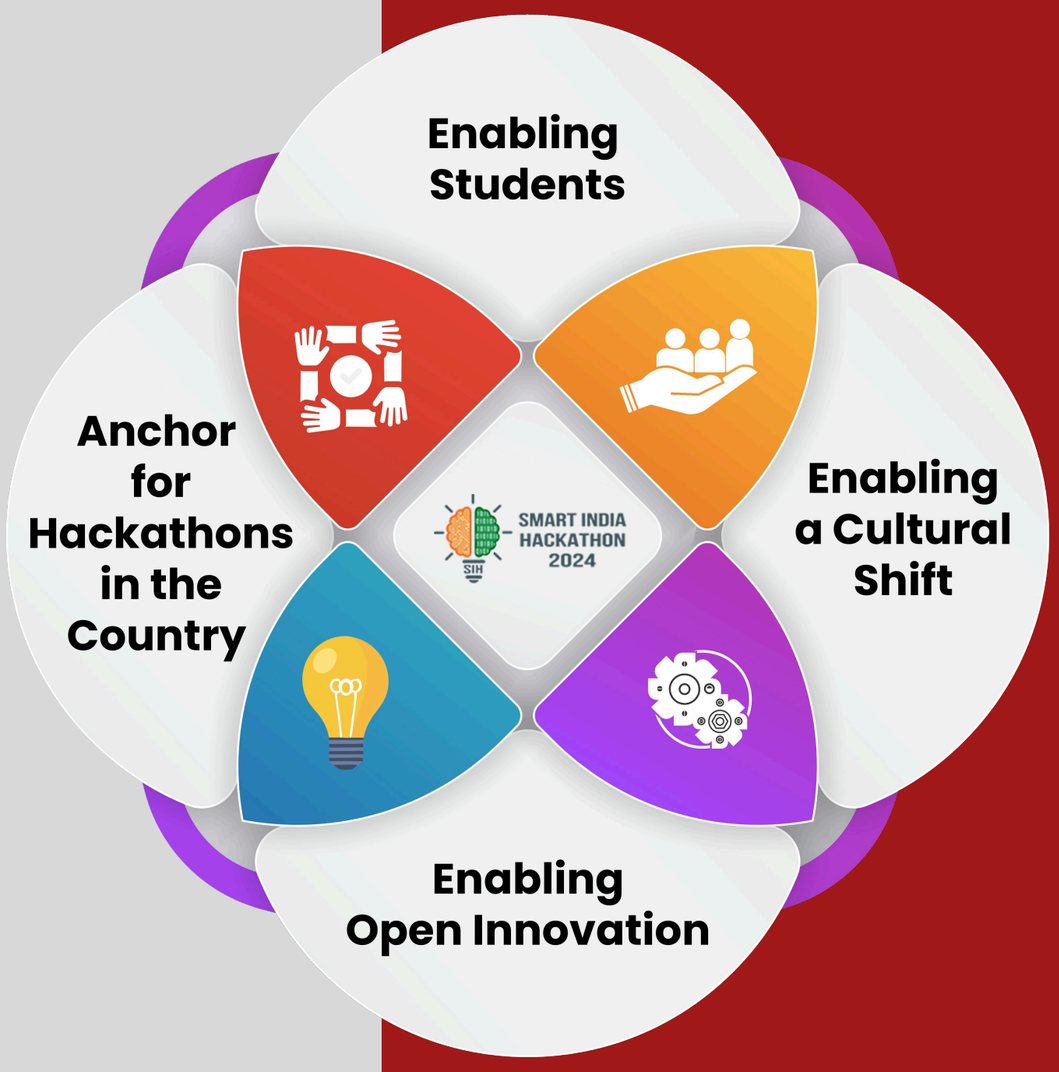
The next day, before the final round we got a dataset that was huge! By huge, I mean literally huge. My windows laptop had given up even on small datasets—it would have burnt down if I had tried executing this code. Even the people with MacBooks had their laptops running for over 60 minutes, and shall, no results came.

Then, all of a sudden, out of nowhere, we saw the results of the code on Pranjal's laptop. And I shall remember the excitement I saw in her eyes after seeing the results.

We showed our results to the judge, and they gave us suggestions to improve on so that we could present better in the final round. In our final round, we explained the model really well showed the results that we had obtained. Our presentation was apt and clear.

After the final round, we saw a lot of people coming to our table—our competitors, the ISRO chairman, ISRO heads, and several other distinguished guests. This gave us the sense that we were actually winning something out of here! I knew that we had put a lot of effort into this. All of us, being more of consultants than ML engineers, actually had a great learning experience.



I wasn't expecting anything before the commencement of the hackathon. But as more and more unfamiliar faces approached us, asking about our model, it started to feel different. Then there was this eccentric ISRO scientist I remember who started sharing his life story with us. He had come himself and was telling us about his journey and his experience in ISRO. Now, it was obvious—we started expecting something out of the competition. So, there are six prizes that are given—three consolaΘon prizes and three for the 1st, 2nd, and 3rd places. In my opinion, consolation prizes are useless since they are just magnified participation certificates.

So, what were we expecting? First? Nah, we weren't that good. Third? No, we had done better than that. So, we locked onto second. Our name did not come when they announced the names for the 2nd and 3rd prizes. Oh no! Having no expectations wouldn't have hurt, but having expectations arise and not geţing a prize is disappointing.

All of our reactions were being recorded on camera, and when our name was announced for the first place, we were crazy happy. Jumping all around, we ran to the stage. It was truly a magical moment that we all will cherish forever. After the mandatory photo session with the trophy, we all left the place and went to celebrate.

DEAR TEAM CEPSTRUM

As I write this message, I feel truly grateful for the amazing journey we've had together. Being the General Secretary—whether as a faccha to my seniors or a senior to my juniors—has been a great honor. Working with this team has been one of the best experiences of my college life.

Over the past year, we have achieved many important goals, including some that had been pending for a long time.

These achievements have made our department stronger and brought our team closer together.

Everyone showed great dedication, from planning events to making them successful. The juniors learned from the seniors, and the seniors guided the juniors, creating a supportive and collaborative team.

While there are a few things I couldn't complete as General Secretary, I believe my team will carry them forward in the next term and take Cepstrum to even greater success.

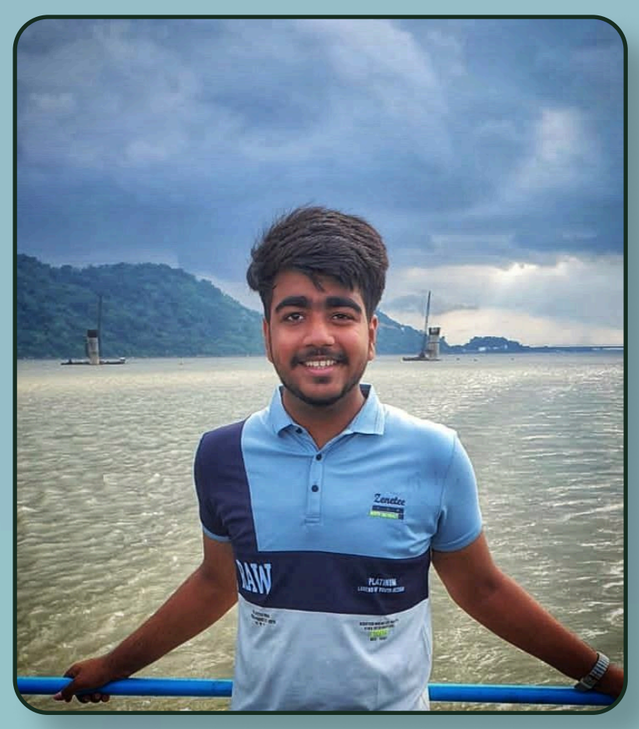
From my first year as a Branch Representative to becoming Associate GS and finally GS, Cepstrum has always felt like family. I have made unforgettable bonds with my seniors, batchmates, and juniors. These friendships mean a lot to me, and I will always cherish them.

My team has supported me in every way, and I cannot thank you all enough for that.
As this journey comes to an end and a new team takes over,
I will always remember the wonderful memories we created together.
Being the General Secretary has been a privilege, and I am truly thankful for this opportunity.
Finally, I want to say that no matter what, I will always be here for you.
Whether you need help, advice, or just someone to talk to, you can always reach out to me.

Warm regards,
Naman Kumar Jangid
General Secretary (2024-25)

Mentors

Naman Kumar Jangid
General Secretary



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Maharsh Raval
Academic Representative

Tejas Kadre
Content Mentor

Geet Manik
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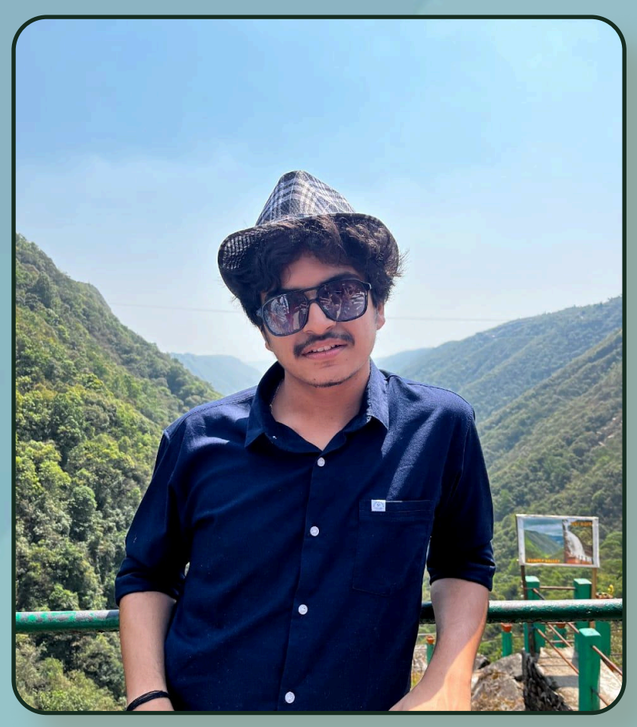
Design Mentor

Heads



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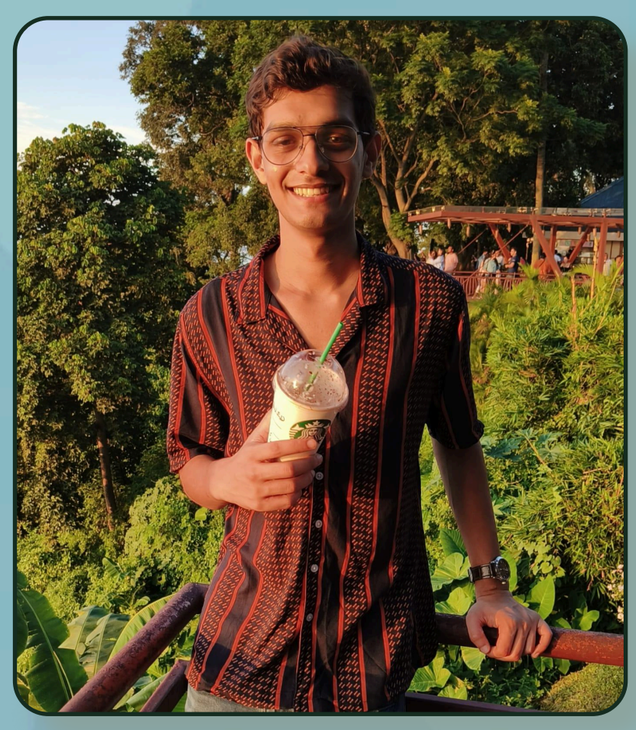
Associate General Secretary

Akshaya Shridhar
Branch Representative ECE

Jasmine
Branch Representative EEE

Chirag Agarwal
Branch Representative EEE

Harnoor Kaur
Academic Representative



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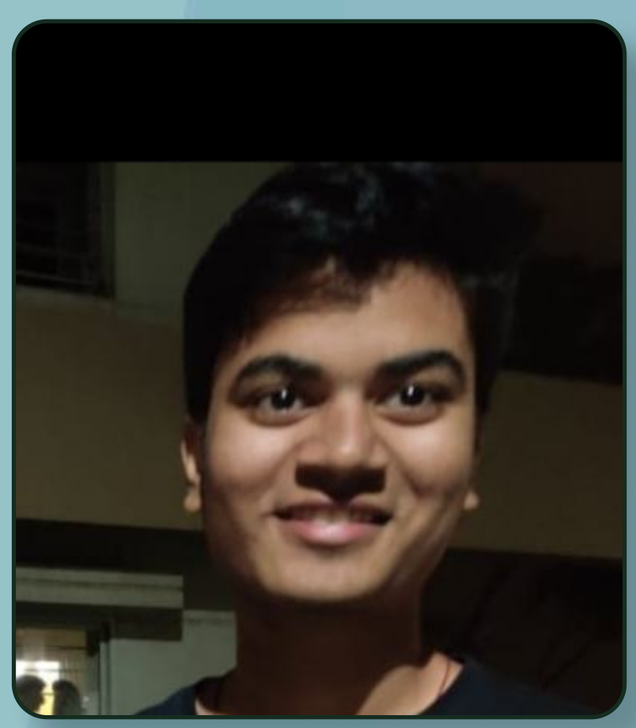

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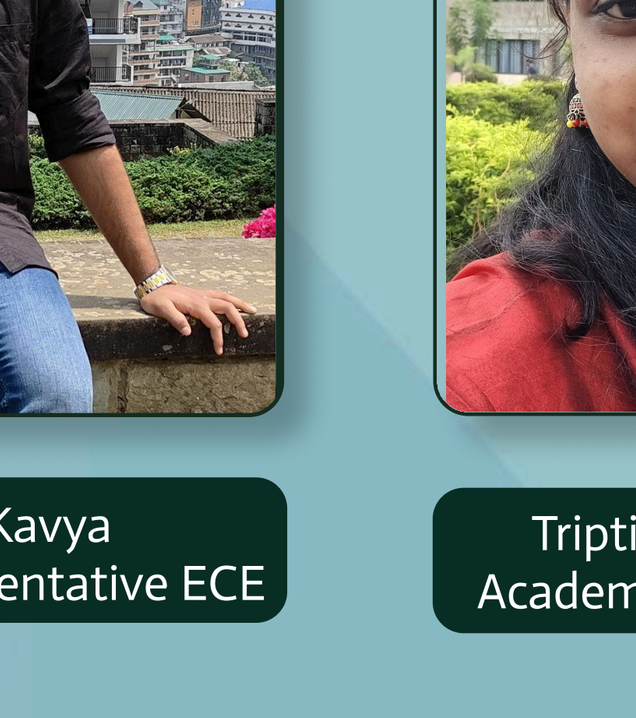

Aditya Jain
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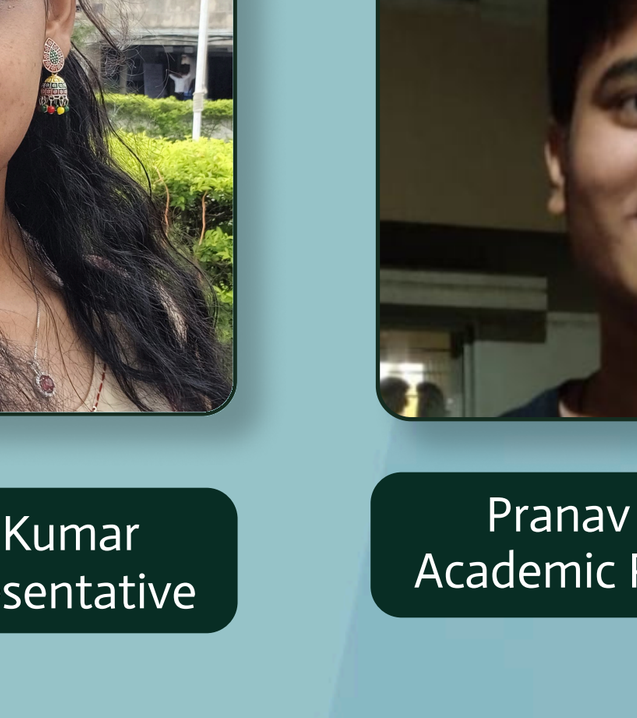

Kushal Dornahalli
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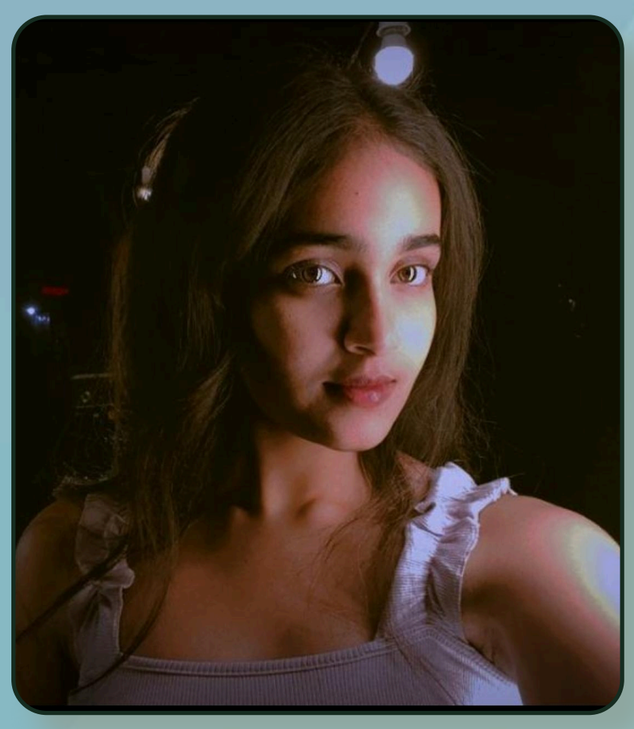

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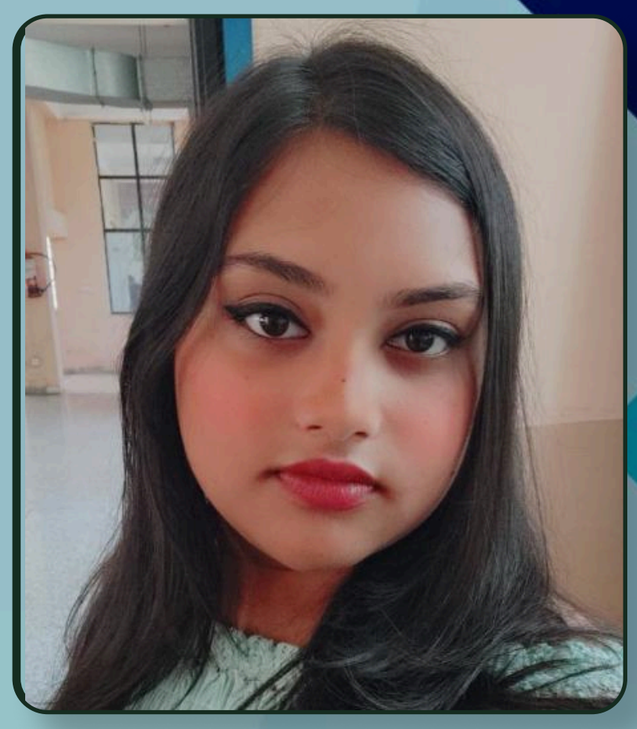

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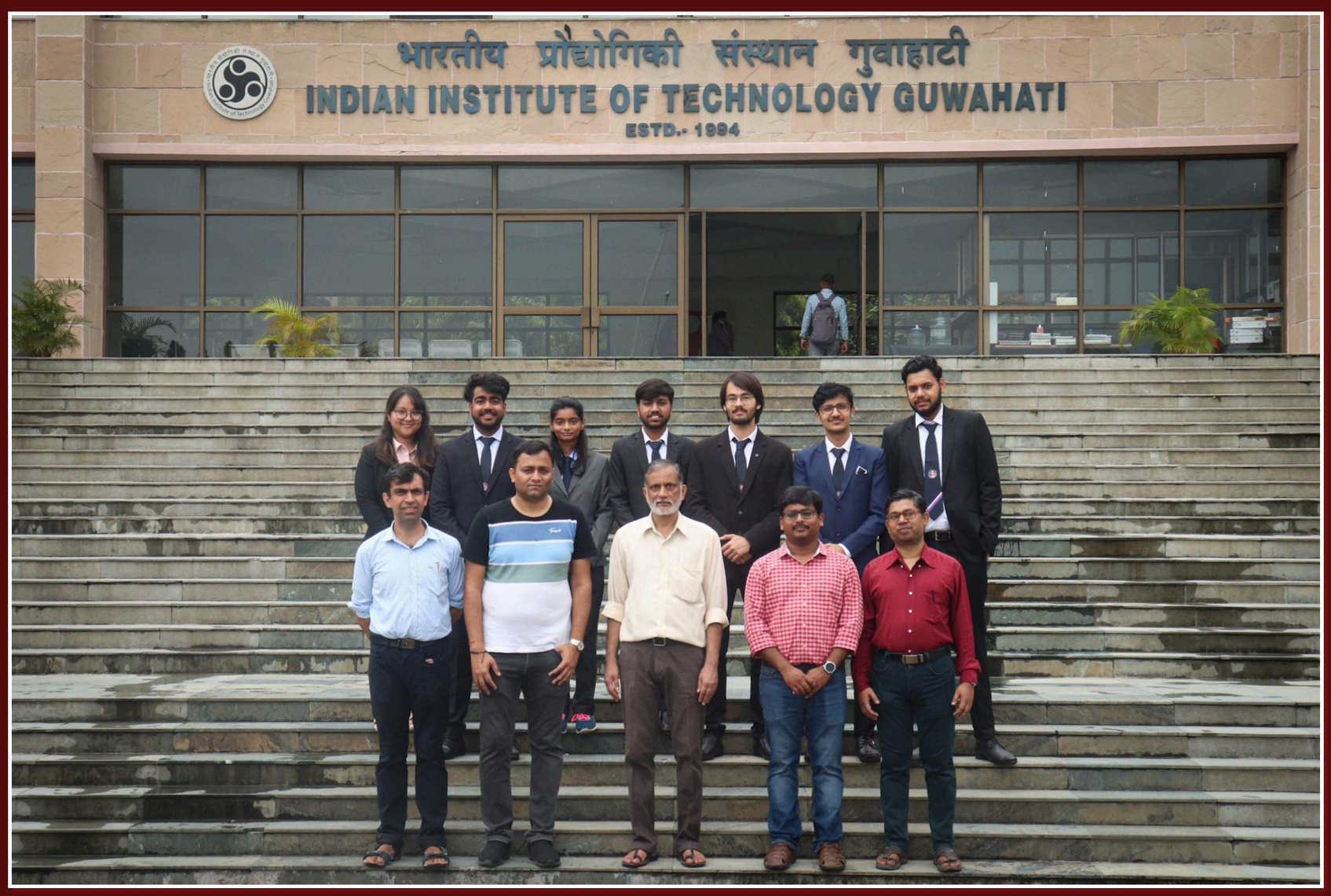

Cepstrum Mentors

2024-25