



InPhase

16th Edition

2018
—
2019

- **Angry India Does It**
- **To Infinity & Beyond**
- **Of Carts And Horses**
- **In Love With the Broken Systems**



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HEAD OF DEPARTMENT, DEPARTMENT OF ELECTRONICS AND ELECTRICAL

It is my great pleasure and honor to write this message for the InPhase magazine. I take this opportunity to put on the record that year 2019 happens to be the Silver Jubilee year for both the Department and IIT Guwahati. This milestone has a special significance in the life of any institution as it signifies a coming of age and maturity. On looking back, one feels proud to be associated with an Institute which has seen phenomenal growth and set up high academic standards. In recent years, both national and international ranking agencies have placed IITG among top 10 institutes of the country. In 2019 QS Global Rankings, the Department secured a place in the 200-250 bracket and has become one of the best-ranked departments of the Institute.

But this is just the beginning. With maturity comes the greater responsibilities. In the present time, the Department, as well as the Institute, is facing challenges in terms of changing priorities. Those challenges are compounded by the continued increase in the student intake in the last few years and the demising budgetary support for the capital expenditure. There is a greater need for the Department to engage in cutting edge research in collaboration with the reputed industrial and academic partners. With increased competition and being situated far away from economic/industrial hubs of the country, it is not easy to succeed on that front. For that, we need to chalk out a clear strategy focusing on our strengths and put in sustained efforts.

Recently, the Department has achieved another milestone with the award of 100th PhD degree. The Department has expanded its post-graduate programs and is actively seeking the involvement of industrial collaborations to enrich them. From July 2019, the Departments of CSE, EEE and Mathematics are jointly starting a new interdisciplinary post-graduate program in Data Science. Supported by the FIST grant from the Department of Science and Technology Gol, a device fabrication facility is being set up in the Department. Despite all these efforts, many more proactive steps are required to be taken with a lot of self-belief. We can draw inspiration from the quote of Dr. A. P. J. Abdul Kalam, great aeronautical engineer and statesman, "If four things are followed - having a great aim, acquiring knowledge, hard work, and perseverance - then anything can be achieved." Therefore, I am confident that with the support of all stakeholders we would continue to march on the path of excellence and serve the nation.

I sincerely thank all the contributors to the current issue for their excellent articles that touch upon some very pertinent issues. The InPhase magazine continues to showcase the extraordinary talent among us and they all truly deserve our admiration. Kudos to the editorial team for compiling such an interesting issue. I'm looking forward to the next issue of the InPhase.

With best wishes to one and all.

Sincerely,
Prof. Rohit Sinha
Head, Dept of EEE





TEAM INPHASE

Greetings!

Sir David Brewster was a distinguished British scientist we more commonly know from Brewster's angle. While looking at some objects at the end of two mirrors, he noticed patterns and colors were recreated and reformed into beautiful new arrangements. He named this new invention after the Greek words meaning "beautiful form watcher".

A cardboard box, some mirrors, and a few pebbles. Who knew these seemingly mundane and common items could become a delight of beautiful patterns and intricate designs. The kaleidoscope has been a favorite toy during each of our childhood days.

This 16th edition of InPhase aims to be a kaleidoscope, a kaleidoscope upon shaking which can alter your perspective, give you insights, be fodder to your brain, motivate you to work on your idea, pursue your long-standing dream, and think differently. We believe that the essence of the beautiful is unity in variety, and hence in this edition, we'll take you on an intriguing journey of the various facets of our department. From the intriguing research articles to student and faculty experiences at IIT Guwahati to the story of our first ever supercomputer, this edition has it all.

We sincerely thank all the authors for contributing to the magazine and writing such prodigious articles. We truly hope that you enjoy reading the magazine. Do remember to share your views on the magazine as it would help us in fine-tuning our efforts with our readers' expectations. See you again next year!

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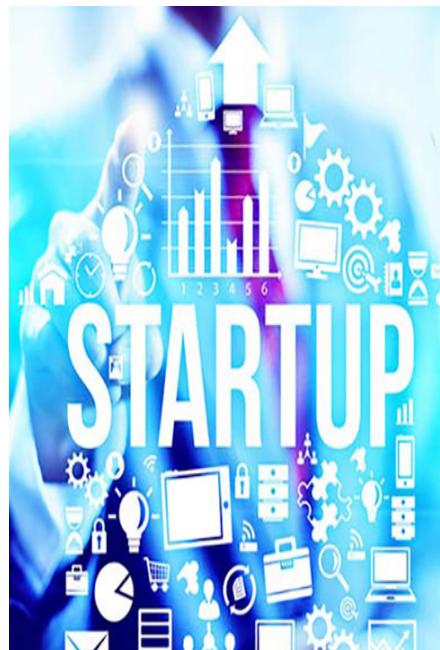
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IIT Guwahati has been

churning many successful startups every year. In this text, we will take you through the journey of all the start-ups that has been co-founded by IIT alumni.

15 OF CARTS AND HORSES

In this brew of statistics and comics, Cepstrum's faculty coordinator Ribhu explains the concepts of correlation and causality with a dash of random processes and time series.

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In September 2016, IIT Guwahati received its first ever supercomputer, PARAM Ishan, the fastest in this neighborhood of the country. India's struggle for an indigenous supercomputer is a thrilling saga of fightback put forth by a nation amidst challenging times. So, how did we, as a country, end up with these supermachines?

21 MY TOUR OF DUTY IN THE NORTHEAST

In this article, Professor Amit Sethi shares his experiences being an IIT undergraduate himself to teaching undergraduates at IIT Guwahati. He talks about how he fell in love with the culture of North-east and discusses how the institute can



progress, given the right choices are made.

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Ashutosh Sharma, ex-Secretary, Equinox Club, talks about developing an interest in the field of Astronomy and gives insights on how to get started with research in the same.

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The general secretary of the IEEE Student Branch of IIT Guwahati talks about his journey in the

role; and the learnings and musings of his tenure.

30 BIOMEDICAL IMAGE PROCESSING

The world of possibilities that was opened in the field of Biotechnology due to the advent of sciences like Image Processing and Machine Learning took the world by storm. In this article, Mayank talks about the prospects of Biomedical Image processing and how it could change the world; forever.

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STUDENT

Moving to a new place can be daunting for any one but not if the place is India as it seems in this brief treatise by our guest from Syria. Journey across India with Sami as the country stands true to its heritage of "Atithi devo bhava" for this young student.

36 HOLISTIC THINKING IN RESEARCH

Research is a fairly vague process. A quick Google search brings up this definition: "the systematic investigation into sources in order to establish facts and reach new conclusions." In this article, Dr. Karthik throws light on the various systems of conducting research.

FACULTY ADVISING

In love with broken systems

In this article, former general secretary of Cepstrum Neeraj Sharma argues about the utility, and implementation of faculty advising, giving constructive suggestions to improve the system.

- Neeraj Sharma

There are many such systems in the IITs which are broken beyond repair and one among them is the system of Faculty Advising. Don't get me wrong, it is a very noble concept to help students sail through the most important four years of their life with expert guidance. But if only intentions could have made a concept successful, demonetization would have been an outright winner. Faculty Advising is a perfect example of the love of Indian institutions for bureaucracy and complicating simple procedures. How else can one explain the fact that the only purpose a faculty advisor serves is signing the Minor and Course Adjustment forms (that too without any discretion or advice)? The only change getting rid of faculty advising will bring in student's life is that they will have one less authority to deal with.

In this article, we try to explore what faculty advising could have been, see if there is any hope of mending this broken system and discuss with various current faculty advisors to understand how we came to such a pass

THE ORIGINS

The concept is fairly popular in all the western universities. But one of the major distinction between Indian and western universities is that the western counterparts allow students tailor-made semesters where they are at liberty of choosing their courses from an available list. Hence the requirement of an expert or a guide is indispensable. But this does not mean that the concept of faculty advising is useless for Indian universities, there are many others functions a faculty advisor has which help a student sail through the college years. Let go through how various

top colleges define the purpose of faculty advisors



MIT is one of the first universities that adopted the concept of faculty advising. Let's go through what is their ideology behind initiating this.

"When students enter the Department, they are assigned a faculty advisor. The principal role of the academic advisor is to help individual students plan their academic programs in ways that are consistent with the degree requirements and their career objectives. The faculty academic advisor is only one of many advising resources. The Department strongly recommends that students reach out to all advising options available and cultivate an advising network. Students interested in grad school will need letters of recommendation. Students interested in going into the industry may find that faculty have different relationships with industry and different perspectives regarding career advice, or different networking opportunities. Your advisor is not an expert on everything, so it is perfectly fine for you to seek advice from other faculty members as well."



UC Berkeley has adopted a different way of implementing faculty advising. Instead of allotting the faculty advisors, various faculty advising sessions are held. Each session has a different set of professors.

You can choose to select any one session according to your interests and clear all the doubts you may have regarding academics. Quoting from their website :

" This is a great opportunity to ask faculty questions about their own experiences, course recommendations, undergraduate research, and how to prepare for graduate school or a job in the industry. These advising sessions may happen in small groups or one-on-one appointments. Questions about degree requirements and policies should be directed to a staff adviser within the department or your college."



Brown University keeps its faculty advising system in very high regard as is evident from the description of faculty advising on their website :

"The success of Brown's open curriculum rests on the strength of our academic advisors, who help students define their academic pathways and shape their educational goals. Together with academic deans and peer advisors, faculty advisors help students to see their time at Brown as an intellectual exploration in and out of the classroom. Opportunities for advising occur almost any time faculty and students come together—in class, in the lab, during office hours, at departmental events or other extracurricular activities. Brown's formal advising program provides the most structured forms of support for our students."

WHERE DID WE FAIL?

Prof. Srinivasan Krishnaswamy, Faculty Advisor for EEE-2017 batch says: "When we accept these small problems as part of our lives we become part of the problem. Rules do not build institutions, people do. Do not blame faculty advising as a concept, we, the college community, are here to be blamed for this mess ". If faculty advising is indeed such a beautiful concept how did we fail to embrace it? It was a system which was intended to help the student make important academic decisions and navigate through college bureaucracy but ended up complicating the things further.

As Dr Krishnaswamy says the complete blame for its failure cannot be put upon the wrong implementation, equal blame rests with the lack of initiative on part of students and faculty to make this concept successful.

THE WAY FORWARD

But the question we are asking in this article is: "Is there still hope?". Dr H.S. Sekhawat, who is the current faculty advisor for EEE (2020 Batch) says: "This is the first time I am working as a faculty advisor and I am more than willing to help if a student approaches me. Unless they seek my advice or help, I can't do much". If the students are willing to take an initiative and authorities show some intent to repair the system, things can always be turned around. Let's have a glance at some suggestions that may transform faculty advising into what it was originally intended to be:

1. Get rid of redundancies: The mandatory signature of faculty advisor for Branch Change and Minor registration should be done away with. Detecting any exam clash or fraudulent case is the job of the academic section. Faculty advisors anyway don't care to check student credentials most of the times before signing. This will prevent faculty advising from becoming a bureaucratic hassle.
2. Assign an Advising Panel: Instead of assigning a single person as advisor a panel of professors from diverse fields should be assigned for faculty advising. Because the purpose of faculty advising is to help a student make tough academic decisions which may be related to any field of his branch, so a faculty advising panel with the diverse field is a more meaningful practice.
3. Promoting Faculty Advising among students: Just when a fresher enters, there are enough posters around the campus which tells them about Anti-Ragging Helplines, student counsellors, etc. But there isn't enough information available about faculty advising, a possible channel for academic counselling. If the students start consulting their faculty advisors early in their freshmen years they may get more motivated towards.

core department activities. But again the condition for this is that the faculty advisors reciprocate the queries with patient advice.

These are some of the pragmatic suggestions which may help to mend at least one broken system of IITG. But these suggestions are mere words, it will need real people with real intentions to turn things

around. By bringing the problem to the fore we have moved a step closer to the solution. I would end this article with words from the famous thinker, Robert Schuller: "Running away from any problem only increases the distance to the solution, easiest escape route from the problem is to solve it." Let's not dodge the problems but confront them.



**Rules do not build institutions,
people do.**

THE NEXT GAME CHANGERS

— STARTUP - IITG —

Curator - Sai Bhaskar
Editor - Neeraj Sharma



Hashedⁱⁿ



IIT Guwahati among other older IITs is like a kid who finds a place in senior cricket team and now wants to prove the seniors that he too is capable of hitting big runs. There is still time before this Kohli starts outshining the Tendulkars, but one field in which IIT Guwahati cannot be ignored for sure is the Start-ups. Though we are yet to come up with Flipkart or Housing of our own but still IIT Guwahati has been churning many successful start-ups every year. Not at all bad for an institute which is hardly two decades old. In this article we go through all the start-ups that has been co-founded by IIT alumni. This article will definitely inspire all the budding entrepreneurs of IITG.

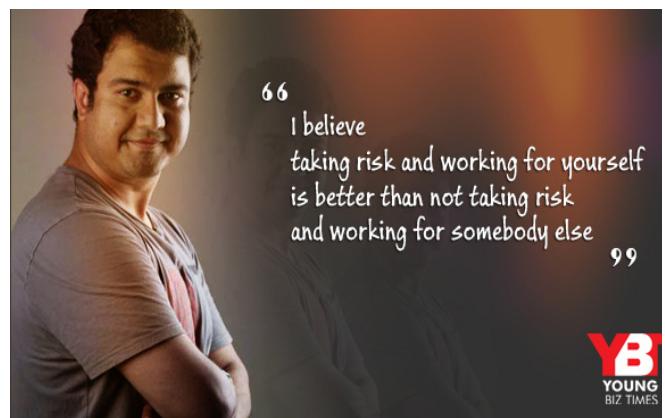
With the hope that you will feel a sense of pride and also get inspired reading the success stories of our amuni, let's look at them one by one.

Cashurdrive

Founder - Raghu Khanna (ECE)
Founded in - 2009

A blog about entrepreneurship and IIT Guwahati can-not be complete without the mention of Raghu Khanna, Founder and

CEO of Cashurdrive. Raghu Khanna can be said as Rockstar of Startups emerged from IITG. You might have read about Raghu in the bestseller book Connect the Dots by Rashmi Bansal where he is featured among 20 entrepreneurs who never went to a B-School and dared to make their own path. He is also a popular entrepreneur known in campus and his story probably has driven recent IITG grads to take up entrepreneurship seriously. He had a job offer from Samsung and MS offer from Georgia Tech but suddenly some events made him an entrepreneur. Cashurdrive is the pioneer in outdoor advertising on vehicles. Cashurdrive has worked with top brands from Google to Visa , Flipkart to Levi's and there is a very high probability that we would have come across an advertisement which was delivered via Cashurdrive. From a simple idea, Cashurdrive has grown to dive into multiple advertising options and have 20,000+ Airport cabs for advertising. They were the media partners of IPL7 Team Kings XI Punjab and helped Dabur Pudin Hara brand 14,500 Autos across India.



Raghu Khanna graduated from IIT Guwahati with B.Tech in Electronics and Communication Engineering in 2008 and is probably one of IITG's youngest entrepreneur who tasted success. He won many awards like Top 30 Young Entrepreneur in India by BusinessWorld 2010, Paragon 100 – Asia's 100 Emerging Young Entrepreneurs by Foundation for Youth Social Entrepreneurship 2010 etc.

YourDOST

Founder - Richa Singh (Design), Puneet Manuja (IIM)
Founded in - 2015

If there is one start-up that has been consistently in the news for its work, it is YourDOST. It is a pioneer in the field of Emotional wellness in India, and perhaps one of its kind across the globe. From NDTV to Forbes, its work has been appreciated everywhere. YourDOST founder launched a special service for its Alma Mater IITG to help students cope with stress and it is free of cost. Do check it out.

YourDOST is a personal emotional wellness trainer – a trusted online friend one can talk to, with qualified experts who know how to help you! The professionally trained experts help you cope with tough times – work stress, relationship, self-image and many more, and support you in your quest for self improvement.

AddoDoc

Founders - Sowrabh NRS (CSE), Satyadeep Karnati (CSE), Avinash Hindupur (Biotech), Siddharth Ahluwalia (IIIT)
Founded in - 2015

AddoDoc is revolutionizing the doctor-parent communication space. We of-

ten face issues in reaching out to a busy doctor when we need advice. We have to make an appointment and visit the doctor physically, even for trivial issues. Sometimes doctors do share their personal phone numbers, but they are afraid to do so with every patient. However, most of the time, the doctor may not be reachable over the phone.

They have an interesting story of their union as co-founders. Satyadeep was going to attend a startup event in Bangalore when he had a flat (to his bike). He called his best buddy, Sowrabh, for help. When both of them reached the event venue, Siddhartha was on the dais, presenting his product idea. Both Satyadeep and Sowrabh loved Siddhartha's idea, spoke to him, and were soon onboard as co-founders of the startup.

Satyadeep and Sowrabh were not any less "machau" during their IITG days. In their second year they had created a Dropbox plugin for syncing folders. Their solution solved a major limitation in Dropbox - folders had to be moved into the Dropbox folder prior to syncing. Their plugin obviated this cumbersome step. The plugin was a great success and was downloaded more than 500,000 times! This stupendous success got them featured in The Hindu, Lifehacker, MakeUseOf, PC World, and Fast Company. That was when they got bitten by the entrepreneurial bug. So, when the Addodoc opportunity arrived, they were quite ready to startup.

Concept Waves

Founders - Raghu Kanchusthambam (CSE), Raju K. (Osmania), Vijay Kumar (DRDL), Niharika (BITS Pilani)

Founded in - 2006

It started with a passion to transform technology adoption in the education sector. Education and Livelihoods are the key focus areas for the company. It is focused on providing holistic solutions for large group of colleges, universities as well as stand alone educational institutes. With a mature product portfolio, the company has received multiple national and international recognitions. Winner of the NASSCOM Social Innovation Honours 2013. Top 3 Innovations at NASSCOM Social Innovation Honours 2014. Awarded Rs. 1 million cash prize at

Vodafone Mobiles for Good programme 2012 and mBillionth Award Mobile & Telecom Summit.

Excellence Technologies

Co-Founders - Manish Prakash (Chemical), Kumar Mukul (ISB)

Founded in - 2009

Excellence Technologies is a Delhi based Indian IT Services company found in the year 2009 by two IIT graduates. Registered under Excellence Technosoft Pvt Ltd, the company has a 15+ IT professionals working for client around the world. Our Services include Web Application Development, Website Development, Web Design and Internet Marketing. Excellence Technologies has mastered the nuances of the business world and understands every hue of customer requirements. They have chosen a strategic global model that delivers ace services and premium quality products to their clients at affordable price

Deshya Technologies

Founder - Prof. Praveen Kumar (Assistant Professor, EEE), Dr. Sadhna Tyagi (EEE)

Founded in - 2012

This startup is the most puzzling one for me personally. This is an e-learning startup in field of Electrical Engineering from one of the assistant professors in EEE department but almost no one among the department students know about it. Despite its relevance, it was never promoted in IITG the way it should have been for reasons unknown.

A look at the Deshya website shows that it is an indispensable tools for Electrical engineering students if they wish to hone up their skills in this fields. Explanations with 3-D models, animations and video lectures is an awesome way to learn more about Power Electronics and Machines. The icing on the cake is the fact on completion of any course, you will receive a certification from Prof. D.P. Kothari, the stalwart in field of electrical engineering. One of the most coming of the age courses on this website is Hybrid Electrical vehicle, which is one of the electives for fourth year students but rarely floated.

Baarzo / Vivu

Founders - Arun Reddy (ECE), Siva Yellamraju (CSE), Sarath Ciddu (CSE), Pritish Jetley (CSE)

Founded in - 2013

In June, 2014 there were ripples in Indian Startup community when the news of acquisition of an relatively unknown novice startup by Google came in news. No doubt the IITGians were elated as this celebrated startup is brainchild of IIT alumni.

IIT Guwahati is still very young to have lots of stories about successful serial entrepreneurs. But the co-founders of Vivu and Baarzo, Siva Yellamraju and Sarath Ciddu are among the very few successful serial entrepreneurs. Vivu Inc was a privately held video collaboration company which got acquired by Polycom in 2011. Polycom is the global leader in standards-based unified communications (UC) for telepresence, video, and voice which are powered by the Polycom Real-Presence platform to which Vivu was integrated.

After the team got acquired they worked for a couple of years with Polycom and later started Baarzo. Baarzo is building a search engine for video and enables users to search specific moments in a video. Baarzo was later acquired by Google.

Review Gist

Founder - Nishant Soni, CEO (CSE)

Founded in - 2013

ReviewGist.com is a product discovery and research tool for consumer electronics powered by online expert reviews. Review gist works to understand what part of the product the reviewer deems to be good or bad. This enables their rating algorithms, product comparison and recommendation tools.

Inoho Smart home solutions

Founders - Deep Singh (ECE), Deepankar Garg (Mech)

Founded in - 2014

It is the second IITG startup from EEE department that is working in the field of home automation. Bangalore-based Ino-

ho was founded in January 2014 by Deep Singh (IIT Guwahati) and Deepankar Garg (IIT Guwahati, IIM Ahmedabad). It later roped in Gagan Singh into its founding team as well. Inoho is a product in the smart-homes space. It allows users to control light, fans, geysers, ACs etc. from the smartphone, and this can be done even over the internet, giving the user the access to his home from anywhere in the world. The user can schedule, time or just set moods for his place.

Hashedin

Founders - Himanshu Varshney, CEO (IITG), Anshuman Singh, COO, Sripathi Krishnan, CTO, Sandeep Singh, VP

Founded in - 2010

They call them Hashers. Founded in the year 2010 the company has grown by leaps and bounds since then. They have executed large scale web applications for Automotive, e-commerce, BFSI and Health-care. They provide clients best ROI, by diagnosing problems, crafting solutions, deploying under harsh constraints & seeing it through the finish line. Clients mainly consists of Enterprises & Start ups in the North America and APAC.

Cubical Labs

Founders - Swati Vyas (ECE), Dhruv Ratra (ECE), Rahul Bhatnagar (CSE)

Founded in - 2013

Cubical Labs is touted as one of the 10 most promising start-ups in the field of Home Automation. Probably the skills gained from debugging faulty circuits in circuits lab came in handy for the two founders, who graduated with B.Tech. in ECE from IITG. Rahul Bhatnagar from CSE is one of the co-founders of Cubical labs. The success of Cubical Labs can be gauged from the fact that it was one of the Day-1 companies that came for recruitment in 2015.

Founded in November 2013 by the young trio, the startup offers solutions that revolves around building a wireless, cost effective, safe and smart home solution, all of which can be controlled remotely through a mobile device. Cubical Labs offers solution for - Controlling Electrical Appliances from anywhere in the world, Monitoring the energy usage, Integration

with multiple platforms such as IP cameras, curtain closer monitors.

The startup has patented communication protocol, Cube-R which it claims to be more suitable for the Indian market because of less data consumption and its ability to integrate with other protocols. They started their major operations in Delhi - NCR and Mumbai a year back and have established a wide network of distributors and dealers in 5 states (14 cities) in India, and till the end of this year. The startup aims to expand to 20 states along with a few south east Asian and Middle Eastern countries.

ClearTAX

Founder - Archit Gupta (CSE)
Founded in - 2011

What does a techie have to do with the tax filing process? Automate it and make it fast, hassle free! That's what the startup ClearTax by Archit Gupta and Anupam Mediratta does. Anupam and Archit who graduated with B.Tech CSE in 2004 and 2006 respectively met again in Silicon Valley and decided to tap into the online tax filing domain. Anupam says experts in this field always had a blind side towards their shortcomings, which someone from a complementary branch could fill-up. ClearTax was founded in 2011 by Anupam, Archit and Archit's father RR Gupta who is a CA professional and decades of experience as tax expert. Recently YCombinator backed ClearTax and it probably is the first IITG Alumni startup to be backed by YC. 300,000 people filed taxes online through their website in 2013 and they expect to grow rapidly as more and more people start paying taxes online. The subsidy that government pays for an IITian could be justified if ClearTax could encourage people to pay taxes!

Anupam and Archit both went for MS and took up corporate jobs before diving into entrepreneurship.

Playment

Founders - Ajinkya Masalne (Biotech)
Founded in - 2014

Very recently, Playment has been in the news for being one of the seven start-

ups across the world selected by Google Launchpad Accelerator. Today, before listing products on their website, internet-based companies face a huge challenge of a basic check of the products, such as its background and hygiene. For these checks, companies usually have huge teams, which involves huge overhead costs.

Playment enables large companies to crowdsource completion of tasks that are typically done by in-house or outsourced teams, in a cost & time efficient manner.

TravelTriangle

Founders - Prabhat Gupta, CTO (CSE, IITG), Sankalp Agarwal (IIT-KGP), Sanchit Garg (IITB)

What happens when 3 IITians from 3 different IITs come together to plan your trip? Travel Triangle is a fast growing startup in the travel domain which was clocking revenues of Rs 1.2 crore in just 7 months. The startup has won many awards since its inception like "NASSCOM top 50 emerging companies of India" and has been featured among 10 Successful startups by IIT, IIM, BITS by ET.

Druva

Founder - Jaspreet Singh (CSE)
Founded in - 2008

We all are bombarded with Ads while surfing online and it is annoying most of the times. But the feeling when you see ads from a startup from your alma mater is amazing. Undoubtedly the most successful startup from IIT Guwahati, Druva Inc provides integrated data protection and governance solutions for enterprise laptops, PCs, smartphones and tablets. Druva has US Army, NASA, Nikon and universities such as Stanford and Berkeley as clients. Druva recently raised a funding of \$25 Million (125 Crores) from Tenaya Capital, Sequoia Capital and Nexus Venture. Behind all this success was none other than our alumnus Jaspreet Singh who graduated with B.Tech in CSE, Class of 2004 and worked for around 3 years before founding the company in 2008. One of the very few product companies India has ever produced despite being the leader in IT space.

Drishti Soft

Founders - Bishal Lachhiramka (CSE), Nayan Jain (CSE), Sachin Bhatia (CSE)
Founded in - 2006

What happens you have 3 IITGians from the same Class of 2001(B.Tech CSE), working to find a way out of their job life and make an impact. Meet Bishal Lachhiramka, Nayan Jain and Sachin Bhatia who were among the early entrepreneurs from IIT Guwahati and founded Drishti Soft Solutions. Drishti is a leading provider of communications solutions that empower enterprises and contact centers (IP Telephony, Unified Messaging, Conferencing, Presence Management, Application Collaboration and Software as a Service-SaaS).

Sachin is among the popular entrepreneurs from IIT Guwahati probably because he turned himself to Sales and Business Development despite having a love for programming. He is treated as a new Markets specialist and has travelled to over 40 countries for Drishti. It was recently in news in April as Drishti-soft Solutions received Honourable Mention in Gartner Magic Quadrant for Contact Center Infrastructure, Worldwide.

RealtyCompass

Founders - Nimesh Bhandari (Mech)
Founded in - 2013

The kids of the 90s must have read articles stating how an IIT or IIM grad is not joining a corporate job and following his/her passion to start something new. Though we now know that many people also start because they don't get jobs!. Anyway we are talking about those who have the entrepreneurial 'keeda'. Here's the story of Nimesh Bhandari which some of us might have read back then. Nimesh was inspired from a talk by Sanjay Bhargava, the cofounder of Paypal, which was held at IIM-A in 2005. Sanjay Bhargava insisted students to come out of the cosy walls of corporate rooms to take challenging roles in the start-ups. Subsequent to the inspirational talk by Sanjay Bhargava, Nimesh started the "Startup Day" at IIMA as a part of placement process in 2006. Interestingly Drishti Soft was one of the 3 companies invited for placements. An IIT Guwahati alumni startup going for

placements at IIMA in those days! That's something very big.

Brigosha Technologies

Founder - Brijesh Singh (ECE), Gopal Jatiya (ECE), Shashiprakash Singh (IISc)
Founded in - 2010

Brigosha was the first company founded in Technology Incubation Centre of IITG and is one of the proud products of Incubation Centre. If you go to IITG TI site, the dominions of Brigosha is written as- Embedded Learning Board, Embedded Application Board, Censor Card, GPS Card. So it is one of the few Core sector start-ups of IITG.

On their website they describe Brigosha as : "We at Brigosha are involved in research and development of solutions and products in the area of Internet of Things(IoT). IoT aids in connecting devices such as everyday consumer products and industrial equipments onto the network, enabling information gathering and management of these devices through software, to enhance its efficiency."

LazyLad

Founder - Saurabh Singla (CSE)
Founded in - 2014

LazyLad is a technical startup in the retail space with an aim of solving the chronic problems of inventory and supply chain management. Our mission is to bring the neighborhood shopping experience at the users' fingertips and to ensure the 14 million mom-and-pop shops in India can also ride the wave of internet commerce.

LazyLad grew from 3 founders to a team of 80 people in a short span of 7 months, grew the company from 2 pin codes to 7 cities. In words of the founder himself - "It's the nature of the model that has given us the boost. A week after getting selected in GHV, we got selected in NASSCOM 10000 Startups, and eventually got selected for Innotrek 2015 (which was held in Silicon Valley, USA). This provided us great exposure of what is happening in the Silicon Valley and how that can be helpful in building a Unicorn product company in India."



OF CARTS AND HORSES

In this brew of statistics and comics, Dr. Ribhu explains the concepts of correlation and causality with a dash of random processes and time series.

- Dr. Ribhu

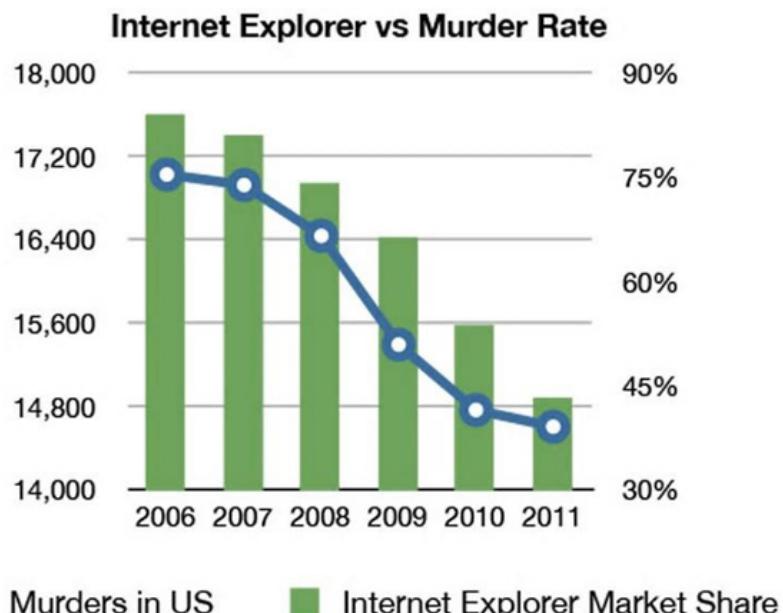


Figure 1: Number of Murders in the US and Market Share of IE (source buzzfeed)

● Murders in US ■ Internet Explorer Market Share

The above image, or what my research paper obsessed mind would call Fig. 1, plots the market share of Internet Explorer and the total number of murders in the United States of America over a period of 6 years from 2006 to 2011. While this data is old, 'experts' from around the globe may want to believe that the reduced frustration levels due to a better web browser are resulting in a safer society. This campaign can be taken a step further to abandon the pursuit for better gun control laws for better browsers. However, since Sherlock Holmes, Byomkesh Bakshi, Feldua, and other similarly gifted yet eccentric people (with the exception of Byomkesh who seems to have led a perfectly normal life) were solving murders long before people started bothering about the browser wars, we can safely conclude that the phenomenon of murders, though not to be joked about, is independent of what browser Microsoft chooses to blunder

(read bundle) with its operating systems. Therefore, there is absolutely no correlation in murders and Internet explorer usage.

However, this does lead us to ask the question, what is correlation?

Mathematically, if we have two random variables X and Y, then these are said to be correlated if the covariance of X and Y defined as:

$$\text{Cov}(X,Y) = E[XY] - E[X]E[Y] \quad (1)$$

is nonzero. The covariance is simply a measure of the dependence of the value of Y on the value of X. For example if we define the X as the number of glasses of sugarcane juice that the author drinks on the roadside, and Y as the number of days that the author has to spend on diarrhea medication, then based on X we can have a fair estimate of the value of Y.

Now, in case we assume X and Y to be

Gaussian distributed random variables, then we can write,

$$Y = aX + Z$$

where 'a' is a constant called the correlation coefficient, and can be seen as a constant of proportionality relating X and Y, Z is another random number uncorrelated with X. That is you cannot predict the value of Z based on the value of X. This Z is called innovation, because it tells us something about Y that we don't already know from X.

See it this way, we call the iPhone innovative because it had things that we had not seen with phones before, or could not have

predicted based on our current knowledge of the cellphones of that era. The designs after that are called lacking in innovation because they do not feature a shift as radical as the original iPhone. (The author has personally never owned an Apple device in his life, and nor does he plan to; but credit should be given where it is due.)

"Is the horse pulling the cart, or is the cart pushing the horse?"



Two events are said to be correlated when the occurrence or otherwise of one of them can be used to reduce the uncertainty about the occurrence of the other.

Though, on a related note, Figure 2 tells another story in correlation:

However, coming back to correlation, we have established that two events are said

The answer thankfully is yes, but to elaborate this we have to introduce another idea, time series. A time series is a collection of random variables collected as a function of time. That is, it is a series of random numbers collected from observing a random phenomenon at some point in time, for example the temperature of a room measured every 30 minutes is a time series. In general, a time series is represented as X_m is a collection of values or samples x_1, x_2, \dots, x_N that can be thought of as measurements of the random phenomenon taken over time. In general, a time

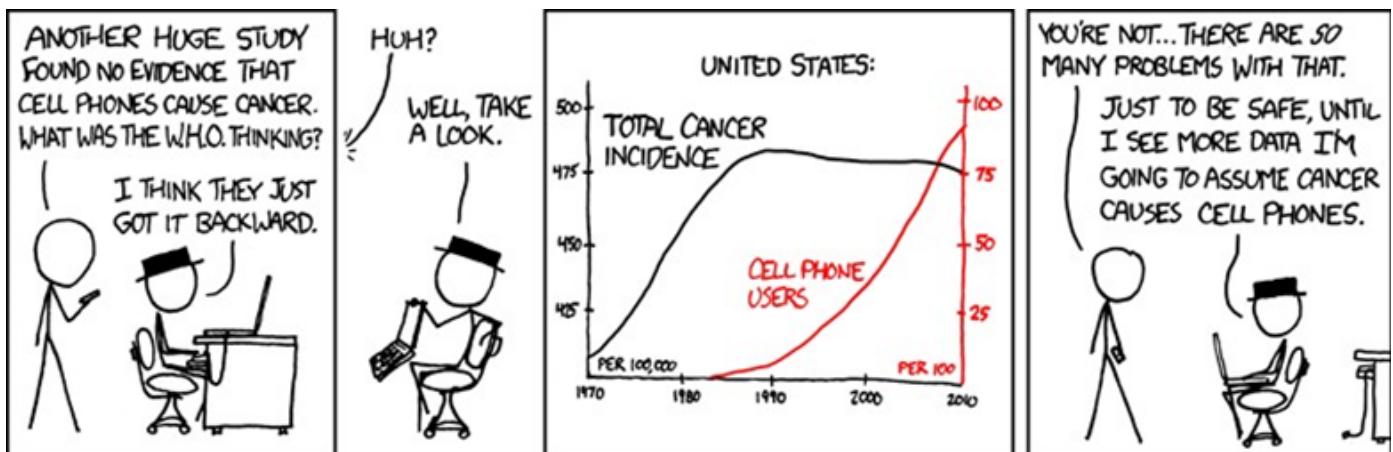


Figure 2: Cancer Causes Cell Phones (Source : xkcd)

series is said to be autoregressive with order M if it can be represented in a form:

$$x_N = a_1 x_{N-1} + a_2 x_{N-2} + \dots + a_M x_{N-M} + z_N$$

with z_N uncorrelated with x_1, \dots, x_{N-1} . That is when the M past values of X_M can be used to reduce the uncertainty about its future. Again if we know the present temperature and the past few temperature measurements, we can predict the temperature 30 minutes in advance with considerable accuracy. This accuracy dwindles as we go farther into the future. 30 minutes in advance with considerable accuracy. This accuracy dwindles as we go farther into the future.

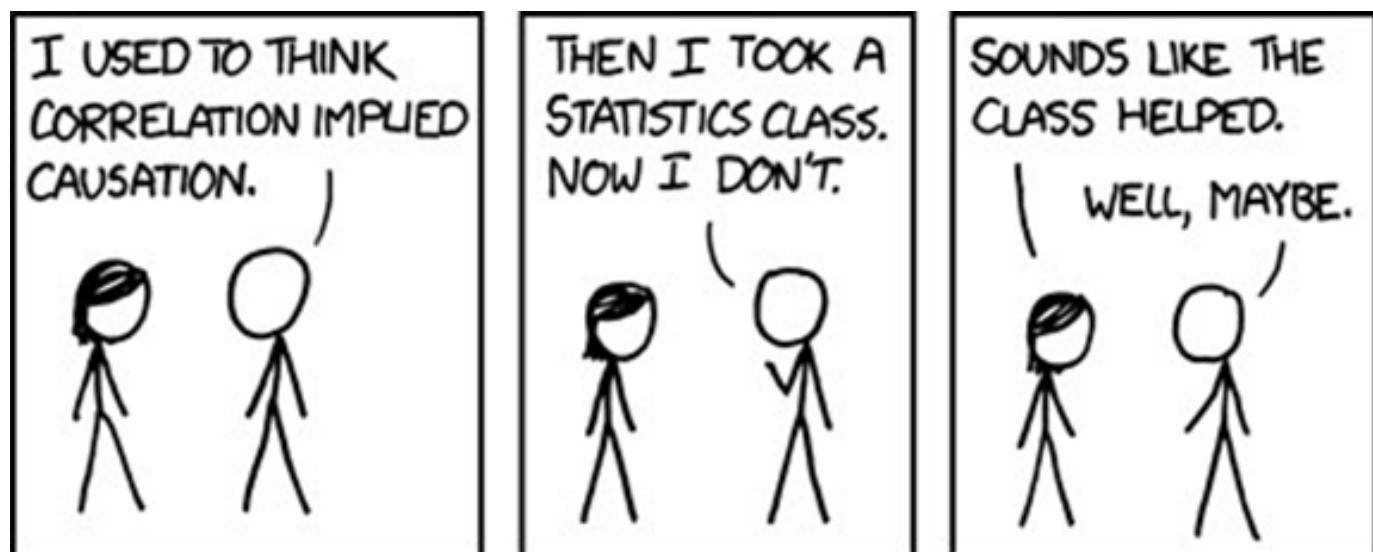
Now, two time series, like the temperature inside and outside a (non-air-conditioned) room can be correlated but what about a causative relationship between the two? We started with an assertion that it is possible to establish that the temperature outside is causing the temperature inside.

The British economist Sir Clive William John Granger (4 September 1934 – 27 May 2009), who to the best of my knowledge was unrelated to Hermione Granger, proposed a test in 1969 to test the causal relationship between two time series. According to this test, a time series X_N is causing another time series Y_N if the uncertainty in predicting Y_N is reduced by the inclusion of X_N into the prediction

model. That is, X_N caused Y_N if the past (and only the past) of values of X_N can inform us something about the behavior of the present and future values of Y_N that cannot be deduced using the only the past samples of Y_N . The exact mathematical modelling for this is too tedious and I request the interested reader to Google Granger Causality to find more.

However, since 1969, Granger Causality has been extensively used to establish causal relationships between various physical phenomena across, neuroscience, physics, climate science, econometrics, etc. The key idea here is to see how does the past information about the supposedly causing time series affects our understanding of the supposedly caused time series. For example, the temperature inside a room can be better predicted by using the additional information of the temperature outside the room. Similarly, it can be shown that the motion of the cart is a delayed version of the motion of the horse, and therefore the motion in the cart is a delayed version of the motion of the horse. Also, there is no causal relation between murders and IE, because IE itself was murdered by its creators (trust me, I am laughing at myself for writing this lame attempt of a joke).

However, since you have managed to follow till here, here is another xkcd comic on correlation and causality below.



ANGRY INDIA DOES IT

The story behind India's first supercomputer

In September 2016, IIT Guwahati received its first ever supercomputer, PARAM Ishan, the fastest in this neighborhood of the country. But, how did we, as a country, end up with these supermachines?

India's struggle for an indigenous supercomputer is a thrilling saga of fight-back put forth by a nation amidst challenging times. Boasting a top speed of 250 teraflops with 162 compute nodes and 300 TB storage, PARAM Ishan has been a vital catalyst to the research initiatives undertaken at IITG. To fully appreciate this historic feat, it helps to understand the backdrop against which India's first supercomputer was forged.

HISTORY LESSON, PEOPLE

In May 1974, India conducted her first nuclear test (Smiling Buddha aka Pokhran-I) under then-PM Indira Gandhi, provoking a negative international reaction. The Indo-US relations were already at an all-time low due to Nixon's open support to Pakistan in the Indo-Pak war of 1971 and India's friendship with the USSR. The fact that the ingredients for Smiling Buddha were part of the nuclear reactor imports from Canada and the US did not go down well with those two nations. In response, the major nuclear powers founded the Nuclear Suppliers Group (NSG) to curb nuclear proliferation and slapped technological embargoes on India and Pakistan, severely crippling India's nuclear program and her credibility. It wasn't until 1998 that India would conduct her second nuclear test (Pokhran-II), again facing similar international backlash.

This disaster in international relations was soon followed by a disaster of similar

proportions on the economic front. The 1971 Indo-Pak war, the 1973 oil crisis, the 1975-77 Emergency and the 1979 oil crisis all played a role in systematically destabilizing the Indian economy. The crumbling economy coupled with increased defense spending, reduced taxes and closed markets drove up the fiscal deficit to about 9% of GDP by the late 1980s. The 1991 Indian economic crisis saw a penniless government which had to airlift 67 tons of its gold reserves to UK and Switzerland and deregulate its markets in order to secure a loan from the International Monetary Fund (IMF) and pay its debts.

The trigger incident for our story came in 1985-87 when India, an agricultural nation, turned her focus towards meteorological research and weather prediction to help her poor farmers avoid nature's wrath. Finding herself needing a supercomputer, India approached the US looking to buy an advanced Cray XMP-24 machine but was refused one by the Reagan administration citing apprehensions about India's closeness with the USSR and the technology's potential for military and nuclear use. The US was willing to sell a less powerful Cray XMP-14, but only if India agrees to embarrassing restrictions.

Frustrated by these negotiations and humiliated at having to ask for technology, the then Prime Minister Rajiv Gandhi challenged Indian scientists to create an indigenous supercomputer.



The US was willing to sell a less powerful Cray XMP-14, but only if India agrees to embarrassing restrictions.

THE MAN AND THE MISSION

Dr. Vijay Bhatkar was a man of humble origins, born just ten months ahead of India's independence to educated parents who quit their jobs and settled in a small village upon Mahatma Gandhi's call for rural development. Dr. Bhatkar completed his Bachelor and Masters education at VNIT Nagpur and MSU Baroda before getting his Ph.D. from IIT Delhi at the age of 26. Giving up a post-doctoral opportunity at Princeton, he joined the Electronics Commission, Government of India and had risen to the position of director of ER&DC, Trivandrum when he first got the call from KPP Nambiar, then-Secretary, Department of Electronics, regarding the PM's supercomputing challenge.

A meeting with the then Prime Minister Rajiv Gandhi ensued, which, Dr. Bhatkar said, went like this:

"Can we do it?"

"I have not seen a supercomputer as we have no access to supercomputers, I have only seen a picture of Cray! But, yes, we can."

"How long will it take?"

"Less than it took for us in trying to import Cray from the US!"

"How much money it would take?"

"The whole effort, including building an institution, developing technology and delivering India's first supercomputer would cost less than the Cray!"

Pleased, the Prime Minister gave the go-ahead for the project. Based in Pune, C-DAC summoned scientists from all over the country to work on one of India's greatest technology projects.

The mission was given a go-ahead with 3 years and 34 crores to spend, the time and money India would have had to spend for the Cray, had the US deal gone through. The Centre for Development of Advanced Computing (C-DAC) was established in 1988 with Dr. Bhatkar

at its helm and a clear mandate to develop an indigenous supercomputer for high-speed computational needs. The Pune-based institution faced initial hurdles with Dr. Bhatkar not being able to officially recruit a single person for about 6 months due to bureaucracy, but soon took off, attracting young talent from across the country with its open management and flexible work culture. The team also had to deal with technological embargoes and the struggles of adopting the novel parallel-processing approach to supercomputers. Frustrated by these negotiations and humiliated at having to ask for technology, then-PM Rajiv Gandhi challenged Indian scientists to create an indigenous supercomputer.

Within three years, the extraordinary happened. With everyone involved working their socks off, C-DAC finally completed its work well within the proposed deadline. With components that could be bought off the shelves, in 1991, C-DAC rolled out India's first indigenous supercomputer: PARAM 8000. The prototype named PARAM (Sanskrit for 'supreme', also PARALLEL Machine), apparently looked nothing like the Cray supercomputer people had come to expect, raising suspicions on the validity of C-DAC's tall claims.

To dispel all doubts, Dr. Bhatkar decided to benchmark PARAM at the 1990 Zurich Supercomputing Show which had five developed countries showcasing their best machines. When PARAM placed second in the contest, beating Japan, Germany and



Russia, and defeated only by one of the three US machines, the world realized that a new nation has risen to join the ranks of supercomputing nations. For the first time ever, a developing country had pulled off such a feat in advanced computer development. Needless to say, the world was shocked at this achievement. A year later, in 1991, C-DAC launched India's first indigenous supercomputer, PARAM 8000, allegedly causing international media to remark "Angry India does it".

Dr. Bhatkar soon left C-DAC and was awarded the Padma Shri in 2000 and the Padma Bhushan in 2015. He is also credited for inventing ISCII, the computer standard for Indian languages which made printing in Indian languages possible and now serves as the chancellor of Nalanda University.

**In 1991,
C-DAC launched
India's first indig-
enous supercom-
puter, PARAM 8000,
allegedly causing
international media
to remark "Angry
India does it"**

PARAM SUPERCOMPUTER SERIES

The first Indian supercomputer, PARAM 8000, was launched in 1991 and propelled India into the league of few nations capable of developing supercomputers. In the following years, C-DAC rolled out PARAM 8600, PARAM 9900/SS, PARAM 9900/US and PARAM 9900/AA, each an improved variant of the original, to meet the growing international demand for cheap and powerful supercomputers. The PARAM 10000 was unveiled in 1998 with an architecture capable of teraflop range, marking India's entry into teraflop supercomputing territory, but was initially built for 100 GFLOPS due to severe budget constraints. C-DAC's

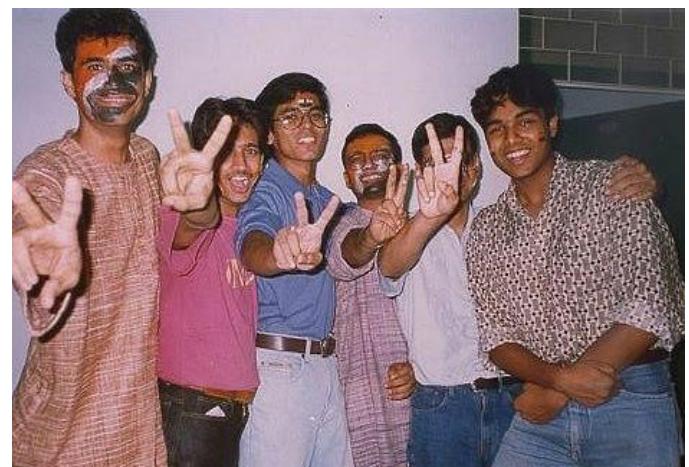
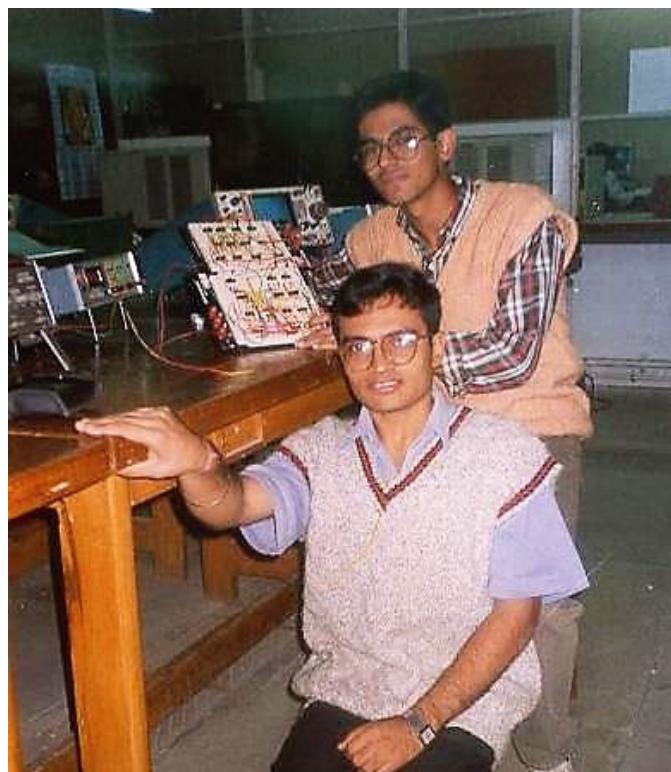
2003 release, the PARAM Padma was the first Indian supercomputer to reach peak speeds of 1 TFLOPS.

PARAM Yuva, launched in 2008, boasted a peak speed of 54 TFLOPS with up to 200 TB storage. C-DAC's best yet supercomputer, the 2013's PARAM Yuva II is capable of a whopping 524 TFLOPS peak speed and consumes 35% less energy compared to its predecessor. In terms of speed, it had ranked 83 worldwide in 2013 but now ranks at 447 in 2016, while, in energy efficiency, the machine was ranked 44 in 2013 but now ranks at 140 in 2016. In conjunction with premier Indian educational institutes, two more supercomputers have been developed by C-DAC, the 15 TFLOPS machine, PARAM Kanchenjunga, stationed at NIT Sikkim and the 250 TFLOPS machine, PARAM Ishan, installed at IIT Guwahati.

PARAM systems have been the go-to choice for countries seeking good performance at reasonable prices. It is estimated that as of 2008, up to 52 PARAM systems are active across the world with PARAMs being sold to Russia, Canada, Germany, Singapore, Kazakhstan and Vietnam, among others. C-DAC has also developed PARAM Shavak, a suitcase-sized compact supercomputer with over 3 TFLOPS peak speed, PARAMNet, a high-performance interconnection network optimized for the PARAM suite, and a host of other indigenous supercomputing tools. The institution is currently raising the bar with attempts at the petaflop barrier. Furthermore, an IISc-ISRO collaboration aims to create a monstrous 132 exaflop supercomputer by the end of the decade, while Cray Inc. has announced its first 1 exaflop machine by the same time.

These are exciting times for High Performance Computing in India.





MY TOUR OF DUTY IN NORTHEAST

A Picture Article

Clockwise from top:

- Days before leaving for IIT Guwahati for the first time as an Assistant Professor
- Hostel fun in IIT Delhi - All painted for 50th Republic Day
- Student Project - Hamming Code Generator Decoder, IIT Delhi

- Dr. Amit Sethi



Top: Finally, me at a student function in IIT Guwahati

Dear students, staff, and colleagues of EEE department,

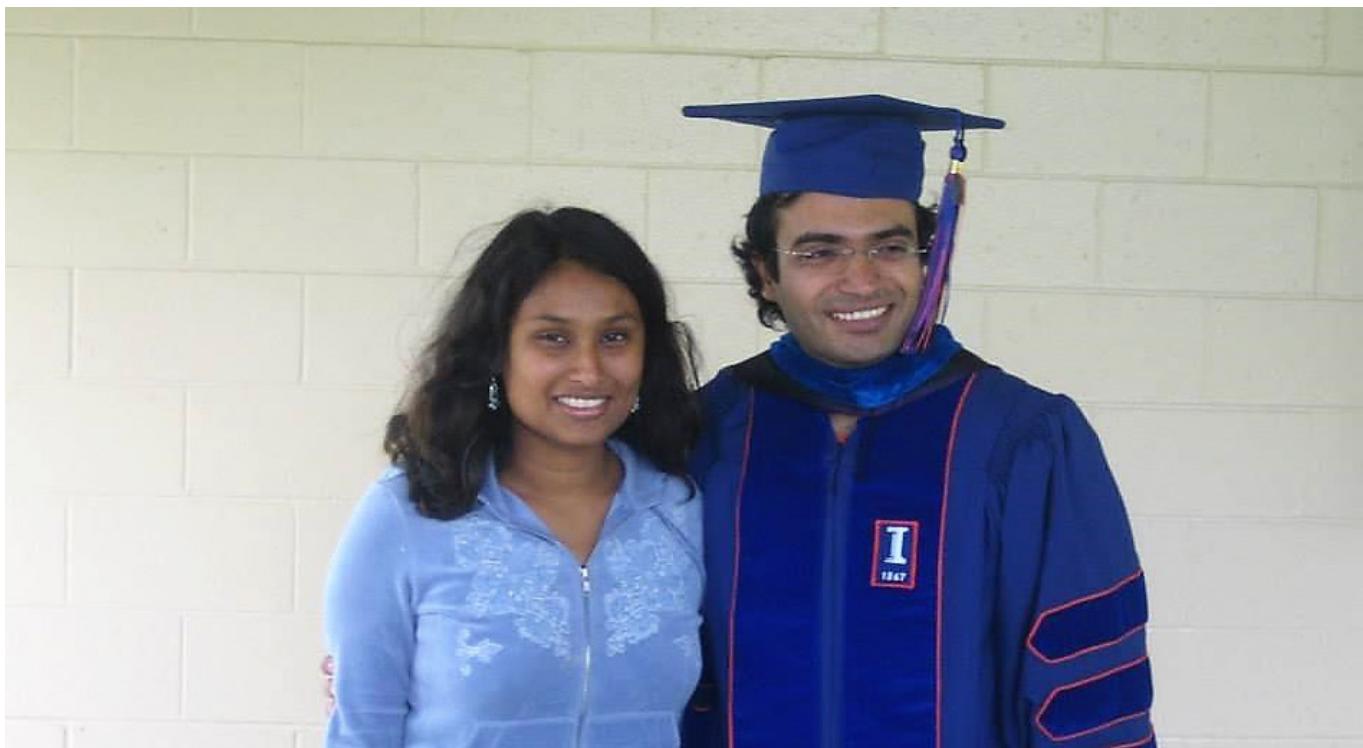
It was exactly six years ago that I joined IIT Guwahati. I am glad that I took that decision, although I also had an offer from my alma mater IIT Delhi back then. Otherwise, I would not have experienced this blessed place, its culture, its people, an amazing campus, and the IIT G community. I have some old connection with the Northeast, which was one of the driving forces for me to apply to IIT Guwahati.

I am asked by several students why I came back to India, and why I joined IIT Guwahati. Mentoring enthusiastic youngsters and learning about their successes is a very rewarding experience. One cannot put a monetary price on knowing that one has made a positive difference in someone's life, however small. Within even a year or two of going into a corporate job, many of our alumni get taken over by a feeling of being a cog in a big machine and not knowing the purpose of their efforts. This is the same feeling that I had in my consulting job before joining IIT Guwahati. Compare that to the experience of seeing your students win an international competition, or a design challenge, or prestigious fellowships. Which other profession lets you be a part of achievements like these based on someone else's motivation

and perspiration, and a little bit of your guidance?

Being a former average IITian myself, I was able to relate to students' experiences of going through similar joys, frustrations, and dilemmas that I experienced years ago - living away from parents, being overloaded with assignments and quizzes, vacillating between confidence, over-confidence, and self-doubt, wanting to have certain "cultural" experiences, and sweating over career choices. Having seen academics in India and the US, and having worked in both engineering and non-engineering companies allowed me to give at least some career advice to students. I hope all those who interacted with me were able to find what makes them happy in life.

As I look back at the inevitable ups and downs of the past six years, I realize that there are many other memories that will make me overcome with nostalgia for years to come. These include teaching my first course, designing new courses, guiding my first BTPs, MTPs, and PhDs, and getting the first papers published as a leader of a research group. Besides the activities related to my job, I have also made fond memories of being a part of the campus community. I hope that my engagement with the community was as helpful for



Caption: "If a girl can stick with you through thesis writing, marry her". Convocation day Illinois University with my then girlfriend (now wife).

others as it was for me in understanding what education and the business of education is all about. Additionally, interacting with students has kept me young at heart, I believe, while the sightings of various flora and fauna on campus have made me appreciate the fragility and importance of preserving the only planet that we have.

My colleagues, both teaching and non-teaching, have been very helpful in both professional and personal matters. Exchanging exam duties, organizing conferences, being on each other's students' committees, discussing course ideas, running labs and tutorials have all been pleasant experiences. Sometimes, I would have not run into some of my colleagues from other departments for months and would be pleasantly surprised to receive a birthday party or wedding reception invitation from them. Being a residential campus, we are not just colleagues but also a community and a society. Our kids play together and go to school and after-school classes together. This campus is a great place to raise kids because of this community.

My family and I have formed lasting relationships with people on the campus. Two of my children were born while I was working here. I am overwhelmed with the blessings and love showered on them by

the campus community. Having never lived in India before, IIT Guwahati was the safe haven for controlled acclimatization to life in India for my wife. She has made some good friends through her initiation of a Kendriya Vidyalaya mothers' group, an environmental awareness group, and



Top: Me trekking during my PhD times - Wakhra Swag

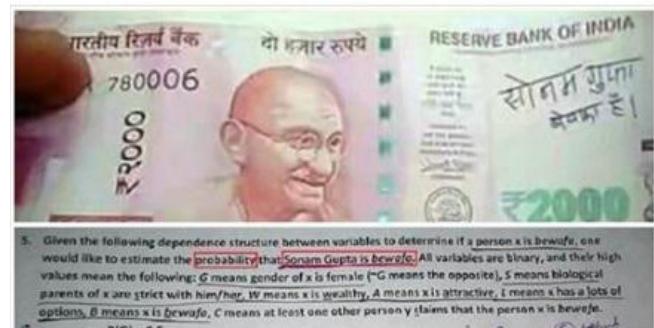


her involvement with Disha (formerly, Zero Illiteracy Zone – ZIZ).

IIT Guwahati is going through a phase of adolescence where it is looked upon as an institute capable of mentoring upcoming IITs, but not yet in the league of the ones that came before it. We have senior faculty members who worked very hard to establish this institute and make sure that its early students got wholesome education. It is on the foundation of their efforts that the younger faculty members like me have had the chance to channelize more time and resources to research, and to even take on more Masters and PhD students. However, with any organization going through a phase transition, the needs of vision, skills, experiences, and attitudes in different phases can be very different. The window of opportunity to bring about a vibrant research culture by infusing fresh ideas, facilitating open communication, and being responsive in decision-making at all levels is fast closing. Utilizing the dividend of not being saturated in faculty strength, yet being able to offer a stable lifestyle with reasonable teaching and administrative loads, IIT Guwahati must be highly proactive and selective in its efforts to hire world-class PhDs. Many IIT alumni, irrespective of where they obtained their PhDs, have a passion

 Amit Sethi
3 December 2016

And now, on buzzfeed.com with name and multiple mugshots. With Piyush Rai. H/T: Vinay Chandragiri.



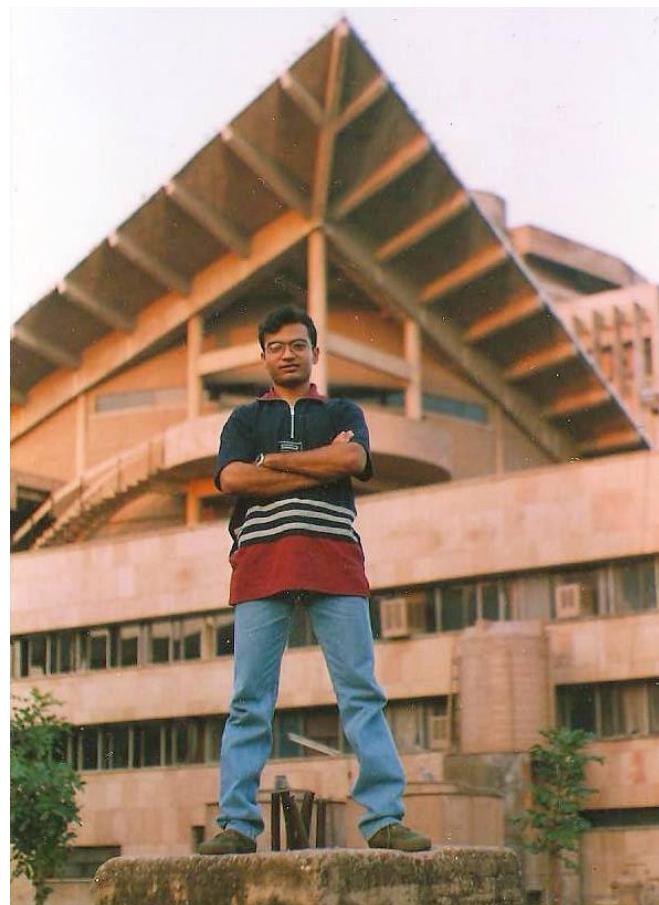
This Professor Shocked His Students By Mentioning "Sonam Gupta Bewafa Hai" In A Math Problem

Maybe I would have been better at math if memes were a prime component.

BUZZFEED.COM | BY ANDRE JAMES BORGES

Left: Mommy's Excuse for a Snowman - My wife with my son
Top: Sonam Gupta Bewafa Hai! And sometimes the moment of glory comes from unexpected

Bottom: Me as IITD Student in front of Iconic roof of Convocation hall of IITD



for contributing to the IIT system. Proactive outreach to hire excellent candidates must be undertaken. Senior colleagues must also encourage merit through efforts to retain

meritorious junior faculty, and in entertaining ideas based on their merit. Once this chance is lost, the culture will ossify, and attracting good faculty and ideas will become not less but more difficult. Similar efforts should be made to attract PhD candidates from NITs, especially those in the Northeast. It is the faculty culture that will lead the way.

I also urge the students to try to do their best in technical endeavors. One of the proudest moments for my research group has been when a team comprising three undergrads and a PhD student - Dileep, Chaitanya, Vamsi, and Abhishek - won the top position in Warwick HER2 scoring contest, ahead of the teams from CMU, Oxford, and IIT Kanpur. It is a testimony to the capabilities of our students and what their motivation and teamwork can allow them to do. Such competitions are a good way to channelize creative energies, meet or interact online with global peers, and add to your resume. The alternative story is all too familiar where students ask for a project from a professor and never return to his or her office after losing enthusiasm in a week or two. Perhaps, the solution is to make sure to keep meeting the



professor with whatever little progress one has made instead of trying to impress him or her with a large piece of progress that is never made. The point is, even if you came to engineering because of parental pressure, coursework is not all that there is to it. There are lots of elegant solutions to be understood and interesting problems to be solved by involving other students and professors. A problem-solving approach along with people skills can build a foundation for success in many careers.

I wish you all the very best.



Clockwise from left:

- Running Chicago Marathon during PhD days
- My Kids in Meghalaya
- Trying Wakeboarding, Brahmaputra River.

TO INFINITY AND BEYOND

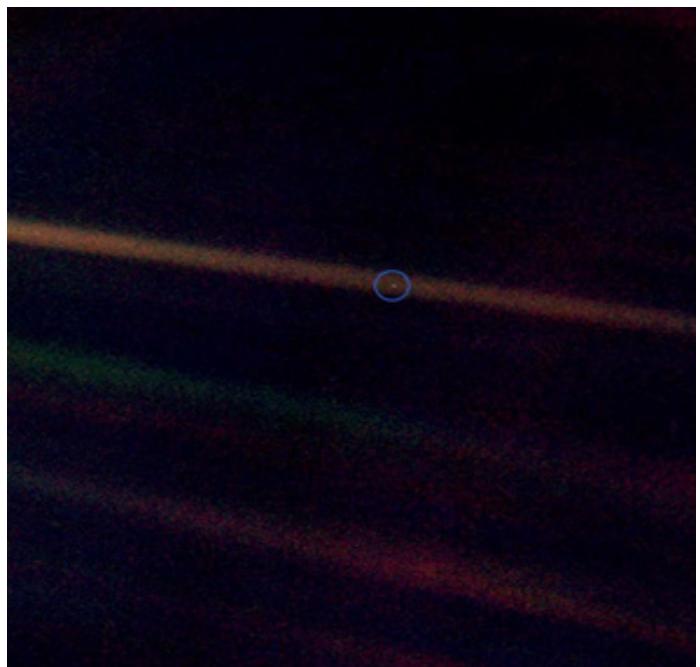
In this article we have the ex-Secretary of the astronomy club talking about his advent in the endless space of astronomy and gives insights on how to get started with research in the same.

- Ashutosh Sharma

To the right is the photo taken by Voyager 1 spacecraft when it was 6 billion kilometres away from Earth, that is approximately how far Pluto is from the Sun. And our blue planet is less than 1/8th of a pixel in a picture of more than 640,000 pixels. That is how tiny our world is, and there is so much to explore in our unfathomably vast universe. That is why space is the perfect stimulus for an adrenaline rush, both frightening and exciting simultaneously.

Being the oldest science developed by mankind, Astronomy has an elegant set of features associated with it and this results from the fact that it is one of the earliest disciplines of science that was formed. Earliest of our ancestors had little idea of science, they imagined the points of light to form different objects, animals and even people, added some imaginary stories connecting them and you get mythology! An important tool for the development of mankind back in the day. And then when the time had come for us to meet science, it was astronomy again that showed the path. It was the idea of heliocentrism i.e. the Earth revolves around the Sun that started the scientific revolution. And in recent time, it is more relevant than ever. It helps in the invention of state of the art technology for various missions. But most important role it plays is philosophical. Just like we discussed discovering our place in the universe through astronomy, it also plays an integral role in understanding how the universe actually works and in discovering the 'Theory of Everything'.

That being said, your interests and motivation are quite likely to be dissimilar to mine. So let's shift gears and discuss what you can do to pursue your interest, especially if it happens to differ from your current



academic discipline.

THE FIRST STEPS

- Apart from introductory books, a great resource is the new revolution of Massively Open Online Courses or MOOCs. When I started getting into astronomy, Coursera was less than a year old and opened up a world of awesome courses offered by excellent institutions around the world for free. These not only help you develop your interest but can showcase your passion for the subject while seeking research opportunities..
- Look for schools/workshops related to your field of interest. For astronomy, there are many prestigious ones organized by IUCAA and NCRA. There is also an introductory winter school organized by IIST. A great thing about

these introductory schools, apart from the fascinating lectures by experts on diverse topics within the subject, is the contacts you make, both with the students and faculty involved.

- A very helpful habit to develop early on is reading scientific literature. This will not only help you understand research methodologies and keep you updated with the latest in the field but also help identify people or groups whose work you find interesting. An excellent resource for astronomy is astrobites. It's a daily astrophysical literature journal written by graduate students. Please check it out! I am confident that such resources also exist for other scientific areas.
- A tip about research papers: scientific papers can be intimidating at first, especially as most of them concern a sub-field of a sub-field of your area of interest. A very good place to start is review papers. They are an excellent resource for getting introduced to an area. For example, the Astrobiology primer by NASA is a must for anyone looking to learn about the various disciplines involved within the field and the current status of related research.
- You'll find many core physics courses like Mechanics, Thermodynamics, Quantum Physics, etc. as part of the curriculum of astronomy undergraduate programs. Try your best to audit these courses from our Physics department. Besides providing you with a solid foundation for astronomy, they will also reflect very well on your graduate school application.

GETTING STARTED WITH RESEARCH

- The first step is to look for a project at our institute. Talk to faculty members regarding small projects that can introduce you to the research in the field. If the faculty member is reluctant to offer you a project or the research of your interest is not being pursued at the institute, the next step is to look for opportunities elsewhere.
- Find out about internship programs. You can find them online or ask any science major friend in institutes like IISc Bangalore or the IISERs. They

usually have a lot of information on such research internship programs. Maintain a list of them, complete with the qualifications required to apply. An important part of the internship applications will be the recommendation letter(s) from any faculty member or researcher. You can approach a faculty member from your home department, maybe someone in whose course you did particularly well. A better option will be a faculty member with whom you have done or are doing a project in a research area close to your field of interest.

- To contact people directly through the mail, first you need to find them. The most straightforward and effective way, in my opinion, is through research papers. Maintain a well-organized database of the papers (a simple spreadsheet should suffice) and the corresponding universities/institutes/labs that you find interesting. A good example can be found here. You should also contact seniors in your research area and find out where they went for internships. It's more likely that you will secure a position in those places. Again make a note of every group/university you find.
- For the BTP, a project in your field of interest or at least an interdisciplinary topic involving your major will feel desirable. But, from personal experience, such a project can cause a lot of frustration if not well guided and planned. I think the pragmatic thing to do is to take one of the projects proposed by your department's faculty members. What matter are the skills you gain from research? Moreover, such projects are mostly well directed and hence contribute more to the field. Your work may even end up as a publication, which is always a plus point. A tip about research papers: scientific papers can be intimidating at first, a publication, which is always a plus point.

A lot of these were suggested to me by Ishan Mishra, a senior from the batch of 2016 from ECE who is pursuing a PhD in Astronomy from Cornell University, and Kunal Gautam, a senior from the batch of 2017 again from our department who is pursuing Masters in Physics at Niels Bohr Institute of Physics. So I would like to end by giving a vote of thanks to them.

FROM EEE TO IEEE

My experiences with IEEE student branch and why you should also be a part of it!

- Indrajit Das



I came in association with IEEE student branch ("IEEE SB" in short) during very early days of my IITG journey. It was the first semester of my PhD and coursework time (or as they say Honeymoon period of PhD) was going on. So I had ample time in hand because apart from attending classes and writing quizzes, there was not much academic activity. And I was looking to get involved in something productive to fill up the free time. It's around that time that I found an email from IEEE student branch calling for volunteers for ADMAT (an annual workshop organized by IEEE SB on MATLAB and its applications). At that time, I had only very basic idea about IEEE SB and didn't even know anyone from the branch (as I was also pretty much new in the campus, hardly one or two months at IIT). The event was scheduled on Saturday-Sunday and I too didn't have much exciting plans other than "eat...sleep...repeat" for that weekend. So, basically thought let's give it a try and registered myself. I must say the overall experience in the workshop was quite good, learnt a few things, met some nice people (including seniors from my department) and to add to that, the food was just awesome. From volunteering to learning a few technical stuffs to making new friends, it was really well spent two days! So, that's how my association with

IEEE SB started.

After that, when the new student branch team was being formed for the year 2015, I was approached by a few of the senior members for being in the committee and I happily agreed. As per I remember, the first event that we organized in that year was a workshop on embedded systems by ARM corporation. In the first team meeting for that workshop, when responsibilities were being divided among the members, I chose the work of designing the banners, posters and flyers for the event. Not that I had much prior experience in designing, but I always had a little interest in this kind of works and so I took that up. I must say I kind of enjoyed the work and as per the views of the other members, I did quite ok! And since no one else was interested in that anyway, I became the permanent design guy for all the events to take place over the next one year. Over the period of one year, we organized four workshops along with a few invited talks and it was a really successful year both as a team and as an individual. As per my personal experience, all I can say is that, yes, I always had an interest towards creative things like making designs and all, but it's only when you are given some responsibility that you start taking things a little bit more seriously and that really helped for me. I got really involved and learned a few new softwares and some cool design techniques that I wouldn't have done otherwise, and all that during the free times without compromising anything on the main track. For me, it was like a breath of fresh air from the routined lifestyle; it rejuvenated me with increased enthusiasm and helped me cope up with all the monotonies of PhD life. That way it really helped me a lot.

Then the tenure of the 2015 team came to an end and it was time for forming new

team, a few members from the earlier team remained while others (mostly seniors) left. I decided to stay for one more year. Being a senior member by now, it was time to take up more responsibility. So, this time I opted for the post of general secretary and got elected as the same. Being in a position of higher responsibility, this time the experience has been somewhat different with more involvement in decision making and overall management part of the branch. But, I guess I can't totally get away from doing things that interests me, so even now I look after some of the design part, can't help! This time around we have given more focus in increasing the IEEE membership count and are trying to reach out to more people in the campus. As an initiative towards that, we held an orientation programme for the PG freshers of our department this year. Apart from all that, we have also organized one workshop and a few invited talks till now. There's still a few months left in this year's tenure and IEEE SB has a few events lined up for the months to come.

It's only when you are given some responsibility that you start taking things a little bit more seriously.

So I have been associated with the IEEE student branch for quite a long time and when I look back, I see that the journey itself has been quite fulfilling and satisfactory. I have got the experience of organizing quite a number of workshops and events and it was really fun doing what I did. All those group meetings prior to any event, late night preparations in the conference centre the day before the event, working in a group to successfully take the event towards the end, all this has taught me many real-life skills and helped me grow as a person in many ways, at least that's what I believe.

Well, I think I have talked much elaborately about my personal experience and I would rather take this opportunity to address a few other things. Over the past two and half years of my association with IEEE SB, one thing that I have noticed

is that the participation of BTechs in the student branch is very rare. Out of a total strength of around 25, hardly one or two are undergraduate students and so, the branch is mainly run by the PGs (mostly PhDs with a few MTechs). And the same scenario holds true for the number of IEEE student members from IITG. I suspect one reason behind this is the communication gap between the BTechs and the postgrads and I really feel that this can be totally changed. Being a member of the student branch, I tend to believe that with increased participation from BTechs, the group dynamics can be much improved. With their unmatched enthusiasm and never-ending energy, I feel BTechs have much to contribute in our student branch. Their participation is not only beneficial from the perspective of the student branch but well, it's good from the perspective of the student as well. Now, even though I know it's mostly known, I would like to give a brief about the benefits of being an IEEE student member and it holds good for everyone whether undergrad or postgrad. Being an IEEE member is a good way to remain connected with the vast community of people from the areas of electronics and electrical engineering. Specially, for students having an interest in research, being an IEEE student member can be very helpful for getting all the updates related to their field of interest. Being an IEEE student member helps in getting sponsorship or even monetary discounts while attending IEEE organized conferences and workshops. And there are plenty of other benefits that you can find out by visiting the IEEE website or you can contact any of our branch representatives.

And if you become a student branch member, you get increased exposure for your work and interests. Being organizers of various workshops and events, you get many opportunities to interact with eminent personalities from both academia and industry. Organizing an event requires many different skills (both technical and non-technical) and no single person can have them all. But when you work as a team, the skills of all the individuals take a positive shift. You develop skills like leadership, teamwork, patience, perseverance and all that with the technical flavour that is there by default. You get to meet with new people and make contacts with people having varied skillsets. So, in a nutshell, there's a lot to explore and it's just you who need to come forward!

BIOMEDICAL IMAGE PROCESSING

The world of possibilities that was opened in the field of Biotechnology due to the advent of sciences like Image Processing and Machine Learning took the world by storm. Mayank talks about the prospects of Biomedical Image processing and how it could change the world; forever.

- Mayank Golhar

From the application of big data to solve the problem of nanoscopic gene sequencing to applying machine learning to find breast cancer, newer recondite problems are been fought head-on by researchers with state-of-art technologies like deep learning etc.



First of all, kudos to the reader for venturing into an article which starts with "Bio" - a subject which most of us thought we got rid of after 10th or 12th, only to be given a rude awakening from our illusion in the form of BT101. Hate it or love it, Biomedical Engineering is the field of this century with interdisciplinary research at its center stage. In this web of interdisciplinary research, elements of computer science and electrical engineering appear ubiquitous. Traditional problems like early and accurate detection of diseases, prediction of the extent of harm to the body and the possibility of recurrence of diseases etc. are aggressively been tackled by the interdisciplinary research community. From the application of big data to solve the problem of nanoscopic gene sequencing to applying machine learning to find breast

cancer, newer recondite problems are been fought head-on by researchers with state-of-art technologies like deep learning etc. in their arsenal. These are in addition to traditional interdisciplinary topics like an application of signal processing to speech, EEG, ECG and Biomedical images.

Now let's focus our attention to Biomedical Image Analysis. Before moving on let's clear a major misconception which many have regarding the difference between Biomedical Imaging and Biomedical Image Processing. The term Biomedical Imaging refers to the acquisition of x-ray, sound, magnetism, radioactive pharmaceutical or light to assess the condition of organ or tissue. Whereas, Biomedical image processing is the enhancement, analysis, and display of images acquired using the various

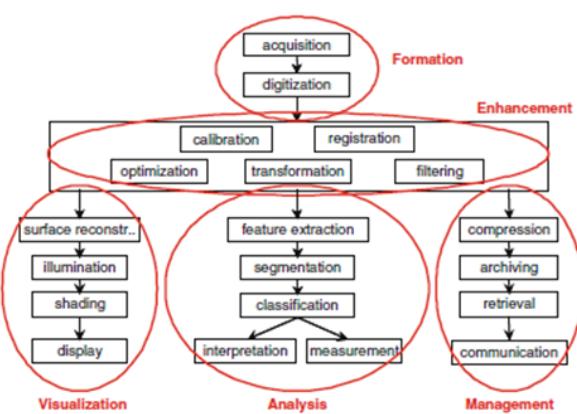
biomedical imaging techniques. Some well known Biomedical Imaging techniques are MRI (Magnetic Resonance Imaging), CT scan (Computerised Tomography), Ultrasound, PET scan (Positron Emission Tomography), OCT (Optical Coherence Tomography), SPECT (Single-photon Emission Computed Tomography) and many more exciting technologies. In much simpler terms, one can say that the imaging guys would be working on development on sensors whereas the processing junta would be focused on algorithm development and their applications.

Moving on to the image processing part. There are generally four major steps in image processing:

1. Image formation - The acquiring of an image using sensors and converting it into a digital form like a matrix.
2. Image visualization - This refers to the manipulation of an image into an optimized output of the image.
3. Image analysis - It includes the processing part through which we can obtain interpretable abstractions and their quantitative measurements from biomedical images.
4. Image management - focuses on storage, transmission, and access to medical images.

For the rest of the article, I will throw some light on some popular visualization and analysis biomedical problems.

Image Data Visualization: Generally in medicine, the main aim is to do realistic of 3D data. One major difference between the computer graphics problem and the biomedical problem is that medical objects, unlike synthetic objects, cannot be accurately modeled as mathematical functions. Eg, a tennis ball can be modeled as a sphere but our brain can not. There are treated as an explicit set of voxels. So specialized methods of surface reconstructions and direct volume visualization are used. Some applications are 3D reconstruction of bones for fracture detection and diagnosis, reconstruction of heart from CT scan and many others. The 3D reconstruction of objects helps in better visualization of medical artifacts for the doctors. Eg. In the case of endoscopy, the size of polyp(a cancerous growth) determines how deleterious is to the patient. The doctors by going through the endoscopic video

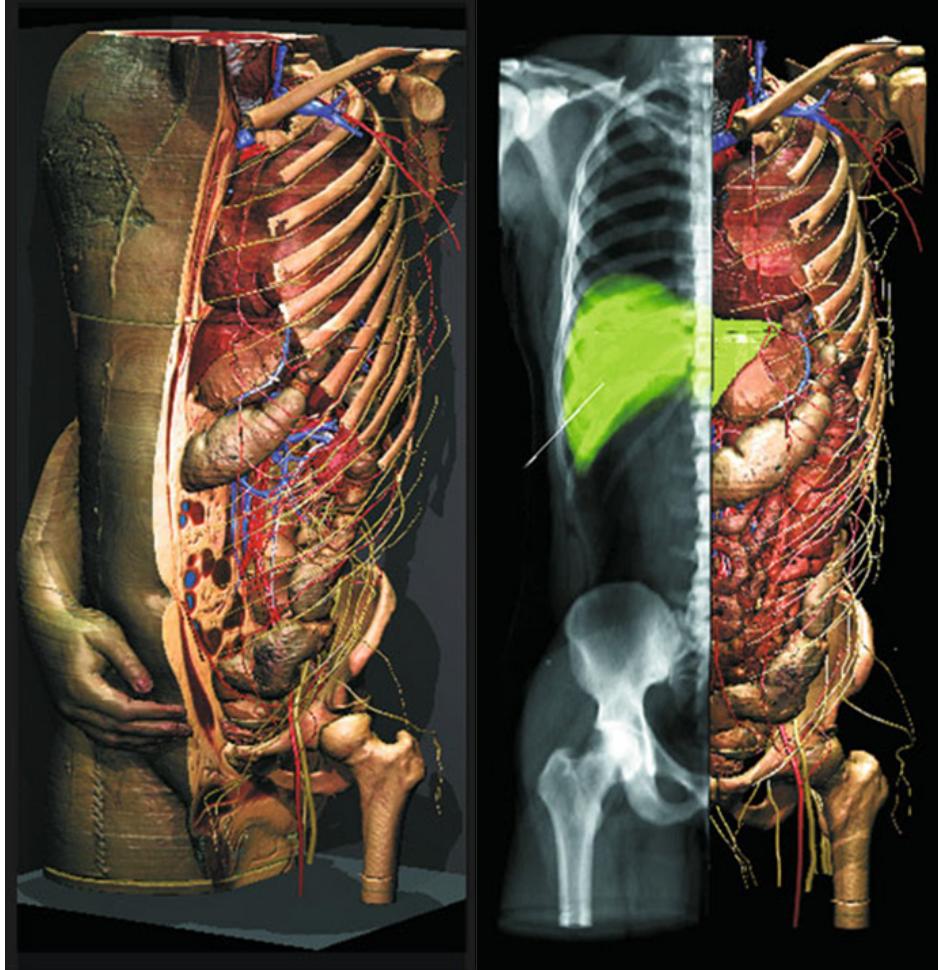


estimate the size of polyp based on their experience. Ref: "Fundamentals of Biomedical Image Processing", Thomas M. Deserno Biomedical Image Processing", Thomas M. Deserno

-rience. If we can provide them with the absolute size and shape of the polyp, it will remove the scope of error.

Image Analysis: Image segmentation plays a central role in Biomedical image processing, where the main focus is to differentiate between the healthy and pathological tissue. It is a key component in surgical planning, post-surgical assessment, abnormality detection etc. Some well-researched problems in the field of biomedical image processing are, in retinal images, segmentation of blood vessel and optic disk, where researchers have used a wide range of techniques from gradient descent to Neural networks. For brain tumor segmentation in MRI images, popular methods range from MRF-MAP estimation to fuzzy c-means. One must keep in mind the "No Free Lunch Theorem" - There is no master algorithm which will solve all your segmentation problems. In the case of biomedical images, this is mainly due to the differences in imaging modalities, difference in shape, structure and other morphological properties of the desired region.

The problem of image segmentation which I have worked on is the delineation of the Blood vessel in endoscopic images. Frangi Vesselness method, a popular blood vessel segmentation method for retinal images was initially applied. It was found that many non-blood vessel edges were misclassified as blood vessel edges. The performance was improved by adding dark background



3D-visualization with Voxel-Man. This 3D model of the internal organs is based on the Visible Human data. The Voxel-Man 3D-Navigator provides unprecedented details and numerous interactive possibilities (left). Direct volume rendering and surface-based visualization of segmented objects are combined with integral shading (right).

Ref: "Fundamentals of Biomedical Image Processing", Thomas M. Deserno

subtraction and a filter was proposed to differentiate between the blood vessel and non-blood vessel edges. A further extension of this work is to recover the absolute 3D shape and size of the polyp using blood vessel information obtained previously. We are planning to use a modified form of structure-from-motion for obtaining the 3D shape. Also, I have worked on detection of sclera-choroid boundary in OCT scan images using gradient descent methods and morphological operations.

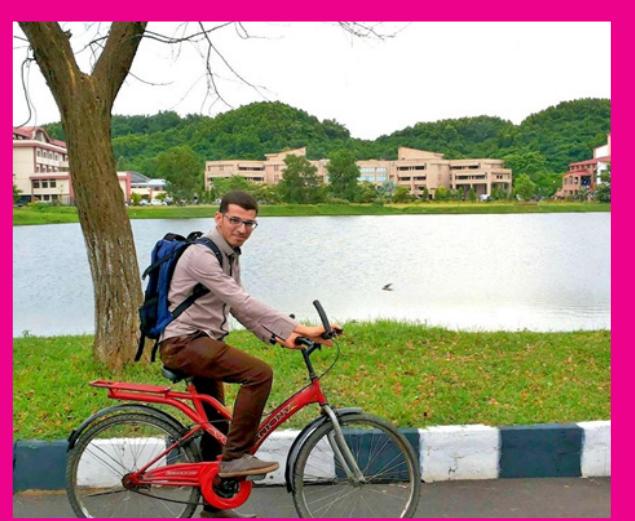
To get your hands dirty in this gargantuan field, you need to acquire some basic skills. Before venturing into Biomedical image processing specialized courses, it is recommended to complete one basic course of image processing and computer vision. As there is a plethora of material freely available online for beginners and there exists the Sturgeon's law - '90% of everything is crap', here is my cheat sheet for you to follow. For image processing, on Coursera "Fundamentals of Digital Image and Video Processing" by Aggelos K. Katsaggelos and "Image and Video Processing: From Mars to Hollywood with a Stop at the Hospital"

by Guillermo Sapiro are some courses which cover the basics. The prerequisites to these courses are Linear Algebra (after all images are just matrices!), multivariable calculus and epsilon of probability, all of which are covered in the first and second year. One mistake which beginners do is just watching the videos and neglecting the hands-on-assignments. For Computer Vision, videos lectures by UCF Prof. Mubarak Shah are easy to follow. As limiting oneself to vanilla image processing in this era of deep learning would be an egregious mistake, it is recommended to get your hands on Coursera's most subscribed course Machine Learning by Stanford's Andrew Ng. If your thirst for machine learning is not satisfied, let Stanford's CS231n: Convolutional Neural Networks for Visual Recognition or UoT's Neural Networks for Machine Learning, both of which are instructed by superstars of Deep Learning, to quench your thirst. For getting practical experience of applying the concepts which you have learned in these courses, you can go kaggle.com or grand-challenges.org, which run online competitions involving real-world problems. Another good way to

get involved in this field is to take part in IP/CV/ML-based competitions in Kriti or Techniche. After getting a flavor in this competition, one can also approach professors actively doing research in these fields of our EEE department, e.g. Dr. Amit Sethi, Dr. M K Bhuyan, Dr. Suresh Sundaram, Prof. P K Bora and Dr. P. Guha. One can approach professors with one's own idea about their project or go through the professor's website, see the projects which they are working upon or even one can approach the PhDs and M.Tech working in their group to get an idea of the projects. Also, there are plenty of summer internship positions in these fields in Indian and foreign universities as well as in industries. If you really get hooked on to this field and want to do learn more about it, doing an MS/PhD should be your next goal. For building a good profile for graduate studies, one should maintain a good CPI and do some really awesome projects. Internships shouldn't be taken lightly as the can add a huge value to your profile for graduate studies. If possible, work on your internship from the beginning with an aim to get a publication in a good level conference or journal as the end result. This would also ensure that

you get a stellar recommendation from your guide.

The doctor to patient ratio in India is estimated to be 1: 2000, whereas the recommended WHO figure is 1: 1000. As the immediate increase in number of doctors is not possible as it will involve huge infrastructural expenditure like building new medical colleges, hiring new faculty etc. One solution is to improve the effectiveness of doctors by expediting the process of diagnosis by automation. Eg. in endoscopy, the doctor has to manually go through the entire video and search for polyp. Now if we can automatically detect polyps in the video, it will save a lot of time and the doctor needs to be only called for surgery etc. This shows there is huge potential for the development of tools of automation in medical diagnosis. As a result, many startups related to the healthcare are mushrooming and giants like Samsung & GE are now focusing their R&D on tapping this relatively untouched market. So surely there will be plenty of job opportunities for you if you take up this field, maybe even you can found your own startup.



PERSPECTIVE OF AN EXCHANGE STUDENT



- Sami Al Issa



From my childhood, I have surrounded myself with books & magazines as they fascinated me a lot. I have only thought of getting good grades, certificates, and career. But I have never imagined that I'm going to win a free chance to tour around in a country with a vast cultural diversity and natural beauty. It's been only a year and a half since I have come to India for higher studies through ICCR scholarship, but experiencing a new culture, new food habits and making new friends, all these things have summed up into something significant in my life and memory which doesn't make me feel like a stranger anymore.

Everything started with a Skype interview and after that, it still feels to me like I am walking a path in my dreams. All the professors here to my concern are quite helpful and very friendly. The classmates and the kinds of stuff in the department were also very amicable when I joined the institute newly. Really I didn't miss my family as much as I thought I will be when I was surrounded by all these people.

ICCR (Indian Council for Cultural Relations) gave us an opportunity to travel to different places 3200 Km away from

where I live. I got the opportunity to visit different places of south India along with the nationals of 19 other countries. We explored the villages in different places of India and experienced their way of living. The local villagers served us green coconut as a token of friendship which tasted very delicious. This trip not only let me enjoy the natural beauty of India but also helped me to make some brothers and sisters with unforgettable memories. Apart from this trip, I went with my friends on every term-end to places like Sikkim, Shillong, Cherrapunjee, Tezpur, Bangalore and many more !! Every place had its own natural beauty and unique culture.

I'm continuing my M.Tech here in IIT Guwahati and currently, I'm in my final year. The place and surrounding environment have made me decide to continue my PhD. in the same institute. The exploration of Incredible India will continue as well along with my studies.

Sami AL ISSA

M.Tech Student, IIT Guwahati, India
Teaching-Assistant, Damascus University, Syria



Everything started with a Skype interview and after that, it still feels to me like I am walking a path in my dreams.

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HOLISTIC RESEARCH

Deductive and inductive logical thinking supported by creative incursions

Research is a fairly vague process. A quick Google search brings up this definition: “the systematic investigation into sources in order to establish facts and reach new conclusions.” In this article, Dr. Karthik throws light on the various systems of conducting research.

- Dr. Kannan Karthik

“ Deductive logic is not very difficult, but the construction of premises demand a different form of thinking which we can term as what is known as lateral thinking.

The skies were crimson red. The birds were retiring to their nests. The shadows grew longer as weary watchmakers found the final session the hardest. The morning had begun with a slice of creative insight and enthusiasm, but sustaining this brilliance throughout the workspace-time was an extremely difficult task. Tired legs and weary minds of the watchmakers forced an inevitable temporary diurnal retirement...

As the great Aristotle once said:

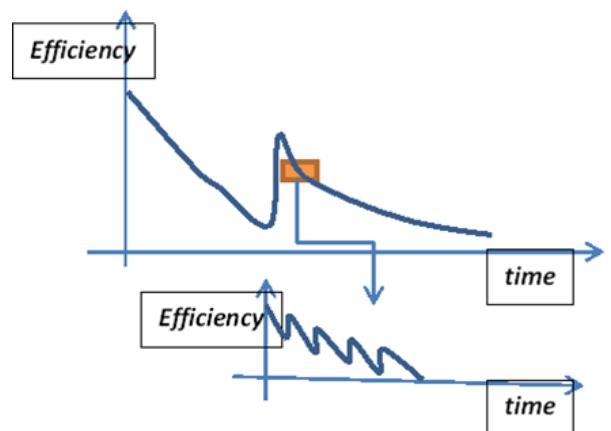
You are what you repeatedly do. Excellence is not an act but a habit.

Note here that the word “watchmaker” used here is CRYPTIC. While the deduction of the context in which this paragraph was written is obvious, interpretations of some key PSEUDONYMS

such as the “WATCHMAKER” and “work-space-time”, require imaginative thinking (as the injections are almost poetic).

DEDUCTION OF CONTEXT

This simple paragraph begins with the description of a typical seasonal EVENING. Taking the word “WATCHMAKER” in the literal sense does not alter the broader context significantly. The two statementsshadows grew longer....weary watchmakers found the final session the hardest... The morning had begun....sustaining this brilliance... difficult task. in a way to discuss a typical work-force efficiency curve widely applicable to all walks of life: students, teachers, industrialists etc... All of us begin the day with a BANG, overflowing with creativity and passion and finish the day with a quiet reflective cup of tea. The cycles



of creation and reflection alternate not just on a regular diurnal scale, but also on smaller scales. The work-space-efficiency curve is not just a simple staggered exponential but when one zooms into a segment of this curve, one may observe an almost fractal-like behavior. The mid-way singularity comes from the injection of the so-called LUNCHTIME. This extension and expansion is via simple deduction and based on the

premise that the attention span of any individual on a specific sub-topic does not last more than a few minutes.

INTERPRETATION OF THE TERM WATCHMAKER

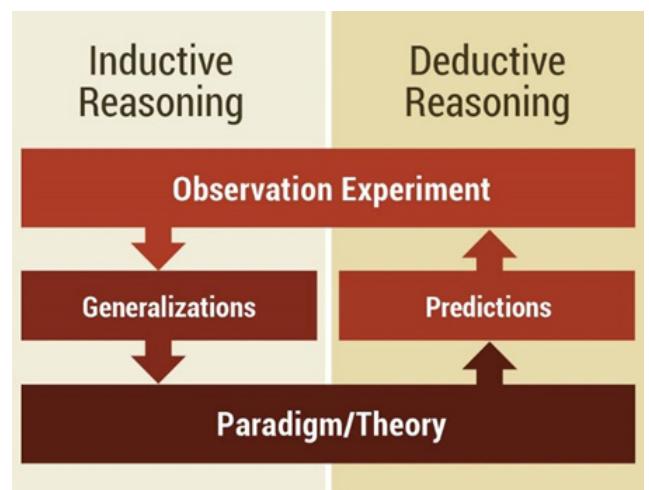
The term watchmaker here refers to a fundamental thinker (to a large extent a sequential thinker who finds a way to build simple premises for arguments). Deductive logic is not very difficult, but the construction of premises demand a different form of thinking which we can term as what is known as **lateral thinking**. Premises are essential levers which permit the thinker to elevate one's thought process and most importantly allow one to JUMP the GUN...The construction of the fractal extension would not have been possible without the deviant premise pertaining to the attention span of an individual.

In a broader context, creative thinking leads to what is known as expansions. Seeds sown in the morning thanks to an enthusiastic and passionate mind will eventually sprout over the day. The stitching of ideas is done by the rational mind in two different ways:

1) Inductive reasoning: Throwing open a conjecture or a rule and validating this at different scales and over multiple sets of observations. Finally, when the rule is shown to be valid for a fairly large set of observations, an attempt is made to generalize it. In case the rule breaks down for some observations, logical adaptations are allowed provided this does not influence the overall generality and compactness of the rule significantly. The conjecture is the idea which is built on certain premises and invariably stems from creative and holistic thinking. The flow diagram here is:

Idea (Conjecture or Hypothesis or Rule) ---> Observation induction ---> Rule adaptation if necessary ---> Generalization

2) Deductive reasoning: In some cases, the ideas are not exactly conjectures but interesting observation points. A certain pattern not seen earlier is witnessed which somehow uniquely describes a certain phenomenon. This phenomenon is sampled through experimental observations and then a fundamental rule is deduced which captures this behavior holistically. The flow diagram here is:



Experiments ---> Measurements/ Observations ---> Interesting pattern identification ---> Rule deduction ---> Rule verification and Justification through physical linkages with the actual phenomenon ---> Rule testing on fresh data ---> Rule adaptation is necessary (preserving compactness) ---> Final testing

The creative venture here is in spotting a certain interesting pattern in the observation set and then associating this with the actual phenomenon being witnessed, i.e. answering the question WHY this ANOMALOUS behavior?

Inductive reasoning is the harder of the two because one has to begin with an excellent HYPOTHESIS or a RULE and is a practice usually followed by purists and theoreticians.

FEATURES OF INDUCTIVE REASONING

- Arriving at a rule in the first place which encompasses the overall systemic behavior or describing the phenomenon.
- Adaptation phase, in case some of the observations do not fit the rule. Which ones and why? Is there a common thread between them? Can the rule be adapted to inculcate these outliers, without violating the compactness of the rule itself? This slowly turns into an iterative tuning and optimization problem.
- Generalization with rigorous testing.

FEATURES OF DEDUCTIVE REASONING

- Setting up experiments.
- Understanding the vagaries of the

experimental setup and the variances involved in various measurements.

- c) Spotting the anomalies pertaining to a specific phenomenon.
- d) Formulating a rule which captures this anomaly and then providing a physical explanation for the ANOMALY.
- e) Generalization with rigorous testing.

NON-EXCLUSIVITY

The main distinguishing factor between the two LOGICAL approaches, is the INITIAL HOLISTIC UNDERSTANDING of either the phenomenon or some systemic behavior (i.e. prior knowledge) absolutely necessary for an INDUCTIVE approach, while this understanding comes later or may sometimes be even accidental for DEDUCTIVE approaches. The interesting factor that needs to be understood is, WHAT triggers one of these two MODES (or directions of thought)? Are these two BINS/ MODES exhaustive? The answer to

the latter is obviously NO as no research thesis can be typically type-cast into one of these two BINS. Sometimes a research thesis may have MULTIPLE PROBLEMS/ SUB-PROBLEMS each of which is of a different type (INDUCTIVE or DEDUCTIVE) and often it is a combination that gives a partial solution to the overall problem.

You toss a coin, you become a creative thinker.

You take a long walk, you become a deep thinker.

You juggle with pebbles, you become a rationalist.

Finally, when you smile at everything, you become COMPLETE.

But then, you were complete, you are complete and you will continue to be complete. This is the **CORE OF VEDANTA**.

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Hey there,

So, you finally reached the end!

We truly hope you enjoyed reading the magazine.

We continually strive to deliver an improved version of InPhase with every edition. If you have any reviews, comments or feedback, please pen it down to us. You can reach us at:

cepstrum@iitg.ac.in

There are two things which make a magazine successful; its readers and the content it offers. Experiences, research, poems or prose, we are open to all. If you believe you have what it takes to get featured on print, you know how to reach us.

It's always a pleasure hearing from our readers. Your constructive criticism and motivation are what drives us every year.

Greetings,

Team InPhase

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