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Is CoViD-19 here to stay?
Exclusive interview with
DR. NAGENDRA PRASAD

Productivity at the time of a pandemic:
Interview with psychologist
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Getting your dream college admit
GEORGIA TECH

IEEE INTERFACE

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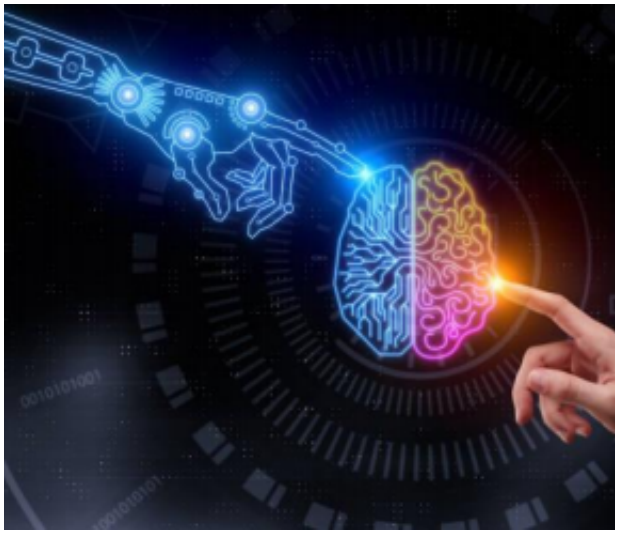
FUNDAMENTALS OF NEUROMORPHIC COMPUTING

-Anagha



Before we dive deep into today's topic, let's revisit what we already know. Let me start by asking you a simple question. How is the 1.4kg mass of muscle inside your skull capable of deciding every aspect of your life influencing every decision you make? Isn't it intriguing? Stay tuned and do read till the end to find the answer to this question.

Working of the human brain

The human brain weighs approximately 1.4 kg and defines all the emotional, physical, mental and spiritual aspects of a person's life. Though a lot of research is going on in this domain, not much has really been discovered about the fundamentals and physics of computation and processing by the brain. Structurally, the brain comprises of about 86 million neurons (nerve cells) with synapses between them. Synapses are the gaps between two neurons. The neurons interact with each other with the help of neurotransmitters. Their states, as we can call them, are set by controlling the ion flow.

Brief of Neuromorphic computing

The currently used computing architecture is that proposed by Von Neumann, which requires a central processing unit and a separate memory unit with data transfer happening between them while the information is being processed.

This technology has a lot of constraints. Firstly, the transfer of data limits the bandwidth and this limits the ability to train the systems which involve a vast number of tasks. Moreover, this architecture proves to be a really energy hungry architecture, when it comes to tasks like pattern and face recognition. It is estimated that if the current trends of increasing energy consumption for data storage and communication continue, by 2040 the amount of total energy required for binary operations would surpass 1027 joules, which is way more than the global budget of energy.

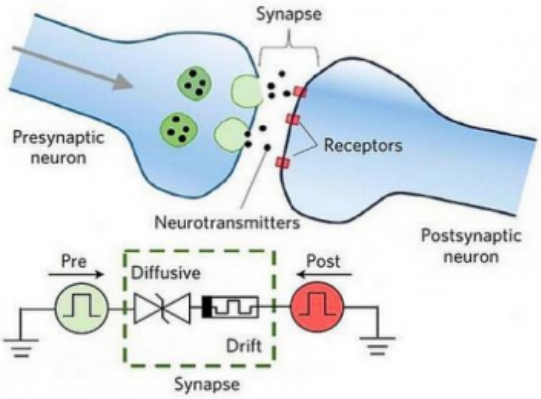
But now, let's take a look at a really profound setback of the Von Neumann architecture. It's the fact that it doesn't actually do justice to the analogy between artificial intelligence and the functioning of the human brain. I mean, have we really got a memory and a CPU inside our brains. No, right? Then aren't we all this while trying to superimpose the artificial neural net onto the Von Neumann architecture, which are two different ideas altogether? Given this, the architecture is bound to fail for advanced applications.

Does this mean we have reached the highest attainable level of advancement? Is this the end of AI advancement? Well, relax. A lot of research is being done in the direction of developing a more direct artificial analogy of the human brain. A brainchild of this idea is Neuromorphic computing.

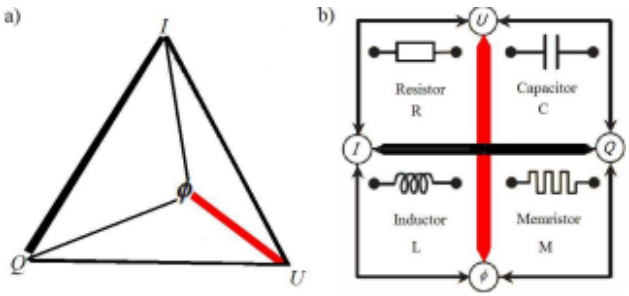
Neuromorphic computing covers a wide range of approaches to processing information, with each technology adopting some degree of analogy to neurobiological processes, making it stand out from the traditional computing systems. As technology progresses we find that the traditional computing methods being used today are on the verge of reaching their limits. Future advancements would only be possible if we re-route and make some reallybig leaps in changing the structure of these computers.This would require the design and engineering of computer

chips using the same fundamentals and computational physics followed by the brain as opposed to neural networks which, in simple terms, is a program run on a normal computer system that mimics the logic of how the human brain thinks. Neuromorphic computing also tries to introduce the idea of context or backdrop as opposed to working with only binary 0's and 1's, which leads to rigid computational architecture. Consideration of the context definitely provides us with a flexible structure, also bringing it closer to modelling the real world decision making mechanism. The fundamental idea of neuromorphic computing comes down to making the computer neurons interact with each other, the way human neurons do. This would require some sort of an electrical spike to flow across the artificial synapses. The neuron on the receiving end would then be activated depending on the number and type of ion received.

The development of the synapse is the first step towards implementation of this architecture. What this means is that we need an electrical device with a memory of its own. But this can't be achieved by the standard resistors available. This is because application of voltage at any instance produces a current independent of the voltages applied on it at a previous point of time. But to be able to implement memory and more importantly, for the system to be able to learn, we need a device to remember what happened to it earlier. That is, a component with memory, which is easy to fabricate and scale, so as to be able to get as many of them as possible on the chip with lesser energy consumption are to be designed. In simple terms we need a technology which doesn't just mimic the CMOS but has additional capabilities.



One such electrical element is the memristor(memory resistor). Till date we have only had resistors, capacitors and inductors as the circuit elements. But the memory component can't be implemented using these. One extreme case of the memory is the fuse, which again can't be used to build a dynamic memory. We are now on the lookout for such materials and compounds through which we can pass some amount of current and do something to it which gets retained even after the supply of current is stopped. In essence, we are basically either stopping or halting or freezing its state thereby creating a memory of it. A lot of what we are trying to do here is to a great extent what the brain does.



One method of implementation of the synapse is by the use of titanium dioxide, which is essentially an insulator. So we have regions of these samples doped and regions undoped, meaning we have impurities which have essentially changed the conductivity. Upon applying a voltage, they cause the diffusion of the impurities which means these impurities move around causing variations in the impurities which creates an electric field. This behaviour is similar to that of a tiny variable resistance.

But wait, if that's the case, why can't we just use the traditional variable ohmic resistor itself? Let me tell you. The traditional resistor follows ohm's law. Which means, the voltage and current relationship upon plotting gives a straight line passing via origin. So upon decreasing the voltage the resistor retraces the path. This is not of much help to us in creating memory. But the memristor on the other hand does not follow the same curve every time. In essence, we have what is called the hysteresis which is caused due to the change produced in the device on application of voltage.

But why is hysteresis so important to us here? Well it's simply because it is this hysteresis which models the biological system in many ways. Practically, hysteresis is used as the neuron spike which helps learn. Memory can be broadly divided into what's called short term plasticity and long term potentiation. We have connections that last short for which we spike to create a snapshot of the ion concentration and distribution at that moment which causes remembrance. If this process is continued, we can also create long-term learning in the brain which causes the ions to connect creating a permanent connection.

Conclusion

To conclude, neuromorphic computing is the advanced technology which aims at implementing the biological function of learning onto computer hardware. The brain or more correctly the neurons follow the Hebbian principle of learning. Which states, 'Those that fire together, wire together'. Also the brain's hardware operates massively in a parallel fashion. While the current Artificial Intelligence and Deep learning models are implemented on the software where the machine learning algorithms operate in a sequential manner rather than being emulated by hardware. Also the amount of time taken by the human brain to "learn" something new is much less compared to the CPU clock cycles taken by a machine learning algorithm to learn the same. In terms of data, the human brain requires really few examples to learn from. For example, if you were to teach a kid to identify a cat, this task could be easily accomplished by showing the kid as many as 5-6 pictures of cat and the kid would be able to identify a cat when shown. But this isn't the case with machine learning algorithms currently being used, which require as many samples as possible for efficient recognition. Doesn't this show the lack of efficiency of the model? Moreover, the amount of energy consumed to perform tasks such as those of face recognition is way larger compared to the amount used by the human brain. All these present the drawback of the current technology, which makes it inevitable to adopt a new technology. This is where neuromorphic computing comes into the picture.

FLYING COFFINS

-Darsha Sorokhaibam

You sense a tingling feeling, it cannot be seen yet, but you can be sure it is far away. The sound gets closer and closer. And before you know it, your heart skips a beat as the source of the sonic boom passes by within a second from above.

Machines that soar the sky, the idea kick started by the Wright brothers, started as a simple “sustained and controlled heavier-than-air powered flight” over time developed into various versions. One of them being, Fighter Aircrafts. With the start of World War 1, fighter airplanes were first used for artillery spotting (scout planes). Humans, with our natural tendency to weaponize, soon realized that airplanes could be armed and used for combat. And then, there was no looking back. The most operated and used aircraft by the Indian Air Force is the Mig-21 Bison.

A little introduction to the most-produced supersonic jet aircraft in aviation history. The Mikoyan-Gurevich MiG-21, is a supersonic fighter jet and an interceptor aircraft. It has a fuselage (main body section of an aircraft) that resembles the shape of a pencil. The aircraft's simple controls, engine, weapons, and avionics are typical Soviet-era military designs.
There are several Mig-21 variants, which is a story for another day, but the version inducted by the Indian Air Force is the Mig-21 Bison. It was inducted in 1963. And since then over 1200 fighters and over 874 variants have been inducted.

The Mig-21 was under the spotlight in the 1971 Bangladesh Liberation War.

Three Mig-21 squadrons, flown by professionals took part in counter-air strike, escort, and close air support tasks demonstrating its highly effective short-range, precision attacks. During the period, it was the most advanced aircraft which received a lot of positive feedback from the pilots of the time.

Unfortunately, this is not the case anymore. A few news headlines depict its repeated failures. "IAF group captain killed in MiG-21 Bison crash in Gwalior" , "IAF's MiG-21 Fighter Jet crashes near Rajasthan's Suratgarh, Pilot ejects safely", "IAF’s MiG-21 crashes after a bird hit in Rajasthan’s Bikaner ,pilot ejects". These headlines, sadly, have become a common sight. With each headline, the outrage against the neglected conditions of the aircrafts would roar. The widely popular movie, "Rang de Basanti" brought to light the loss of many young pilots and the political games involved, which won't be addressed in this article.

The "Bison" upgrade was launched in the 1990s in an attempt to modernize the aircraft. New features were introduced such as the capability to fire medium-range air-to-air missiles Coming to the harsh reality faced by the pilots who have boarded this aircraft, over 180 IAF pilots and over 40 civilians have been killed in Mig-21 accidents since 1970, and a minimum of 14 fighters crashing between 2010 and 2013. Out of the 1200 Mig fighters inducted, more than 840 aircrafts built between 1966 and 1984 were lost to crash accidents. The bitter grief associated with the continuous series of accidents led to the term, "flying coffins" being coined. The Mig-21 Bison forms the bulk of the fighter aircraft capability in the IAF's inventory. IAF had to keep its MiG-21 fleet flying longer than it would have liked because of the delay in the induction of new fighters.

The LCA program (Light combat Aircraft) began in the 1980s in an attempt to replace the aging Mig-21 fighters. It was officially named 'Tejas' in 2003, which is the second supersonic jet produced by Hindustan Aeronautics Limited (HAL). There are mixed reviews about the Tejas fighter. Some put forward that it is not a match for modern-day fighters even though it is a proven improved version of the Mig-21. The CEMILAC (Centre of Military Airworthiness and Certification) confirmed Tejas as a multirole fighter with capabilities beyond visual range, air-to-air and air-to-ground attack capabilities and longer endurance during mid-air refueling. In terms of kinematics, Tejas has a significant edge over the venerable Mig-21 as it shows much more maneuverability, flexibility, and better climb rate compared to the vintage Mig-21. The cockpit layout of Mig-21 and its external view have always been viewed as a comprehensive nightmare for the pilot. Due to it's low-level ejections with its CK ejection seat, it is very dangerous to eject when the jet is flying at 300kmph leading to many unsuccessful ejections, and sadly, deaths. Mid-air collisions, engine flame-outs, bird strikes can cause botched missions.

Tejas has one too many pilot-friendly features like a Digital Fly-by-Wire Control System which makes it easier to handle the aircraft, a glass cockpit along with a Mk 16LG ejection seat which provides an easier and safer ejection method. In every aspect, Tejas outperforms the Mig-21.

In 2008, the Hawk Mk. 132 was inducted for a similar purpose as Tejas. Finally, in 2016, the much-awaited Rafale deal was signed between India and France for 36 Rafales, multi-role
India and France for 36 Rafales, multi-role fighter jets in fly-away condition. And for a change, India chose Dassault, a French Aerospace company over the traditional Russian Mig. This deal is the biggest ever procurement made by our country with the Rafales having various India-specific modifications, namely, 10-hour flight data recording, infra-red search, and tracking systems among others.

Currently, about 54 Mig-21s are in active service with the Indian Air Force. IAF pilots undergo rigorous selection and training to protect our skies. And to rightly quote Adolf Galland, "Flying is more than a sport and more than a job; flying is pure passion and desire which fills a lifetime". Let it not be cut short by the shortcomings of a veteran aircraft.

INTERVIEW ON CORONAVIRUS

-Dr. M.N Nagendra Prasad
Associate Professor in Biotechnology and Student Welfare Officer,
JSS Science and Technology University, Mysuru

~What are your overall views regarding the pandemic?

With more than 16.5 crore cases worldwide and 2.5 crore cases in India alone, Covid-19 has undoubtedly affected business and healthcare across the world and India. The coronavirus has certainly hampered the global economy. Besides taking millions of lives, the covid has forced many businesses to shut down. Production across various sectors is in downtime, service industries have been severely affected by a stay at home, stock markets have tumbled, working capital of major businesses have shrunk like never before, challenges galore in order fulfillment, the list goes on. The economy of the globe has gone years behind.

Coronavirus has cast a deep impact on the education sector. Most of the schools, colleges, and universities are shut down due to govt imposed lockdowns and the entire education system had to transform itself through digital platforms, thereby running the show via online classes. The conventional pedagogy of the very teaching has taken a huge beating and there is a huge increase in online education platforms, mobile apps, websites so on.

Cases of coronavirus are increasing day by day in India, creating a clear ruckus threatening to destabilize the healthcare system. The first wave of Covid was just a trailer compared to the devastating rampage created by the actual movie in the second wave bringing the healthcare system on its knees. As of mid-May 2021, we are seeing 4 lakh positives and around 4K deaths daily, which no disease has cast such a dark shadow over the last 100 years. This deadly Virus that can manipulate itself for its survival has mutated a few times staying clearly ahead of our scientists. This virus is surging ahead, not differentiating the rich and poor, and our nation, because of the enormous population in the poverty line, is really struggling for strict implementation of lockdown as compared with our developed counterparts. The main takeaway from this precarious situation is that all of us should be on our own taking care of our family, avoiding exposure with infected individuals, staying back home as much as possible, eating healthy food, taking vitamin boosts, and seeking immediate medical attention when suspected with any flu-related symptoms and get vaccinated as soon as possible. As the saying goes "Tough time never lasts, tough people do" we need to take hard decisions during this hard time and face the situation head-on. This is the time when we should use our intellect and maintain harmony among diversity.

~As somebody who has extensively studied immunology and vaccines, has the pandemic surprised you?

Yes, the pandemic for me was a real surprise from the point of view of its alarming spread of wings like a wildfire. Generally, whenever any microorganisms do spread including viruses, they have a specific choice of conditions but this deadly virus, the way it has acquired the entire globe is a major concern. The human race has seen few viral diseases like H1N1, swine flu, Dengue before too, but in the last ten decades, no other disease has spread so alarmingly worldwide the way Covid has. Also, the successive wave of the disease is getting mightier and more devastating, bringing the healthcare system of the world to its knees. The covid virus is mutating to better adapt with increased virulence and infectiousness thereby making the treatment more robust and challenging with time. This disease has given a clear understanding of how different life looks when we are going through rosy times and when going through the grinding period. This pandemic has taught us many lessons – About our people, about the importance of life skills, about hopelessness at times, and about fighting back when there is no option left. All the problems we faced to date look small now.

~How old is the Corona Virus actually?

Viruses have been in existence for well around 3 billion years and coronavirus is no exception. This strain of Corona-19 has been seen in bats in

south east Asia for many decades. Many human activities like deforestation, strange eating habits have led to making the virus consider humans an intermediate host and inhabit. SARS-CoV and MERS-CoV are two highly transmissible pathogenic viruses that emerged in humans at the beginning of the 21st century, likely to have originated from bats and are related to this Covid virus.

~What makes CoViD-19 powerful enough to become a pandemic in a matter of months?

The virus got so powerful to create such a pandemic within a few months owing to the reasons below.

1. Its easy mode of transmission from person to person (Respiratory illnesses spreads the fastest and are always difficult to plug the spread)
2. Ability of Coronavirus for rapid mutation, and newer mutants always comes with better adaptability, more infectiousness and requires a different treatment strategy.
3. Many people who got infected were asymptomatic, thus allowing population spread.
4. Virus being novel and hence miniscule studies have been done by scientists before.
5. Second wave of Covid is certainly more devastating as people thought they won the war against covid at the end of the first wave and started enjoying new year, wedding ceremonies, enjoying trips, almost stopped wearing masks and many preventive measures.
6. Serious state of medical unpreparedness as no one imagined the might of its destruction
7. Many doctors getting infected while treating Corona, especially in the first wave.

~How can we expect the virus to evolve?

Viruses are known to evolve, and if they do not then they would not survive. This is the exact reason why people get flu shots in many countries every year as the old vaccinations only give protection against the virus that appeared in that year. The plethora of strains of flu virus continue to evolve and certainly have different genetic profile. Smaller genome size of viruses makes them to mutate faster and thereby faster evolution. Some of the viruses like Influenza have RNA dependent RNA polymerase which shows low fidelity rate leading to lots of mutations. They also possess faster reproduction time, accumulated mutations, antigenic shift, antigenic drift with capacity to bypass cellular defence thus contributing to better evolution.

~Which vaccine would you recommend and for whom?

There are two vaccines which are in use at present in India Covaxin and Covisheild. Both the vaccines being inoculated in India have been found to be safe and effective. Covaxin is developed by Bharath Biotech Ltd in association with Indian Council of Medical Research (ICMR) and National Institute of Virology (NIV). Covaxin is an inactivated vaccine developed with whole virion inactivated vero cell-derived technology. These types of vaccine have been in use for decades now. Whereas Covisheild has been developed by Oxford-AstraZeneca and has been manufactured by The Serum Institute of India (SII). Covisheild has been prepared using viral vector platform, the same technology which was used in preparing the vaccine for Ebola. Both the vaccines have mapped well-effective matching WHO standards and prompting definite immune response. The choice is not between which of the vaccines to take but to compulsorily take one on the first available instance.

~Can we eradicate the virus or is it here to stay?

Bitter truth, Covid is not going to end anytime soon, rather we have to learn to live with it keeping in mind the all-important precautionary measures. A lot of research is going on worldwide in finding a cure and the vaccines which have come as a boon will certainly help in our fight for survival. An efficient vaccine can solve the chunk of the problem, but eradicating the virus requires a collective herculean effort from all the nations working together and every one of us adhering to strict guidelines. There are few countries who have handled this deadly disease better than the others, by their people belligerently following all the precautionary guidelines. Also, there is a hope as the whole of the scientific community working hard to come out with a targeted designer molecule against this

virus. Only time can give a clear answer to this question.

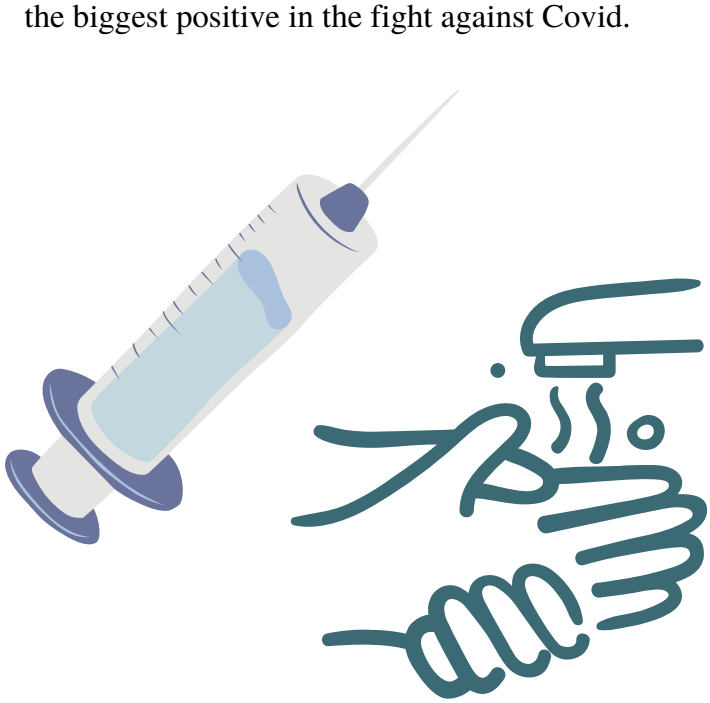
~What according to you is our biggest weapon against the virus?

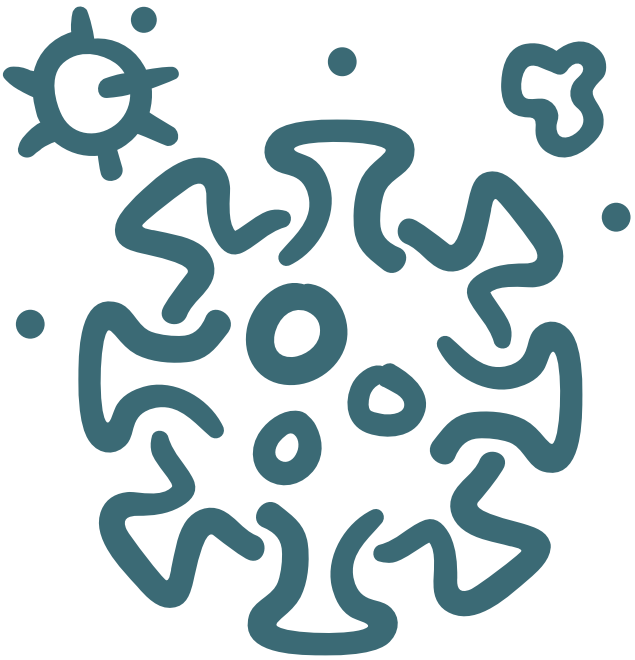
According to me, recent breakthroughs on Covid-19 vaccines look like the biggest weapon against this deadly virus. Though getting all our people vaccinated on time looks like a real challenge ahead, vaccines look like the biggest weapon on hand. With most of the vaccine showing near 90% efficacy in dealing the virus and trials in India boosting a stat of only 0.04 % of completely vaccinated individuals contracting the disease or the wrath of its complications, it's the biggest positive in the fight against Covid.

~Any final words/suggestions/ observations.

We have lost a few friends and neighbours and it is difficult to reconcile with this bitter reality. Some of my personal observations are

1. Doctors and health care workers are real heroes working day in and out in handling this pandemic and keeping check of mortality and complications.
2. The healthcare system requires major upgradation as a sudden surge in any such pandemic can crumble the entire system, be it requirement of oxygen or any required immediate medication.
3. There always exist good and evil people, there are some who are donating their major purse, dedicated working on war footing in hospitals risking their lives and on the contrary, there are few who stock oxygen cylinders for extra money and even faking lifesaving drugs at crucial times.
4. The media, both the print and electronic have chosen their political side over ideology.
5. Quarantine has taught us that life is not only about our career, but also of passion and family.
6. Be it teaching or in the restaurant business or any retail sector with changing scenarios and newer challenges, we always adapt and find innovative solutions.
7. Last but not least, life is unpredictable.





THE STORY OF BITS

-Manjunath HT

We are living in a world where technology is advancing at a breakneck speed. Modern-day computers are capable of carrying out highly complex computations within seconds. It would not be wrong to say that we will reach a point in the future when there won't remain a single thing that computers wouldn't be able to do. But we should not fail to realize the fact that the study of computer science in essence eventually boils down to the way we communicate with computers to get our things done. In this article, I will walk you through some of the earliest discoveries in the field of computers.

The need to communicate over long distances led to the birth of so many communication systems. But most of them were capable of sending only predefined trivial messages. Now, for the messages to be sent across through electric cables, they had to be encoded into some form that was compatible with these electrical devices. The earliest encrypted form of data that could be sent across through electrical cables was Morse code, developed by Samuel Finley Breese Morse in the year 1830. The invention of the Morse code led to the discovery of the Morse telegraph, first used in about 1844.

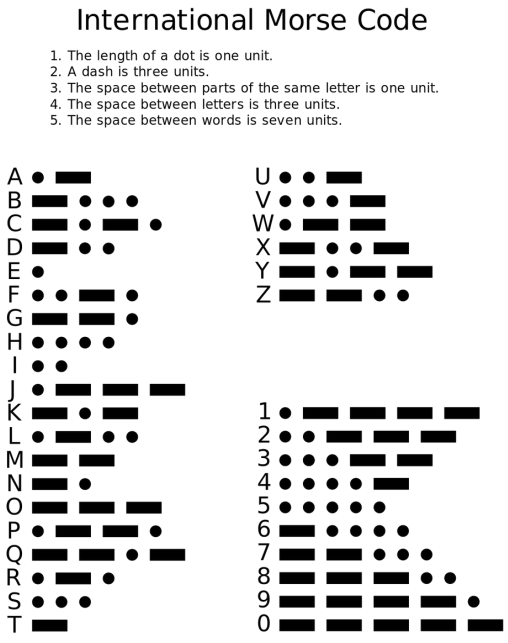
The Morse code makes use of dots and dashes to encode the characters. A dot is a short pulse and a dash is a long pulse, which is roughly three times that of a dot. The possible number of characters that can be encoded depends on the number of dots and dashes being used to encode the message. One dot and one dash give us four combinations, which means we can encode four different characters using them. Two dots and two dashes give us 16 different combinations, and so on. The present-day binary encoding of data can be attributed to the Morse code. And of course, Morse code did influence the way binary digits are used to encode the data. Morse telegraphy remained a standard form of communication for a long time.

One breakthrough in the field of mathematics that laid the foundation for modern-day computing was the discovery of binary representation of numbers.

In plain context, the binary representation of numbers means that we use two symbols to represent the numbers and they happen to be 0 and 1. And it is also the simplest number system possible. There are other representations of numbers as well. The most common one is the decimal number system that makes use of ten symbols. Even though the use of binary numbers has appeared in several ancient cultures, the actual credit of discovery goes to Gottfried Wilhelm Leibniz. Another breakthrough in the field of computation came with the discovery of 'Boolean Algebra' by George Boole. He introduced Boolean algebra with the publication of his first book, 'The Mathematical Analysis of Logic' in the year 1847. And he improvised the concept with another publication, 'An investigation of the Laws of Thought' in the year 1854. But unfortunately, George Boole failed to connect the dots. It never occurred to him that his Boolean expressions could easily be realized using trivial electronic circuits. In fact, nobody in the 19th century could connect the dots between ANDs and ORs of Boolean algebra with the series and parallel connections of electronic circuits.

Then in 1938, Claude Elwood Shannon in his famous MIT master's thesis entitled 'A Symbolic Analysis of Relay and Switching Circuits', established the equivalence between Boolean algebra and electronic circuits.

His work exposed the intricate relationship between Boolean algebra and electronic circuitry, and it came in handy to electrical engineers who used the tools of Boolean algebra to design circuits with switches. In 1948, John Wilder Tukey realized that binary digits were likely to assume utmost importance in the future and wanted to come up with an alternative name to ‘binary digits’. And he coined this beautiful word ‘Bit’ to denote a binary digit. And the first publication to have used the word bit was Shannon’s article, ‘The Mathematical Theory of Communication'. Coming back, Shannon’s discovery escalated the use of electronics to make computations, and that eventually led to the discovery of logic gates, flip flops, and feedback circuits, which are basic building blocks of computer hardware. During the same time, that is around the 1940s, an English mathematician and cryptanalyst Alan Turing discovered a machine that could recognize a pattern and give answers to simple questions based on some preset algorithms, all in binary. This machine came to be known as the 'Turing Machine' and paved the way for modern-day general-purpose computers. The study of computers escalated in the mid 19th century, and computers have evolved very fast since then.



International Morse code

We could easily encode numbers into binary using the logarithmic function to the base 2. But we needed a way to encode character sets into binary. And ASCII (American standard code for information interchange) was one of the earliest encoding schemes. It uses 7 bits to encode 128 specified characters. The encoding schemes have undergone a tremendous change in recent times to include characters from various languages. And that led to the birth of Unicode. With the help of Unicode, we can encode all the existing characters into binary.

Everything that has got to do with computers is in binary form. All forms of data, be it multimedia, text, or anything, everything is stored in binary form. All the computations happen in binary. Can you imagine a human society without a common communicating language? It’s impossible, right? And the binary digits or ‘the bits’ what we call, are the only syllables in the computer’s language. It understands only these two syllables. Everything other than these does not mean anything to it. Bits are so fundamental to a computer. They are the smallest building blocks of information. The only thing that remained constant throughout the evolution of computers is the use of bits, and they will remain as long as computers remain. And that justifies my title.

Vera Nazarian’s quote echoes in my head as I write this article, and I feel it finds relevance here. She says, “Each letter of the alphabet is a steadfast loyal soldier in a great army of words, sentences, paragraphs, and stories. One letter falls and the entire language falters.” So are bits. Thank you.

INTERVIEW ON MENTAL HEALTH

-Leanne Pais

Founder of The Unopened Box, Psychological Therapist and Trauma Specialist, Bangalore

~What are the biggest mental health challenges you see during this pandemic?
The second wave of the pandemic has been a lot more challenging for a lot of people. This time around, we're dealing with a lot of burnout, grief, bereavement, secondary and vicarious trauma. We adapted beautifully to the first wave by learning how to successfully work from home, adjusting to classes and working online, getting services that are so convenient that we don't have to leave our homes.

However, the flip side of this is that we have stopped making time for breaks and to stop caring for ourselves the way we used to.
This lack of space to take breaks, taking on multiple roles like playing the caregiver, living in constant fear, and having to show up as high-functioning people has led to creating higher expectations for how we "should be".

This in turn leads to guilt and all of the emotional overwhelm about not being able to do enough. This causes burnout, where we're too emotionally and mentally overwhelmed to function. At the moment, this is the biggest challenge, followed closely by grief and bereavement.

~How does one deal with these challenges?
You'll be amazed as to how simple this actually is. All we need to do is start by making time to take those breaks without guilt-tripping ourselves. Engage in activities you enjoy, make time to go to a balcony, and catch the sunrise or sunset. Allow yourself to enjoy light, happy, and even silly little things that bring you joy. Make time to do you.

I've heard a lot of people saying that the only way to catch up is by hosting Netflix watch parties. Not necessary. Allow yourself to be mindful. There are many apps that can help you discover new hobbies: Udemy, Coursera, Unacademy and more, offer a wide variety of courses that you can pick-up from the comfort of your home. Apps like Slowly (a community to find online pen-pals) and Smule (a community for Karaoke) are beautiful spaces to use fun apps to connect, share and be mindful. Connect with yourself and connect with others.

Allow this to be a time to also nurture yourself and slow down. If you can get even 20 minutes a day to engage in an activity you love, that's a great start! Set boundaries with yourself and the environment- your family, friends and work spaces to make that time to give in to your needs. Believe me, it will do you a world of good.

There will always be college work and assignments, taking breaks between your study time to stretch and engage yourself in mindful activity without guilt will go a long way in enhancing motivation and concentration. Allow yourself to pay attention to what you need for a while without guilt, so that you can go back to work feeling rested and rejuvenated!

~As we're adjusting to the pandemic mentally, too, how do we deal with our mental health to cope better?
Learning to self-care and set good boundaries is a great space to start. Often we try to postpone our joy by saying "We'll do this fun thing, after the pandemic, or when we have more time". Sometimes, it's important to pause all the other things and do what gives you joy because that bit of joy will fuel you to do what needs to be done.

Take breaks. Regardless of how well we function, the idea isn't to glorify it by avoiding self-care. There needs to be a balance. Too much or too little of anything can be harmful. Allow yourself to find the balance with what works for you. If you've always been a high achiever, allow yourself to slow down. If you're someone who's overwhelmed, take that pause.

Avoid labelling yourself as lazy, unproductive or demotivated. These are signs that your body wants to slow down and probably needs to slow down. Allow yourself that rest. We all need it and are deserving of it.

Important DOs and DON'Ts to keep in mind:

- Take breaks, stretch, move your body, connect with your body
- Focus on being more mindful rather than scrolling on social media and playing online games/ catching up on Netflix
- Get some nature time: this is highly therapeutic. From sunrises and sunsets to gardening or just gazing at the sky, this is possibly the easiest and most freeing mindful activity
- Allow yourself to feel both the feelings of joy, love, connection and the feelings of anger, sadness and grief. We are going through a lot and all of it needs to be validated
- Be kind to yourself, especially now. Instead of labelling yourself, focus on encouraging yourself, supporting yourself and appreciating yourself. You'll realise that this will go a long way in feeling motivated.
- Reach out to people, speak to friends and family who bring you more joy and less conflict. Build connections and have good conversations.

DON'Ts:

- Don't be harsh with yourself and call yourself names.
- Don't force yourself to show up when you don't have the energy to do so.
- Don't have unrealistic expectations of where you should be and what you should be doing. Our timelines have changed. You're allowed to be upset about it and it'sokay to change plans.
- Don't constantly defer plans. Allow yourself to find joy in the small things. Be creative in your own ways. Creativity can bring in a lot of joy
- Don't create a culture of fear. Prevent over-sharing and constantly speaking about Covid and Covid news.
- Don't engage in unsafe behaviours like not wearing masks or taking the necessary precautions that are recommended

- How does one deal with the social isolation that has followed these new circumstances?

We prefer using the term Social Distancing rather than Social Isolation because while we might be distanced from each other, we are not necessarily isolated. We have ways to connect using our phones, video calls, emails, community apps and more. Allow yourself to reach out.

You don't have to physically meet to connect with people. I think an important realisation that most people are having is that for the first time in a long time, we're forced to actually converse about real things and have meaningful conversations that we didn't necessarily have to do pre-pandemic. This onus of actually connecting, being vulnerable, talking about our own lives, creating a space to actually be our truest selves can seem overwhelming. However, it's actually you just showing up for yourself and being your fun, kind, and loving soul with others more freely than you ever have. Please reach out and connect.

You are not alone. You have people. Even if it's friends from the past, reach out to whomever brought you joy and connect. **Set yourself free from your own personal judgement!**

~What are your thoughts surrounding news-induced worry?

This is a huge source of vicarious and secondary-trauma. A lot of people consume copious amounts of news with the hope that it will make them feel safer, better and happier**.**

~What is your recommended protocol for Instant care?
This is my favourite! I'm breaking it down into four categories:

- **Self-Care Package:** Make yourself a box of things that bring you comfort. Put in chocolate bars, a book you love to read, a playlist with soothing music (NOT sad music!), candles, aromas that you enjoy, or anything that offers you a sense of comfort. The idea is to open this up and give yourself whatever you need on a day you need comfort.
- **Happy List:** Make a list of People, Places, Food and Objects/Activities that bring you joy. Include all things and people who are comforting. This is your cheat-sheet. On a day that you're feeling overwhelmed, engaged in whatever it is that makes you feel comforted. Comforting yourself is important and on a day you're overwhelmed, you may not know where to start. This Happy List will be there for that day!
- **Bucket List:** Make yourself a list of achievable, affordable and desirable things that you want to do. It can be to start a herb garden on your balcony, learn a dance form, have a pen-pal across the world. Make it happen for yourself.

The Unopened Box: Follow us on Instagram because we have a ton of free resources on self-care, self-love and self-soothing that you can use right from your home!

~What is your recommended protocol for Long-term care?
I'm a big believer in people going for therapy because it is a beautiful and safe environment to heal yourself with a professional who is trained to look after your mental health. There are multiple forms of therapy like individual, couple, family and group therapy set-ups that are available.

I'd also recommend beginning to self-care in whatever forms work for you. Having a mental health routine that includes mindfulness, creativity, engaging in activities that bring joy and also slow you down, can be extremely helpful. Connect with people and form friendships that are supportive and help you grow. Engage in personal growth and enjoy the process of growing slowly and surely.
Be mindful of not indulging in self-care burnout where you over-consume and overdo engage in healing for an intense experience. Take your time. Therapy is a slow, gradual process. Don't rush the period of healing.

Where can our readers find affordable mental health resources?
Instagram has a huge collection of resources. Some of my favourite accounts include Dr. Nicole LePera's @the.holistic.psychologist and Nedra Tawabb @nedratawwab.

Our website www.theunopenedbox.com and our Instagram page @the.unopenedbox also has a lot of coping mechanisms in the form of posts, worksheets and YouTube videos. Do check it out!
Please also be aware that all the resources are made for general consumption and may or may not always apply to everyone. Take what works for you. If you want an individual experience or group experience that is guided, please sign-up for therapy and workshops to build and foster emotional connections and to allow yourself that safe space to feel held and to heal. **There is absolutely no shame in seeking professional help. If anything, the professionals are best suited to guide you through these difficult times.**

- **Any final tips/thoughts?**

Your Mental Health is important. Please care for it as much as you do with your Physical Health. Taking care of your Mental Health can greatly benefit your physical health. You matter. You are loved. Allow yourself to be that person who also shows yourself that you matter. Love yourself enough to make time to nurture, appreciate and validate yourself and your experience!

I'm so thrilled to have had this opportunity to be here and share with you. I do hope this helps all of you and you do try this out. I'd love to hear from you either in my DMs or you can email me at connect.tub@gmail.com. Sending you all lots of warmth and light, I hope you and your families stay safe through all of this. Take care.

ABOUT

Sahaj software | inspiring brilliance

Sahaj is an artisanal technology services company. We are a collective of individuals, in pursuit of innovation and simplicity to build and deliver technology-based solutions that give our customers an edge. We combine artisanal autonomy and expertise with the first principles of solution design to inspire brilliance.

The name 'Sahaj' reflects the mission that binds us together. As a company of technology artisans, Sahaj does this by harnessing the individuality and diversity in every one of us along with an emphasis on 'first principle' thinking. The pedigree of solving complex problems in software engineering amplifies the different aspects of artificial intelligence (AI), machine learning (ML), and data science, is what they believe. Musing to inspire brilliance with purpose-built Solutions.

Founded on the principle of reducing exploitation, we aspire, above all else, to be fair to people both within and outside the company as we conduct our business. People are at the heart of Sahaj, and reflected in our ethos of trust and respect. We maintain high standards of integrity and our employees are always treated with respect regardless of their identity. To that end, we enforce transparency in our business and ensure that our external suppliers also do not indulge in any manifestation of modern slavery. As a growing business, we are committed to be in compliance with this.

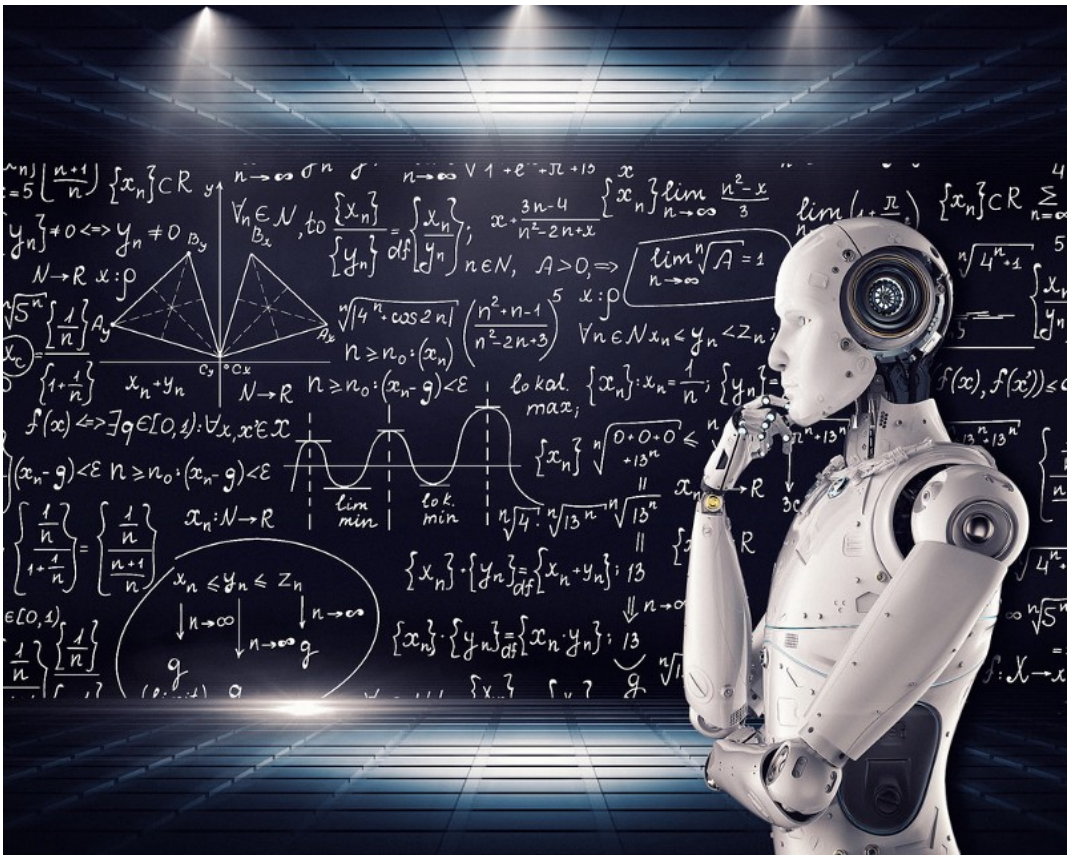
MACHINE LEARNING

Vivek Adrakatti
NTU Singapore

Machine Learning and AI touch almost every a aspect of our lives today. From traffic predictions on Google Maps to advertisements that seem to know exactly what you want online. All of these Machine Learning based systems require data to become better at doing their jobs, and generally, this data is personal data such as phone numbers, location data or internet activity. This data, in plain text form, is generally stored at prodigious Data Centers where Data Scientists and Software Engineers have access to it. One with malicious intent could view and use this personal data to target an individual. Furthermore, these centralized data centers are subject to breaches and hacks that allow the owners of the personal data, us, to be blackmailed or threatened by these hackers.

To address this problem, a group of AI Researchers from Google introduced the concept of Federated Learning. Federated Learning turns our current view of Machine Learning on its head. Instead of taking the Data to the Model Owner, it takes the Model to the Data Owner. It achieves this by sending the current model to every user on their mobile phones. The model is then trained on the device, in the background, on the user's data. The model updates are then sent back over to be Securely Aggregated, and the original model is updated.

This system is currently being used to make predictive text better for GBoard for all users. By using the concepts of Cryptography such as Homomorphic Encryption or Secret Sharing, the Secure Aggregation process is achieved. This is a great leap forward towards Perfectly Privacy-Preserving AI.



NATURAL LANGUAGE (PRE-) PROCESSING

-Rakshitha P

Chat bots are getting really common these days. From Eliza, the first-ever chatbot to Alexa, researchers have finally succeeded in making computers understand the human language input. This article will introduce the technological process that allows computers to derive meaning from user text inputs.

Natural Language Processing (NLP), a subset of machine learning (ML) , deals with training machines to understand and interpret natural or human language. Like any other machine learning processes, NLP involves two main phases: data pre-processing and model training using ML algorithms. However, NLP has several data pre-processing techniques that are designed specially for text processing. The purpose of pre-processing is to transform raw data into a useful format which can then be fed to ML models. Below are the three important steps in text pre-processing:

1. Noise removal: In text descriptions, such as product reviews or YouTube comments, a high proportion of text data contains HTML tags, stopwords like 'is', 'the', 'it', punctuations and URLs. Any text which is not relevant to the context of the data and the task that we want to perform is considered as noise. ML models won't be generating any useful pattern from it. Hence, removal of such noise increases the performance of ML algorithms.

```
Excellent tablet with nice screen. I wish Amaz...
Preloaded with the reading app from Kindle but...
Very happy with this product and easy to use.....
My grandchildren are home schooled and utilize...
Great size, easy to carry for traveling. Need ...
I purchased this when my last tablet died. It ...
Perfect for downloading and reading books !! P...
I was surprised when I learned of the capabili...
```

Original reviews (from Amazon)

```
excellent tablet nice screen wish amazon would...
preloaded reading app kindle expandable apps p...
happy product easy use picture clear takes gre...
grandchildren home schooled utilize tables man...
great size easy carry traveling need spend tim...
purchased last tablet died meets basic needs p...
perfect downloading reading books perfect size...
surprised learned capabilities device husband ...
```

After removing noise

2. Text Normalisation: While processing huge chunks of unstructured data, sentences are often fragmented into smaller units. This is called tokenization. These tokens are cleaned, pre-processed and then converted into numeric values by the method of vectorization. But before that, we can bring the words to their root forms by stemming and lemmatization. The goal of these techniques is the same, i.e., to reduce the inflections between various forms of words. But both follow different algorithms. Stemming reduces the words to their root form just by removing the suffixes, whereas lemmatization considers the context and converts the words into their meaningful base forms.

Actual word	troubled	was	reading	cities	worse	sang	very
Stem	troubl	wa	read	citi	wors	sang	veri
Lemma	trouble	be	read	city	bad	sing	very

Here, stem is obtained using PorterStemmer and lemma from WordNetLemmatizer with different part-of-speech (pos) values as arguments.
Both of these techniques are widely used in SEOs, web search results, information retrieval, tagging systems and indexing.

3. Object Standardization: Raw text data often contains words or phrases that are not present in any standard libraries. These include shorthand forms, abbreviations and words with variant spellings which are not recognized by search engines and models.

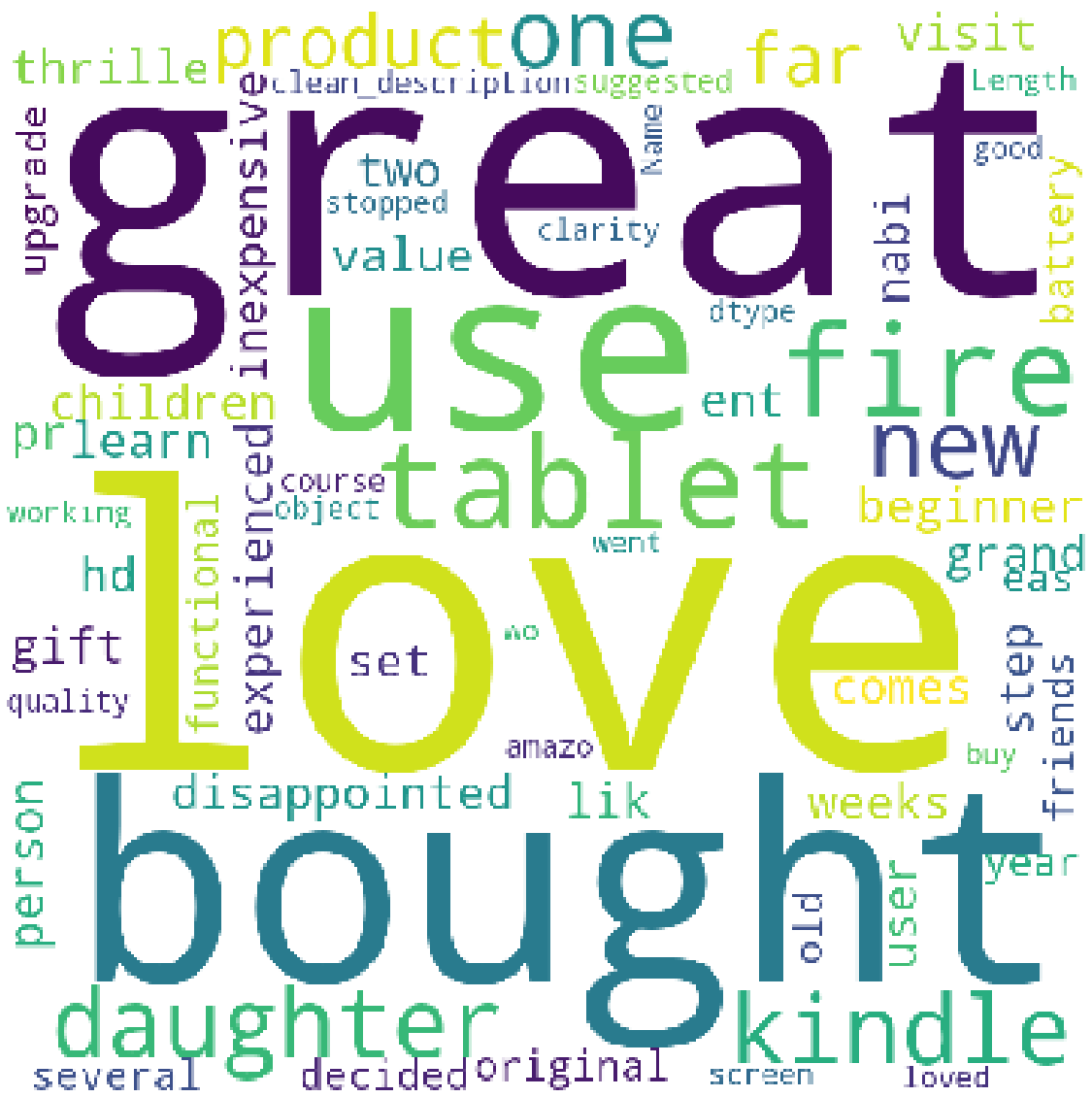
All such words have to be handled with the help of a custom code that contains a lookup table that fixes these non-standard words. A simple lookup dictionary would look like:

```
lookup_dict = {'rt': 'retweet', 'dm': 'direct message', 'b4': 'before', 'imo': 'in my opinion', '...'}
```

The next crucial step in NLP is Exploratory Data Analysis (EDA). The main goal of EDA is to gain maximum insight into the data and get a better understanding of the uncommon patterns present inside it. A visual summary of information like graphs and charts makes it easier to identify patterns and trends than looking through every line of text data.

WordCloud package is one such data visualization tool for representing text data in which the size of each word indicates its frequency or importance.

EDA is followed by feature engineering, where pre-processed data is converted into features for machine learning models to work on. And the final step is model building and deployment. The data is split into training and test data sets and a suitable machine learning algorithm is applied.



WordCloud generated using Amazon reviews dataset

Getting into your dream college | Georgia Tech

~Akshay Krishnan

Akshay Krishnan, a former ECE graduate from JSS Science and Technology University graduated in 2018 majoring in robotics and computer vision from one of the most prestigious universities in the world, Georgia Institute of Technology and is currently working at Waymo, known for their pioneering and cutting edge work in the field of computer vision and self driving

~What was your motivation to pursue your education further in the US?
My major motivation was the vast number of opportunities for robotics here when compared to anywhere else especially in India where it still hasn't gained considerable traction yet.

~What factors should one consider when choosing their college?
Haha, I wish I made better choices in applying for college or at least did some more homework. Not all universities are affordable, they can be quite taxing financially and I felt I could have saved some fees with the applications.
You must first decide your interests and in turn decide which college aligns with your passion in terms of how good their programs and their faculty are along with the job prospects in that area etc
I would also encourage public over private universities as they assist you with more financial support.

~Considering how expensive it is, how did you work around this and what would you suggest for future applicants?
My tuition fee was paid only for the first semester, for the subsequent semesters, being a Research Assistant for my professor covered my fees along with providing a good stipend to cover my lifestyle. If you're good at research and published papers, professors will entertain the thought of you working as their research assistant. I would also recommend you to work as a teacher assistant by choosing courses and volunteering to ease the workload of teachers, that covers your fees as well.

~What suggestions would you give to help students get accustomed to the college life there?
I highly recommend them to read as many technical papers as they can. It really helps with broadening your knowledge and I wish I had read more papers during my initial years of college. Also for ECE/EEE students who are interested in computer vision and robotics, math in general and linear algebra along with statistics are vital!

~When did you gain clarity on what you wanted to pursue and guide us through how you prepared for it?
Lucky people figure out what they want early on and unfortunately that wasn't the case for me, haha! Those fortunate enough to know their interests do not multitask and juggle various things like I did. I had multiple internships, college work, projects, placement preparation and GRE to deal with. So I would suggest students to find their interests first instead of trying to do everything at once which doesn't really yield much in the end. I gained clarity and focused on GRE during my 6th semester because I liked computer vision and robotics and they had a better future in the US than in India and started working more on GRE from then on.

~What tips would you recommend for GRE applicants?
I used to read a lot of fiction, primarily, Dan Brown and mystery in general. I would suggest a lot of reading and expanding your vocabulary, there is no other shortcut. In the end, your GRE score and CGPA is just a number to filter applications and does not indicate your potential. Unfortunately, they do matter as it gives a relative aptitude insight which will soon change hopefully. Each college has their individual thresholds for GRE scores so work accordingly. Learn the words that are commonly used and practice writing essays

~How contrasting was your education at Georgia Institute of Technology with JSSTU?
In SJCE, there was more focus on scoring well

for placements. It was a very contrasting experience here with respect to communication with professors, researching papers and the approach towards conducting practical experiments.

~What compelled you to do masters immediately after undergraduation and how did it fare?
I did not want to work in India as I wouldn't have been happy there. There is very limited scope with opportunities pertaining to what I was interested in and I feel this is a very common issue, as well. Computer Vision has a better future here, but it's not a job you take to learn on the go, if you are knowledgeable and know what you're doing it's a good field.

~What are the challenges of self driving here? Do you feel there is potential for computer vision in India?
The way people drive, of course! There are no fixed lanes and rules that people follow to help inculcate self driving. That being said, that gives another huge opportunity and potential for self driving in India. I do hope AI develops to that level someday.

~Lastly, what is the lifestyle of work there and what do you do?
I can't really disclose what I do at Waymo but software engineering is really vital, it really helps having practical knowledge of python and C++ and applying them to solve problems like depth perception. Otherwise, it is really humbling and interesting to work with so many talented individuals and it is really diverse. The quality of life is really something else!

The above excerpt was from a podcast with Akshay Krishan along with many other episodes featuring guests from other top colleges who are former students of JSSSTU. Do check the YouTube channel 'IEEE-SJCE' for a realm of different insights and stories from other guests across the globe.

QUIZ TIME

1. What is the name of Elon Musk's aerospace company?

2. Who is considered the "Father of the Internet"?

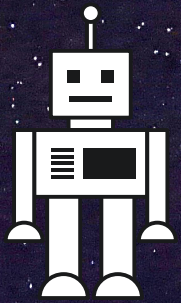
3. Which company, in 2013, revealed plans to deliver packages using drones?

4. What was the name of the first home computer?

5. What query resolves a domain name to its IP?

6. What does 8 in "Core i5 8250U" stand for?

7. In what year was the "@" symbol picked for use in e-mail addresses?



8. Which car company made the humanoid robot ASIMO?

QUIZ TIME

9. What year did the Apple iPhone first become available?

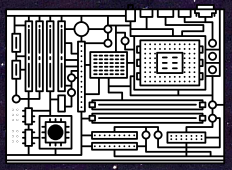
10. What does the acronym URL stand for?

11. In web design, what does the acronym CSS stand for?

Microsoft

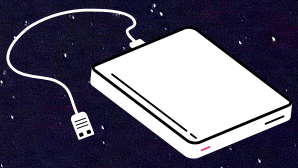
12. In what city did Bill Gates and Paul Allen found Microsoft?

13. Who co-founded Hotmail in 1996 and then sold the company to Microsoft?

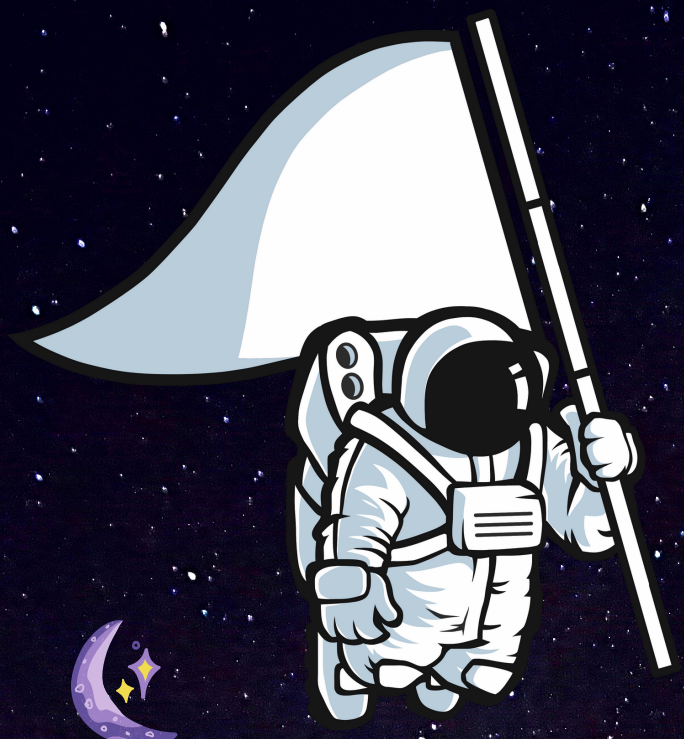


14. What cell is used for maintaining clock in motherboards?

15. The first 5MB hard drive weighed approximately _____ pounds.



Crossword Challenge



Hints

Across

2 is used to measure the transmission speed of electronic devices.

3 is a clock frequency, also known as a clock rate or clock speed, representing a cycle of time.

9 is a hardware component that supplies power to an electrical device.

10 is a facility allowing computers, smartphones, or other devices to connect to the Internet or communicate with one another wirelessly within a particular area.

11 is a common type of network cable used with wired networks.

12 a printed circuit board containing the principal components of a computer or other device.

13 is an electronic device that connects a computer to a computer network, usually a LAN.

15 a place in a computer where an expansion card can be inserted.

16 a high-capacity, self-contained storage device containing a read-write mechanism plus one or more hard disks.

19 is a hardware bus used for adding internal components to a desktop computer.

Down

1 a unit of information equal to one billion (109) or, strictly, 230 bytes.

2.is a unit of information equal to 220 bytes or, loosely, one million bytes.

4 is a small device able to be connected to and used with a computer, especially to allow access to wireless broadband or use of protected software.

5 is a device or substance for absorbing excessive or unwanted heat.

6 is a computer is a piece of hardware that carries out the instructions of a computer program.

7 is a USB-based device that transmits and receives wireless signals.

8 is a printed circuit board controlling output to a display screen.

14 is a device which can be slotted into a computer to allow the use of audio components for multimedia applications.

17 is a type of computer memory that can be accessed randomly.

18 is a type of storage medium that permanently stores data on personal computers.

ANSWERS TO TECH QUIZ

1. Spacex
2. Vint Cerf
3. Amazon
4. Altair
5. DNS
6. Processor Generation
7. 1972
8. Honda
9. 2007
10. Universal Resource Locator
11. Cascading Style Sheets
12. Albuquerque
13. Sabeer Bhatia
14. CR2030
15. over 2,000

ANSWERS TO CROSSWORD CHALLENGE

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