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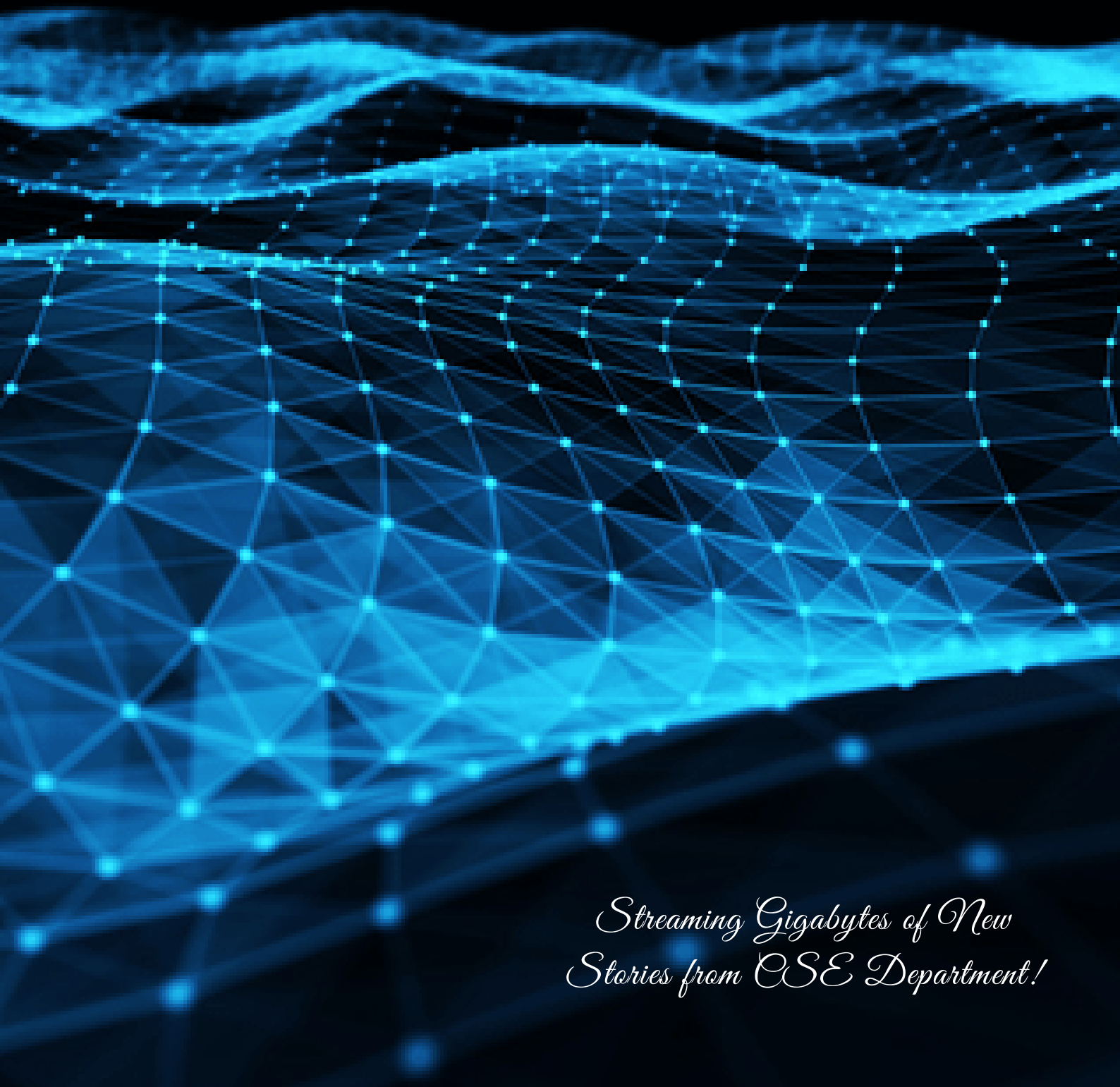


Streaming Gigabytes of New Stories from CSE Department!

contents

A Day With Biswa!

Prof. Biswabandan Panda
Computer Architecture for performance and security
CASPER Research Group, CSERL Lab

Research & Labs

I will try to give you a high level, a 10,000 view because otherwise, it will be too technical and boring. So, I work in the field of Computer Architecture, lowest level in the entire computing stack. If you look at all the courses you take during UG, architecture is the bottom of the stack and after that, you start talking to maybe transistors or maybe above that, from protons, from where physics start coming to picture.

So, I try to work in that interface which deals with improving the performance of modern systems, including desktops, laptops and mobile phones. I also work on making it secure from last two years. A pretty high level, high school level answer is that I try to make computing devices secure and faster.

I started a group called **CASPER**. It stands for Computer Architecture for Performance and Security. It is under the umbrella of SYNERGY, which is a bigger lab in terms of systems research. You work with other faculty members who are part of SYNERGY. There is no specific architecture lab per say, but there is a group specifically for the architecture.

Involving Students in Research!

I think in today's world the best thing is to email. On a lighter note, I can also take a call!

On a serious note, you should be aware of what I do. I expect that you have at least gone through my course webpage, lecture videos and there should be some understanding about what I am doing, at a pretty high level. I don't expect experts to join my group, then there is no role of me being here in the department. If all others are experts, then there is no need of faculty.

Those are are the initial hiccups that usually students have, like what should be your first step, but mostly based on my limited experience, it is not that technicality that matters, it is the non-technicality that matters, like how passionate you are about anything. *You persevere and persist continuously even if you fail.* These are the qualities that I kind of expect, no matter whether you are a UG, PG, CS, non-CS, IITB or non-IITB.

> ***I usually call it 3P- Passionate about, Persevere and finally, you should be Professional.***

At the end of the day, no matter what you do, where do you go, people will expect that you behave professionally. These are the places where you start learning professionalism. As long as you have these 3Ps, you are more than welcome to work with me. I will take care of the rest of the technicalities.

I will give you example. So at IIT-K, I had students from Mechanical and Material Science who have done awesome in research and now they are doing PHD in Georgia Tech in CSE. I hope that answers all the questions that you have. It does not matter, at least for my research area, Maybe in other areas, you should be good at Mathematics or statistics, or ABCDE'S, but I need these 3Ps that I talked about. As long as you have those 3 P's, I will take care of this.

But having said that, it is fairly difficult to get folks with 3Ps in today's world.

Getting Started in Computer Architecture

For my field of research- computer systems, it is a bit different from other areas of research in the sense, that no, it is not a sacrosanct research as per say. It is not a pure scientific way of doing research, it is more experimental, you kind of do something, observe it, find out new insights and come up with a new idea. It is kind of iterative process that we try day in day out.

A simple example that I usually give to second year undergraduates, that you must have gone through simple physics experiment about finding the value of g, that is 9.8. Did you get 9.8 during your experiments?

That is what we do. But if you compare with other areas, you have precise answers. You will have algorithms, there will be lemmas, there will be proofs. Here is not like that, here the kind of question is like if something works, why and if something does not, why not. And then you try to find out the answers by experiments. There is no theory. And that is why maybe I kind of enjoy it, not because I don't appreciate logic, but I can't use my brain to apply logic, lemmas and proofs. If I see things happening, that is all, the is the best proof.

Teaching & Courses

I really did not do anything different in the online mode, but even in the pre-COVID era I used to offer the courses in a different way. The main reason for that is, all of you, UGs and PGs, are good at writing exams. You have cleared the toughest exams as per the media. So there is no point in testing again whether you can write, earn marks in the exams in my course. That is my personal opinion, I am completely fine if others disagree. So what I instead try to do, is to assume all of you are intelligent, which is why you are here at IITB. You have cleared the toughest exam and all, now what to do with that intelligence? So can we move away from exams and try to do something that is not predefined or predetermined? A bit of hiccups in the course? The folks who have taken my course this semester, maybe they will give you a better answer. The last part of the course, it was completely exploratory based. There was no support for TA's or me, and they have to learn on their own.

I believe this is the key, because you have to learn on your own. It is not 1970s or 80s where someone has to teach you things! Currently, it is like teachers are more like facilitators. They will tell you that this is one of the ways to learn, but it is not the only way to learn. You find your own ways. Initially, when I started this so called way of doing it, there was resistance. So if you look at my course feedback for the first course elective at IIT-K, it was...just forget about it! But from the very next year onwards, it improved and then last few courses that I taught at IIT-K, they were amongst the Top 5 courses at IIT-K. We are used to the typical way of courses, where you write the exams, there is competition for grades, there will be race for AA, BB. Instead of that, I ideally appreciate if someone fails and then bounces back during the course. I appreciate that, because at the end of the day, everyone learns at a different rate. If I put a fixed deadline, say Sunday night 11:59 pm, you have to submit it or else it is zero, it is for most, but not for all. I used to make it more fun oriented, where you make mistakes and there is no penalty for making mistakes. In fact, I used to give bonus points if you failed successfully. So you may find that some of the folks who have low CGPA, they might have very high grades in my course. But I do not know whether it will work here at IITB, I have to wait and watch.

Ditching the Sir Tag!

The primary reason as I already mentioned that in today's world, we are not the teachers but facilitators, and it is not like, only students learn from prof. It is also that profs learn from students.

So it is kind of mutual exchange of ideas, interactions through debates and discussions. And unless, you feel free, you won't be able to do that. So unless the way you talk to your seniors, say on WhatsApp, unless you do that with "Prof", you won't be able to spell it out where exactly your issues are, where exactly you are struggling, both academically and non-academically. So that was the primary reason.

However I completely respect the idea behind calling Sir, Madam, or Doctor. I am not against them but yes, this was kind of motivation behind encouraging profs to just to use the name. In fact at IITK, for one of the courses, I started calling students as dear students, instead of their name. So, instead of Parth, I would say- "Dear Student would you mind asking your question?" It went on for 2-3 weeks and they found it really weird. They said that we have a name. I said- C'mon, even I have a name! Why are you calling me Sir?

But yes, at the same time, I completely agree with the other side of the world, where they say, no, no, we should give respect, we should do all the things that we are trained and learned. I completely agree, I am not saying don't do that.

Sharing 2 Cents!

Advice is already there, like the 3P's advice that I talked about. Basically, try to fail. Fail when you are young so that the consequences are not that high, for example if you fail now, there is nothing to lose. If I fail now, there is a gap of 15 years or so! Yes, fail and learn from those failures and bounce back.

That is how things are and then, it is always good to have perspectives from everyone, because at the end of the day, you make your own decision.

You know there is this, I hope you must have seen this movie- "Invictus" which has this famous line:

> ***I am the Master of my fate;***
> ***I am the Captain of my Soul***

Your goal is that movie! That should be part of the curriculum.

I also remember a poem that motivated me to do something different 10-12 years and looking back I strongly feel it correlates with the Indian education!

"A young Apollo, golden-haired,
Stands dreaming on the verge of strife,
Magnificently unprepared
For the long littleness of life."

-Frances Cornford

The way we start with high school, then coaching, then JEE, and keep on doing what the society, or what the rest of the world demands us to do, and then you get lost in the race. Suddenly you realise, Oh where am I?

We are kind of highly intelligent, and we are at the best place, at least in terms of Indian academia, but we are still unprepared for the 'long littleness' in life, and once, you finish the IITB, and you enter into the real world, suddenly you see that- Oh there are no exams, there are no grades, the world looks different!

That is the main reason behind jumping and doing something different through courses so that we can realise that okay, world is not about the courses and grades. So, do pretty simple things if you can- you know pause a bit and think through it! Otherwise we are running 24/7, and finally, you may not realise but you are done with your BTech.

In an Online sem, it becomes a little bit difficult, but even in Offline sem, you are in for different kinds of things. It is better to pause once in a while, do a little bit of introspection, take a hard break. When I say hard break, I mean completely cut off from Internet, mobile, TV, screen time. That will give you a better perspective. Otherwise, everyone is running through, let's say, Marina Beach, okay, let us all run through Marina Beach. That is what is the current way of looking at things.

Sources: Memes submitted by students in course taken by Biswa (CS 305, Autumn 2021)

Unorthodox Ways of Conducting Courses

Every year, every semester we have multiple written examinations per course - quizzes, midsems, endsems and what not. Since the beginning of time, this has been the standard way to gauge the students' understanding of the course. The transition to online teaching meant that professors had to come up with measures in which the exams could be conducted in a malpractice-proof fashion. However, this transition has also led to the birth of creative grading practices which our professors have incorporated into their courses. Let's first look at some of the courses that employed such creative techniques are:

CS 747 – Foundations of Intelligent and Learning Agents
Prof. Shivaram Kalyanakrishnan

This course did not have any proctored exams and the focus of the professor was on continuous learning via take-home weekly quizzes. Along with that, the application of the methods taught in the lectures was given more importance as assignments were given higher weightage The professor also wanted to judge the comprehensive understanding of the students about the course and thus, kept a take-home endsem in which students were given 10 days to answer various application-centric questions.

CS 771 – Foundations of Verification and Automated Reasoning - Prof. Akshay S

This course did not have any proctored exams and the professor was keen to keep a check on the students' understanding of the course topics by taking weekly progress quizzes on Moodle. Students were asked to present a research paper of their interest and peer questioning sessions were conducted to grade students' ability to answer queries related to their topic. This turned out to be a good way to promote peer learning in an online setup. For the Endsem examination, students were given a choice between a take-home exam or a lightweight homework + paper presentation.

CS 760 – Topics in Computational Complexity
Prof. Mrinal Kumar

The intention of the professor for this course was that students learn as many new concepts without worrying much about marks. The course evaluation structure consisted of a couple of homework assignments, a take-home endsem exam, and a course project in which students had to present their analysis of a research paper in some relevant field.

CS 754 – Advanced Image Processing – Prof. Ajit Rajwade

This is one of the courses that adopted an assignment-centric evaluation scheme well before the education moved online. The professor chose the road not taken by balancing the weightage between assignments, exams, and the project. There were assignments for each topic in the course which consisted of both theoretical and programming questions. The midsem and endsem exams were conducted as usual but had lower weightage compared to the typical.

Giving higher importance to assignments motivates students to also focus on applications of the theory that they learn. Given that students do not adopt unfair means, these evaluation techniques are a much better test of students' understanding of the course content as compared to a time-bound test. In an online setup, that has led to a dearth of in-class or in-hostel interactions among the students, these creative techniques provide an opportunity to encourage peer-to-peer interactions and thus, helped counter this important online setup problem. Reading research papers and presenting your analysis in front of the class develops a students' critical and independent thinking ability and also boosts their confidence. In contrast, an exam-centric approach often leads to students adopting rote learning as their mode of preparation. Also, our institute encourages students to participate in extracurricular activities, and such courses help students to manage time for other activities alongside their studies.

However, the effectiveness of such evaluation methods heavily relies on students maintaining the honour code. Checking for plagiarism in take-home exams which are typically hand-written is another cumbersome challenge. We tend to retain things that we learn for an exam for a longer time. If all the exams are made take-home, the students are not expected to memorize any concept because the course material is available at hand for them to refer to. Hence, the retention of the topics taught in the course could be low. One of the methods to promote peer learning is to incentivize students to take part in discussions on the online forums established for the course. However, this often leads to unwanted spamming as has been observed in the past, defeating the whole purpose of the idea.

These unusual approaches have been the ray of light in the online era where effective teaching has been a very difficult task. Change is an essential step in the path of evolution and these changes have received a unanimous welcome from the students. We thank our professors for coming up with such amazing ideas and hope that by covering this subject we will see a lot of other courses incorporating such innovative techniques in the upcoming semesters.

ADDITIONS TO CSE CURRICULUM!

COMPETITIVE PROGRAMMING

Competitive programming is a **mind sport** usually held over the Internet or a local network, involving participants trying to program according to provided specifications, in order to gauge their **logical** and **mathematical aptitude**.

77% students interested in the Course!

Courses
- **Stanford: CS 97SI** Introduction to Programming Contests
- **NUS: CS3233** Competitive Programming

ROBOTICS

Robotics is an interdisciplinary branch of computer science and engineering. Robotics involves **design, construction, operation, and use of robots.** The goal of robotics is to design machines that can help and assist humans

68% students interested in the Course!

Courses
- **MIT: 2.12** Introduction to Robotics
- **Stanford: CS223A** Introduction to Robotics

GAME DEVELOPMENT

Game Development is the process of **creating games** and describes the design, development and release of a game. It may involve concept generation, design, build, test and release.

69% students interested in the Course!

Courses
- **Stanford: CS 146** Introduction to Game Design and Development
- **Harvard: CS50** Introduction to Game Development

GAME THEORY

Game theory is the study of mathematical models of **strategic interactions** among **rational agents**. It has applications in all fields of social science, as well as in logic, systems science and computer science

65% students interested in the Course!

Courses
- **IIT Bombay: IE 616** Decision Analysis and Game Theory
- **NUS: MA4264** Game Theory

COGNITIVE SCIENCE

Cognitive science is the interdisciplinary, scientific **study of the mind** and its processes with input from linguistics, psychology, neuroscience, philosophy, computer science/artificial intelligence, and anthropology. It examines the nature, the tasks, and the functions of cognition.

34% students interested in the Course!

Courses
- **MIT: 9.01** Introduction to Neuroscience
- **MIT: 9.10** Cognitive Neuroscience

FINANCIAL MODELLING

Financial modelling is the task of building an **abstract representation** of a real-world financial situation. This is a mathematical model designed to represent a simplified version of the **performance of a financial asset** or portfolio of a business, project, or any other investment.

55% students interested in the Course!

Courses
- **IIT Bombay: SI 527** Introduction to Derivatives Pricing
- **Stanford: FI350** Corporate Financial Modelling

CYBER SECURITY

Cyber security is the application of technologies, processes and controls to **protect systems**, networks, programs, devices and data from cyber attacks. It aims to **reduce the risk of cyber attacks** and protect against the unauthorised exploitation of systems, networks and technologies.

84% students interested in the Course!

Courses
- **MIT: 6.857** Network and Computer Security
- **MIT: 6.858** Computer Systems Security

SOCIAL IMPLICATIONS OF COMPUTING

Study of Social implications, including economic inequality, lack of diversity and inclusion, and **bias in data** and systems to consider Human rights as well as **potential impacts** on the labour market, and issues around transparency.

26% students interested in the Course!

Courses
- **University of Waterloo: CS492** The Social Implication of Computing
- **Stanford: CS 278** Social Computing

QUANTUM COMPUTING

Quantum computing is a type of computation that harnesses the collective **properties** of **quantum states**, such as superposition, interference, and entanglement, to perform calculations. which delivers a huge leap forward in computation to solve certain problems.

72% students interested in the Course!

Courses
- **IIT Bombay: PH534** Quantum Information & Computing
- **Stanford: CS 269Q** Elements of Quantum Computer Programming

BIO-INFORMATICS

Bioinformatics is the application of tools of computation and analysis to the **capture** and **interpretation** of **biological data**. It is an interdisciplinary field, which harnesses computer science, mathematics, physics, and biology

38% students interested in the Course!

Courses
- **NUS: CS 2220** Introduction to Computational Biology
- **NUS : CS3225** Combinatorial Methods in Bioinformatics

*For the statistics, a form was shared amongst the students of all batches in the department.

Questioning the Defined CSE path!

Craxxx bro! Day 1 intern lag gayi, ab toh paisa hi paisa hoga...

You read your friend's story, and a surge of accomplishment runs through you. A few seconds later, the story changes to an ad for the latest Nike shoes. Will you be able to afford these shoes with your internship stipend? Hmm...

Is the above a glimpse into a moment in the life of an average IITB CSE topper, finest cream of the nation? Perhaps. Is it what one might have expected it to be? Perhaps. The fact remains - at present, the wish to live as many such moments as possible guides the choices that many of these toppers make at college.

Is this wish a good guiding light on the path we walk at IITB? Maybe - or maybe it acts as a bulb that is close to fusing, hanging precariously over the narrow alleyway that we all try to force ourselves to fit into. Fighting like hyenas against each other to get ahead, one misstep and we find ourselves in someone else's shadow, and end up losing sight of the light altogether and getting trampled under someone else's new Nike shoes. The problem: the entrance of this alleyway is so deceiving, has so many flashy sign boards surrounding it, that we forget how dark can get for some of us in between. We forget that it is often a wiser choice to step a little to the left of the entrance, and find better lit streets that we can walk more comfortably and confidently on.

We forget that the grass is greener on the other side irrespective of the path we choose (provided of course, that one is willing to work hard for something that they believe in). Then why not choose a path where the light suits us better?

Respecting that everyone has goals that they want to achieve, and has reasons for the same, we want to ask you - are your goals your own, or has the rush of the madding crowd decided them for you? Because entering the alleyway may seem easy at first - at least you'll have company - but I think a lot of us who have been in the midst of it and gotten the short end of the straw, know how lonely it can actually be.

The signboards surrounding the other streets maybe aren't that brightly-colored - but the streets themselves definitely have just as much (if not more) to offer as the alleyway. And the best part is - you can switch from one path to the other even after you have entered. Yes, it may be easier to let the crowd carry you along, but if you find that their goal is theirs and not actually your own, don't hesitate to take the first exit you see. Walk along the quieter streets, use the peace to reflect.

If you find your way back to the alley out of your own free will, all power to you. But if you think the silence suits you better, don't be afraid to walk ahead! The path may be lonelier, but you will know it is your own. And who knows, the courage to define your path for yourself may inspire others to branch out from the alley as well.

Several questions and thoughts come to our minds when we think about our careers.
What do I do exactly after college? Should I get a job or pursue higher studies or research? Am I doing what I enjoy? Which fields do I really want to explore? Are these the only things that I can do? Are there more options?

These all questions seem normal but at the same time can be very confusing or even stressful. At times we even doubt ourselves whether we are on the correct path or not. We don't always know what exactly we want.

These uncertainties can make us cling to the familiar, especially when it comes to our careers. Thus, we tend to follow what most people around us are doing, which feels like a "safe" option to us. Sometimes, we don't even think of exploring a path we like simply because no one is doing it, or because we don't have enough information about its future scope.

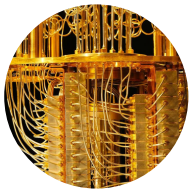
We need to change our perspective about such situations. Don't just pursue a thing you don't like just because most of your friends are running after it. And even more importantly, have faith in yourself and try out what you appreciate, even if you can't find anyone alongside you. Once you make up your mind, you are halfway done. There are countless opportunities out there in any field, you just need to choose the best path for yourself and try it out. If you are unsure about the field or its scope, you can always talk to seniors or alumni that are in the same field. They can help you with any questions and doubts you have in your mind.

There are many new fields and opportunities that most of us don't even know about. We often hear about placements in the fields of software engineering or in data science or quantitative trading. But there are several other fields as well, like, cybersecurity, network engineering, blockchain, quantum computing, cloud computing, and many more. This list is not at all exhaustive. You can pursue either research or jobs in any of these fields. Even if you are unsure about trying out what you like, you can just give it a shot and see what happens. There is no rule that you cannot change your field once you enter it. In fact, it can be easy to change fields in many cases. Also, at the initial stages of your career, it is normal to try out various fields and select what suits you the most.

Always keep in your mind that you can do anything you desire. It is your choice what you want to pursue in your life. Just have faith in yourself and don't be afraid to try things that you like.

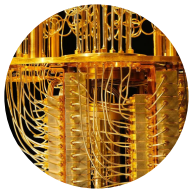
As a closing note we quote the poem "The Road not Taken" by Rober Frost which perfectly sums up our thoughts!

"Two roads diverged in a wood, and I—
I took the one less traveled by,
And that has made all the difference."



Quantum Computing & Information Theory

Interview with Prof. Sai Vinjanampathy (Physics, IIT Bombay)



Let's start with a brief introduction about this domain, can you please explain what Quantum Computing & Information is all about?

Quantum computation and information theory (QIT for short) is about what happens to classical computation in the presence of quantum mechanics. I urge you to recall that the behaviour of the "software" of the universe is governed by the rules of computer science whereas the rules of the "hardware" are governed by physics. For example, if you think of a black hole as a computer which accepts matter as input and outputs radiation, this changes your perspective on what that object is, bringing ideas from computer science to pollinate our point of view of physical systems. Likewise, if I think of software as a physical process happening on a machine, ideas such as Landaeurs erasure limit appear. So this cross-pollination between hardware and software is quite fruitful.

Within this context, QIT is an attempt first and foremost to understand what a computer will do if it could access its on quantum mechanical nature. This means one has to understand computer science where the physical model underneath of the physical device that the computation is being performed on is quantum. So this is one explanation of the field of quantum computation. This can of course be extended to ask questions about other technologies. For instance you can ask if sensors made to detect electric fields, magnetic fields and so forth would benefit from being able to access their own quantum nature. Would that be better for the outcomes of the sensor in your phone or smartwatch? Or would that be worse? The answer in general is that it would of course be better, but to understand this you need to understand the theory of quantum computation.

Is Quantum computing an emerging field these days? What makes it exciting?

Yes, it is an emerging field these days. Though the seed of the idea has been with us since Feynman in the early 80s, Shor in the mid-90s showed that QIT has implications on security. This and other results by Grover, Simon, Vazirani etc to name a few people really established that there was something to this field. This led to about 20 years of research mostly in labs and universities. What causes me to describe this field as emerging now is the fact that companies like Google and IBM have started developing large scale quantum computers for commercial use. Furthermore, nation states around the world, including India with the so-called NMQTA program, have promised Billions of dollars of investment towards bringing quantum technologies to industry. Hence the description.

What kind of opportunities does this field offer in terms of career growth and development? Can we expect more job opportunities in this domain in the future?

The old saying goes that you should never predict the future, but yes, the trend seems to be that for a while now, the demand for a skilled quantum workforce will far outstrip the supply of qualified and mature scientists and engineers, who are being trained in our very institute.

As I mentioned, there are large companies investing in everything from hardware to algorithm development, so there are bound to be jobs for folks with a variety of interests. Furthermore, ther are several specific companies that hope to provide quantum computing services to solve complex tasks in pharma companies, drug design, operations research etc. its a good time to do quantum computing.

What courses do you offer in QI&T? Is there any specific order in which students should take these courses?

Since instructors for courses usually change over time, let me answer this with regards to courses and not with attention to just myself. The core quantum information course in the institute thusfar is the quantum information and computation course, currently taught by Prof. Himadri Dhar. Another theorist in the physics department is Prof. Santra, whose courses I also recommend. If you zoom out and talk about experimental condensed matter physics and quantum materials, which are a well recognised part of the experimental effort towards QIT, then various professors work in this area.

Look up the courses given by Profs. Mahapatra in the physics department and courses offered by Profs. Bhaskaran Muralidharan, Kasturi Saha and Swaroop Ganguly. I would also chat with Prof.Avradeep Pal from MEMS who works on superconducting devices.

You manage the QI&T@IITB lab. Can you please tell us more about it? What kind of research work does the group do? And what are you working on currently?

My group works on three themes. The first is quantum information theory persay. Let me give you an example or two of projects I have worked on in this area. With colleague Carlos Perez Delgado at Uni Kent in the UK, I coauthored a paper on the implications of quantum computers on universal classical computation. On a different note, with dual degree EP student Policherla, I coauthored a paper on how noisy quantum computers (so-called NISQ devices) can be engineered to perform quantum control. This was a theoretical proposal for "device engineering" combined with theoretical tricks to implement control.

The second topic I work on is quantum control theory. This topic involves solving important problems to control quantum systems to come up with either experimental designs or control protocols (or both) to engineer outcomes desirable to the quantum computing community. I note that since machine learning, optimization and control are closely related areas, I also work on machine learning of quantum systems. The aforementioned paper on quantum information is actually about performing control algorithms on NISQ devices using techniques from the quantum machine learning community. On a sidenote, let me highlight Prof.Navin Khaneja who is a real expert on this topic and works in the Systems and Control department.

The third topic I am interested in is non-equilibrium quantum thermodynamics. This is a vast topic with decades of work, so I am by no means the expert. Having said this, my recent interest in this has been in the field of optimal engines and refrigerators in the quantum regime. This alongside some of the work we have done with Prof.Bhaskaran's group has been about contributing realistic quantum technologies beyond computers. For example, with students Adil Khan, Anuranan Das, Parvinder Solanki, and coauthors who passed through IITB, Prof.Bhaskaran and I worked on an "engine" whose output is not mechanical work, but entanglement. This weird device can with modifications be implemented in quantum dot architecture like the one in prof.Mahapatra's lab and can serve as a tiny engine that emits entanglement on demand. This preprint can be seen here.

How can interested students get involved in the research work under your guidance? Do you have any advice for those who want to get started in this domain.

I encourage folks to come in via an SLP route and transition to a BTP/DDP. This is because learning the ropes of this new and exciting field already takes about a year, and hence real progress takes about two years to achieve. Just come chat with me and also talk to my group members to get a good sense of what we do. I recommend take quantum mechanics course beyond 107 (something with bra-ket notation) followed by the quantum information theory course. After this, come talk to the various faculty members I have mentioned to find mutual interests.

MARVEL CROSSOVERS WITH CSE IITB

FRESHIES

SPIDER-MAN

Peter Parker is a brilliant young student eager to explore the insti culture. During the weekends, Peter often visits Sameer Hill. He wishes to become just like his ISMP Mentor - Tony Stark, and taking inspiration, he has been dedicated to academics from the get-go!

MS MARVEL

Kamala Khan is the most cheerful and enthusiastic person one could meet! She loves exploring new domains and meeting new people. With eyes beaming, Kamala screamed with excitement when she met her idol alumni- Carol Danvers, a.k.a Captain Marvel, last week!

SOPHIES

DEADPOOL

Wade Wilson, a.k.a Deadpool, is a second-year student. He loves to stay active amongst the Freshies Whatsapp Groups, where he spams his sticker collection and shares poor guidance with his fellow juniors. Amongst his batchmates, he is well known for his RG - Antics.

WOLVERINE

Logan has no clue why he took Computer Science and Engineering. He does not remember when was the last time he studied or bathed! He does love to go to Gymkhana for weight-lifting, but most of his physical activity comes from the regular fights he gets involved in. Well, if you wish to conduct a GPL, you know whom to contact!

THIRDIES

MR FANTASTIC

Meet Reed Richards, a.k.a. Mr Fantastic! Often seen in the reading halls of the Central Library, Reed loves working on research projects, tackling difficult problems and expanding upon a perfect solution. With his scientific brilliance and a perfect academic score, Mr Fantastic looks forward to making a career in the field of computer science research!

DOCTOR STRANGE

Well known as the Coder-Supreme, Stephen Strange holds expertise in Competitive Programming. With years of practice, Stephen has mastered the time itself, solving the most difficult problems fairly quickly. He looks forward to participating and perhaps, winning the ICPC next year!

BLACK WIDOW

Having taken the Cryptography elective, Natasha Romanoff has developed an interest in the subject. She is a member of the Cybersecurity Club and often participates in different events and competitions related to cybersecurity and ethical hacking. She loves to roam around the whole campus and the city of Mumbai with her best friend, Clint Barton, a.k.a Hawkeye!

FOURTHIES

CAPTAIN AMERICA

The best way to describe Captain Rogers would be honourable, humble and hard-working. Throughout the years, Steve has worked dedicatedly in various positions of responsibility, and his unwavering devotion to bringing change is inspiring. He finds content in service, and for the same reason, Steve has started preparation for the IAS exams.

IRON MAN

Tony Stark's confidence is only matched by his passion for innovation in technology. Tony has led multiple projects working as a Senior member of DevCom Team. Launched in his third year, his AI Startup- named "Stark Industries", has been a source of motivation for many students.

HULK

Unlike his outgoing best friend Tony, Bruce Banner is a bit more reserved and reticent. He loves reading literature and working on different projects with Tony. One such project was "Ultron" which we prefer not to talk about in the insti. Though soft-spoken and polite, it is well-advised not to make him angry!

UNKNOWN

THOR

No one knows how long Thor Odinson has been in insti, but rumour has it that he is much older than he looks! Could be ten, hundred or a fifteen hundred years! What we do know is that he misses his roommate Loki often, who graduated a few years back. Thor loves his Electric Guitar "Mjolnir". You should have had a glimpse of him playing "Thunder" last year!

PROFESSORS

THANOS

Thanos teaches an elective course on Computer-Resource Optimization. His courses are considered the most dreadful across the Department because he likes to pass only half of the students that register. "Perfectly balanced, as all things should be!" Thanos smiles as he snaps away the CPI's of all the students.

NICK FURY

Nick Fury teaches the Department Introductory Course, or as he likes to call it - "The Department Initiative". He looks forward to training this year's batch of talented and enthusiastic cadets, such as Peter Parker, Kamala Khan and Groot.

RISE OF THE CSEC

The Past, the Present and the Future...

CHINMAY AWALE
CSE, IIT BOMBAY (BATCH 2020)

EARLY DAYS AND STRUGGLES STARTING UP

HISTORY THE DARK AGES

The initial problems with setting up anything is always gaining the momentum. Akash (Akash Trehan, Founder, B.Tech CSE, batch of 2019) had to start from the bottom. It started from convincing people that there was a problem that needed to be solved. The problem simply was even though there was a lot of coding culture in the insti – WnCC, Finace clubs, departments like CSE and EE, the issue of security is conviniently skirted over by programmers and this called for a dedicated security club in insti.

Mind you, such sub-clubs were established with great enthusiasm in my tenure as a volunteer, but the issue was publicity and reach due to which these niche clubs could not survive even for an year. There was also deliberation as to whether the club should be under CSEA or ITC. Influence in CSEA, freedom that came with it (from decisions of ITC) and also the ability to exclusivity to active members in case of some resource constraints (something that would've been difficult to implement under ITC) were major factors in the decision of establishing it under CSEA. Also, since professors have a busy life, Akash recollects it was difficult getting replies from them too!

"THIS WAS NOT WITHOUT RETALIATION, THERE WAS SOME OPPOSITION AND SKEPTICISM ABOUT THE CLUB AND WHY IT COULD NOT BE A SUB-CLUB AFILIATED TO WNCC"

ROLLING IN THE DEEP

The club started late in 2016. It didn't immidiately gain traction, in fact to this day people are unaware of the existance of the club. I was also oblivious too till late 2017 when during a fateful meeting with WnCC managers, (Akash was a WnCC convener in 2016) he decided to record a video on buffer overflows on the WnCC channel, (which can still be found till date on WnCC YouTube) eventually I was tasked with editing the video and thus began my voyage with the so called CSeC club.

The gears of the machine were in place: the club had a name, logo, facebook group, mailing list (now inactive), but it lacked a crucial element, the manpower. This is where we came in Rishabh Raj, Yash Shah, Aryan, Rupesh, Ashish Mittal, and I (All B.Tech, CSE, batch of 2020) formed what can be called the first generation of conveners, although the position of a convener was not officially recognised at that time.

We had a lot of fun arranging the first ever insti CTF GC (and convincing Akash to let us host it from his room and not the dreadful computer room of hostel 7), although the problems had some gaping flaws, we managed to get a very positive response. The same people who doubted the premise of another club now were cheering us on after a gruelling year, both from clubs point of view and academically.

With the newfound enthusiasm from freshers we were also able to organise 'Intro to CTF' session with a full CC103. It was the first time we planned to demostrate attacks live in small environments we created locally. For instance, Rishabh demonstrated XSS vulnerability that could be experienced by the at- tendees by visiting a local server on his laptop, while I demonstrated game hacking by tweaking in game currency in memory. It was a massive success with many freshies eager to interact with us. This was probably the year Sahil (Sahil Jain, Current manager, B.Tech CSE, batch of 2022) entered the institute but I was to know about him a lot later.

MANAGERIAL RACE AND DARK YEARS

Then came my third year and talks of succession to manager position were just around the corner. By this time, Rupesh, Yash and Aryan had left the club and had started working full fledged on Machine Learning problems exclusively and Ashish had started the process of slowly drifting away along with them. The only candidates for the manager position were Rishabh and I. I barely knew anything about security except a bit of reverse engineering and binary exploitation; I deeply respected and wanted Rishabh to become the manager owing to his perfect balance of people skills and web exploitation knowledge despite his disinterest. In fact, he also managed to discover a vulnerability in the placement portal (which probably isn't fixed yet, I hope) and that lent even more credence to my choice of him as the manager.

After that I helped organize a few talks on from prof Vinay Rebeiro and a few from some other students in the institute. Eventually, due to certain circumstances I was away from the institute for the entirety of my 6th semester and cannot give a proper account of what happened during that time. But to my delight, Rishabh took the reins of the club. Unfortunately, the club was mostly stagnant online during majority of this period, with barely any events.

"SO, JOINING THE CLUB IS BASICALLY EQUIVALENT TO HOPING ON THE DISCORD SERVER AND INTRODUCING YOURSELF."

ACTIVITIES - OF THE JEDI COUNCIL

A NEW HOPE

Enter Himanshu and Lakshya (B.Tech CSE, batch of 2021). These guys singlehandedly revived the club from a state of neglect and popularised various events of the club throughout the institute. Himanshu went on to specialize in cryptography and also bagged some medals from NSU Crypto International cryptography olympiad and joined the widely acclaimed CTF team, Zh3r0. Fol- lowing in his footsteps came Sahil, he buttered up Himanshu and developed a deep bond with him over the course of solving problems and CTFs with him. I was not much associated with the club during this time too.

RETURN OF THE JEDI

After a long break from club activities, graduation and an intership later, I decided to reconnect with the club having gained some more security knowledge. This brings us to the activities that our club conducts and how can one join in. The club is very open and aspire to spread our influence far beyond the limited scope of CSE branch, since security is pervasive. To that end, we've also had 3 conveners from Mechanical Department too. As a result, joining the club is a very simple affair. We have a very active discord group with a plethora of resources to suit all your needs. All discussions pertaining to CTF participation and hobby project happen there.

We also have a WhatsApp group, whose membership is a bit exclusive to active members, although we shun the idea of exclusivity it is due to the participant cap on WhatsApp groups, however, we ensure that all important information is circulated promptly on discord. So, joining the club is basically equivalent to hoping on the discord server and introducing yourself. As for activities, we participate in CTF competitions that are organised by various bodies, whenever we find ourselves free. We don't have any flagship event per se. But there are some basic events which you may consider as flagship events namely – 'Intro to CTF', 'Insti CTF' and the latest addition to the rooster, a semester long student run security education course dubbed 'Year of Security (YoS)'. Apart from that, we recently held sessions on linux, python and CTF for incoming freshie batch and have also taken sessions on various topics which can be found on Teams. Hope to see you there, soon.

MIRAI - THE FUTURE

CSEC - THE NEXT GENERATIONS

I am personally very happy the way the club is functioning. The conveners are working day and night (and somehow joking about not working for even longer durations of time. I don't know how they manage that). But going forward there are many things the club wants to accomplish. Obviously, knowledge transfer and blessing everyone with a good time are hallmarks of the club but going forward we want to inspire and keep the club a very inclusive one. Organize sessions on interesting topics to facilitate knowledge transfer, improve our publicity and gather likeminded people.

We also want to appoint a professor as a faculty mentor like a lot of other clubs from other institutes, in order to gain credibility and funding. Eventually, use that funding to establish a CSeC room in CSE department and creating environment for hardware reverse engineering and hacking to pique in- terest of people from other departments too. The list of ambitions is going to expand with time and I'm happy that we have really able juniors who we can entrust the torch to.

"WE ARE CURRRENTLY COLLABRATING WITH OTHER CYBERSECEURITY CLUBS (AND TECHNOLOGY CLUBS IN INSTITUTE TOO) IN THE COUNTRY AND ABROAD, LIKE IIT KANPUR AND NYU. "

HACK THE PLANET!

Online Semester: am I the devil?

POV: It's March 24, 2020 there has been news of some virus called SARS COVID-19 spreading in Wuhan district of China. It is projected that the virus will be a global threat and may as well cause global pandemic if precautions aren't taken. PM announces a nation-wide lockdown for 21 days. Ohkay! 21 days it is... or is it?

Following WHO guidelines to tackle Coronavirus many institutions were closed and all the students were asked to vacate their hostel rooms, in order to avoid spread of the dreaded COVID-19 virus which had resulted in pandemic, and that too on a hysterical level. Eventually government notice came out that dictated that all the colleges be shut and the classes be conducted "online".

And since then it has been more than a year and a half of Online Semester with recorded video instructions, online exams with multiple devices, homes transforming into classrooms, workplace and offices. Hostel common rooms replaced with whatsApp chat groups and Discord servers, events burnt down to series of instagram, facebook stories, posts and google meetings, fests becoming mere YouTube lives. Eventually, this became the new normal-and boom! Freshers never knew college life, seniors never missed their small, packed hostel rooms more, and some never got to say goodbye to the insti the way they had planned.

But as they say, "Worst experiences teach the best lessons". The online semesters definitely came with some of their own learnings apart from what we could grasp academically. The biggest of them all being time-management and the wonders that it does to make our life more efficient and days more fruitful. How can we utilise the time we save because of not dressing up every morning? How do we choose to handle Discord gaming sessions with Zoom meetings? This newfound free time (and the lack thereof) allowed us to introspect and change aspects of our lifestyle. Previously, those who were too tired to hit the gyms after class found an opportunity to try home workouts. Those who never entered the kitchen were suddenly after the *Dalgona coffee* craze. Those who never watched movies discovered the joys of anime. Honestly, not everyone is great at it and those who plan their time well often fail to stick to the same. Eventually, we all say *"Agla sem phodunga!"* with the hopes that we are gonna attend every lecture and make notes and what-not.

> *Discussion amongst friends and acquaintances dropped drastically, Online classes were not as engaging as offline classes and of course rampant cheating and unfair attitude towards honest students.*
>
> *- a Fourthie*

> *The business side of 100s of aspects I learnt at home (from my father), is something that was more worthwhile than just studying in my department (which I was able to comfortably do at home).*
>
> *-Pranav Goyal (another Fourthie)*

Online semester, through its classes, meetings and virtual collaborations taught us how to work synchronously over the internet remotely, interact and collectively work towards goals without even seeing each other in real life. In today's globalized economy, WFH, remote jobs and projects are widely prevalent and we can thank the online semester for training us to handle the same. .

But above all, we will probably agree on the fact that the online semester taught us the significance of face to face interaction and how offline interactions can't be replaced by the online regime. Seeing a loved one over Zoom can never replace the joy of giving them a tight hug in real life. It taught us the importance of friends, who in times like these, kept us motivated through late-night VCs, sharing reels with "this reminded me of you" and having random chats over the phone.

On a lighter note, the online semester gave us a huge amount of texting slang ranging from lol, lmao, to a host of newer terms like afaik, afair, iirc. Not to mention the countless WA sticxx it gave us xD. In some sense this became the unsaid official insti lingo. Nothing to be proud of, but something that can indeed be cherished as a memory.

pros

It gave us flexibility. A person can literally attend lectures from wherever he wants: bedroom, balcony, in the car, you name it. Recordings of these lectures gave us the flexibility to watch it at our own speed (2x huh?), whenever we want. In an offline setting this is hardly possible especially because lectures may or may not be recorded.

The professors became more approachable. Now contacting/discussing something with the professor is as simple as dropping him an e-mail or a MS Teams message. No need to take appointments or wait for the office hours.

Online semester gave us a chance to accommodate our academics in a way that allowed us to explore more and take up more credits. More credits meant more load but online semesters helped us manage them efficiently.

> *Good thing is we had the opportunity to spend time with family.*
>
> *- Thirdie*

Apart from that, owing to the various problems: network connectivity, power outage, medical emergency or any other such issues, the deadline for assignments and labs were softened. We got more time to complete our labs which did become tiring but at the end of the day, helped us submit efficient solutions with proper learning.

cons

Efficiency of online studies is debatable. While one may say that online semesters are more flexible,online studies lack the rigour and the quality of an offline classroom. There have been cases of cheating and plagiarism in an online semester. Don't worry we cover this in detail in a separate article.

The reason why college is different from a school is essentially due to the environment it gives us. In an offline setting, we get to interact with our peers and seniors learn together, fail together, bounce back together. A dynamic campus like ours gives us endless opportunities to explore and develop ourselves not just as a professional but also as a person .

"Yahi baatein to baad me yaad ayegi": 20 years from now when we are settled we won't cherish memories of DSA or any other course, we will cherish the memories that we made as friends, as family. We'll cherish the greenery of Sameer Hill, serenity of Powai lake, random hangouts in Gullu, late night lukkha sessions and group study before endsems, etc. Studying online certainly deprives us of that :(

> *The F in online semester stands for Fun.*
>
> *-anonymous*

From a professor's perspective, as many have said, teaching an empty blank screen hasn't been a great experience for them. For a healthy and successful lecture, closer interaction is preferable. When both are involved in an offline discussion, then they acknowledge each other's presence and only then does efficient communication of ideas occur both from students to professor and vice versa.

This article was one small attempt to analyse both the sides of online semester and give an unbiased opinion on what was truly a rollercoaster ride! There are ups and downs in the article much like our experience in the past semesters. But was the online semester good or bad? Well, some things are best left open for the reader's discretion.

EXPLORING C-MINDS DEPT.

PROF. SUNITA SARAWAGI

"I am a faculty member at Computer Science and Engineering department of IIT Bombay. Since March 2020, I am also the Professor in charge of CMInDS. My area of research is Machine learning, data analysis, and data bases. "

INSTRUCTOR WEBPAGE

https://www.cse.iitb.ac.in/~sunita/

COURSE WEBSITE

https://www.minds.iitb.ac.in/index.php/academics#minor

The C-MInDS department was set up last year and since then has been one of the most popular Minor among students. It'll be great to know from one of the founding professors the motivation behind starting the C-MInDS department?

Students at IIT Bombay, across all departments, are eager to learn about AI/ML and Data Science. We believe that students across the board should learn more, not just to satisfy a demand from the industry, but because of the importance of these areas in R&D across every branch of knowledge. Today, multiple departments offer courses in these areas. There is an opportunity for better coordination between and structuring of these multiple offerings keeping in mind the needs of the bulk of our students. Industry is keenly looking to hire students trained in AI/ML, and we as a country are lagging behind on AI/ML research. A formal minor in AI and Data science is a small step that IITB is taking to address these needs.

There are already courses in Machine Learning, AI and Data Science being offered within the CSE Department. So what makes the C-MInDS department unique? And were there any academic challenges faced in starting this intiative?

The interdisciplinary nature of the curriculum and the opportunities to interact with experts in the application domain spread across various engineering disciplines of IIT is what makes the center different from CS. The major challenge is to handle the huge demand for the two core courses that are part of the CMInDS minor (DS 203 & DS 303). Also, design of curriculum to make it appealing to students of all departments was a challenge.

What was your personal motivation to join the department? What are some of the research fields that you're working on related to C-MInDS?

First, let me clarify that this is a three year position, and I continue to be a CSE faculty. I was asked to serve as Professor-in-charge of the center based on my seniority and relevant experience in the area. The center offers opportunities to interact with faculty and students across other departments at IITB, and AI organizations who wish to collaborate with us. My research has not changed much as a result of this position. I continue to work in machine learning topics spanning structured predictions in NLP, domain adaptation and generalization, low resource adaptation for Indian language and speech tasks, and data analytics. However, I have greater appreciation of their application in other engineering disciplines.

What are the practical applications of this minor and which domain of Computer Science research/field does this train a student for?

The minor comprises two core courses: DS 303 focused on providing the foundations of machine learning and DS 203 on covering the programming aspects of data science and machine learning. Thereafter there are a large number of electives spanning greater mathematical concepts, core AI/ML, and applications of AI/ML across various disciplines.

Data Science is a buzzword these days and the number of career opportunities in this field are growing at a fast rate. How does the C-MInDS minor prepare the students for this increasing demand?

Several large companies in India and worldwide are hiring engineering graduates with AI and Data science expertise. Further, some students may use the minor to decide on further studies and/or a research career in AI/ML. Even though many CS students are already taking several AI/ML courses, the minor in CMInDS allows them to explore courses that stress.

Apart from the minor and courses, what are some of the research opportunities that the department offers?

The center facilitates ties with AI/ML industry and government organizations. This provides opportunities to explore interesting and relevant research projects. Announcements about such projects are circulated with CMInDS associated faculty periodically. Interested faculty may in turn engage students as appropriate. CMInDS runs an AI/ML seminar series that seeks to foster inter-department collaboration.

Are there any opportunities that the department offers for the post-graduate students?

CMInDS already has an IDDDP program and plans to start a MS by Research and PhD program in Fall 2022. We hope to find projects for these students that are developed in close collaboration with companies. Also, we are exploring sponsorship, internship, and fellowship models with industry. We also plan to have a visiting student/exchange program whereby our students can spend time working in other academic institutions or companies worldwide.

What are the future plans for C-MInDS ? Are there any new initiatives that the students should look forward to?

CMInDS will grow to be like a normal department in IIT Bombay. Starting Fall 2022 we plan to offer a MS by Research and PhD degree in AI and DS. Eventually, as the center builds up its own core faculty strength and with the partnership of existing departments in IITB, CMInDS will also offer an undergraduate degree in AI/ DS.

Unravelling PhDs | Talk with Seniors

ANUJ DIWAN

UNIVERSITY OF TEXAS. AUSTIN

Natural Language Processing and Speech Processing

WHAT WAS YOUR MOTIVATION BEHIND GOING FOR HIGHER STUDIES?

There are multiple reasons that motivated me to pursue a PhD after my undergraduate education. Since childhood, I always dreamed of getting a doctoral degree and being able to deeply understand and become the academic authority in a particular subfield of my interest. While my topic of interest has changed and become more specialized over the years, the desire to pursue higher studies has remained. A second reason for pursuing a PhD is that I really enjoyed the research work in NLP and Machine Learning that I did during my undergrad. I realized that I would enjoy pursuing research as a career (in academia/industry) and pursuing a PhD would provide me the requisite skills, background and maturity to do so.

WHEN SHOULD ONE GIVE GRE & TOEFL? AND HOW TO PREPARE FOR THE SAME?

The best time to start preparing and appearing is anytime after the third year winter break. I appeared for them in September (fourth year) after preparing in August. It is a good idea to give enough time to potentially appear a second time in case you didn't get a very good score the first time you appeared. The GRE and TOEFL websites have very detailed information on the structure of the exams, recommended techniques, sample questions, etc. so I recommend first reading all the information that you can find on the website. I recommend registering for the exams before starting to prepare so that you get motivation for studying. For GRE Verbal, I used two free Magoosh apps (available on the Play Store and also I think the App Store) for learning GRE-specific English vocabulary. I also completed the two free mock tests provided with the exam registration and used those to improve my exam solving technique. For GRE Quantitative, I read the ~ 200-page long syllabus PDF from the website. I didn't prepare much for the AWA. For TOEFL, I just practised the free mock tests and practised the Speaking section a bit.

IDEALLY, WHEN SHOULD ONE START WRITING THE SOP? HOW SHOULD ONE GET IT REVIEWED?

You should give yourself about 4 months to write an SoP. What I mean by this is, 4 months before the earliest deadline, you should have figured out approximately what you're going to write in your SoP and should start writing a very rough draft of the SoP. Then, after a few iterations improving it yourself, you should send it out to a bunch of seniors to get it reviewed. You should choose a diverse set of seniors; those who work in your field of interest as well as those who don't, to get a good idea of whether your SoP uses very field-specific jargon or if it is understandable by any computer scientist who doesn't necessarily work in your field. After incorporating their suggestions and making a few more changes to the SoP, you should have your almost-final SoP ready!

HOW DID YOU DECIDE WHICH FIELD YOU WANT TO PURSUE? WHAT IS YOUR ADVICE FOR STUDENTS WHO ARE CONFUSED ABOUT DECIDING THE FIELD?

I got interested in ML after I completed my first ML project as part of ITSP. Starting in my second year, I explored various elective courses on ML and Statistics to figure out what my specific research interests look like. I really enjoyed the ASR course by Prof. Preethi Jyothi and took up an RnD project under her. After completing this project and finishing a BTP under her guidance as well, I knew that I am deeply interested in NLP and Speech. My childhood fascination for languages and linguistics drove me towards this field as well. For students who are not very clear about their field: If you're in your third year i.e. you have another year to go before applications, I'd recommend working on research projects and internships on some of your fields of interest to narrow it down and determine what types of research you really enjoy & what you really dislike. If you're in 4th year, I recommend applying for a Master's degree; in those two years, you'll be able to explore many of your research interests and get lots of exposure to different fields in Computer Science.

HOW DID YOU DECIDE WHICH COLLEGES TO APPLY TO? HOW SHOULD ONE DECIDE HOW MANY COLLEGES TO APPLY TO?

Note that I was applying for a PhD in CS, specifically in NLP/Speech. I checked a) university rankings in CS, b) rankings specifically in my subfield (NLP) and c) general rankings and shortlisted a list of 20-25 universities. These were 'coarse' criteria. After this, I re-ranked all these universities using my own NLP-PhD- specific 'fine' criteria, broadly 1) number of professors working in my field of interest 2) professor fit and my interest in their specific research areas 3) general CS dept/NLP research culture, etc. I ended up applying to 14 universities. I think a general 10-15 universities is a good number to apply to.

WHAT IS THE RECOMMENDED NUMBER OF LORS ONE SHOULD GET? DOES AN LOR FROM THE COMPANY THAT ONE INTERNED HOLD VALUE FOR MS/PHD APPLICATIONS?

3 letters of recommendation are ideal (and also a requirement!). Try to get letters from advisors or supervisors whom you have worked closely with and who can attest, at a reasonably personal level, your abilities and style of performing research. Generic letters, even from famous professors, are not as impactful. Research-oriented letters hold the most value for most MS/PhD applications. An LoR from a company certainly holds value, especially if your letter writer is someone you closely worked with and impressed; the letter will likely be very positive. However, in general, company software development is valued less than company research, which is valued less than academic research. There are of course many exceptions.

WHAT IS THE SCENARIO OF GETTING FUNDING? HOW EASY IS IT TO GET TASHIP OR RASHIP? APART FROM THIS DO WE ALSO GET SOME SCHOLARSHIPS OR GRANTS? IF YES, THEN HOW?

PhD students are almost always guaranteed funding for the entirety of their PhD programs. MS students are almost always not guaranteed funding (with the exception of a few MS programs like Cornell/Princeton), but it is possible to get a TA/RAship in some of your semesters. The ease of getting these positions, as well as whether they pay a stipend or waive off all or some of your tuition, varies widely across universities. There are a few scholarships, grants and loan programs in India, like the Narotam Sekhsaria program, for US higher education. Some universities also grant fellowships at the time of admission, but I am unfamiliar with the selection process.

FINALLY, ANY WORDS OF ADVICE FOR STUDENTS LOOKING TO APPLY IN THE NEXT SEASON?

Be confident in yourself and your applications! Talk to other people in the same boat like your friends who are also applying to grad school; it'll help relieve stress to some extent. Talk to professors and knowledgeable seniors; they often have really great pieces of advice! Know that grad school applications are really stochastic and uncertain, so don't fret too much during or after the applications; just have faith and you'll make it through!

RITIK ROONGTA

NEW YORK UNIVERSITY

Computer Security, Systems Security

WHAT WAS YOUR MOTIVATION BEHIND GOING FOR HIGHER STUDIES?

I had chosen a field with a very niche exposure in IITB. With my current level of expertise (an industry and university intern in the field), I felt not entirely capable enough to contribute to the field. Also, the university internship that I undertook in my 3rd year had arisen in me, an interest in doing research. Since this field of cybersecurity is a growing one, it is not given much focus in the undergraduate curriculum. Due to this, the majority of the Masters's programs in cybersecurity in the US, focus on instilling the basic knowledge of the field into the undergraduates. Hence, for me, the question of MS vs Ph.D. was dealt with reason.

During my undergraduate years, I tried experimenting with different domains like security, HFTs, Data Science, etc. I realized that security fascinated me the most out of them. Definitely, the thing that fascinates you does not necessarily have to be the reason for your bread and butter, but I realized I was not very good with the other fields and my lack of interest inhibited me to work towards improving myself to become industry ready in those fields.
I am still very early on in my career to be actually advising someone but one thing that I want to highlight is that Indian societies are pretty much based on comparison and instant results. It is entirely fine to not earn for some time while your friends are securing packages in crores. But this decision should be backed with appropriate reason. You should be well aware of your own scenario currently and how you project yourself over the years. The bubble that you create around yourself, free from others, should make you confident but with realism.

IDEALLY, WHEN SHOULD ONE START WRITING THE SOP? HOW SHOULD ONE GET IT REVIEWED?

SoP, according to me, is the most important part of the student's application. Hence, one should start working on it pretty early and plan to give it at least a month's time to be ready. A piece of caution here is that one should never consult any other person's SOP before starting his/her as it might shape your opinion quite drastically which can be easily caught by the application reviewers. So the best approach is to start with jotting down points that you want to be in your SOP. Then you should start phrasing sentences and then paragraphs. It is a good indicator if your first draft of the SOP exceeds the word limit by a huge margin which reflects that you have ample liberty to trim it down. Pick up 3/4 reviewers you feel might be good enough to review your SOP. Having too many reviewers can have a negative impact as the SOP might be subjected to a lot of perspectives. Lastly, don't take the word of reviewers as the final verdict. SOP is the reflection of yourself, so the last decision of what goes inside it should be yours.

WHAT SHOULD STUDENTS LOOK OUT FOR, WHERE, RESEARCH ABOUT UNIV/PROF?

Csranking.org is one. The best way is to apply the topic filter and the time filter to a span of the last 5 years. This helps you to filter out those professors who are pioneers in their field but not currently active in research. The next step should be to browse through web pages of every professor/lab you think might be of interest and read about their work, projects, students, etc. I'll strongly suggest contacting professors before actually applying to Ph.D. Firstly, you get to know whether the professor is actively working in the field or is planning to take a sabbatical, etc. Secondly, you get to hear about his lab's work on a first-hand basis. It might help you enormously to decide whether you are a good fit for the lab. Thirdly, very few people take so much pain to contact the professors, and such interactions might tilt the professor's decision in your favor since he has a better understanding of your profile.

HOW DID YOU DECIDE WHICH COLLEGES TO APPLY TO? HOW SHOULD ONE DECIDE HOW MANY COLLEGES TO APPLY TO?

I can particularly speak for Ph.D. here. In the Ph.D. application, the university ranking takes a back seat. Your application process should revolve around professors, their research, and their labs. Some of the very good universities might have the best professors in Computer Science, but they might be lacking the professors in the niche area that you are targeting. Also identifying active professors should be an important part of the brainstorming phase. If one has a very specific bias based on location, college, community, etc. then the choices might differ but on a general level, for a Ph.D., the above three things should be enough to help you shortlist colleges. Again, the public standard is around 10 colleges which I feel is decent enough given the high application fees. Also, 10 colleges give you enough chance of selection while providing you with enough flexibility to include ambitious as well as safe colleges. Personally, I applied to 7 colleges and I never had (or was unable) to make the ambitious/safe bifurcation. I realized all the professors at these universities did work that aligned with my interests and my profile was a strong match with their lab's research. I was planning to apply to EPFL and CISPA as they had some really good security professors but then did not as they had an early deadline.

WHAT ARE THE CULTURAL OR ACADEMIC DIFFERENCES/SIMILARITIES THAT YOU OBSERVED IN YOUR CURRENT UNIVERSITY WHEN COMPARED TO IITB?

There are many differences for sure. Personally, I found the focus on coursework to be less in the universities in the west and more on research. While this could be counterproductive when seen from the industry's perspective, it is definitely helpful for students to develop their interests themselves and at their own pace. The research topics available here are diverse and constricted core curriculum helps students to take up multiple minors in different fields if they find themselves unfit in the core domain, which is a common scenario in almost all Indian universities. Another striking thing is the absence of a university-wide placement cell. I have always been of the opinion that the purpose of a placement cell should not be to actually put students into jobs but only to make them ready for the application process and aware them of the opportunities present. Pan-US portals like Handshake helps to list job vacancies and placement centers of the universities help the students with resume building, interview prepping, etc. This helps the students to actually study the company they are applying to and not merely run behind getting a high package or Day 1 jobs.

FINALLY, ANY WORDS OF ADVICE FOR STUDENTS LOOKING TO APPLY IN THE NEXT SEASON?

I think I would say "Just apply" if you feel you are not industry-ready. It is always good to invest some years in yourself if in the least amount of doubt. And anyway, having the IITB tag would ensure you land somewhere nice no matter whatever path you take.

THE ROOMMATE AGREEMENT

1. THE NIGHTLIGHT CLAUSE

In any case, my roommate would allow me to switch off the lights after midnight, and I would wake him up in the morning. Thanks to the pact, that even though my roomie slept at around 4 am, he only missed one Physics Lab. He later gave a Pink Slip but slept through that lab too, so there's that.

2. THE GIRLFRIEND CLAUSE

If (ever) my roommate gets a girlfriend and brings her to our hostel room, I will pack my belongings and stay in my wingie's room indefinitely. Needless to say, it was just a pipedream, and never saw the light of day.

3. WINGMAN CLAUSE

Self Explanatory. You are encouraged to undertake further readings of the clause in The Friendship Agreement.

4. KEY-HOLDER LIABILITY CLAUSE

As one key got lost for good, the primary job of the incumbent, is to unlock the room after the lecture ends. This subsection was later removed with the invention of number locks.

5. WATER-RETRIEVAL CLAUSE

Alternate night duties to fill up both the water bottles. The floor water supply not being adequate, the roommate is expected to use the water tank, downstairs in the mess.

6. THE PANEER CONUNDRUM

Contingent upon the Service of Extra Veg Specials in our mess, my roommate has an obligation to timely inform me. I shall oblige and inform my roommate in case of Extra Non-Veg.

7. PRIVACY POLICY

One is strictly not allowed (or advised) to unlock the roommate's phone (and by implication, read his WhatsApp chats), as he is asleep, using his thumbprint. The policy, as stated by my roommate, when broken (again) might lead to some stringent actions being taken.

"No hootenannies, sing-alongs, raucous laughter, the clinking of glasses, celebratory gunfire, or barbershop quartets after 10 pm. as well as no whistling, no spontaneous Biohazard drills, or Tuvan throat singing" **Dr Sheldon Lee Cooper**, PhD reminds Dr Leonard Hofstadter, of the Article 23 Subsection 2C on loud noises, mentioned in The Roommate Agreement.

"Hey! Where are the keys?" I asked as I carried my luggage from the auto when for the first time, I witnessed my lush-green campus and beautiful Mumbai rainfall in the last week of July. "With the security guard. Put the luggage quickly, and come to Convocation Hall. The Orientation has started!" my roomie said.

Due to the continuum of quarrels I have with my younger sibling, we always studied in separate rooms and having a permanent roommate for three years, was going to be a big challenge! Still and all, things went pretty well (maybe our consecutive birthdays helped, who knows), and with my roomie, I struck up my first friendship in insti. But when you get teensy hostel rooms (looking at you, H3), tiny adjustments become essential and herein, comes our Roommate Agreement!

The Roommate Agreement might not be a Sheldon-Esque agreement, an evenly spaced and neatly formatted, formally signed, and printed document, but just a bunch of implicit rules, you bound your roomie to follow!

Even though about two years have passed with most of the clauses rendered inapplicable (except the Wingman Clause, quite naturally), these often unsaid but sincerely followed rules of companionship bring back wonderful memories. College friends that you can share all your joy and sorrow with, are but a blessing in disguise. A roommate can be one such blessing (use the following algorithm!) who, like Leonard does for Sheldon, keeps your dear sanity in check!

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Hey readers,

Hope this finds you and your loved ones happy and sound. We are delighted to bring to you the 2022 edition of our department's student newsletter, bitStream. This is the first time we're publishing in the print form.

With this edition, we've gone all in! We've cover interviews with professors, talks with alumni, discussions on some important but untouched topics, and introduced a fun section as well!

We want to thank everyone who has contributed to this newsletter in any capacity. We would like to especially extend our gratitude towards the faculty, alumni and students who graciously volunteered for the interviews and helped us document their experiences. If you have some topic that you would like to be covered, feel free to contact us. Do share your thoughts and suggestions on this edition by writing to us at editor@cse.iitb.ac.in.

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