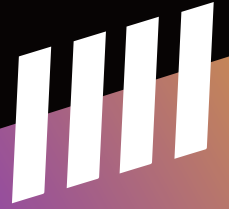




cepstrum

InPhase 2021

17th Edition



✉ cepstrum@iitg.ac.in

📘 @Cepstrum

📱 @cepstrumeeeiitg

📷 @cepstrum_iitg



FOREWORD

It gives me immense pleasure to write the foreword for the 17th edition of InPhase magazine for the year 2021. I congratulate Cepstrum, the students' society of the Department of Electronics and Electrical Engineering, IIT Guwahati whose precious efforts have made this edition of the InPhase magazine possible.

I feel this effort is all the more special due to the following reasons. Firstly this magazine is predominantly initiated and managed mainly by the students of our department. Especially at a time when our country is going through the difficulties and challenges of the present COVID pandemic, I am very glad to see that our students are engaged in creative activities. I think the best way to face the challenges of this time is by doing our responsibilities well. It is noteworthy that the students and others who have contributed articles to this magazine have taken an extra effort despite their normal day-to-day responsibilities.

I would also appreciate the diversity of thoughts presented in this magazine. The discipline Electrical, Electronics and Communication is a fast-changing one and I could see that most of the articles have kept up-to-date with the latest innovative ideas. I am sure that everyone who reads this magazine would relish each and every article.

Thank you team for this joint endeavour demonstrating a spirit of friendliness and sharing. I wish to assist and support all our students while they transform their potential ideas into tangible applications and devices for the need of humanity. As Mother Teresa said, "We ourselves feel that what we are doing is just a drop in the ocean. But the ocean would be less because of that missing drop."

Yours sincerely,

Dr. Roy Paily Palathinkal

Professor and Head, Dept. of Electronics and Electrical Engineering, Professor, Centre for Nanotechnology



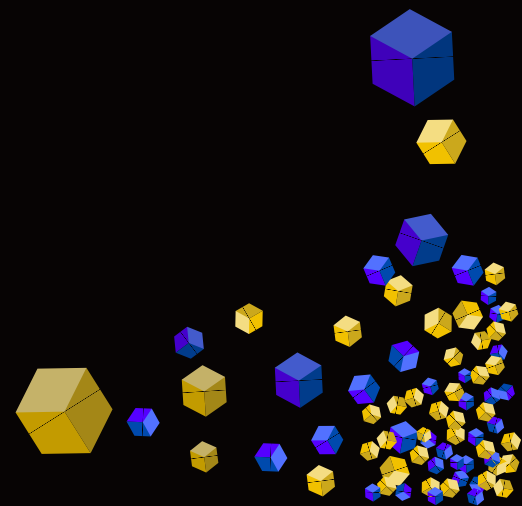
TEAM INPHASE

Since its inception in 2007 (14 years ago), it has been Team Cepstrum's mission to bring forth ever more engaging, new editions of InPhase magazine. This legacy continues year after year, adding to itself new people, new ideas, and new vigour.

In creating the 17th edition of InPhase, we gave our all to capture the EEE department at its creative, tenacious, versatile, ambitious, and innovative best. The past year was full of challenges; curating this edition from our homes being one of them! But once we began, the incredibly meaningful experiences and sheer wisdom contained on every page of this magazine quickly became our driving force.

We sincerely thank the authors for contributing to this edition and for helping us launch InPhase even in this difficult year. We truly hope it turns out to be an enjoyable read for all!

We welcome your feedback, it would enable us to emerge stronger next year!



CONTENTS

Yearn To Learn 6

Dr. Rishikesh Kulkarni

Through The 1s And 0s Of My BTP 9

Balbir Singh

Know All About Cryptocurrency 12

Tanmay Thakur

Data Breach: The Hidden Pandemic 16

Bhaswati Boro

Mixed Signals And Me 19

Mridul Krishnan

Marut: A High Flying Drone Dream 21

Prem Kumar Vislawath

Cruising The Cosmos 26

Tanmay Shreshth

Film-Making Through My Lens 28

Yash Kulkarni

The Do's Of Data Science 32

Gaurav Sinha

Working At A Too Big To Fail 33

Aditya Shekhar





Impacting Lives 35

Aman Dalmia

The Birth Of Parents 39

Chirag Hegde

The Language Of The Universe 41

Shirin Jain & Snigdha Jain

IITG Students' Senate: Behind The Scenes 43

Nishtha Rautela

Life At IITG: A Retrospective 46

Sasank Gurajapu

Art & Creativity 49

Anvita Kodru, Mitali Potdar
Nirupama Jha, Amey Varhade

YEARN TO LEARN

-Dr. Rishikesh Kulkarni

To find anything inspiring, some appreciation about that thing is necessary. Such appreciation comes with an uncorrupted and unbiased view towards it.

When I was asked to write an article for a college magazine, I was not sure whether to say yes or no. Since I could not say no, I agreed. I was told that faculty members usually prefer to write about their research work. Initially, I thought I would do the same. But then I realized, what difference would it make compared to my usual academic work? Possibly only that I need not see sleepy faces reading the article 😊. So I thought of writing something which is not as sleep inducing as Digital holography for quantitative phase imaging. While writing this non-technical stuff, my respect for writers has increased multiple times. It is not easy. Moreover, English is not my first language (not even second for that matter). I might be highly incoherent in putting things together here. I leave it as an assignment to the reader. I am mainly going to discuss two things, inspiration and education. I hope you understand that there is no preaching going on here. These are simple observations I have made, and experiences I have gained which I think might resonate with most of you.

To find anything inspiring, some appreciation about that thing is necessary. Such appreciation comes with an uncorrupted and unbiased view towards it. That is to say, viewing things as they are. But most of the time, we see what we want to see. These 'things' are mostly People. These people are either those around us or those we get to know about by some means.

Inanimate things hardly inspire. They can, at the most, create desire. I have been extremely lucky to find highly inspiring people around me throughout my life. They have guided me on a path which may not be successful (it is a relative term) but a right one. The highly inspiring lectures of my school English teacher made me realize the sheer beauty of languages which goes well beyond the academic curriculum. While everyone was motivating (read pestering) me to study hard when I was moving to another city to pursue my Bachelor's degree, he said to me, *"I won't tell you to study. I know you will. Just make sure that you stay away from bad habits. If you can do that, you can achieve anything."*

After joining my engineering college, I found plenty of highly inspiring people. Despite being a faculty member, I have no reservation in admitting that you learn much more from your peers than you do in a classroom. In the first two years of my engineering, I had two roommates, while in the last two years, I had six (same room size by the way 😊). You may think that it would have been chaos, but each of them was an inspiration in their own way. On one occasion, one of my roommates scored very well in an exam. However, he wrote on the wall *"Very good is not good enough when Excellent is your aim"*. No wonder he got into Stanford university later on. When the lethargy to study used to creep over, someone reminded us the truth by writing,



Very good is not good enough when Excellent is your aim



'Dedication to your duty is not a sacrifice, it is the justification of your existence'. It was not the writing on the wall, but the fact that they were putting it into practice, which was highly motivating. 12 years later, I find many students in our institute highly inspiring just by looking at the way they manage to do well in exams and at the same time participate actively in Alcheringa, Techniche and other such events. I was fortunate to have two of such students who did BTP under my guidance. While BTP is not a popular subject among final year students ☹, these guys were thoroughly dedicated. One of them suggested that I read a book titled '*Deep work: Rules for focused success in a distracted world*' which was a very timely and mature recommendation for his age. How can you not get inspired by such people!

Apart from these personal experiences, some other great resources of inspiration I have come across are: the incredible and courageous story of Andrew Wiles proving 350 year-old mathematical conjecture (Fermat's last theorem, Simon Singh); heartwarming and extremely detailed accounts of Galileo's personal and professional life (Galileo's Daughter, Dava Sobel); History of mathematics (Journey through Genius, William Dunham).

The list can go on. But, you might wonder, why do we require inspiration or motivation in the first place? Well, you don't if you want to do regular work. Richard Hamming in his profound talk on '*You and your research*' has provided key insights into how only a few people can contribute in doing important work in a given field. To do great work, inspiration must be drawn time to time since our own repository of inspiration is limited and volatile.

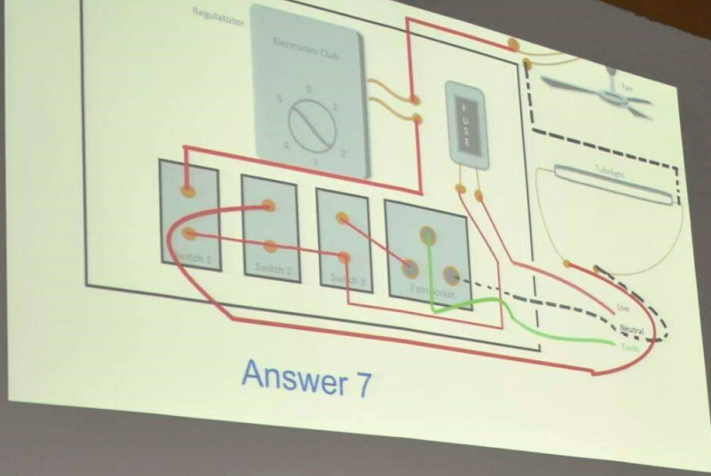
This leads me to talk about another topic of discussion, that is, education. I am talking about education in a wider sense, not just engineering because for me, it is a skill development program. Inspiration leads to self-education and education further results in drawing inspiration from different resources. I think we hardly ever contemplate the philosophy of education. The first thing that comes to our mind when we think about education is its utility. What I am going to DO with it. Well, it makes complete sense if we are educating ourselves in a professional development course such as engineering. However, what is really the purpose of education? I think we should ponder over it at some point of time in life. Since such a question is rarely asked, I observe that most of us think about the



outcome of education more than the education itself. We think about placements, internships, promotions, increments, etc. well ahead of its time. We fail to realize that the process of getting educated is worth so much in itself. The joy in say, understanding a concept or experimental validation of a simulation model is unparalleled. From a practical perspective as well, if we are getting education for making money, I think we are fooling ourselves. Think about the time we invest in education and later on in a job. In comparison to that time, the monetary returns are miniscule. More importantly, do we ask ourselves whether our education is helping us in becoming a better human being? If not, what will?

I was once told that 'Ability takes you to the top, character is what keeps you there'. In that sense, character building should be the purpose of education. The rest just follows. Deriving inspiration from great minds can certainly help us in doing so. For that to happen, we must remain an eternal student of the subject called Life. At any moment, if we ponder over results or outcomes of our education or any action, we can refer to ancient wisdom wherein this has been discussed in significant depth (Karma Yoga, Bhagavad Gita). In this respect, I leave you with the following stoic wisdom which I would like you to contemplate. Ciao!

“ **The essence of greatness is the perception that virtue is enough!** ”



Answer 7



THROUGH THE 1s AND 0s OF MY BTP

-Balbir Singh

Bachelor Thesis Project (BTP) is a project based course in which students pursue a research topic of their choice under the guidance of a professor. In the dept. of EEE, it is now an optional course which students can opt for from the fifth or seventh semester, spanning two or four semesters based on when they start..

How did you decide on your BTP topic and guide?

Right from my sophomore year, I developed an interest in electronics, mainly because I was closely associated with the fascinating world of 0s and 1s through Electronics Club, IITG. Through Techevince'2017, Saumitra Sharma and Aakhil Sheikh introduced me to Prof. Gaurav Trivedi, EEE Dept, IITG. I was set on wanting to pursue VLSI as my research field and career -

specifically digital design. In EEE Dept., FPGA is a popular choice of technology to design and prototype VLSI circuits. I've been actively involved in FPGA related research projects from sophomore year.

Over the span of my internship and exposure to VLSI, I delved into the field of hardware security - after all who does not want to be a 'Hacker'.

So, as a topic for my BTP, I discussed my field of interest with Prof. Gaurav Trivedi, and fortunately there was an open problem statement in 'SoC design of post quantum crypto processor'.

Did you work solely with your BTP guide or with a team?

Teamwork is my goto myntra. Right after the first discussion on the topic, I was certain that this topic is an amalgamation of theory (abstract algebra, theoretical cryptography) and practical VLSI (FPGA design, ARM Architecture).

To diplomatically answer your question, I worked under the supervision of a guide while being in constant discussion with my team - 2 undergrads (designing VLSI Circuit), an MTech student (mathematical analysis) and 2 PhD students (formulating and developing the concept).

Can you tell us about your work in detail?

"The devil is in the details", said Aladdin, but let's not go there. Otherwise just like most of our lectures, things will start rolling off the ceiling.

Let me briefly provide the core idea of our project. "Fancy" Title: Implementation of Post-Quantum Cryptographic Algorithms on SoC.

Post-Quantum Cryptographic (PQC) Algorithm - Basically an encryption scheme that even quantum computers cannot break through. (Sorry Google, IBM, China XD). So, we designed and implemented a 'crypto processor' on ARM SoC based FPGA, which encrypts the input messages in such a way that the corresponding output is secure against an attack by a quantum computer. Now, the natural question you might ask here is, "How can we make something (systems) secure against something

“The Devil Is In The Details”

(quantum computer) that is not yet designed?" The answer is - with mathematics! PQC algorithms are mathematically proven to be quantum secure, because they are extremely "serial". The main steps of the process were - Design, implementation and hardware-level optimization of encryption/decryption algorithms, and establishing an efficient data communication interface between host machine (message sender, receiver) and ARM SoC through AXI.

How much flexibility did you have with respect to your role in the project?

All thanks to my guide Prof. Gaurav Trivedi, PhD supervisor Bikram Paul, and my BTP partner Tarun Kumar Yadav, I had full flexibility regarding my role in BTP. I started off by developing the mathematical understanding of the field which was necessary to functionally plan the hardware implementation. Next I worked on software implementation (python / SageMath) for the proof of concept. Then, the actual hardware SoC was designed on FPGA primarily in Verilog HDL and SystemC (for ARM processor side memory and register configuration). Your role and flexibility regarding your BTP would

depend on the nature of the problem statement and support of your guide and team.



BTP is now an extra credit course for third and fourth year undergrads in the EEE department. Would you advise them to opt for it?

A simple answer to this question would be 'do what you want to do', but this is not what I'm here for XD.

Rather, I'll point out how BTP makes engineering more meaningful:

-Journey from an idea to implementation:

Every BTP starts from just a problem statement and concludes with a fully functional project that has an impactful existence. The journey associated with this idea transforming into a project is extremely valuable.

- Exploring the field of interest: BTP provides a fantastic opportunity to pursue and explore your field of interest thus driving you one step further towards developing the field specialization.

-Research Publication: For serious BTP pursuers, the ultimate aim is to publish a good journal/conference paper. BTP documentation sufficiently forms a good base to develop on preliminary paper writing and submit a research paper in a renowned publishing organization.

- For those who want an opportunity to express their professionalism and skills in an

interview, nothing can be better than discussing your BTP.

Would you recommend coming batches to undertake BTP from third year?

This is very subjective and mainly governed by the skill level / interest / career preference of the decision maker.

Opting for BTP in third year mainly depends on the problem statement and the dedication / interest of the candidate in the field. If you are motivated to continue working on the same problem statement for about two years of engineering, and the problem is good enough, then surely go ahead take up BTP from third year itself. Many research based topics are bulky enough to be worked on for two years or more as there's always scope of next version or comparisons or accuracy improvements. This is better specifically for students interested in higher studies searching for a strong academic project.

However, if you are still exploring different fields, then it would be better to take up a smaller problem statement and work on it for a semester or two. In this case committing to BTP in the third year itself might not be the best choice.

I believe, BTech third year is academically and professionally very crucial as we are already acquainted with the tools necessary to develop our skills, have an idea of our core subjects and can figure out a way to work on problem statements independently. We didn't have the option to choose BTP from third year. So, I spent the fifth semester doing Electronics Club projects and took up the departmental design project in the sixth semester. This helped to develop a level of versatility in skills needed for later projects.

KNOW ALL ABOUT

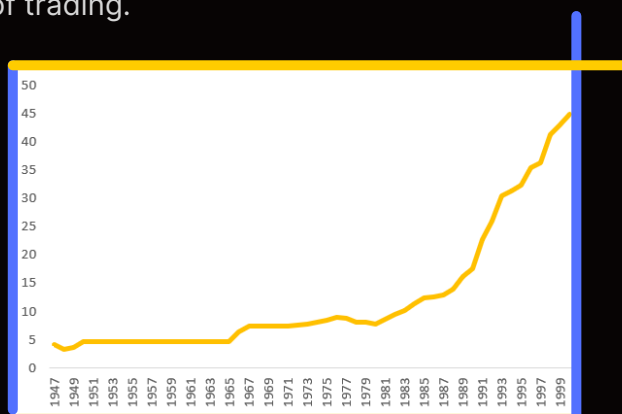
CRYPTOCURRENCY

-Tanmay Thakur

"Currency is like god,
it exists as long as people believe in it."

- Abhijit Naskar, The Gospel of Technology

The currency system that is in use today throughout the world is called Fiat currency system. Fiat is derived from a Latin word that means 'it shall be' or 'let it be done'. In simple terms, the currency is a currency because the government says so. But this wasn't always the case. Prior to 1971, the currency system that was in use was called Gold Standard. In this system, currency was backed by gold, unlike the Fiat currency which is backed by nothing but faith in the government. So for example, if 1 Kg of gold was worth Rs. 50,000 then the value of Re. 1 was 1/50,000 Kg of gold. The subtle fact that the amount of gold on Earth is finite in quantity, limits the issuance of money by imperfect human beings. Thus, avoiding inflation in the simplest way possible. And since, purchasing power of gold remains relatively stable overtime, the exchange rates in this currency system were very stable, which translates into ease of trading.



Clearly evident that the exchange rates were very much constant prior to 1971

The Fiat currency obviously has its own

benefits and that's the reason why it is in use all over the world today. A Fiat currency is considered good when it satisfies the demands of nation's economy - **storing value, providing a numerical account and facilitating exchange**. It also has excellent seigniorage (the profit earned on printing money).

Who controls our money?

It's certainly not us. It is neither our employers, nor the government, but the central banks. In India's case it's the RBI. It decides when and how much money needs to be pumped into the economy. Whenever new money is printed, inflation rises. In spite of this Superhuman power which may lead to the belief of Godly status of RBI, it is nothing compared to the Federal Reserve (US central bank). Federal Reserve is the single-most powerful organization in the US and presumably in the world. Unlike RBI, there is zero interference of the US government in the working of Federal Reserve. There have been several instances of the decisions made by Federal Reserve backfiring on the US economy, most notably the Dot-com bubble burst of 2000s and the Subprime Mortgage crisis of 2007-08.

Since 2008, there has been an increase in the number of followers of the school of thought that believes people themselves or at least the government should have

greater control over their money. On October the 31st, 2008, an anonymous person or group by the name of Satoshi Nakamoto released a white paper titled, **Bitcoin: A Peer-to-Peer Electronic Cash System.**

“ If the American people ever allow private banks to control the issue of their currency, first by inflation, then by deflation, the banks and corporations that will grow up around them will deprive the people of all property until their children wake-up homeless on the continent their fathers conquered. The issuing power should be taken from the banks and restored to the people, to whom it properly belongs.

*-Thomas Jefferson
3rd US president*

Bitcoin and Blockchain

The paper detailed methods of using peer-

to-peer networks to generate what was described as "a system for electronic transactions without relying on trust." On 9th of January next year, Bitcoin network came into existence when Satoshi Nakamoto mined the first block of bitcoin (block number 0), which had a reward of 50 bitcoins.

Commerce on the internet relies heavily on the financial institutions acting as trusted third party to process electronic transactions. The aim was simply to get rid of these third parties and develop a 'peer-to-peer' version of electronic cash which allowed online payments to be sent from one party to another directly. A bitcoin is actually an entry on a huge, global register (ledger) called Blockchain. Consider the ledger as a notebook in which all the transactions are noted. The notebook has pages (Blocks) and each page can only contain a certain number of transaction. Once a page is filled, you move on to the next page, following a certain order of pages (a Chain), hence the word Blockchain.

The existence of Blockchain gives an illusion that there exists a central authority, similar to a central bank, in the digital world, but the truth is there is no official group of people who update the ledger and keep record of all the transactions. Instead, millions of people keep track of all the transactions individually and keep it in sync with other people's records.

Imagine playing a game of Poker with your friends. But you don't have any cash to play with, so you decide that everyone write the amount won or lost by each player on separate pages in order to tally them at the end of the game to ensure fair play. Bitcoin works in the exact same way, but on a huge scale. The Bitcoin Blockchain is one huge poker table. Some are there to just exchange money but a lot more are there to keep track of it. There are millions of such

trackers today who are commonly referred to as Bitcoin Miners.

It is now clear why Bitcoin and other cryptocurrencies give people complete control over their money and why are they becoming so popular: There is no imperfect issuance of money by the central banks, inflation remains in check, and there is no single country that controls your money like the US is currently doing because almost all of the currencies of the world are backed by the US dollar and hence any decision by the Federal Reserve affects every other currency in the world. So whenever you perform a Bitcoin transaction, you merely announce your account number, the account number of the person you are sending to, and the amount of bitcoins you want to send - on the table so that everyone knows about it.

At first, it seems like anyone can use your account number and transact bitcoins into theirs. But, Bitcoin wouldn't have been called a "remarkable cryptographic achievement" if this was the case.

Whenever you open a Bitcoin Wallet (similar to a bank account), you are given a pair of keys. A private key and a public key. At the time of announcing a transaction, you sign the transaction with your private key, and the people maintaining the ledger use your public key to verify that the transaction has indeed been initiated by you.

The removal of third parties in a transaction has a downside. Double Spending is a flaw in the digital cash scheme in which the same coin can be used twice. Centralized currencies have the third party verify if a coin has been used or not. To avoid this, both the Bitcoin network and the Wallet check your previous transactions and make sure you have sufficient balance to go forward with the current transaction.

Every cryptocurrency offers different levels of privacy. Some cryptocurrencies like Monero, offer complete anonymity

hence making their transactions impossible to track, while other cryptocurrencies like Bitcoin are much more transparent.



Bitcoin is a remarkable cryptographic achievement and the ability to create something that is not duplicable in the digital world has enormous value.

-Eric Schmidt
Ex-CEO, Google



All of Bitcoin's transactions are public and therefore completely traceable. Every transaction is identified by the senders' and receivers' Bitcoin address, so, if someone knows your address, they can mine out your entire history of transactions and your current balance.

Why have Cryptocurrencies gained such traction in India?

On 4th of March 2020, the Hon'ble Supreme Court of India lifted the ban imposed by RBI which had curbed a wide range of cryptocurrency activities in India. The lifting of this ban allowed banks to do business with various crypto-trading firms in India. This led to the number of traders to rise up to three times and the volume of trade to rise to twenty-five times of the initial within three months.

India is seen as a huge market for crypto-trading, perhaps due to our ability to adapt to newer ways of life easily which was

brilliantly showcased in the aftermath of the 'Note-ban' when we adapted quite well to newer payment systems like UPI.

In spite of the various opportunities that cryptocurrencies provide, most notably among them being giving rise to the Blockchain phenomenon, the current Indian government is looking to put in place a law to completely ban any kind of trading in cryptocurrencies. The main reason for this must be the problem of untraceability.

There are as many downsides to introducing cryptocurrencies in our daily lives as there are upsides. While on one hand, they provide faster international transfer, freedom from third-party organizations and store-of-value, on the other hand they provide complete anonymity and untraceability. The last two traits are more likely to become the root of all evils rather than a silver spoon for Indians. All kinds of illegal activities will get a new momentum when cryptocurrencies become a mainstream. Whether the law comes into place or not remains to be seen. If it does, there should at least be some kind of provision for the advancement of the Blockchain technology because it has been quite rightly dubbed as 'the next Internet', and India surely won't want to miss out on it!

What lies ahead for Cryptocurrencies?

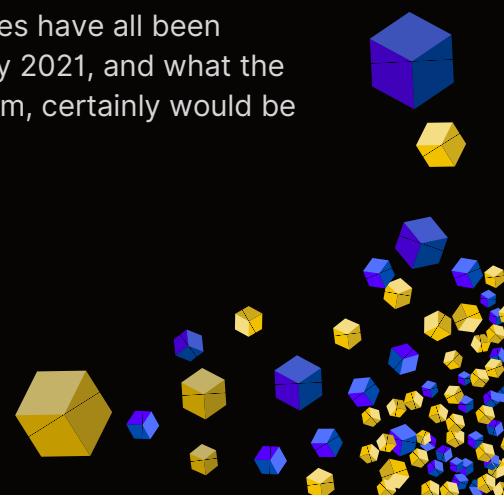
Historically speaking, Bitcoin and other cryptocurrencies have held a negative reputation for being an extremely unstable asset class. It is clearly evident, if one rewinds just a couple of years back.

Heading into 2018, Bitcoin was trading around \$13,500 just after reaching its then peak of \$19,783 in December of 2017. It further dropped to \$3,729 by the end of that year. Other currencies weren't faring any better at the time either. Ethereum dropped from \$1300 to \$91 in a span of a year during this period.

The cryptocurrency craze, which started around the same time as the onset of global lockdowns in April 2020, has since propelled them into a completely different league with Bitcoin reaching its all time high of around \$65000 in April 2021 and other currencies following suit. This craze was triggered by various factors like investment in cryptos by big companies, governmental acceptance, ease of accessibility to the general public and some tweets by the CEO of Tesla, Inc.

But as the word spread, one big caveat that the cryptocurrencies came with, also gained attention: their environmental impact. Cryptocurrencies require a lot of electric power to mine. According to some estimates, Bitcoin consumes as much energy in one year as the country of Argentina. With over 65% of the mining happening in China, a country that produces the majority of its electricity from coal, the natural resources are indeed under strain and pollution has risen. This has resulted in a widespread denouncing of cryptos, with even Tesla, Inc. - a company which itself invested in Bitcoin - no longer accepting Bitcoins as a mode of payment for its cars.

The cryptocurrencies have all been stumbling as of May 2021, and what the future holds for them, certainly would be worth watching!



DATA BREACH

THE HIDDEN PANDEMIC

-Bhaswati Boro

Data is one of the most valuable assets in today's world. The commercialization of digital data has been accelerated by technologies like IoT, Blockchain and ML. Even our day-to-day interactions on social media add to the vast pool of data which is then used by social media and e-commerce giants to enhance customer experience.

The simplest definition of data security is protecting data that we produce through digital activity from other unknown sources. A basic example would be protecting our password. On higher levels, the idea of data security encompasses everything from the physical security of hardware and storage devices, administrative and access controls, to the logical security of software applications. It involves deploying

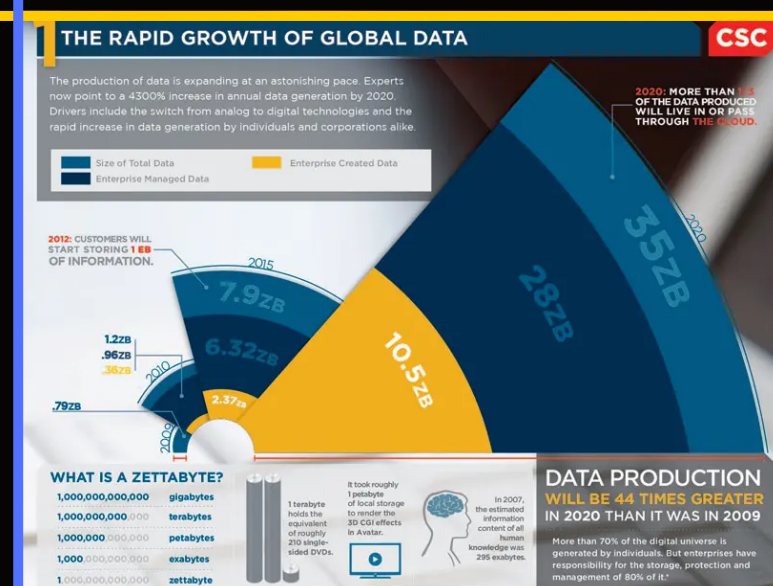
mechanisms that apply protection on our data.

One such mechanism is **encryption** i.e. transforming normal text characters into an unreadable form, using an algorithm known only to authorized users. These authorized users can use an encryption key to scramble the data and extract it when needed.

Another way to protect data is via **data masking** i.e. masking specific areas of data to protect it from disclosure, for example, the first 12 digits of a credit card number may be masked within a database.

The need and importance of data security can be felt strongly today against the backdrop of the severity and impact of data breaches.

On 21st June 2020, the Government of India banned 59 Chinese mobile apps. Following this, the Government went on to place bans on more than 200 apps by the end of 2020. The Ministry of Electronics and Information Technology in a press release asserted that it had "received many complaints from various sources, including several reports about misuse of some mobile apps available on Android and iOS platforms for





stealing and surreptitiously transmitting user data in an unauthorised manner to servers which have locations outside India". How can using simple mobile applications pose a threat to us? What was the significance of this ban?

There are millions of internet users throughout our country. The sheer volume of data that is being created, manipulated, and stored is growing exponentially. Estimates show the app TikTok had users pegged at around 200 million, file-sharing tool SHAREit had about 400 million users and PUBG had around 33 million daily users in India. So could these apps really be stealing Indian users' data? Let us look at TikTok, one of the apps banned in India in July of 2020.

By the second half of 2020, reports emerged that the TikTok app had collected device MAC addresses, skirting protections in both iOS and Android designed specifically to protect against such collection. The app collected MAC addresses for around 15 months, halting the

practice in November 2019 as scrutiny into the security of TikTok increased. A 'media access control address' (MAC address) is a unique identifier assigned to every network adapter. Collecting the MAC address for every device is a powerful identification tool, as the MAC address never changes. (Yes, there are ways to spoof a MAC address, but most regular TikTok users are not in the practice of doing this.)

The collection of device MAC addresses alone wasn't the entire reason for suspicion. ByteDance (the parent company of TikTok) used an unusual encryption to send user details from the remote user device to their servers, above and beyond the standard protection afforded by the standard protocols like SSL/TLS. The extra layer of encryption has no explanation besides the fact that the encryption would stop Google and Apple from analyzing data traffic, thus stopping the MAC address and other data collection from appearing on the radar. Even if no one can ascertain if these apps were stealing our data or not, the possibility

of theft isn't zero. It is important to note that all applications we use on our devices collect similar data and information from us. Though it is alleged that the banned apps collect suspiciously more data than others like Facebook, Twitter, Instagram; all social media apps essentially perform the exact same actions as TikTok - Hoover up user data, create detailed user profiles, and target those profiles with strategic advertising. Grabbing information regarding the device operating system, screen resolution, device model, and similar data is par for the course with social media apps. This calls for better awareness and an understanding of data security among social media users.

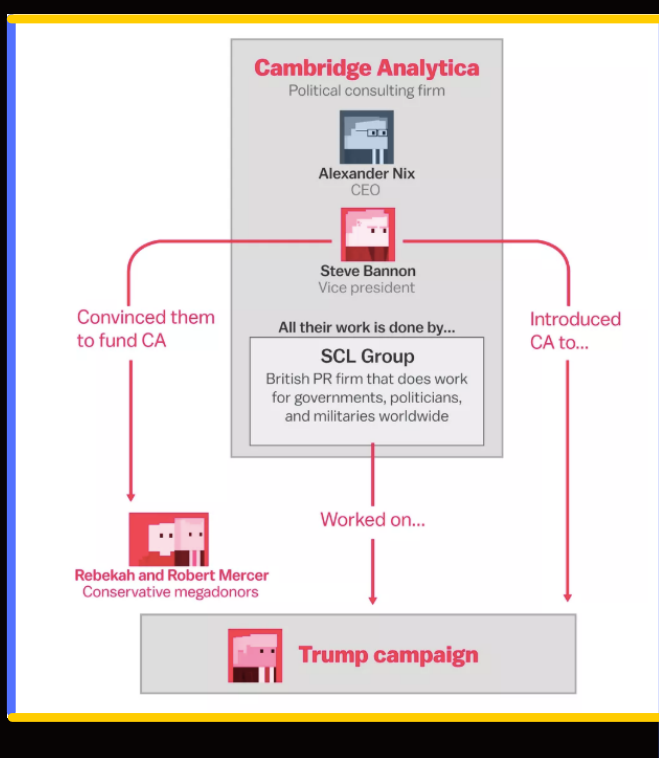
The Cambridge Analytica Scandal

One may wonder what could be the use of data collected from social media apps. The 2016 data theft case during the US elections by giants like Facebook is possibly the strongest answer there is.

As claimed by a former employee of consulting firm Cambridge Analytica, Facebook sold the personal data of more than 50 million American users to them. An

algorithm was then used by Cambridge Analytica to classify people into 5 categories in order to bombard them with adverts best suited to their personality type. These ads were allegedly meant to sway their political opinions and to further the then presidential candidate Donald Trump's campaign. This sheds light on how an individual's digital footprint is key to their personality and is sensitive enough to alter their opinion, as shown by its alleged role in influencing an entire country of more than 300 million people.

A country like ours is equally vulnerable to such tactics unless we are aware of the gravity of each click we make on the internet. The Indian digital ecosystem used to be vastly dominated by Chinese applications, until now. Following the ban, the top 500 most used apps in India hardly have any app from China today. This has opened up opportunities for Indian developers, and many Indian versions of the banned applications have landed on app stores. This is not only a significant step towards upholding data security, but also an opportunity to tap into the enormous technological potential of India.



MIXED-SIGNALS AND ME

-Mridul Krishnan

In this article, the writer talks about his role as a Mixed-Signal Circuit Design Engineer at Nvidia and what propelled him to take up a career in this field.

When I first came across the term “mixed-signal” in relation to circuit design, I assumed that such a team would predominantly work on Analog-to-Digital Converters (ADCs) and Digital-to-Analog Converters (DACs). However, I soon came to realize that they only constitute a portion of the mixed-signal design space. From serializer-deserializer circuits (or serdes) for combining parallel data to serial data or vice-versa to Clock and Data Recovery (CDR) Circuits to dealing with signal integrity issues (like Power-Supply-Induced-Jitter), I learned this design space is huge!

Coming to me personally, I work in the Mixed-Signal Verification team at NVIDIA. More specifically, I work on the high speed Memory-IO interfaces between the GPU and the DRAM. Such an interface typically involves serializer circuits when sending out data to limit the number of lanes you are sending out (because of area and signal integrity constraints) and corresponding deserializer blocks when receiving data. My team’s primary goal is to verify functionality of the interface across all intended modes and speeds of operation and identify parts of the circuit with small margins that are susceptible to failure at specific conditions of supply voltage, temperature, etc. In order to do so, we would develop testbenches to exercise the worst case input patterns so that failures can be brought out. If a failure is found to be a real cause for concern, we then bring it to the

notice of the circuit designers whom we work with to resolve the issue.

Two key elements of my work are:

- Coverage: Am I checking all possible conditions? Have I missed anything? In this case, scripting becomes very useful and languages like Python and Perl come in very handy.
- Analyzing results: Given the large number of cases to cover, the resulting data to analyze is also very large. And yet it is important to identify all failures. As it may only take one failure to cause the entire chip to fail. In this regard, data organization becomes very important.

While building my testbenches, I would start by studying the circuit from the top-level. This brought to my attention how several concepts we learned in different courses were ingrained into each other. For instance, a circuit may be designed to implement a type of channel equalization. However, it is very difficult to identify the purpose of the circuit simply by looking at all the transistors, especially at first glance. This highlighted to me the importance of behavioral modeling using languages like Verilog, VHDL, etc. to enable a quick understanding before diving in deeper.

Although I intended to work in core analog design while starting out, I have found verification has grown on me. As part of my

work, I get to view the different architectures my company uses from the top-level rather than at the level of a sub-module. This helps me follow discussions at our quarterly meetings, for instance on the choice of architecture better than I would have had I been working only on a sub-module. Another element of my job I like is that I get to work with designers from different teams. This not only improves my understanding of the job but also helps me learn new work styles that I sometimes find very useful. I believe the mixed-signal space is a fantastic place to be and verification is a growing branch that still has lot more to explore.

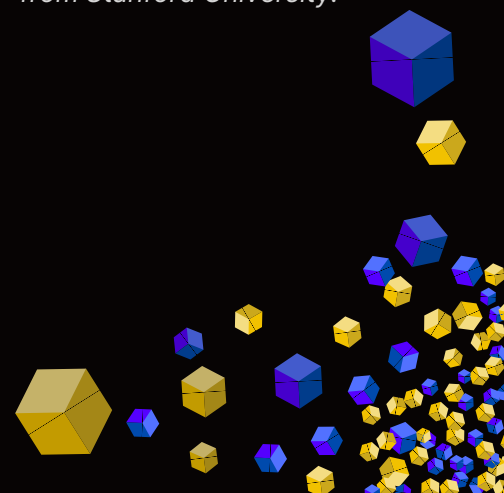
But what drew me into such a role? To answer that question, I will divide my career's journey so far into three parts. The first part was landing a summer internship at NVIDIA with the Mixed-Signal Verification team. Some of the core circuit concepts that helped me do well in the interview were actually fundamental concepts concerning flip-flop setup/hold times I first came across at IITG in the courses "Digital Circuits and Microprocessors" under Prof Amit Sethi and "Introduction to VLSI Design" under Prof Roy Paily. So, I was really glad I revised those courses!

The second part was, the internship itself, during which I learned what the mixed-signal team does and gained a lot of exposure. During my internship, I learned how valued scripting (in languages like Perl or Python) is to simplify work. It is here that I realized how important a basic understanding of programming is in most engineering fields.

The third part of my career's journey is my actual full-time job at NVIDIA. When I first started working, I was asked to get familiar with a circuit I would have to verify later. I soon realized the circuit I was looking at did not look familiar to anything I had come across in my courses. Determined to understand the circuit, I tried analyzing it transistor-by-transistor but to no avail. Giving up, I googled for a tutorial on the circuit as a concept. The tutorial I found cleared up what the circuit was trying to achieve. Armed with this understanding, I looked at the circuit again and was able to better appreciate what it meant and where it might fail. What this showed me was, when stuck (which happens quite often), it is sometimes better to look at the problem from a different angle. But knowing the right angle to look at a problem comes with experience. So different experiences, whether they be internships, courses, jobs, research or even hobby projects, play an important role in our careers however, unrelated they may seem. They build our ability to stomach failure, and instead look out for solutions.

To conclude, I believe having a strong knowledge of the fundamentals of your field of interest, building familiarity with the concept of programming and a willingness to take on new experiences would certainly help to build a good career.

Mridul Krishnan has worked at Nvidia as a mixed-signal circuit design engineer. He holds a Bachelor's degree in ECE from IIT Guwahati and a Master's degree in EE from Stanford University.



MARUT:

A HIGH-FLYING DRONE DREAM

-Prem Kumar Vislawath

The writer's entrepreneurial journey started with a lake near his parents' residence in Hyderabad's Gachibowli area. As the water body was teeming with mosquito larvae, the Lab32 entrepreneur realised that a comprehensive solution was needed to combat vector-borne diseases that are a leading cause of deaths in India every year.

"What disturbed me was that around 9.7 million cases of mosquito-borne diseases are reported annually, leading to 40,297 deaths" says Prem Kumar, the co-founder of Marut Drones, a Hyderabad-based startup that uses drones to spray mosquito killing repellent in the city's massive lakes. Understanding the urgency of the problem, Prem Kumar wrote multiple times to the local Municipal authorities, seeking their assistance to rid the lake of the high density of mosquitoes. And, thus, Marut Drones was co-founded in March 2019 by Prem Kumar and his batchmates from IIT Guwahati: Sai Kumar Chinthala and Suraj Peddi. The startup has been largely bootstrapped but recently raised seed funding from Freshworks' co-founders, Kiran Darisi and Parsuram Vijayshankar. Marut Drones was a part of the second cohort of T-Hub's flagship Lab32 program in 2019.

MULTIPLE SOLUTIONS

Since its inception, the startup has been attempting to solve multiple problems by applying data analytics, IoT, AI and machine learning to the fledgling drone industry in India.

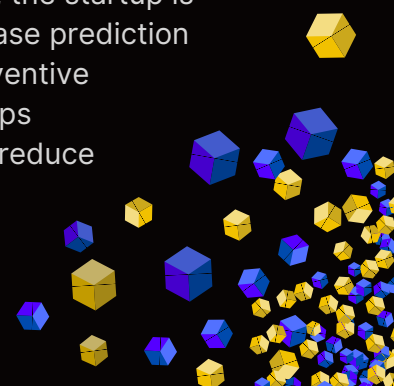
Mosquito eradication and AI-powered disease prediction system

Observing the difficult and time-consuming efforts of the municipal corporation to

manually navigate hyacinth-infested water bodies to conduct anti-larvae activities—thus, risking employees to chemical exposure—prompted Prem Kumar and his team to experiment with automated drone technology. After around seventeen trials using drones, the once skeptical officials now recognised the value addition of the startup's technological innovation to combat the problem. They realised that **Marut Zap**, the startup's AI platform to identify the breeding ground for mosquitoes, has the potential to save the government's time, effort and money.

Purdue University is the research partner for Marut and RICH hyd, for a project titled "Sensor technologies for real-time monitoring of mosquito populations through heat maps in India". It aims to facilitate a healthy atmosphere by reducing the cycles of larvae and limiting the transmission by vector control.

Marut ZAP became India's first comprehensive solution involving mosquito surveillance, effective interventions and vibrant awareness campaigns based on emerging technologies and data-based disease prediction. Further, the startup is developing AI-backed disease prediction systems to strengthen preventive measures. This solution helps eradicate mosquitoes and reduce disease prevalence.



Marut ZAP's disease prediction system alerts local authorities of potential disease outbreaks, to take necessary precautions. Moreover, this technology reduces manual intervention, saving workers from harmful chemicals thereby creating a safe working environment.



The IoT-enabled device provides the municipal authorities key insights into the gender, type of mosquito larvae, density and the kind of disease they carry. This ground-breaking solution to solve the mosquito menace involves sending real-time data to the AI platform and identifying high-risk and low-risk areas using predictive analytics.

This platform based on a mosquito IoT sensor creates mosquito maps by location, gender, species and subspecies, and offers real-time reports to identify high and low risk areas using predictive analytics for diseases like malaria, dengue and chikungunya.

The platform is designed for disease prediction and location-wise eradication of diseases such as dengue and malaria. The startup's technology can cover 6.7 hectares in less than one day, down from 300 person-days. Marut Drones has already covered more than 4,730 hectares of lakes and *nalas* in the city of Hyderabad.

Enabling Intelligent Agriculture

The founders of Marut Drones identified the agricultural sector as a potential

prospect and the fastest growing sector to extend drone solutions. They observed that Indian farmers are prone to TB, cancer and other illnesses, as they are regularly exposed to harmful pesticides and fertilizers. Farmers also have to contend with issues such as soil salinity, the paucity of data on soil and crop health, among other challenges. Therefore, Prem Kumar and his team developed **Agricopter**, a comprehensive tech-based solution which uses data analytics and machine learning to facilitate targeted spraying and reduce the harmful side effects on farmers. The implementation of this solution begins with mapping the area, followed by spraying/fertilization.

The startup is working with ICRISAT for Crop Monitoring and Diagnostics project, and is also developing protocols for the diagnosis of major pests and diseases and targeted drone spraying on crops with PJTSAU scientists. This study has targeted five crops that will be grown in five different districts to conduct research work - Rice (RRC, Rajendranagar), Cotton (RARS, Warangal), Groundnut (RARS, Palem) and Redgram (ARS, Tandur) as well as in selected farmers' fields during Vaanakalm 2020 and Yasangi 2020-21 A14AI - AI for Agricultural Innovation with WEF and Govt. of Telangana. It has resulted in increased crop yield, enhanced efficiency of resources and low pesticide residue levels in food.



Additionally, they are collaborating with the World Economic Forum and the Telangana Department of Information Technology (ITE&C) on an 'Intelligent Spraying Drone' to formulate standard operating procedures (SOPs) based on scientific evidence.

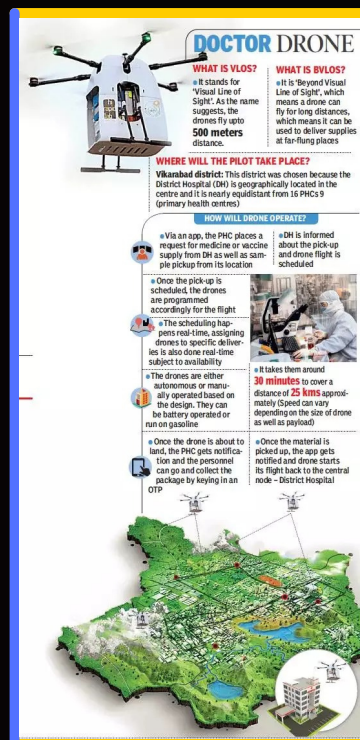
Scalable Afforestation

Seedcopter, the company's scalable model of reforestation is yet another product that aims to create a sustainable future for the world. In a bid to identify areas that require afforestation, drones backed with AI survey the deforested areas as the first step. Next, the company determines the type of trees to be grown based on various parameters like soil, climate, indigenous seed varieties and historical growth data using AI. The drones are then deployed with seed balls that sow around 15,000 seeds per day from height between 50-100 feet. "For years, people have been planting trees without possessing scientific data on their height, canopy and survival rate," says Prem Kumar. Adding more light on the data generation, "We also get the geo-coordinates that enable us to conduct periodic surveys to determine how many of these trees survive. The data is procured in a digitalized form that allows remote analysis and monitoring of the data points." The development of Seedcopter by Marut Drones is being supported by the Pernod Ricard India Foundation and the CIE-IIITH. Soil and location are the key factors which are studied before the deployment of seedballs through drones to ensure the penetration of seedballs in depth.

Supplying Medicines and Vaccines

Telangana Govt's "Medicine in the Sky" project in collaboration with WEF, Niti Aayog and Healthnet Global along with the Ministry of Civil Aviation (MoCA) has been granted the necessary exemptions and rights to fly drone flights on an experimental basis in Telangana, including

conducting beyond the visual line of sight (BVLOS) drone operations. Under this project, the state govt. will utilize BVLOS flights in Vikarabad district with the Area Hospital as the take-off site and various PHCs and sub-centres as the landing sites. Marut's **Hepicopter** is one of 7 participants in this project.



EXPLORING NEW PARADIGMS TO BEAT COVID-19

Cities around the world have used drones to deliver essential goods or medical supplies. In the age of the Coronavirus, there is a constant need to supply sanitizers, masks and Personal Protection Equipment (PPE). Drones can enable the swift and efficient delivery of these items directly to hospitals and quarantine zones. "Marut Drones, like a few other innovation leaders, will continue to help leverage such technology to ensure that it keeps improving our safety and our lives," says Prem Kumar.

The company has partnered with the Government of Telangana to deploy drones for various COVID-related applications,

such as disinfection and sanitisation; movement tracking; thermal analysis; medical delivery of critical supplies; and surveillance of quarantined areas.

Marut Drones has used drones to spray disinfectants in contaminated zones and in large scale public spaces, such as airports, SEZs, warehouses, parks and railway stations. The startup has observed that drones cover fifty times more area than traditional methods of disinfecting places. One of the primary advantages of using drones for this purpose is the reduced workload on sanitation workers who are also protected from further exposure to COVID-19. The drones have the capacity to carry up to 10 litres of disinfectant, cover about 20 kilometres and spray 200 litres a day. In another use case, the startup's drones are calibrated with infrared cameras that **test human body temperature** in crowded places. Thus, drones have come to the rescue of personnel conducting temperature checks, who could otherwise be at risk of exposure to the virus.

The medical delivery drones routinely **supply critical medical necessities** and ensure minimum wastage of medical resources in this hour of crisis. Marut Drones has come to the aid of affected households that are in dire need of medicines and other supplies during the quarantine period. Since most of the blood banks and testing facilities are in urban areas, Telangana's rural belt is bearing the brunt of the lockdown. In such trying circumstances, the drones deployed by the company ensure timely availability of blood,



medicines and other critical supplies to save lives.

Yet another innovative use of drones undertaken by the startup is to help in the surveillance of citizens, especially in heavily quarantined areas. The Drone Patrol Team can carry out this task with the cameras installed on the drones. The drones are equipped with cameras and speakers, enabling the patrol team to make



announcements and issue warnings to the general public.

Drones have also presented a unique perspective on how to reimagine the flawed supply chain in the healthcare sector that is riddled with challenges such as shortage of stocks and wastage of resources.

The ingenious use of drones has also displayed the spirit of innovation required by startups to cope with the tough times. According to Prem Kumar, India will stand at an advantage if it continues to adapt to drone technology at a relatively early stage of the pandemic.

HOW THE MODEL WORKS

At the outset, the startup maps the zones and their unique requirements to enable the hassle-free customisation of drones for various purposes. The company currently owns eight drones and also has a network from where it sources drones from other locations to fulfil its deployment requirements.



The drones' deployment to deliver various services works based on a hub-and-spoke model. When Marut Drones' team receives a message requesting for inventory supply, the inventory is loaded at the central hub. As the next step, the coordinates are fed into the system after which the drones take off.

TACKLING CHALLENGES AND THE WAY FORWARD

Marut Drones has gone from strength to strength since its inception. The founders recently featured in the coveted Forbes 30 under 30 list. However, despite creating a massive impact on the ecosystem and receiving accolades for their path-breaking innovation, Prem Kumar and his partners have also faced challenges along the way. For instance, funding, nascent technological, human resources, sceptics etc are among the longstanding issues the startup faces till date.

Another challenge faced by Marut Drones—that is peculiar to all players in the drone industry—is the regulatory hurdles. "As of today, payload drones are not allowed," explains Prem Kumar. "We can deploy payload drones during these times due to the Telangana government's support for procuring special permissions and approvals."

Further, the sudden emergence of COVID-19 also put a spoke in the startup's funding scenario. Marut Drones had geared up to raise a fresh round of funding in Dec-May 2021, which will now have to be deferred. Prem Kumar laments the paucity of talent in the industry as commercial drones are a relatively new area of technology. However, to counter the problem, Marut Drones has partnered with the Telangana government to start a drone training academy to create a talent pool that will be beneficial to the

larger drone ecosystem. The company is trying to scale based on its bandwidth, available resources and other contributing factors.

The COVID-19 situation has shown the importance of drones and it has created opportunities in the drone industry by promoting contactless operations. Prem Kumar believes that the work in these times will build recognition, mark appreciation and help in raising investments.

Prem Kumar hopes to see more support from stakeholders in the startup ecosystem. He credits T-Hub for providing access to the Telangana government and for the opportunities to network with peers and industry players. Prem Kumar is of the view that the pace of innovation in the drone industry calls for the continued support from the government and credible influencers, such as Ratan Tata and Anand Mahindra and Bill Gates, to name a few. Further, he adds, the drone industry should have easy access to grants from iconic philanthropic institutions such as the Bill and Melinda Gates Foundation as such grants will enable companies such as Marut Drones to contribute more effectively to the society at large.

"With a sense of optimism, we firmly believe that technology and ingenuity can help the global population to fight and defeat this viral attack. Our startup is prepared to combat this crisis in a way that we know the best—through drones," concludes Prem Kumar.

Even as the world waits with bated breath for COVID-19 to leave just as suddenly as it came, the social good contributed by startups such as Marut Drones will hold them in good stead for posterity.

CRUISING THE COSMOS

-Tanmay Shreshth

Disclaimer: Sound can't travel in vacuum, so this is a work of fiction-lip reading.

CRASH!

The Moon sighed. Another meteorite. Though much more common in its infancy, the scars remained, and still haunted him. He looked towards Earth, his centre of attention for the past four-point-something billion years.

"Feels great to have an atmospheric insurance" she taunted. "Indeed. The dinosaurs would agree, if they could." he shot back.

"Huh, you are just jealous."

"I did have an atmosphere, you know." Moon continued, "Not as majestic but still. But the dynamo inside me cooled down and I lost my magnetic charm. Those pesky little particles, the Solar ones, pounced.."

Seeing into the distance, he gazed at the Sun, with squinted eyes of course. The giant furry fireball. The harbinger of light & warmth. The leader of planets, moons, dwarfs, and mobs (they like to call themselves "space rocks" though).



How Dare you!

The Sun didn't care. He was engrossed in a conversation with Mercury.

Meanwhile, the Earth's reddish neighbour was having fun with the twin moons.

"You are so old you have rusted!" laughed one, pointing to Mars.

"Shut up, potatoheads! It's supposed to be blood. I'm the God of War! Don't they teach these things nowadays?"

"More like the God of Iron Oxide!" chided the other.

"Just wait. The day that Elon guy sends humans here- I will be terraformed."

Mars envied Earth (Who didn't?) and often had visions of his own glorious past. Flowing rivers, wind caressing the surface. His atmosphere had met the same fate as the Moon's; although he put up a stiff fight, it was never a contest. Out of nowhere, space rocks attacked, depleting the field. Then the Solar particles did what scavengers do to dead meat.

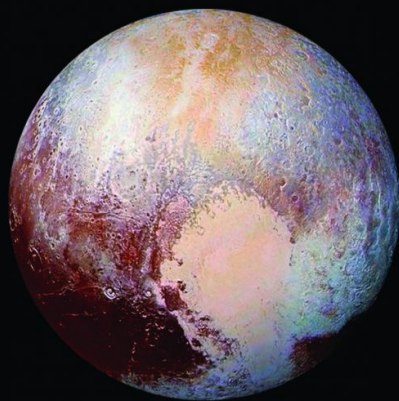
In case you were wondering what happened to Venus, we had trouble eavesdropping.. I mean connecting. The signal was lost due to dense clouds made of sulphuric acid hot enough to toast anything.

Moving beyond the Inner Solar System, Jupiter and Saturn had their own bandwagons. And new ones joined all the time.

Of course Saturn was boasting about her rings. And of course Jupiter was bragging that he was the boss around here.

Neptune and Uranus refused to be dragged into this badly scripted family drama. (To be fair, when you live in temperatures of -200 degrees Celsius, conserving energy becomes a top priority).

Venturing towards the outer echelons, we bumped into New Horizons, travelling at a measly 35,000 kmph. NH was admiring the photos it took of Pluto. No one had gotten this close to the previously inaccessible floating freezer. It even wanted to livestream them. But an internet speed of 2kbps didn't help matters.



Little Pluto, still grumpy about his downgrade.

The Voyager brothers preferred not to be disturbed, and so were left alone (RIP).

Large voids filled the interstellar space, accompanied by deafening silence, which was only broken by the occasional distress signal from a rogue planet or small talk of a pair of fiery nuclear spheres courting (binary stars). And then, there was a spectacular sight. A disk radiating lots of.. em, radiation.

A star being torn to shreds by nothing. That was the Satan of Space, aka a Black Hole. The terrorizer of stars and planets. The ruler of all things shady and dark. The non-refundable-one-way-ticket-to-hell. The largest ones resided at the hearts of galaxies, though not in the hearts of many space folks. Trying to establish contact was useless: just like the Task Manager, they never seemed to respond when needed.

With the Milky Way firmly in the rear-view mirror, the Local Group chatter signals started to show up. But things were not looking good (no not the view, that was majestic). Fuel levels were running low, and although stars lit up the sky, they can't fire up solar panels, can they?

And so our PhaseCraft had to turn around. On the way back, we tried to interview Halley's comet; but he seemed to be in a hurry (at least that's what his speed suggested).

Although PhaseCraft's journey was cut short, we weren't disheartened. Ordinary matter makes up only 5% of the universe's contents. Who knows what's out there, beyond the visible. Dark matter? Dark energy? Space snowballs? We are confident that humanity would one day find answers to all of these...



Signing off with Snowballs..

Image Credits:

- 1) New Horizons 2015 via NASA/JHUAPL/SwRI
- 2) sciencenews.org/Heather Roper/Univ. of Arizona

FILM-MAKING

THROUGH MY LENS

-Yash Kulkarni

Everything that we have ever heard or experienced becomes a story. But if you have lived a great story, how can you share it with the world?

Our earliest ancestors carved their conquests onto cave walls. But a couple pictures weren't sufficient to describe all their emotions to their caveman friends. So what next? Somewhere along the line, humans made one of their most crucial inventions ever – structured language. Just grunt some specific sounds or scribble some magic symbols, and voila! You could get (almost) anything in your head into someone else's head. For the first time in the world, stories began to be 'told'. And it didn't stop there. Stories were woven into plays, songs and musicals alike. But despite all these amazing art forms, stories still had to be imagined in your own head. A theatre was the most real a story could get, but you had to be filthy rich to be able to get a seat good enough to read the actors' expressions.



Fast forward to the late-19th century, when legend has it that the first audience of cinema was so overwhelmed by the arrival

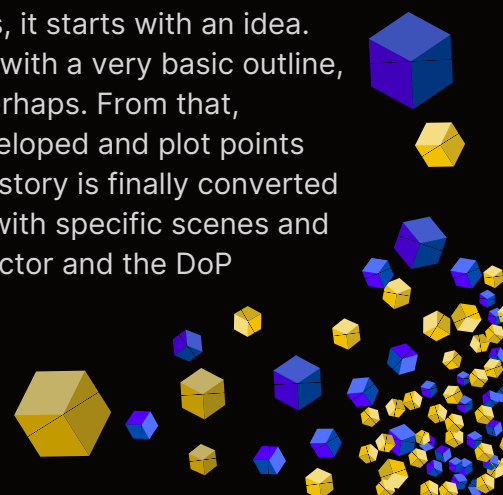
of a black-and-white life-sized train that some screamed and ran away from the projection screen. Though this might be an exaggeration, the inception of the Cinematographe (the 3-in-1 device to record, develop and project moving pictures) was just a seed that would, one day, redefine storytelling forever.

From Shawshank to Endgame, from Skyfall to Ratatouille and from Masaan to Barfi, movies have shaped the essence of society from decades. The universality and formidable scale of cinema gives it a very special place among art forms. The experience of having lived the lives of our protagonists, having seen their struggles, having rejoiced in their victories, and perhaps even for a moment having forgotten that you were you, is a feat that films continue to achieve with millions of viewers every single day.

But how does a film actually come into being? Behind the scenes, the process of filmmaking is often divided into 3 stages.

PRE-PRODUCTION

Like all great things, it starts with an idea. Most stories begin with a very basic outline, a simple conflict perhaps. From that, characters are developed and plot points are laid down. The story is finally converted into a script – one with specific scenes and dialogues. The director and the DoP



(Director of Photography) plan how each scene is shot. You might have experienced the effect different camera angles and movements make on the way you perceive the emotions in a shot. This planning is encapsulated in a storyboard, which contains rough sketches of all shots. The casting director selects the perfect candidates for the characters, and thus concludes the pre-production phase.



PRODUCTION

The production phase actually creates a movie. And naturally, a major part of it is shooting. There is much more to shooting than one person holding a camera and another saying lines in front of it. Tremendous effort goes into production design, from arranging a set/location to fixing make-up and costumes for the actors. Lighting and shooting apparatus needs to be arranged. All the elements of a scene converge for the first time.

POST-PRODUCTION

Post-production is started by getting all shots in the correct sequence, which may involve sorting through hours of footage for a minute-long shot! Then transitions are applied between shots. It involves choosing from a myriad of cuts – match cut, j-cut, l-cut etc., each bringing out a different emotion. Folly and sound is added

thereafter, which essentially become the soul of a movie. Additional CGI is added. Color-correction and grading are very important steps that can easily separate a great movie from a mediocre one. With these finishing touches, the film is finally ready!

Filmmakers follow many variations to this process. But in each case, it still requires a collective effort from a dedicated team to even complete a decent film. It is a herculean task to actually make a viewer empathize with the characters and their conflicts.

Behind every film, there is a filmmaker trying to build a universe from scratch and nurture it, breathing life into the characters and plotting their paths with challenges and rewards. This worked just fine for me, because I have always wanted to play God!

I entered the Lumiere club room as a wide-eyed fresher when I heard that they were making a short film. Like most great things, I had no idea what an important part of my life this would soon become! We had just 4 seniors in the club then. By the end of that year, I had learnt basic cinematography and editing, worked on a couple projects, and even assisted in organizing an editing workshop.



Sophomore year started with my directorial debut of the Freshers' music video and ended with me having co-led the Events team of Chalchitra – the Film Festival of IITG! By then I had learnt a great deal about

filmmaking as well as about leadership. Over time, the club members had come together as a family. I really cared for the club and I had some dreams for it. I decided to apply for the position of the secretary, and I took over in April 2018.



Something that I learnt early on was that there was a lot more to leading a movie club than knowing how to make films. So I sketched out a neat plan for the club. First, I wanted us, as a club, to understand filmmaking more thoroughly and under a more formal structure. Second, I wanted to cultivate a culture for cinema on campus, and work with other student bodies. Third, I wanted to introduce novel initiatives to take Chalchitra to the next level.

Then, I dove headfirst into implementing these agendas. I started regular film screenings in the club room followed with a group discussion. Here, we analyzed different aspects of the movie and attempted to understand the techniques that made the movie great. I also encouraged members to specialize in certain skills instead of becoming jacks of all trades. By the end of the semester, through multiple side projects, some of us had specialised in cinematography, editing and script writing. The progress had been slow, but it all paid off!

THE GOLD

Inter-IIT Cultural Meet is a very prestigious event where we have an opportunity to lock horns with older and highly experienced (and funded) film clubs of other IITs. The first step - selecting a team, was the hardest. I could either take a huge team and have more hands on the job, or I could take a tight nifty team in favour of agility. Either way, it was a risk and also a moral conflict. After days of painstaking deliberation, I finally took one of the toughest decisions of my life by choosing a small and efficient A-team.

The format of the competition was 51-hour filmmaking, where teams are given merely 51 hours after declaring the topic to complete a short film from scratch - an intensely competitive and exhausting format. It was also very discouraging to see some teams using highly specialized equipment, when we were working with the bare minimum. Our choice of script and the cinematography technique had also been incredibly risky. After submission, we were completely drained of both energy and hope. So we slept through the screenings and judging.

It was only later in the next day that we came to know that we had come first! This was also IIT Guwahati's first team gold in the history of the Cultural Meet. It appeared that the risks taken worked out for the best.



Back on campus, we organized open filmmaking workshops and collaborated with multiple other student bodies. In the middle of these multiple engagements, it started getting harder for me to pull it off on my own. That is when I switched strategy towards delegation by introducing 2 positions for Project Managers within the club and relying more heavily on the convener of Chalchitra. This enabled me to focus on the greater goals instead of worrying over minutia.

CHALCHITRA 2019

All 3 previous editions of Chalchitra had been exponentially bigger than the previous. There was a lot of pressure riding on us. However, the choice for theme and decorations was simple. That year, the Marvel Cinematic Universe and Game of Thrones were both going to release their last, and we wanted to give them a tribute. We built props ranging from Thor's Stormbreaker to Ned Stark's 'Ice' with sigils of the great houses of Westeros hanging in the auditorium foyer. We invited Ms. Meenakshi Shedde, National Awardee for the Best Film Critic, serving on the selection boards of several international film festivals, as a guest speaker.

We also organized a movie-based treasure hunt during the fest, which had clues spread all across the campus. Both the treasure hunt and other filmmaking competitions of Chalchitra received an overwhelming response. The selection of movies for screening during the festival, with varying tone, underlying culture and languages, was highly appreciated by Ms. Shedde. We also hosted the premiere for a local independent filmmaker for his Assamese movie - the first found-footage film from Northeast India.

FINAL WORDS

Through the journey, we learnt so much – about the world, about life and even a little about films. When it all seemed too difficult, I found that it is hard to let go when you see everyone around you so dedicated and motivated for a cause. I learnt that dedication and discipline can only take you so far, but it needs teamwork and empathy to really achieve feats that are bigger than life and reach beyond yourself, and I am glad I got to do that. The growth of Lumiere – in members, cinematic expertise and impact in a short span of 4 years is a thing of immense pride for each of the 70 members of the club.

I am happy that I confronted most of my insecurities in college. The road from a naïve freshman to an explorative sophomore was followed by a year of responsibility and multi-dimensional growth. I was truly humbled to receive the 'Best Secretary, Cultural Board' award at the end of my tenure.

Looking at the next horizon, I am thankful for all the amazing opportunities that college offered me, and the million different things I have learnt – both academic and otherwise. There is something about the lakes and the trees here that I will never forget. Most of all, I am grateful for all the amazing people I have met along the way. They will always have a home in my heart.



THE DO'S OF DATA SCIENCE

-Gaurav Sinha

Blog : <https://medium.com/@gauravsnh210>

Website : <https://gauravsnh210.wixsite.com/mysite>

I am writing this for InPhase magazine which is very close to me as I had worked as General Secretary of Cepstrum! Before coming to UBC, I worked as a software developer at Oracle for 3 years. Here I will share some of my experiences which might be helpful for you.

We all know we are part of one of the best institutions of the world. But when I came to UBC, I noticed one significant difference. Here the teaching is very practice-oriented. One thing to clarify, I am in a coursework program and not a research-based one. We have lectures in the morning, and in the afternoon we implement all codes and solve questions related to the concepts covered in the lectures. I feel this is missing in the Indian education system.

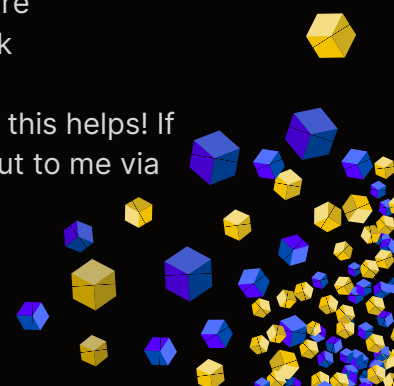
The takeaway from this is - try to implement what you learn in class using coding. Take up any real life problem and try to solve it with your existing knowledge. This is very necessary because when you go out to work, go for research or build your own start-up, these are the things which will help you. Some of the things which you should definitely know are **GitHub**, **Docker**, and **Linux**. These tools will help you grow beyond your theoretical knowledge and will help you execute your ideas to the end.

The above was general gyan! Now I will talk more specifically about Data Science. Data Science is actually a combination of Statistics and Machine Learning in very concise terms. You need to have a very

strong mathematics background in order to be a good Data Scientist.

Earlier I pointed out that IITs are very theoretical. Is that bad? No! There is something which IITs offer apart from brand value. The courses we are taught help us build a very strong foundation. The courses at IITG helped me a lot here at UBC. So I would suggest taking up a few subjects of your interest, and studying them thoroughly. A few subjects that you must know properly are Linear Algebra, and Calculus. These are the building blocks of Machine learning. Try to be well versed with Probability, and Data Structures and Algorithms as it would help you in the placement season as well as later in the field of Data Science.

There is one key quality required in the Data Science world - the art of communicating your results to a non-technical audience. One of the best ways to practice this is by writing blogs. You can explore Medium for this and check out '*Towards Data Science*'. Try to explain difficult concepts to a layman audience, use analogies and bottom-up approach to create an effective explanation. Create your web presence by using social media. Use Twitter to connect with people, post your blogs so that more people can know your work and help you better your communication skills. Hope this helps! If you need any help, reach out to me via LinkedIn or Facebook.



WORKING AT A TOO BIG TO FAIL

-Aditya Shekhar

My journey at JP Morgan Chase & Co. started with campus recruitment after the seventh semester as a full-time hire. Before diving into my experience at JP Morgan Chase and my motivation to join a QR role, I would like to take a step back.

During my bachelor's, I was fascinated by research and ended up working on a couple of research projects apart from the curriculum. Along with these projects, I also did two academic research internships. These internships along with my bachelor's thesis gave me a good exposure to research. I developed an inclination towards ML during my second year while I was doing courses on Probability and random processes and parallelly doing projects under Dr. Amit Sethi.

I did my second year intern at Tohoku University in Japan. During this internship I worked on visualizing deep convolutional neural networks by inverting them.



This internship helped me get deeper insight into CNNs, especially for solving vision problems.



Post second year, I applied for Mitacs Globalink Fellowship and got awarded with the same for a research internship in Canada. There I joined CVSL Lab at Laval University. I worked on six degrees of freedom object detection and tracking using Deep Learning. These academic internships made me realize that research is like pushing the boundaries of science. Mostly, it is identifying a problem for yourself and then trying to solve it systematically.

My two cents for the MITACS Globalink fellowship application process are the following. First, try to do a research internship in your second year. This will bring more credibility to your profile. Second, look for professors whose research interests match yours. If you apply in the same field of research as your second year internship, it would really increase your chances of acceptance. Third, and the most important,

put serious thought into the order of preference of professors for the application. Try to be practical rather than over ambitious. If you contact the professor before applying, it could be helpful.

To students looking for similar opportunities while in college, I would recommend starting early. Knowing Python language and gaining familiarity with some deep learning libraries would be very helpful. I would strongly recommend working on a research project in your field of interest with professors at IITG starting from second year. This would help you get a direction and also build your profile in the field.

By the end of my third year, I was eager to explore the research and development profile in the industry. Through my seniors, I learned that JP Morgan Chase had recently set up their Quantitative Research (QR) team in India, and that it would be coming for the first time to IIT Guwahati for full-time hiring. During my journey at IIT Guwahati, courses such as Probability and Random Processes, Optimization, and



PRML had already piqued my interest in the field of Deep Learning and Statistics. I liked coding but I also liked problem solving, so I found this role in QR to be quite exciting, as it is a perfect blend of problem-solving and programming to a large extent.

This led me to put the Quant role as my first preference during campus placements.

EXPERIENCE AT J.P. MORGAN

My experience at JP Morgan Chase has been great so far. I am currently working in a modeling team, so I get long-term projects with a time horizon of six to eight months. I have worked on a diverse set of projects, from building a Credit rating model using machine learning to a completely algorithmic problem like building a subset-sum solver for real numbers. The best thing about my work is that I get to do things from scratch, starting from building datasets and doing research to find the solutions, to writing production-level code. I have also been fortunate enough to work with graduates from diverse backgrounds such as PhDs, postdocs, and MBA graduates in finance, economics, computer science. The best thing about this work is the level of exposure and the sense of accountability that one develops. I have worked on projects directly impacting billions of dollars. I still remember Prof. Sanjay Bose's course where he impressed on us to develop a sense of accountability. I remember back then, he had a very tough policy against silly mistakes. His reasoning was, "Today these silly mistakes would cost you a few marks and maybe a notch of grades in the course, but if you make these silly mistakes in the industry tomorrow, it can cost you your job, and can cost millions of dollars to the firm. One mistake of yours can make others lose jobs as well." Having worked in the industry, I completely concur with his words now.

Apart from regular work, I have also got opportunities to be involved in other areas such as recruitment, organizing events, and setting up problems for the JP Morgan Quant Challenge. Overall, it has been a truly rewarding experience for me.

IMPACTING LIVES

-Aman Dalmia

"I wanted to project myself forward to age 80 and say, 'Okay, now I'm looking back on my life. I want to have minimized the number of regrets I have. I knew that when I was 80 I was not going to regret having tried this."

-Jeff Bezos

MY STARTUP EXPERIENCE AND HOW IT CHANGED ME

When Jeff Bezos was stuck at the decision on whether to start Amazon, he introduced the idea of a regret minimization framework. It goes like this:

"I wanted to project myself forward to age 80 and say, 'Okay, now I'm looking back on my life. I want to have minimized the number of regrets I have. I knew that when I was 80 I was not going to regret having tried this."

Although I encountered this specific term only recently, this is the mantra I have always adopted throughout my college life and still do everyday. So, when faced with the choice of whether to work on building a start-up when I was a sophomore, the answer was very clear: I would definitely regret not trying this. A few of my close friends and I came up with this idea of building a unified platform for teachers, students and parents during Code.Fun.Do hackathon organized by Microsoft in October 2015. Instead of reading success stories, I read a ton of startup failure stories, so as to avoid making the same mistakes that many startups have already made. The big lesson was, validate that the need you are trying to address is real and whether your idea solves that need before building anything or spending a load of money. So, we made a list of all the schools in Guwahati and every day we used to

shortlist the schools to visit that day. The Principals were largely excited about the idea and supportive of us. Finally, we got a chance to have our app demonstrated to parents during the parent-teacher meeting in one remotely located school. We had a demo and when we showed it to the parents, we got great testimonials. The Principal was so happy that he decided to start the next academic session using our app. That was big. We were actually going to operate in a school. We were extremely excited.

There were many implementation challenges we faced, but the biggest mistake this exercise highlighted in our user study was that we never talked to teachers and hence, the incentive mechanisms in place, were for the Principal and the parents. For the teachers, it was just additional work and soon, they lost interest and motivation to use the app to enter information like attendance or homework. Another major factor that came into play was our acads. After that semester got over, we took some time off and finally, decided to not continue further.

This experience changed me as a person profoundly. Earlier, I couldn't speak to strangers, the thought of giving a presentation scared me. After this experience, I gained a lot of confidence not only

on my speaking and communication skills, but also on my ability to make a difference in the world.

HOW DID I GET INTO MACHINE LEARNING?

Around the time of my sophomore year, the hype around Machine Learning had just begun. In particular, Machine learning presented an amalgam of everything I loved in mathematics and demonstrated how it could be used in a practical manner beyond the basics.

I am a person who learns by doing. So, I started contributing to the famous open-source library scikit-learn, which caused an exponential growth, both in my knowledge of the field and my understanding of open source. The best part was having discussions about how to solve a specific issue with the authors of a library driving a large chunk of ML research, in industry and academia, getting their feedback on my code and my morning hope became seeing those four letters (Looks Good To Me (LGTM)) to merge my code into the main repository. Soon, I approached Prof. Amit Sethi to work on a project under him and he introduced me to Deep Learning. I used to spend most of my time reading papers and trying to understand every single line, both in terms of intuition and math. That enabled me to go back to those



The HyperVerge team when I was an intern there

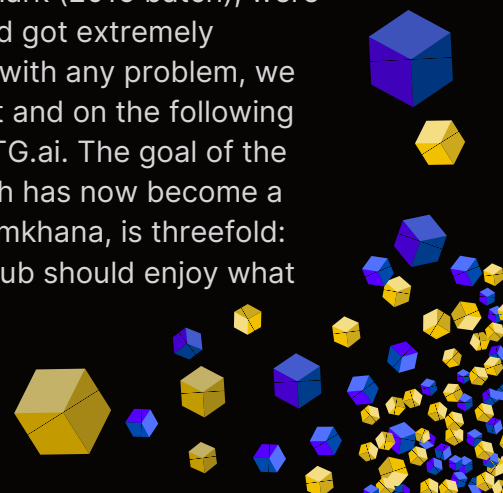
foundations whenever I needed to understand a new concept and also, to come up with new ideas.

INTERNSHIPS, PROJECTS

Most of my practical learning has always come from internships. Specifically, my internships at Niramai and HyperVerge have really added immense value to me, both personally and work-wise. I interned at Niramai in the December of 2017, where I left right after my placement in Ola on Day 1. I was looking for research opportunities in AI, and most of the ones out there seemed to require a past publication. So, my motive was to get a paper out of my internship. Finally, we had something we felt would be valuable for the community, wrote it up and submitted it. I got my first conference paper. HyperVerge was a tangential experience. I had already made up my mind to join Wadhvani AI and interned there in the summer of 2018, before joining full-time. The exciting part was to work in a startup that is moving out from its early stages and the fact that my work would be related to climate change. I received excellent mentorship on how to write good code, how to really build an AI product So, the key message here is, always go for internships when possible but also make sure you are comfortable and thorough with your basics.

IITG.ai

Something that I always felt was lacking in the campus was a sense of community among those working in AI. One night, me and my junior, Konark (2016 batch), were discussing this and got extremely frustrated. But as with any problem, we decided to solve it and on the following day, we started IITG.ai. The goal of the study group, which has now become a member of the gymkhana, is threefold: members of the club should enjoy what



they do; they should feel valued and find value; they should feel a part of a community. And everything we do, should always be to serve that purpose. We tried a bunch of things, some worked, some didn't. But it was enough to make a subset of people believe. And that is the best thing I could have hoped for- graduating in a few



IITG.ai orientation of freshers in 2019

days, having a set of people whom I could trust with the vision of the group and to find others who believe as well.

WHAT MOTIVATES ME / WHAT AM I LOOKING FORWARD TO?

Ever since I got started in building tech, right from Android development in 2015 to AI solutions for helping people, the aspect of building something myself has never failed to excite me. Being an AI researcher, I understand a lot of shortcomings of the current state of AI. This not only provides me with a tough and interesting problem statement to work on, but also helps understand the effect technology can have when these repercussions are not acknowledged and AI is used, just for the sake of using it. Elon Musk has been my hero, in his determination and sheer relentless will to help humanity advance its own potential. Finally, I've always noticed how easier and enjoyable things become



I think it is possible for ordinary people to choose to be extraordinary.

-Elon Musk



when there is a sense of community, with every member trying to help the other one out, with the beautiful sight of creative minds intermingling with each other.

MY WORK AT WADHWANI AI AS A RESEARCH FELLOW

I have always been immensely intrigued by the idea of using tech for good. Most of my work prior to joining Wadhvani AI had been on this intersection: deep learning for early detection of breast cancer (Niramai), deep learning on satellite imagery for change detection (HyperVerge), deep learning to find signals in the human genome that contribute to a process called splicing (my bachelor thesis project). Hence, it was only natural that I continue my work, only this time actually going much deeper. I joined Wadhvani AI, a non-profit with the goal of using AI for social good. Specifically, for solving problems in the developing world. I learned a lot, not only about AI research, but also about how to build an organization, which I share later. I worked on two projects: using AI for pest monitoring by providing them recommendations on pesticide usage. Knowing when to spray pesticides is very hard. We operated over three cotton seasons across 2 geographies, collected data for 6 different pests, developed a single multi-task architecture for outlier detection and object detection, compressed our models from 250MB to 5MB and deployed it on

phone to enable offline inference for working in areas without connectivity. Another project that I was involved in captures the video of a newborn and estimates the weight and other anthropometric measurements (height, head circumference, chest circumference, etc.) from video by learning a full 3D model of the baby using a combination of a learned deformable model that captures the latent subspace of realistic baby shapes, and domain adaptation from synthetic to real data. The problem is that spring balances are used to measure the weight in the field by health workers, but more often than not, they are either not available, broken. Hence, we had to build a non-intrusive solution that can work in a rural setting. We are also the first organization to create the full 3D scan of a baby.

WORKING IN AI

- Focus on math and deeply understand how something works. Undergrads should only focus on building strong basics in linear algebra, probability, statistics, optimization, calculus, etc.
- Pick a topic and go deep into it sufficiently for you to make an informed choice of continuing or not.
- Read papers, appreciate the contribution but always have a critical eye. It's important to have mentors around to

give you feedback to point out potential mistakes in your modelling/analysis. Otherwise you keep believing the conclusions you have derived, only for them to be invalidated much later.

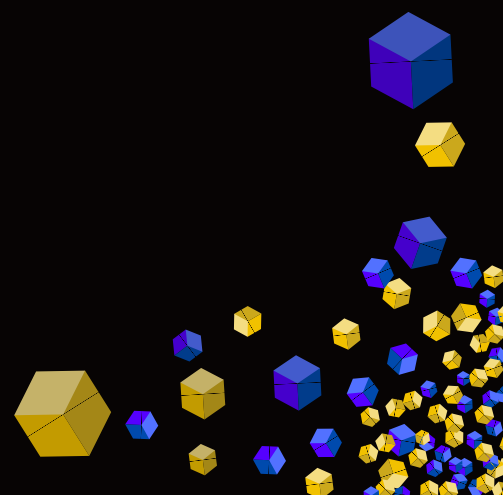
- Modelling is just one aspect of AI, when building an AI solution. Track your experiments and as much as possible, visualize (use <https://www.wandb.com/>).
- Stay updated with what the community values: use Twitter, Reddit, etc. whatever works for you.
- Set up conference weeks: When a major AI conference is happening (look up <https://aideadlin.es/>), behave as if you are in the conference.
- Read. Implement. Read.

BUILDING AN ORGANIZATION

- People are everything. Hire very carefully, and once hired, care for them relentlessly.
- Always keep the vision in mind for doing anything and keep reminding everyone the same.
- Process is important, not boring. Keep track of everything you intend to do and keep weekly check-ins to ensure you are making progress.



Aman Dalmia is a 2018 batch graduate of the EEE department. He's currently the co-founder of Plio, a non-profit dedicated to improving learning outcomes for government school students.



THE BIRTH OF PARENTS

-Chirag Hegde

As the hands of the clock struck twelve, with the red bulb turning off and the shrill cry of a baby echoing through the delivery room,

a Mother was born.

Rakesh and Garima were a middle class couple, living from paycheck to paycheck. He was a government clerk who toiled day and night with a monotonous rigor to make ends meet, Garima tailored clothes with the black sewing machine that was as old as their marriage, a gift from her father.

They had both been declared infertile by the doctors and had given up all hope of conceiving until one fateful evening, Rakesh returned from his jejune day, loosened his tie, and plopped heavily on the sofa letting out a long sigh. There was a muffled squeal, and after what seemed like forever, Garima walked into the hall with slow steps, disbelief on her face, "I'm pregnant." On the midnight of 10th September 1992, their 10th marriage anniversary, they received the greatest gift possible, Aman.





As the nurse walked out of the operation theatre, she could see the bent silhouette of a man in the waiting area, his forehead resting against clasped hands, rocking back and forth, muttering inaudible prayers. "Congratulations, it's a boy", said the nurse with a gentle smile. Rakesh, as if waiting to hear these exact words his entire life, sprang up! Brimming with ecstasy, he quickly got the box of sweets out of the bag, and handed it to the nurse with trembling hands. The nurse let out an amused laugh and said, "You may see them in 5 minutes."

Those 5 minutes felt more like 5 years for Rakesh, as he paced across the hallway, fiddling with his worn-out silver wedding ring. Finally the doctor walked out of the operation theatre, "Both the baby and the mother are perfectly healthy, you may see them now." Rakesh, without missing a beat, touched the doctor's feet and half-walked, half-ran into the room.

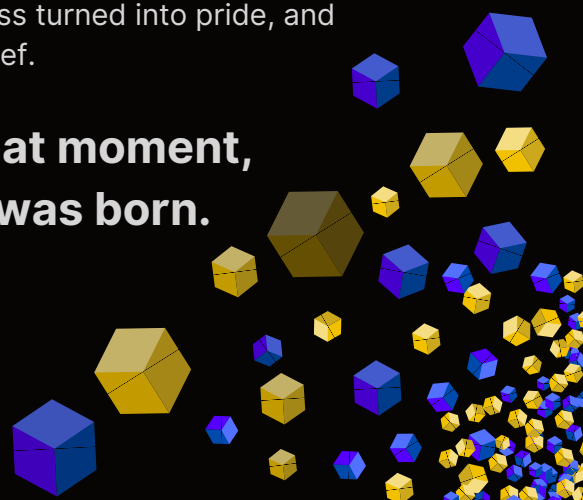
The light from the ceiling bounced off the bright fluorescent walls, flushing the room with a congenial warmth. Relief flooded through Rakesh when he saw Garima sitting upright against the bed with the baby on her lap. With a newfound glow on her face,

she carefully picked up the baby and handed it to Rakesh, closely observing him, observing the excited child inside him that rarely made an appearance.

He held the baby in his arms just as he had practiced countless times in front of the mirror. "How is this the right way? I look ridiculous!" said Rakesh looking at the camera, behind which was a seven month pregnant Garima, whose laughter echoed through an almost empty flat.

As he looked down at the baby, his lungs felt heavy, warmth spreading across his chest just like the first rays of the sun adorn the clouds in the morning. "Aman", Rakesh said, just like Garima's father would have wished if he were alive. A strong man in his days, weakened by the shackles of cancer. Rakesh also felt an emotion he didn't quite understand. It was like a blotch of Incredulousness turned into pride, and doubt into belief.

**And at that moment,
a Father was born.**



THE LANGUAGE OF THE UNIVERSE

-Shirin Jain &
Snigdha Jain

"The more man learned, the more he realized he did not know"
- Dan Brown, The Lost Symbol

Nothing is hidden that will not be made known. Nothing is a secret that will not come to light. Behold, and you will notice that this universe; no matter how complicated, intricate, and perplexing it might seem; has veiled its mysteries in the most subtle and delicate way.

Nature is symmetric. It follows patterns, and these alluring and stupefying symmetries are what makes the universe the most beautiful creation of the gracious Almighty. But before we start deciphering the laws that govern the universe, before we decode the grand yet fundamental philosophy of the universe, and before we plunge into the deepest secrets of the existence of mankind, we need to know the language of the universe: Mathematics!

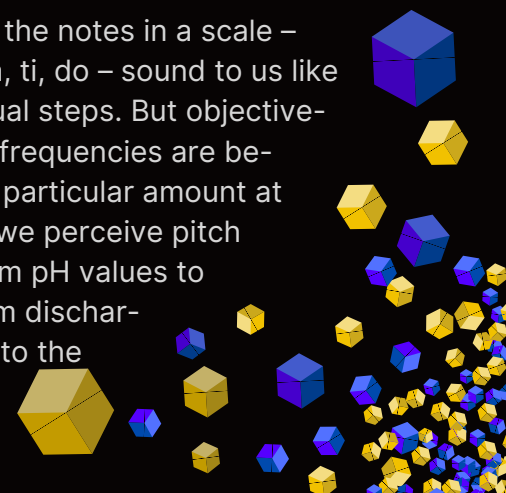
Galileo Galilei once rightly said and I quote: "Philosophy is written in that great book which ever lies before our eyes - I mean the universe - but we cannot understand it if we do not first learn the language and grasp the symbols in which it is written. This book is written in the mathematical language, without which one wanders in vain through a dark labyrinth."

There is one thing that possesses true universal appeal - for which all humans share a longing without even knowing it. It is not love, nor desire for food, shelter or safety, but mathematical truth that applies equally to us all: normal or abnormal, living or dead.

In keeping with this proclamation, I present to you some of the most bewitching and enchanting symmetries of nature, dictated by Mathematics.

But first, there is a need, deep within me, to articulate how I feel about logarithms. I fret they've already been ruined for you, obscured and concealed by the shuffling of numbers. The fact that early school years are squandered on nitpicky particulars of elementary algebra is astonishingly tragic. Beyond these particulars lies a whole new world of numbers dotted through an exponential increase. This, my dear future inventor of mortal space robots, is the logarithm, a beast which, at times, transcends even the fanciest of counting. As you 'plus 1' your way towards your noble goal, I only hope that you allow yourself the occasional indulgence of stopping and smelling factors of this magnificent realm. For instance, I like the number 8. I like the way it smells like 2 and 4 with a hint of 3, in a cubic sort of way, though that only further amplifies the sweet and gratifying scent of 2.

The frequencies of the notes in a scale - do, re, mi, fa, sol, la, ti, do - sound to us like they're rising in equal steps. But objectively, their vibrational frequencies are being multiplied by a particular amount at each note. Hence, we perceive pitch logarithmically. From pH values to safety indices, from discharging of capacitors to the



kinetics of chemical reactions: I won't hesitate to say that nature encapsulates its beauty and wonders through logarithms. First-order differential equations forever reign and sway nature and, by extension, our existence.

And then there is the famous Fibonacci Sequence which has captivated and charmed scientists, mathematicians, artists and scholars for centuries. The Fibonacci sequence is the sequence in which each number is the sum of two preceding numbers, starting with 0 and 1. It goes like this: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55 and on and on forever. Pretty simple, yeah? But this sequence, my dear future authors of scientific best-sellers, is what constructs the basic structure and pattern of the universe and leaves us in awe and bewilderment as we ponder over the impact it creates in our lives. For example, the number of petals in flowers follow the Fibonacci Sequence. The seed heads also follow the same pattern. They are arranged in a spiral pattern and the number of steps matches the Fibonacci digits. Snail shells follow the sequence through spirals, as does the cochlea of the human inner ear. From Spiral galaxies and hurricanes to DNA molecules, the Fibonacci Sequence is everywhere.

The ratios of the successive pairs of numbers in the Fibonacci Sequence converge to the Golden Ratio or phi, which is 1.618. If you keep dividing consecutive terms of the Fibonacci sequence it will eventually get close to the golden ratio. The proof for that uses eigenvalues, but you can check the results yourself by picking consecutive larger terms. The Golden Ratio is a special proportion that helps demonstrate the idea of incommensurability - which is to say,

“ **Math is beautiful, but that beauty is lost in the classroom where we only focus on its (ironically named) real-world applications.** ”

the existence of irrational numbers. It begins to delve into the mysteries of mathematics. Math is beautiful, but that beauty is lost in the classroom where we only focus on its (ironically named) 'real-world' applications.

Studies say that the most beautiful faces are the ones whose dimensions obey closely the Golden Ratio. Moreover, the dimensions of the Earth and the Moon form a golden triangle. That means, if you were to take the Earth's radius and add it to the Moon's radius and divide it by the Earth's radius, you would get the square root of phi. Pretty cool, isn't it?

All around me, I see the beauty of mathematics and I get carried away by its whims and fancies. I see it showering light upon the most obscure and concealed mysteries of the cosmos, finding the lost truths and untangling riddles in the most dramatic way. I applaud and admire the symmetries, algorithms, patterns, logics and paradoxes that nature is filled with. From spirals to helices, from never ending irrationals to infinite sequences, from logarithmic variations to exponential growth and decay, nature has it all.

Nature loves symmetry.
Who are we to question that?

IIT GUWAHATI

STUDENTS' SENATE

- BEHIND THE SCENES

-Nishtha Rautela

The Students' Senate is the central representative body of the students of IIT Guwahati. It guides the activities of all five boards of the Students' Gymkhana Council. It serves as the main forum of expression of students' opinion. It is in continuous touch with the general body, consulting with the students and acts as a feedback system. The Senate also ensures that the executive wings carry out all their functions under its guidance.

What are the responsibilities of the student senators?

All candidates in the Students' Gymkhana elections have to state their agendas, based on which students vote for them. Once elected, the student senators put forth their agendas, and discuss how to implement them effectively. Based on this discussion, the senators are assigned to different specialized committees, such as Finance & Overseeing, Academic Affairs, Food, and so on. This could mean that you might end up working for someone else's agenda or vice versa, but that is the core principle of the senate. No matter which agenda you propose, once you are a member of the senate, you work collectively, in the best interests of the student community.

There are four to eight members per committee in the senate. I was part of two committees, Finance & Overseeing Committee, and Rules, Procedures & Nominations Committee.

- Finance & Overseeing Committee** - Technical, Sports, and Cultural Boards conduct many events throughout the year. The members of the Finance & Overseeing Committee supervise the financial matters, verify and sign off on the bills of these events, before submission to the office.
- Rules, Procedures & Nominations Committee** - The members of this committee check whether rules are being followed by students, whether a certain rule needs to be amended or completely scrapped, and so on. They also decide on procedures for introducing and assigning a new position (for e.g Associate GenSec) in the senate.
- Academic Affairs Committee** - The members of this committee take up academics related concerns with the Academic section; for instance, UG students in some departments feel the need for an Integrated MTech/Dual Degree at IITG. This committee also coordinates with Students' Academic Board (SAB) regarding communication of academic procedures and announcements to students, and improvement of facilities like the AAMS portal.
- Food Committee** - This is understandably one of the most robust committees! The members of this committee review the pricing, food quality and hygiene in all the food establishments on campus, including the food court, IRCTC canteen (now Vinaigrette), etc. They also collect feedback from the campus community.



Apart from these, there is an Establishment Committee, which works on issues like restoring network, street lights, and general maintenance. The Emergency Committee is in place to help students in any kind of trouble, or if a rule/policy change affects students adversely. An important thing to note is that the senate, consisting of eight to ten members, essentially represents the entire student body on campus. Whenever a new policy is being drafted by the institute, it is the responsibility of the Students' Senate to analyze its impact on students and to raise concerns or spread awareness about it. The Senate also proposes new policies based on the needs of students.

What made you want to be a part of the Students' Senate?

I had worked with several cultural and technical clubs in my freshman year, and while I learnt a lot from that experience, I felt that my work with these clubs did not directly affect the students on campus. I did not have much of a say in the policies being made regarding student activities. I wanted to be involved in the decision making process and to bring a positive change in student life on campus. This prompted me to run for the post of Girl Senator in the Gymkhana elections.

Did you introduce any novel initiatives during your tenure?

My strongest agenda as a Girl Senator was to build a community for girl students, which would serve as a medium to share knowledge and resources. Often, in consecutive batches, girl students are assigned different hostels, leading to a disconnect between seniors and juniors.

My aim was to forge a connection between girl seniors and juniors through an academic mentorship program. The program was introduced through the Academic Initiatives Club of SWB. Sophomore year girl students were assigned mentors based on their department and matching academic inclination and interests. An average of 5 mentees were assigned to each final year mentor, who interacted with them and provided valuable insights regarding academics, extracurriculars, internship programmes, etc. I was also a part of the conversation regarding the creation of girls' washrooms in boys' hostels, especially in placement hostels, like Umiam.

What are some challenges you faced during your tenure?

When we, as senators, propose a new initiative or policy for the good of the students, the decision making bodies cannot simply take our word for it. We need to show that it is a real need for students, and that it would see a positive response and active involvement from students on campus. Ensuring participation from students is a challenging task.

Another significant challenge is that many people either hesitate to issue their concerns/complaints with the senate or do not know the proper channel to do so (which is by contacting the concerned student representatives in the senate/gymkhana). Other times, we may propose a new policy/action to be taken in accordance with someone's complaint, and for that we may need them to come forward and show their support for it, but if they don't, it could severely reduce the credibility of our proposal in front of the decision making body.

What was the role of the Students' Senate in the decisions regarding online instruction during the COVID-19 pandemic?

We raised concerns regarding online instruction on behalf of students belonging to economically backward and/or geographically disadvantaged areas. Many students (such as research scholars) could not complete their degrees without being present on campus, since they could not continue their research work remotely. Provisions were made to bring such students back on campus so their learning would not be hampered.

What would be your message for the upcoming members of the Students' Senate?

Be passionate about whatever you do. Give justice to each and every agenda on the table, because in the end, it's not just about the agenda you bring, but about the welfare of the entire student community that you and subsequently your juniors would be a part of. Think about the bigger picture.

LIFE AT IITG - A RETROSPECTIVE

-Sasank Gurajapu

Looking back at college life triggers a number of memories, be it the hostel rivalry, planning responses to your crush, cramming on the night before exams and the first and last moment when I looked at the main gate! Another way to look back at college life is the transformation throughout this period, not just in me but friends, batchmates, seniors and juniors alike.

I'm rather fresh into the corporate world, but it's indeed lovely to look back at my journey through college.

A LITTLE BIT ABOUT ME

As a kid, I had the privilege to try out several things throughout my childhood. And I'm grateful for that, it was what made me today.

That part of my personality stayed with me as I decided to explore a number of clubs and fields right from my freshman year.

Being a part of the electrical major, I wanted to give it a fair chance if I found a knack for it.

Attending a number of orientations was a start, but prior to that, I decided to venture into Photography club (I used to shoot before college), Quiz club (I was a national level quizzier back in school) and finance club (I had some interest going into finance).



You might not have interest on the surface of it, but in my opinion, it's criminal to not give your branch a shot.



But these predefined inclinations didn't exactly stop me from trying out a number of other clubs and activities.

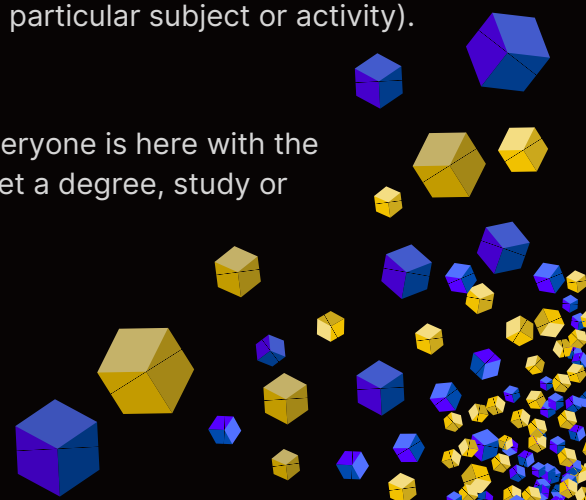
From IoT, Image processing workshops to working on blockchain and Product design, I've put in effort towards a number of fields.

In some cases I found a knack for it, in other cases my curiosity was satisfied.

This exploratory attitude has been more in the direction of being a generalist (person with a wide array of knowledge on a variety of subjects, useful or not), and less about me being a specialist (who concentrates primarily on a particular subject or activity).

Courses

Obviously, everyone is here with the intention to get a degree, study or otherwise.



You might not have interest on the surface of it, but in my opinion, it's criminal to not give your branch a shot.

People have a number of opinions on college, curriculum and the way it's taught. While I would refrain from giving any opinion, I would really suggest people to explore what's the level of research being carried out across different fields, even those outside your department.

My friends actively sought out projects with various centres (of energy etc.) and departments like Chemistry while pursuing a major in Electrical.

Another great option is pursuing a minor. I really had no idea of what I was getting into when I opted for Product Design as my minor, but that turned out to be a great addition to me completely. A sense of design and user understanding is an understated tool in my professional journey.

The departments are more academic and research-oriented in their approach and understandably so. The way I look at it, participating in clubs and internships gives us the corporate and industry-grade idea of skills and carrying yourself in professional environments.



Clubs and activities

I've mentioned clubs a lot so far, so why have clubs been crucial to my college experience?

- Peer motivation - Peers with similar experience, starting with zero/minimum experience out to conquer a field.
- Guidance - Instead of digging your way, you have seniors and a network to bank upon for focused efforts.
- Social network - The closest of my connections across batches and some of the most special moments can all be tied back to a club.

These are some of the prominent reasons to join a club, with each club offering something different.

While several clubs could be focused on learning a craft for the sake of it, many can pave your way to professional expertise.

At first glance, one might think that only technical clubs can aid with professional expertise, but I've personally witnessed professional photographers out of Montage, aspiring filmmakers out of Lumiere and playwrights/actors of expressions, just to point out a few.

I was involved in the Finance club, and had aspirations to learn a lot about valuation. Though I haven't made a career in Finance, the learnings are invaluable, same is with the connections.

It's one of those senior guidance things that made me enter a case study and valuation competition, and the work I did then is useful even today, as part of my consulting experience.



Talking about Consulting

Through campus placements, I was placed in Deloitte Consulting. With apprehensions of it being a coding job, which I was ready for but didn't get me interested, I headed into the first day to realise it was a strategy consulting role. Quick introduction, we deal with solving company problems, specifically concerned with adopting Cloud technology.

Usually, I analyse large sets of data to come up with business reasons to adopt the cloud, how to implement the changes and manage the implementation. While core electrical skills may not be of use to me in this job, a number of soft skills and few hard skills that I've picked up during my college definitely surface on a regular basis.

So, what do I carry with me?

Learnings from clubs, past knowledge from major and minor degrees waiting to be leveraged in professional discussions, and an incredible social network to help out whenever.

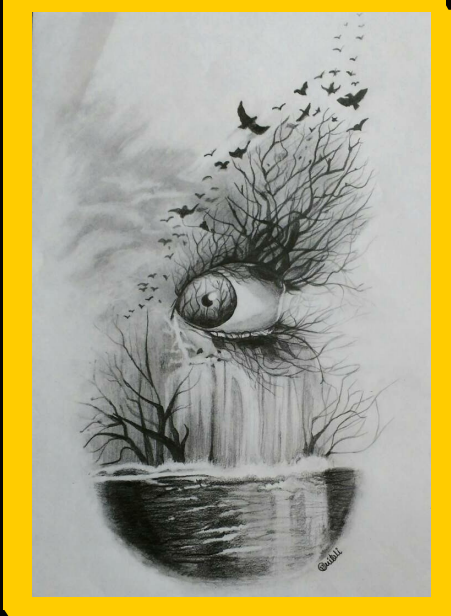
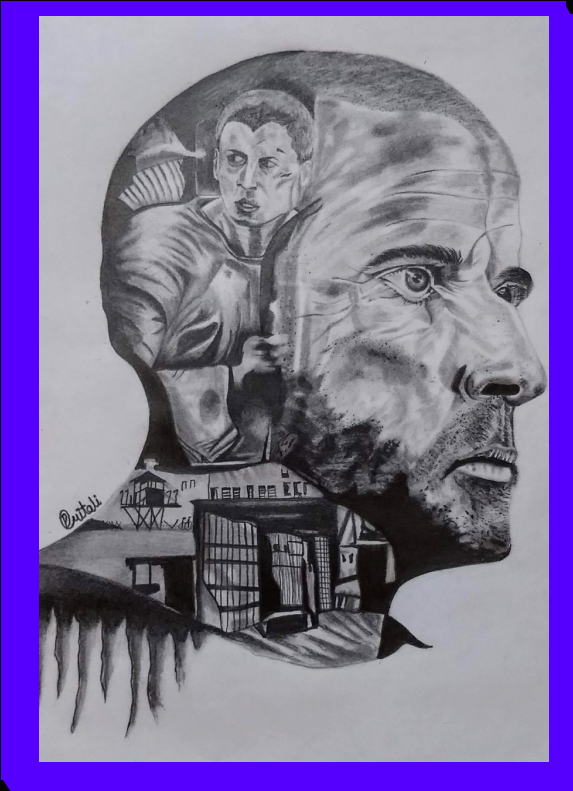
My advice to students on campus would be, focus better on getting a decent grade! Other than that, make memories, friends and learnings for a lifetime!

Art & Creativity

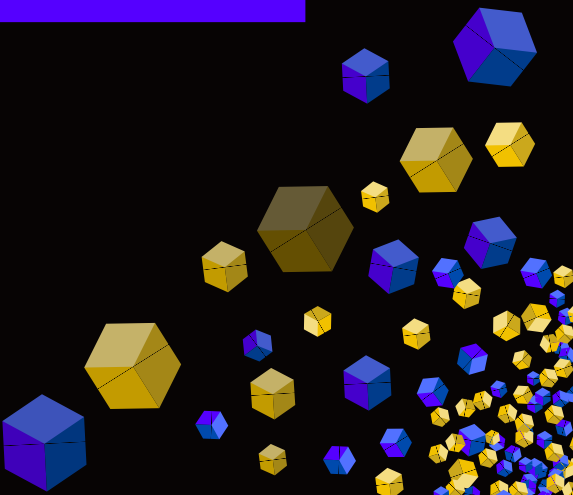


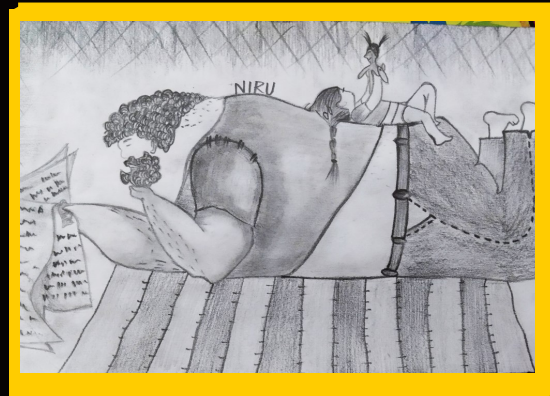
Anvita Kodru

Pre-Final Year, EEE Department



Mitali Potdar
Freshman, EEE Department





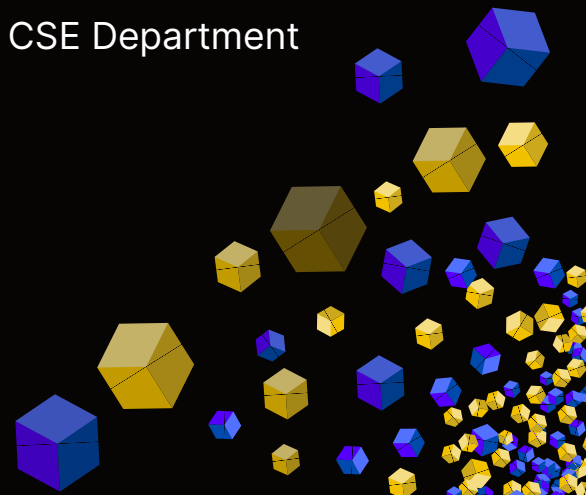
Nirupama Jha

Freshman, EEE Department



Amey Varhade

Pre-Final Year, CSE Department



Hey there!

We truly hope you enjoyed reading!
If you have any comments, reviews or feedback,
please write to us at
cepstrum@iitg.ac.in

TEAM

Supervising Editor



Samruddhi Marathe

Design Head



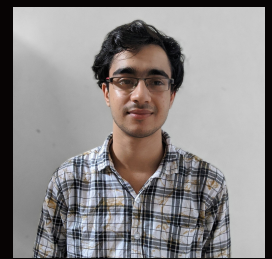
Sushant Timmapur

Inphase Mentor



Karthik Tata

Design Mentor



Mayank Soni

Content & Design



Tanmay Thakur



Bhaswati Boro



Tanmay Shreshth

Content



Snigdha Jain



Shirin Jain