CONNECT

"All Birds find shelter during a rain.

But an Eagle avoids rain by flying above the Clouds."

-Dr. A.P.J. Abdul Kalam

CONNECT
VOLUME - 10

LCC, SJCE

Dr. T. N. Nagabhushan - Principal, SJCE

Dr. H. C. Vijayalakshmi - Chief Mentor, Head of Dept. of CS&E, SJCE

Sri. P M Shivamurthy (PhD.) – Technical Advisor, Dept. of CS&E, SJCE

Sri. R Guru (PhD.) – Financial Advisor, Dept. of CS&E, SJCE

LCC, SJCE COUNCIL

Chief Coordinator : Srivatsa R, 7th CS&E

Technical Coordinators :

Anoop Bhat, 7th CS&E

Kshipra S, 7th CS&E

Shubhashree Hebbar, 7th CS&E

Veeresh Koti, 7th CS&E

Student Coordinators :

Mohammed Ateeq, 7th CS&E

Prince Raj, 7th CS&E

Swati Shetti, 7th CS&E

Treasurer : Sandesh Hegde, 7th CS&E

Editor in Chief : Kavitha Ramachandran, 7th CS&E

LCC, SJCE EXECUTIVE COMMITTEE

Adithya S K, 7th CS&E

Meghamala N S, 7th CS&E

Panchami R, 7th CS&E

Rahul Amin, 7th CS&E

Rakshit I, 7th CS&E

Ravishankara K, 7th CS&E

Revanth Krishna, 7th CS&E

Shrinath K, 7th CS&E

Smitha S, 7th CS&E

Srijan R, 7th CS&E

Copyleft © 2017 by Linux Campus Club, SJCE, Mysore, India

mail : lccsjce04@gmail.com

web : http://www.lccsjce.org

Coverpage Design : Shubhashree Hebbar, 7th CS&E

Typesetting : Kavitha Ramachandran, 7th CS&E

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.3 or any later version published by the Free Software Foundation; with no Invariant Sections, with no FrontCover texts, and with no BackCover texts. A copy of the license can be found at http://www.gnu.org/copyleft/fdl.html. Under the terms of the GFDL, anyone is allowed to modify and redistribute this material, and it is our hope that others will find it useful to do so. That includes translations, either to other natural languages, or to other computer source or output formats. You may also extract text from this book for use in a new document, as long as the new document is also under the GFDL, and as long as proper credit is given (as provided for in the license).

Message from the Chief Mentor

I am extremely happy to witness this batch of enthusiasts at Linux Campus Club, under the Department of Computer Science and Engineering, working passionately to foster the use of FOSS and to educate the members about it.

Now in its 14th year, Linux Campus Club has made a steady progress and has become the heart of open source in the campus since its birth in 2004. The increase in the membership, technical sessions conducted and popularity among students year by year being the indicators of it.

LCC CONNECT has always served as a medium for the student community to connect to the FOSS world. I hope the students avail this opportunity to contribute articles to the magazine and share the knowledge they have acquired with others as that is the ideology driving the entire Open Source Movement.

I congratulate the magazine committee for providing the students with LCC CONNECT, 2017-18 and for the opportunity to contribute articles to it. I wish FOSS CAMP SJCE, 2017-18 and LCC all the success and all the very best in all its endeavours.

- Dr. H. C. Vijayalakshmi

Head of the Department

CS&E

SJCE, Mysore.

From the Editor

Linux Campus Club was started back in 2004 by a group of enthusiastic students. Over the years it has experienced tremendous growth and has flourished as an organization with a participation of over 150 students for the sessions conducted so far.

This spring time, LCC brings together students from various branches across colleges to instil the idea of Free and Open Source Software, FOSS CAMP'17 serving as the platform.

In our 14th year of glory, we are delighted to present to you the FOSS CAMP edition of Connect'17, our annual technical magazine which aims at exposing the students to the world of FOSS and the latest developments in the world of open source.

"Coming together is a beginning, keeping together is a progress, and working together is a success"

- Henry Ford

Individually we are each one drop, but together we are an ocean. I take great pride in congratulating each and every member of LCC, SJCE'17 who has strived hard to make FOSS CAMP a great success. It is my privilege to express our sincerest regards to our respected chief mentor and H.o.D. Dr.H.C.Vijayalakshmi, technical advisor Prof P.M. Shivamurthy and financial advisor Prof. R. Guru for guiding us throughout our journey. I am extremely grateful to everyone for their support in bringing out the annual magazine Connect'17.

Wishing everyone the very best for all future endeavours!!

- Kavitha Ramachadran

Editor-in-Chief

Linux Campus Club

7th CS&E, SJCE, Mysuru

CONTENTS

FREE AND OPEN SOURCE SOFTWARE

CONNECT
VOLUME-10

1. A brief history of Linux

- Veeresh Koti, Technical Coordinator, LCC, 7th CS&E, SJCE

Let us find out how this little OS got its start: From Bell Labs (the 60s) to Torvalds(the 90s)…

Though the birth of Linux didn't occur until 1991, when Finnish college student Linus Torvalds started work on a new and free operating system, its roots go all the way back to the late 1960s at an archetypal research and development facility still known and revered as Bell Labs. Taking a break from building a massive, complex and powerful multi-user OS called MULTICS, Ken Thompson (and later Dennis Ritchie, and eventually a host of others) started working on a simple, minimal OS so he could use it to run a favorite computer game of his at the time, known as Space Travel.

Ultimately, Brian Kernighan (another then-unsung luminary also working at Bell Labs at the time) jokingly referred to Thompson's toy OS as UNICS to contrast its minimal simplicity against the massive complexity of MULTICS. Soon after, it became known as UNIX, and it set the standard for minicomputer (and even microcomputer) operating systems throughout the 1970s and 1980s. That is until the PC revolution drove different OS designs beneath the UNIX architecture and design philosophy.

But even by the 1990s, when Torvalds got started on Linux, there were plenty of more serious computing needs for multi-tasking, parallel processing, high-volume computing and so forth, that microcomputer OS simply couldn't handle. At the same time, it still remained too expensive to invest in the hardware and software required to do an industrial-scale computing. Richard Stallman's efforts with Hurd (a GPL licensed patchwork OS that fell shy of completion) failed to reach critical mass, so nobody ever used that platform much, either.

From the 1970s to the 1990s, AT&T tied up many of the major computer makers of the day in litigation based on patents taken out on UNIX, as it moved into System V releases and beyond. Though the famous Berkeley Software Distribution (aka BSD) did much to open up UNIX and make its inner workings visible, intelligible, and infinitely customizable, those same lawsuits ultimately strangled development and adoption of BSD before the end of the twentieth century.

In short, Torvalds had lots of good reason to assemble and promulgate a free and open operating system, and every reason to expect that credible and usable work in this arena would be rewarded by large-scale participation from other developers, and broad adoption from legions of computer users eager to run a powerful, multi-tasking operating system. And of course, Torvalds understood very well that the implementation had to be new so that there could be no grounds for AT&T to come at him with its legal artillery blazing away.

Wikipedia attributes this crucial move to Torvalds: "...if either the GNU or 386BSD kernels were available at the time, he likely would not have written his own. But they weren't, so he did write his own kernel, and called it Linux." That kernel has only continued to grow over the years.

In 1996, Torvalds revealed the Linux penguin, Tux, which was reportedly based on a story that Torvalds was bitten by a penguin in Australia.

Today, companies such as Dell and HP sell Linux on their servers. Red Hat and SUSE sell their own enterprise distributions. And Google's popular Android operating system is built on Linux.

2. My view on Open Source – "Involving open-minded people across the globe to evolve knowledge and distribute"

- Divakara N., Assistant Professor, CS&E, SJCE

"An apple a day keeps the doctor away" is an old proverb which may be tailored to "An apple a day turns Cancer our way". We are living in such an infected surrounding. The same is appropriate to software too.

The use of proprietary software is not at all a setback as long as it is affordable and bug-free; however current circumstances are completely different. It demands the development of language-independent software and also building one's own security procedure to suit the requirement. We are living in an epoch where people are free to do anything and everything - "*By the community, for the community*". If so many things are available at free of cost and serve us competently, why pay for proprietary software. The philosophy of open source gives the customer the "*Freedom of Choice as opposed to the Freedom from Choice*"

Conception of Open Source Software

- FREE SOFTWARE relates to the user's ability to use and improve the software, not the price.
- Users have access to the source code of the program and can change it.

LICENSING: GNU's GPL - General Public License

- You may make copies of the software and give them to friends.
- You may use the software on as many computers you want.

The perception of open source software is made very clear to respective field applications by the LCC-SJCE FOSS Campus. I'm very glad to have this forum in our department which is executing extremely well. I personally congratulate every individual involved directly or indirectly.

I would like to wrap up my feelings by remembering the great soul His Excellency Dr. A. P. J. Abdul Kalam, *Evergreen President of India*, Speak on Open Source Code Software:

"*In India, open source code software will have to come and stay in a big way for the benefit of our billion people.*"

- Dr.A.P.J. Abdul Kalam, President of India, May 28, 2003, Posted by egovindia on June 21, 2006

3. Open Source – Freedom of thinking

-Prof. P. M. Shivamurthy, Asst. Professor, CS&E, SJCE

Openness is the essence of freedom. A mind in its working status would like to be let free for a healthy thought process. There is an argument, "In the hierarchy of understanding, data is in the bottom most position, above that information, followed above by Knowledge and above all is the Wisdom". An experience with the open thinking process leads to the justification of the above argument.

The attainment of wisdom happens through an intensive processing of raw data, with an exploratory thought process. The need for the rawness of the data is the essence of openness.

Open Source is an idea to expose the rawness of the data at its original form. In contrast with closed source systems, the barrier limiting the thought process, has been eliminated with the transparency achieved through open source systems,

A complete ownership of the mind on the open data leads to effective summarization. The freedom of thought process broadens with the openness of the raw data resulting in meaningful information. The comprehensive nature of the information expands the scope of logical reasoning without causing the hindrances to thinking process.

In this direction, the open source system eliminates all barriers to the expanding scope of thinking, which leads to a sophistication in the knowledge. With an expanding horizon of such a knowledge acquired through an openness and freedom of thinking, one can attain wisdom of philosophical thought process.

Hence, the freedom of thinking of an open source software developer would lead to wisdom of philosophical thoughts expanding without barriers.

4. Deliverance of Research Innovations using open source

- Dr. Trisiladevi C. Nagavi, Asst. Professor, CS&E, SJCE

More and more academic researchers rely on a variety of commercial software which is expensive. Investigators need to buy costly single licenses for a specific computing system in a laboratory. Hence open source software is less popular among academic researchers.

Open source software is cost saving and facilitates customizing the software to researcher's specific needs. They can even share their work with other groups which are working on similar research areas.

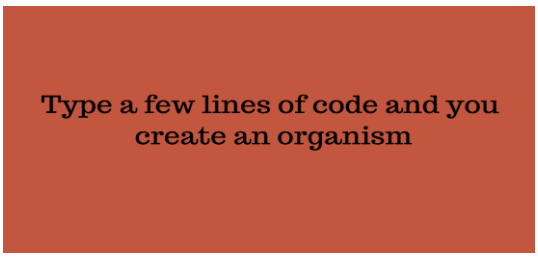
Suppose if a researcher envisages a good idea and plans to bring it in the form of a commercial product. He or she publishes the research findings in a reputed journal; someone in a software company likes the idea and starts the process of product development in collaboration with researcher which could take several years.

Instead, researchers can implement their ideas on open source software and tools and demonstrate and straight away. Also, if it is shared among open source community, many people would use it and they articulate their feedbacks. Subsequently, based on the usage statistics and the user feedback software, the

company can find out whether it is a viable product for their company. The company can suggest reforms to the research project and release the product as commercial software to the market at the earliest.

5. How to convert your idea into code?

- Raghunandan J, Walmart Labs



About a famous man who did it the cool way!

No, not Steve Jobs or Bill Gates again. I bet you are tired of hearing these names with quotes, success stories and how they changed the world. I'm going to talk about a man who was a coder, sold his company and bought a basketball team. His name is Mark Cuban.

At the age of 12, he sold sets of garbage bags to save up for a pair of shoes he liked. In high school, he earned extra dollars any way he could, mainly by becoming a stamp and coin salesman. Cuban landed a job selling software and eventually formed his own consulting business, Micro Solutions. Cuban was soon an expert in the field of computers and computer networking. He also had a knack for building a smart, profitable company. In 1990, Cuban sold the firm to CompuServe for $6 million.

He also started broatcast.com software company and later sold it for 5.7 billion (billion with a 'B'). He started many companies thereafter and has been a shrewd businessman. He also features in Shark Tank, a TV series with entrepreneurs and investors. I highly recommend you to watch that program.

Why am I telling his story?

A man who was just born in a middle-class family in the US (as you and I are) is worth billions now only because he knew how to convert his IDEA TO CODE, improvise and execute. He bought a basketball team for about 250$ million because he loved basketball. Who knows you might end up purchasing an IPL team if you learn how to convert your idea into code?!

It's not so hard....

When I was doing my final year project in engineering, I was thinking who would use this project anyway, all our effort we put it for almost a year is down the dustbin of our department. (Teachers are going to be offended on reading this). I bet many of you may echo these thoughts with me because rarely final year projects make it to the end consumer.

1. Open source - Lego pieces are out there - Open source software is scattered like Lego pieces over the internet. You just need to take all the Lego pieces out there and stitch it to make a nice usable craft. There are numerous projects on GitHub, GitLab which will help to create what you want with less effort of your own.
2. Open source frameworks
   A framework is something which will give you a skeleton and you will have to fill in blood, muscles, and veins. Spring in Java, Angular for typescripts

are some of the popular frameworks people use to achieve their purpose of building websites.

3. Open source community
   Give me a cheer if you use stackoverflow.com! All those answers you see on stackoverflow.com are people you don't know. People help people with problems for free. Although there are some points given by StackOverflow, answering a problem of a guy who lives in a different country, who they owe nothing is real social service, I would say. Open source community is extremely generous for budding coders. Take advantage of it.

Where should you start?

1. Invest in learning
   i. Take a look at emerging technologies used worldwide for building websites. I'm suggesting web building technologies because the whole world is running on the internet. You can switch to whichever stream your interest lies in.
   ii. Learn a language you can use for building a backend of a web application. Code it, deploy it, and test it!
   iii. Build a nice front end using bootstrap, html5, javascript (angular if possible). And attach it with a backend which you have written. Deploy it, test it and tell your friends/family to give feedback about it.
   iv. Learn about its business use case. Who's going to use it? Why? Will they be able to pay to use it? Why, why not?!. Come up with a business model which will make money and try selling it. Fail at it! Learn from it!

2. Invest in mentorship
   i. You need some Guru to make you learn things by their experiences. It can be your teacher, father, mother, friend or anyone who has your best interest in mind. Ask them questions, get answers.
   ii. Attend conferences where people talk about business, technology, ideas etc. You will realize how less you know about things.
3. Invest in hardware assets
   i. You need to have a good laptop/computer to make all these things work. Save money and buy a good laptop on which you can work because you are going to spend a lot of time on it.
   ii. Get a good internet connection. No, your Jio connection won't work. Save money by eating less in that bakery, Gobi Manchurian stall, invest every month for a quality internet broadband connection.

Concluding, there's no wrong time to start a right thing. Start coding your heart out just after you finish this script. Happy Coding!

6. Open Source – Issues of concern

-Prof. P. M. Shivamurthy, Asst. Professor, CS&E, SJCE

Software development has taken a new facelift ever since the advent of open source technology. The term "open source" has led to many issues of debate in the software industry. There are as many pros and cons as well, which are still a matter of serious thinking. Almost after a decade of its growth in the field of software system development, still there are many issues which are unknown or either ignored by many young developers.

The feel of freedom is the real essence of open source technology. It has been celebrated and continued, leading to a great threat to the proprietary ownership. It has been a privilege for the developer to own the rights of implementing the great ideas and contribute towards improved solutions to many of the problems. This is also an advantage for the end users to use those solutions free of cost. This has been growing in a huge way to side-line the proprietary ownership and may even eliminate them. The major players, who develop and deliver proprietary licensed software, are struggling really hard to succeed and survive and few are really there.

Here comes the issues, how are they still be able to survive in spite of free software revolution. Are the users are still ready to spend on licensed software, when there is free software available? If yes, why? Is there any lacuna in the open source systems?

Open source systems are made available to the developer or user free of cost to allow them to create or customize the systems as per their needs. Many software industries are existing since many years and have given life to the field of software development and all are basically driven by business needs. The survival mainly is based on their business rating in major stock exchanges. This has led to proprietary ownership on their products and a competition leading to customer attractions. These business firms focus mainly towards customer satisfaction. An open source developer may not need to please the customer rather portray his talent. The customer needs are really not focused in open source technologies. Hence many solutions remain a failure and a lot many become a piece of junk code.

Thinking along these lines, the open source technologies are neither attracting the customers nor are they making business. A completely open source based firm cannot raise their revenues and may not be able to sustain longer in the business world. A reduced business may lead to reduced fiscal growth of the overall software industry leading to an imbalance in the global economy. Hence it is time to think towards industrializing the open source development along the lines of linking customer satisfaction under focus.

This will lead to deployment of suitable regulatory system in the field of open source development. A proper set of business guidelines need to brought in and a strategic way of controlling and managing open source software development has to be established. This will avoid dirty hands destroy the integrity of the open source and stop becoming a piece of junk code.

Let the open source systems be regulated and controlled by certain standards and focus on end user needs to contribute towards global economy.

THE WORLD OF AI

CONNECT
VOLUME-10

7. What do you think about machines that think?

- Samarth Deyagond, 7th CS&E, SJCE

We speak about Artificial Intelligence, Machine Learning, Data Science where we claim that machines think, machines draw insights from huge data, machines identify the patterns which a data follows and machines also predict the properties and sometimes future!

Listening to this, not everyone will be convinced that machines can think! Let me make an attempt to convince. If I ask you, "*Do plants eat?*" you will certainly say, "*Yes, they do. They absorb minerals from the soil with their roots and then send them to the leaves via Xylem and Phloem tissue and undertake the process of photosynthesis which prepares their food."* Right? So, just because plants aren't following the conventional way of eating as we do, we didn't conclude that they don't eat. Likewise, just because machines don't think in the conventional way as we do, we cannot conclude that machines don't think either. They do think, in their own way.

If today, humans are intelligent to this extent, then it is because of the fact that nature helped us to understand our surroundings; nature supported us to question our experiences and find an answer to it. Right, in the same way, the computers are evolving and we humans are acting like the nature for them. We are helping them explore the insights from the data by developing machine learning and deep learning algorithms and with this; there will come a day when computers and humans will co-exist in this society.

How did this all begin? The story is beautiful. When Charles Babbage first invented the computer, he said, "*I built the most complex machine that calculates*." but Lady Ada Lovelace who sounded like a visionary said, "*I don't see this computer just as a calculating device rather I see a potential in it to do everything that a human does. Because a computer does the math and everything human does is math as well"* Her words were not justified right at that time. Then comes the real hero of computer science, Allan Turing who said, "Machine is said to be intelligent when the work done by a machine is indistinguishable from that done by humans" and people came up with actual intelligent algorithms which would take decisions without an explicit 'if' statement but with pure math. This laid the foundation for Turing Machines which is the final court of decision to decide if a problem is solvable by a computer.

See, how visionaries thought about the possibilities and probabilities, how great men worked and today the growth of fields like Machine learning, Artificial Neural Networks, Natural Language Processing and Data Analytics is simply dramatic. They are independent and interdependent as well. Almost everything involves their application. This has led to the formation of new work domains like Computational Biology, Neural Sciences, Knowledge

Graphs and derivation of interconnected knowledge (which Google does) and what not?

All this wouldn't have been possible if we had not allowed the computers to evolve just like we evolved. With this five minutes of reading, tell me now, "*What do you think about machines that think?*"

Thanks for reading!

8. Go ahead, I'm listening….

- Sushmitha Mallesh, 5th CS&E, SJCE

As I started to think of ways in which I could enjoy my Sunday morning: after pointlessly using Instagram, Pinterest and playing back-to-back clips from Stranger things, I just decided to speak to Siri and it can be amazing how the Siri that annoyed you by not giving just the right response for a question, can lift your mood by just saying something subtly sarcastic and witty.

Virtual assistants are definitely funnier than we give them the credit for. It is not even about the lame jokes it will tell you when you ask it; even on a long day, it can make you laugh out loud.

The real humor is when you ask them questions you would ask a real person or when you ask questions about itself or for that matter other digital assistants. For a simple question like "Is Jon Snow dead?" Siri says "Dead, alive… wilding, crow… north, south… name, no name… Hodor, Wylis… all I know is that I know nothing." It also, among other things will just get you by using the many of the popular: "The Hitchhiker's Guide to the Galaxy", "Game of Thrones" references.

It's interesting to see how companies are trying to win the looming battle of the tech world: to be the de-facto digital assistant running on all your gadgets, all the time, while, much of the initial focus was on voice-based computing capabilities of these devices. It is perfectly clear from recent improvements in this year that digital assistants are going to be everywhere: from Apple's new and improved Siri to amazon's home assistant Alexa. Each of the big companies is jumping onto reach more users and are constantly learning from huge data generated through these assistants. The key to success as the companies are beginning to realize is not just cutting edge technology but it is believed to be as well-explained by AI expert Qi Lu "dedicated AI devices to solidify an emerging base of ecosystems". By focusing on the very same thing amazon's Alexa and Google's home are way ahead in the race and have better chances at being the meta-platform digital assistants that they are envisioned to be.

Digital assistants no longer just perform the simpler task of just searching for a restaurant nearby or setting an alarm it now can let you control smart lights and other smart devices. Siri now almost perfectly translates sentences for you. But the advantages these assistants would add to the existing business say marketing is still very low, for example, the percentage of Alexa users who have ever used it to buy something on Amazon Prime is just 32.1%.

We all know the intelligent digital assistants' use AI but what goes on

between listening to your request through the microphone is interesting. It is a combination of different things including speech recognition, language analysis, AI-based natural language processing, language translation etc. There is also a new front that is being used where the voice assistant predicts what the next question would be. Most big companies are also working on methods for "deep linking" content inside standalone apps to make it possible to automatically find and use the information in other contexts.

Even though there are still many limitations in the digital assistants of today, there doesn't seem to be any doubt in their growth and presence in our lives. They are going to get better when they go meta-platform: where it can access all of the data from the currently closed apps and grow into something resembling a wide-open world of hyperlinked web. In this world, information would flow continuously, reflecting the nature of computing when users are surrounded by always-connected devices.

9. How would you interact with a machine?

-Rishika, 1st CS&E, SJCE

How does our experience of social interactions with other humans influence the way we interact with machines?

Social and digital media have become a huge part of today's society. The Cyber World exists parallel to our physical reality in that the Internet, television, video games, and cell phones all play a role in shaping who we are as individuals existing together outside of technology. Experts say digital media helps us because it may enhance time management skills, optimism, and self-esteem, as well as general knowledge. However, social media is a metaphor for real life. We think it might change our lives for the better, make it easier, make us happier… but we all know what they say: you can't buy happiness. Well, social media comes with a cost. But an excess of anything becomes a problem where we are no longer helping ourselves, where we are beginning to become handicapped by changing our relations with society and perhaps even our evolutionary path.

Social media may appear to make our lives easier, but at the same time, it complicates them. Studies show that the pressure of having to present oneself in a way that is acceptable to online friends increases stress levels. The fact that we have to worry about how we appear to "everyone" in cyber-society adds unnecessary stress to our lives. Simultaneously, we have far more information accessible to us than what we're programmed to have. Knowing too much about everything going on in the world through constant access to cyber reports requires us to be involved in it. We become seemingly too busy caring about the people we hardly know inside these machines; then we can no longer balance worrying about things with which we should be concerned, such as real-life relations, skills, and (probably the most unfortunate) ourselves.

Constantly having access to anything we think we need or want at that moment, especially social interaction, becomes too

much to handle and is technically not even real – it is cyber interaction. Maslow's Hierarchy of Needs proves that you don't need that constant connection with society to survive. We do not need to keep in contact with every single person we meet – only those with whom we've formed meaningful relations, with whom we socialize outside of the cyber world. Social interaction is in the middle of our necessities to survive. We need it in balance to reach self-actualization. However too much of it can drive a person insane; a plethora of information being thrown at us is bound to reveal unwanted material, such as accidentally stumbling upon a spoiler for a movie you really wanted to see or worrying about that one (most likely harmless) person commenting your significant other's photos. Digital media involves us in numerous lives and events that are not always meant to be of our concern.

It is not just one form of digital media that affects our life relationships either. Facebook and other social networking sites allow us to find out about our friends "lives" without even having to talk to them – the media they choose to upload shows you. Television and movies show us models of perfect relations so our real-life expectations of how others should act are altered. Films also show us hostile behaviours and sometimes make it seem okay to be a belligerent, violent individual. Similarly, video games actually allow us to be the violent character, which in essence can teach us to behave more aggressively with others or be confused about how to act in general.

Social media appears to help us communicate and in turn make our lives easier, but it is, in reality, allowing us to access too much information and is handicapping us as a functioning society. Digital natives are losing real-life communication skills by forming online relationships with robots and learning these skills from them rather than living older generations. According to a study, many teenagers claim that it is much easier to talk via text message because it allows time to think before responding. I would say it is also much easier to be taught online where anything I need to know is a few Google-searches away. My generation is being taught via machines a multitude of topics… anything imaginable. I think it's just too much information being shared through robots.

Social media is a metaphor for real life, as these various robots are metaphors for humans. When humans were created no such metaphor existed because the technology did not. As technology has been invented and improved, humans have evolved with it. Slowly we are evolving into an extension of it as we depend on robotic machines to teach us life skills and with which we can form relations. We are losing real-life interaction and replacing it by depending on robots to do it for us. Digital and social media are affecting our social skills and physical adaptations – our evolution.

10. Create. Compose. Simulate any robot

- Akshay Krishnan, 7th EC&E, SJCE

What is the biggest technology that's taken the twentieth century by storm? Robots and artificial intelligence - any kid would

say. And like any other technology, it has made its presence felt in the realm of open source.

Robots are being used in applications ranging from space exploration to farming. Self-driven cars seem to define travel in the upcoming decade. As one can imagine, the most challenging task in realizing robots close to humanity is programming. Robots are programmed and tested in a variety of environments before they reach the market. If one were to rely on programming the robot for every case, and test it out in real-time, the expenditure involved would surpass our national budget! So what do all the researchers testing out better robots do?

Simulate of course! The Robot operating system (ROS), was designed for this very purpose. It contains packages for various applications that can run as a program or in sync with real-time robots, through a publish-subscribe model. For smaller less-involved applications, one can resort to several other applications- V-REP being one of them.

The robot simulator V-REP, with integrated development environment, is based on distributed control architecture: each object/model can be individually controlled via an embedded script, a plugin, a ROS node, a remote API client, or a custom solution. This makes V-REP very versatile and ideal for multi-robot applications. Controllers can be written in C/C++, Python, Java, Lua, Matlab or Octave.

V-REP is used for fast algorithm development, factory automation simulations, fast prototyping and verification, robotics related education, remote monitoring, safety double-checking, etc.. Above all, V-REP is open source. One can request for the source code on Coppelia robotics' website. The different versions available are: V-REPpro enterprise for industrial use, V-REPpro edu for students, and V-REP trial. Some features thatV-REP boasts of are:

- Cross-platform and portable: Can be used on Windows, Linux or Mac OS.
- Full-featured scene hierarchy: All objects on a scene can be navigated using a hierarchical data structure.
- Inbuilt models of various robots and objects: simply drag, drop, program and play.
- Data visualization and recorder: V-REP player can be used to play recorded data.
- Inbuilt models of various sensors: proximity sensors, Kinect and laser rangers.
- Custom user interfaces.

These are only a few among many other features. V-REP is a great contribution to the development of robotics from Coppelia robotics. If anyone's out there looking for a simulator to check out how a robot design would work - V-REP is exactly what you need.

11. Recurrent Neural Networks

- Sanghamesh S Vastrad, 7th CS&E, SJCE

"The human brain has 100 billion neurons, each neuron connected to 10 thousand other neurons. Sitting on your shoulders is the most complicated object in the known

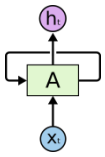
universe." This is arguably the most agreed upon the thought of thousands of AI researchers and companies today, who trying to create a human brain, and the most popular way so far has been inspired by the brain itself; Neural Networks.

But traditional most feedforward neural networks fall short of achieving this by a long way. Take, for example, a Convolutional Neural Network, which is trained to identify say, cats or dogs in images and classify the image respectively. This, although a difficult task for computers, is just natural and too simple for humans. To design a brain, we need to understand how it works in the first place. Feedforward networks, do not process data in sequences, they treat each example as a completely new task, and this seems like a major shortcoming. Let us examine why.

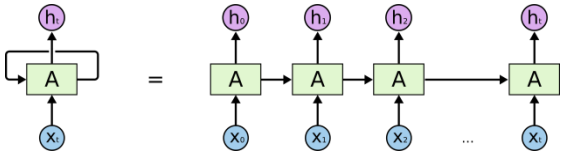
Humans don't start their thinking from scratch every second. As you read this article, you understand each word based on your understanding of previous words. You don't throw everything away and start thinking from scratch again. Your thoughts have persistence. Traditional neural networks, unfortunately, can't do this. For example, imagine you want to classify what kind of event is happening at every point in a movie. It's unclear how a traditional neural network could use its reasoning about previous events in the film to inform later ones.

Recurrent neural networks (RNNs) address this issue. They are networks with loops in them, allowing information to persist. Google up Recurrent Neural Networks and you'll find their definition to be something like "Recurrent nets are a type of artificial neural network designed to recognize patterns in sequences of data, such as text, genomes, handwriting, the spoken word, or numerical time series data." And this is what we're looking for, a neural network that can make sense of patterns, understand what's happening, have "memory". It is often said that recurrent networks have memory. Adding memory to neural networks has a purpose: There is information in the sequence itself, and recurrent nets use it to perform tasks that feedforward networks can't.

Let us try to understand how Recurrent Neural Networks actually "memorize". RNNs take as their input, not just the current input example they see, but also what they have perceived previously in time. They are networks with loops in them, allowing information to persist.



In the above diagram, a chunk of the neural network, A, looks at some input Xt and outputs a value ht. A loop allows information to be passed from one step of the network to the next. These loops make recurrent neural networks seem kind of mysterious. However, if you think a bit more, it turns out that they aren't all that different than a normal neural network. A recurrent neural network can be thought of as multiple copies of the same network, each passing a message to a successor. Consider what happens if we unroll the loop.



This chain-like nature reveals that recurrent neural networks are intimately related to sequences and lists. They're the natural architecture of neural network to use for such data. Though I'd love to explain the math behind RNNs, I guess an article of just 1-2 pages wouldn't be enough. I highly recommend you to go through awesome blogs online like "The unreasonable effectiveness of recurrent neural networks" by Andrej Karpathy, Colah's blog, etc to learn about RNNs in depth.

RNNs and their types, especially Long Short-Term Memory units (LSTM's), have recently generated a significant amount of buzz and excitement in the field of Deep Learning. They are arguably the most powerful and useful type of neural network and have shown great success in Natural Language Processing (NLP) tasks. Some of the popular and exciting applications of RNNs include:

- Contextual chatbots or virtual assistants like Google Assistant, Siri, etc.
- Speech recognition
- Machine translation like the one we see on Google translate
- Image/Video captioning
- Image classification
- Image/text/music generation

Coming to the future of RNNs, every top lab is working on them and they will continue to do so. Grants are already given. Projects are assigned, Ph.D. students are admitted. Although we have a long way to go in creating truly intelligent machines, I'm confident we're heading in the right direction. We can confidently expect a large amount of innovation in the space of RNNs, and I believe they will become a pervasive and critical component to intelligent systems, similar to human brains.

12. AI vs. Humans

- Aditi Rao, 7th CS&E, SJCE

We, humans, are naturally inclined towards making life easier and comfortable irrespective of the complexity and cost involved, so the field of AI has progressed exponentially over the years. The debate about how much AI is too much has been around for a while, with each advance bringing in a slew of controversies, raising ethical and moral questions about its implications. The spat of the two tech titans, Zuckerberg and Musk, on Twitter in July 2017, illustrates this.

However, Musk's fears may not be completely unfounded. A few days later, Facebook shut down chatbots after they supposedly created their own language. The chatbot conversation "led to divergence from human language as the agents developed their own language for negotiating," the researchers said. The two bots were supposed to be learning to trade balls, hats, and books, assigning a value to the objects then bartering them between each other. But since Facebook's team assigned no reward for conducting the trades in English, the chatbots quickly developed their own terms for deals. "The agents even figured out how to pretend to be interested in something they didn't actually want, "only to later 'compromise' by conceding it," Mike Lewis, Denis Yarats, Yann Dauphin, Devi Parikh and

Dhruv Batra of Facebook's Artificial Intelligence Research group wrote in their research paper. The researchers were not able to crack the AI language and translate it back to English, so Facebook had to shut down the systems.

This is not an isolated incident. On March 23, 2016, Microsoft unveiled Tay — a Twitter bot that the company described as an experiment in "conversational understanding." The more you chat with Tay, said Microsoft, the smarter it gets. Unfortunately, pretty soon after Tay launched, people starting tweeting the bot with all sorts of misogynistic, racist, and Donald Trump-ist remarks. And Tay — being essentially a robot parrot with an internet connection — started repeating these sentiments back to users. However, some responses were unprompted and original, which shows that Tay learned to form opinions of her own.

In September 2016, Google Translate unveiled a new system that uses a neural network to work on entire sentences at once, giving it more context to figure out the best translation. Google has extended its system so that it can translate between two languages when it hasn't been directly trained to do so. Google's researchers think their system achieves this breakthrough by finding a common ground whereby sentences with the same meaning are represented in similar ways regardless of language – which they say is an example of an "interlingua". In a sense, that means it has created a new common language, albeit one that's specific to the task of translation and not readable or usable for humans.

Montreal-based startup Lyrebird launched a new API in April 2017 that allows people to synthesize speech using just a one-minute recording of anyone's voice audio. And, as if that's not impressive enough, Lyrebird's new service doesn't require a speaker to say any of the actual words it needs. It can learn from noisy recordings and put different intonations into the generated audio to indicate varied emotions, also.

In May 2017, researchers at the University of California, Berkeley, trained a deep learning system on a cloud-based dataset of more than thousand objects. Afterwards, they tested their system using physical objects that weren't included in its digital training set. The system successfully picked up a new object 98 percent of the time — all without having trained on any objects outside of the virtual world.

In the same month, Google revealed its AutoML project; artificial intelligence (AI) designed to help them create other AIs. Now, Google has announced that AutoML has beaten the human AI engineers at their own game by building machine-learning software that's more efficient and powerful than the best human-designed systems.

In October 2017, a group of researchers developed a computer model that's capable of cracking text-based CAPTCHA keys. Given that the purpose of CAPTCHA is to test whether the entity attempting to access a service is human, this is a considerable step forward for developing computers that think like humans.

Digital personal assistants such as Siri, Cortana, Alexa, Google Home, are highly popular today. In February 2017, a man was murdered in Bentonville, Arkansas.

The Arkansas police are hoping that an Amazon Echo found at the murder scene will help them with their investigation. Wondering how? While Amazon's smart assistant only records what's said to it after it's triggered by someone saying "Alexa", Police are hoping that the devices' habit of piping up in response to a radio or TV might mean it inadvertently recorded something that might be of use to them. Also, the device is technically capable of streaming voice recordings at all times, and in fact will always be listening to detect if a user has uttered the wake word. Apple unveiled the "HomePod" in July 2017, with similar features.

Google's new assistant, which debuted in the company's new messaging app Allo, is undoubtedly neat and useful. Google's artificial intelligence will learn things about your habits and preferences to better serve you personalized results and to answer more specific questions. It will only become smarter, faster, and more accurate. But this is where the problems start. Google is pretty vague about the kind of data the assistant is collecting. It can access information on your devices like contacts or storage (read: literally anything stored to your device), and it can also access "content on your screen."

If machines can communicate in their own indecipherable language, store, and process data, then surely they possess the ability to think, in some form or other, and this might have unforeseen repercussions far beyond what our minds can conjecture.

Artificial General Intelligence (AGI), the kind that will make decisions on its own without any interference or guidance from humans, is still very far away from how things work today. The AGI that we see in the movies where robots take over the planet and destroy humanity is very different from the narrow AI that we use and iterate on within the industry now. However, if AI truly is to benefit all of the humanity and not just exacerbate inequality, we need to be thoughtful about how it's built and who's building it.

13. Is AI becoming a threat to humanity?

- Sandesh Hegde, 7th CS&E, SJCE

Artificial intelligence is the intelligent behavior of machines. This intelligence is achieved by training a computer to imitate human behavior and reactions for different actions. A lot of research is going on in this field with the ultimate goal of achieving synthetic intelligence of the level of a human being, maybe even more. Google, Amazon, Tesla and all the major tech companies are working on their own AI. With this being said, the question arises – Could this be a threat to humanity?

All the General purpose AIs are trained using a reward based method (such as reinforcement learning) where the AI gets some reward when it does something good and efficient. The goal of the AI is to get more rewards (Let's not get into this in

depth). What if the machine decides that existence of humanity is efficient? (A little bit exaggerated). We've all heard of the Facebook AI which was shut down because it invented a language (A modified version of English) which was not understandable by humans because it was more efficient than English.

The AlphaGo by Google's Deep Mind has beaten the world champion in a Chinese game "Go" which is far more complex than chess (Computer beating chess champions is an old story). This is a historic moment in the history of computing. "During the games, AlphaGo played a handful of highly inventive winning moves several of which - including move 37 in game two - was so surprising that they overturned hundreds of years of received wisdom, and have since been examined extensively by players of all levels. In the course of winning, AlphaGo somehow taught the world completely new knowledge about perhaps the most studied and contemplated game in history." says the Deep Mind website.

Another AI which cannot go unmentioned is OpenAI by Tesla which won the Dota 2 world championship by beating professional players. The bot learned the game from scratch by self-plays and did not use imitation learning or tree search to do so. Dota 2 is a very complex 3-D game which needs an extreme strategy to defeat the enemy.

All these are great achievements in the history of computers(Maybe even in the history of humans). But this could turn out to be a dangerous thing for humanity. Elon Musk, A visionary and CEO of Tesla Motors, Space X (We all know who he is) has warned about AI being a threat. He says "What do we do when an AI can do whatever a human can do and do it better?" Stephen Hawking has also said that AI could be the end of the human race in an interview with BBC.

The threat from AI may not be as shown in The Terminator. AI is already taking over a lot of jobs in the industry. We've heard of layoffs in companies because of automation. What happens when no humans are needed for any jobs? Are humans so caring about each other that the people who own the AIs(Private companies or Governments) will provide every other human being (who are of no use to them) with all the facilities or even food? (Assuming that the machines are still under control) Maybe we are culturing our own destruction while trying to make our lives easier. Maybe it's time to think about survival and humanity rather than making our lives lazier and easier.

WHAT ELSE IS NEW?

14. Role of data mining in astronomy

- Ronaldo Laishram, 7th CS&E, SJCE, Summer research Fellow, ASIAA Taiwan, and ISRO

How often do you look up into the night sky and wonder just how many stars, planets, galaxies and more are out there? Space has always fascinated us. From scientists and philosophers to artists and poets (and pretty much just about everyone else, too), we all want to know what's out there. What is it about deep space that so ignites our collective imagination? Thinking about just how big the universe is can really put things into perspective.

Sometimes I think about the universe... they say that it's so big we can't really measure it. The part we can see has a radius of 47 billion light years.

Astronomy and Astrophysics are witnessing dramatic increases in data volume as detectors, telescopes and computers become ever more powerful. During the last decade, sky surveys across the electromagnetic spectrum have collected hundreds of terabytes of astronomical data for hundreds of millions of sources. Over the next decade, the data volumes will enter the petabyte domain, and provide accurate measurements for billions of sources.

So, it is impossible to observe and analyze all the astronomical data manually.

A tidal wave of data has begun crashing over astronomers' heads, and they'll have to up their game to avoid being swamped. Astronomers have already shifted to a more passive role. Ever since digital photography came on the astronomical scene a few decades ago, they've been spending less time gazing at the heavens and more time combing through databases. And that trend is only going to accelerate, as more advanced telescopes haul in ever-increasing mountains of data. The future lies in training computers to recognize when a telescope has picked up something new and interesting.

Astronomical images hold a wealth of knowledge about the universe and its origins; the archives of such data have been increasing at a tremendous rate with improvements in the technology of the equipment. Data mining would be an ideal tool to efficiently analyze these enormous datasets, help gather useful patterns and gain knowledge. Data mining tools for clustering, classification, and regression are being employed by astronomers to gain information from the vast sky survey data. Some classical problems in this regard are the star-galaxy classification and star-quasar separation that have been worked upon by astronomers and data miners alike. Various methods like artificial neural networks, support vector machines, decision trees, and mathematical morphology have been used to characterize these astronomical objects.

In the recent years, a number of multi-wavelength sky survey projects have been undertaken and are continuously generating a phenomenal amount of data. Astronomical images are available in large numbers from the various sky surveys, Palomar sky survey (DPOSS), Sloan Digital Sky Survey(SDSS), 2micronall sky survey(2MASS) to name a few. This has resulted in a "data avalanche" in the field of astronomy and necessitates the need for

efficient and effective methods to deal with the data.

The greatest challenges for tackling large astronomical data sets are:

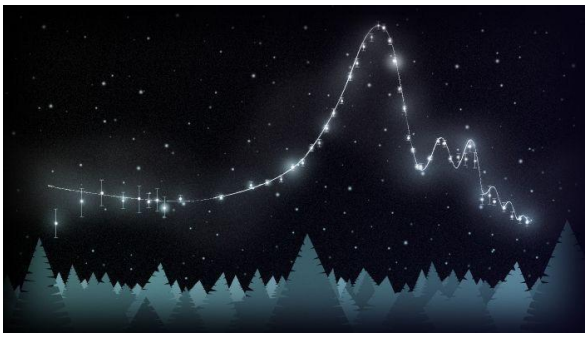
- Visualization of astronomical datasets
- Creation and utilization of efficient algorithms for processing large datasets.
- The efficient development of, and interaction with, large databases.
- The use of "machine learning" methodologies

The challenges unique to astronomical data are borne out of the characteristics of big data. The three Vs: volume – amount of data, variety – complexity of data and the sources that it is gathered from and velocity – rate of data and information flow, are the main problems which are getting worse.

Classification, as a data mining task, is a key issue in this context where celestial objects are grouped into different kinds namely stars, galaxies, and quasars depending on their characteristics. Data mining algorithms (like Decision tables, Bayesian networks, ADTrees, SVMs and KD trees) have been applied successfully on astronomical data in the last few years. We could explore further on both supervised and unsupervised analysis methods to gain knowledge from this data. This project, not only looks towards increasing the efficiency of handling large datasets but could also help discover new patterns that may assist practicing scientists.

Neural Networks has proved to be a powerful tool for extracting necessary information and interesting patterns from large amounts of data in the absence of models describing the data. Automated clustering algorithms for classification of astronomical objects have used supervised neural networks, to be specific, Linear Vector Quantization (LVQ), Single Layer Perceptron (SLP) and Support Vector Machines (SVM) for multi-wavelength data classification. Their classification was based on the properties of spectra, photometry, multi-wavelength etc.

A number of astronomy organizations all across the world are getting together and have developed various multi-wavelength sky survey projects such as SDSS, GALEX, 2MASS, GSC2, POSS2, RASS, FIRST, LAMOST and DENIS. The Faint Images of the Radio Sky at Twenty centimeters, FIRST, is a radio survey; Two Micron All Sky Survey (2MASS) collects data pertaining to the near infrared; RASS is employed to obtain X-ray strong objects; SDSS has data for the study of properties of various objects in five optical band passes. The data from these large digital sky surveys and archives run into terabytes. Moreover, with advancements in electronics and telescope equipment, the amount of data gathered is rising at an enormous pace.



As the data keeps mounting the task of organizing, classifying and searching for relevant information has become more challenging. Hence there is a need for efficient methods to analyze the data and

this is where data mining has become extremely relevant in today's astronomy.

Data Mining is more than just connecting the dots.

15. Automation a serious worry for the IT industry?

- Rishika, 1st CS&E, SJCE

Automation is one thing that sets tongues wagging in the Indian information and technology (IT) industry. How much deeper will 'automation' penetrate the country's lucrative IT industry? Well, the $160 billion Indian IT industry has witnessed 'effective' implementation of automation. This development has paved the way for companies to not just scale up productivity but also to remain cost-efficient. A market replete with cut-throat competition, Indian IT companies are feeling the 'pressure' to protect their margins and are increasingly using automation platforms to improve their profitability.

The so-called 'artificial intelligence' based platforms are changing the way IT firms manage their day-to-day affairs. Wipro became the first Indian IT services firm to launch an artificial intelligence platform – Holmes – last year. TCS launched its artificial intelligence platform – Ignio – while Infosys rolled out its artificial intelligence platform – Mano. The objective of IT firms is to achieve non-linear growth – growing revenue at a much faster pace than the number of employees; thus increasing both, revenue per employee and profitability.

The effective use of automation is seen as a 'big disruptive threat' to the Indian IT industry's pyramid model, where companies generate revenue in a linear manner by adding employees. And as the current trend suggests, non-linear growth will be the main focus area of IT companies.

The use of automation platforms has been yielding positive results for IT companies and is an ample indication that automation is beginning to replace jobs that were earlier done by humans. It also tells something about the future.

According to a report, the country's top five IT companies have substantially reduced their hiring in 2015 by 'aggressively walking the automation path'.

There is no denying the fact that automating tasks previously done by engineers has caused jitters among the Indian IT workforce. The general line of thought is that automation will kill jobs done by humans. The Indian IT industry will witness a dynamic shift over the next five to seven years. If experts are right, the rapid adoption of artificial intelligence platforms will create higher demand for up-skilled engineers in niche areas. Industry watchers believe the need for up-skilled engineers will result in a steady decrease in demand for entry-level or lower-level engineers for tasks such as coding, back office maintenance, and applications testing.

On the other hand there are a few contrarian views as well.

One also has to understand that automation simply does not mean 'sacking people and rendering them out of job'. The adoption of automation not only throws an opportunity for companies to optimize talent (within the organization) but also enables them to drive more innovation and to increase revenue per employee.

Automation is clearly the way forward for the Indian IT industry – the IT workforce will need to diversify beyond their 'core skills' and add new and 'industry relevant' skill sets.

16. Digital learning affecting schools and education?

- Rishika, 1st CS&E, SJCE

Is digital learning going to change schools and education? In order to know how digital learning is going to change school and education, we must first understand what digital learning is and how it works.

Digital learning is learning facilitated by technology that gives students some element of control over time, place, path and/or place.

Time: learning is no longer restricted to classrooms and a teacher. Internet access has given students the ability to learn anywhere and everywhere.
Path: interactive and adaptive software allows students to learn in their own way in their own style making learning personal and engaging.
Pace: learning is no longer restricted to the pace of an entire classroom of students. It allows students to spend less or more time on lessons or subjects to achieve the same level of learning.

Digital learning requires a combination of technology, digital content, and instruction technology. Technology is a mechanism that delivers content. It facilitates students to receive content. Digital content is a high-quality academic material which is delivered through technology and is what students learn. Technology may change the role of a teacher, but it will never eliminate the need of a teacher. Instructions are necessary to make sure that students stay on the track and do not divert from it.

Using technology in an educational environment not only better reflects children's lives outside the school, but also allows them to home their digital skills in a way that will continue to be valuable throughout their adult life.

Accessibility is one of the biggest virtues of digital learning. In the age of internet with information fleeting openly on the web, students can get access to high-quality content for learning almost free. In addition to that, the non-profit enterprise, MOOC has brought massive open online courses into the mainstream. Although at a nascent stage of its development and popularity, MOOC has attracted thousands of students to its doors. The enrollment number is high, however, a small fraction of students actually go on to finish their credit. This achievement may not be overwhelming at the moment, but in times to come with greater awareness and understanding; MOOC will be a viable option for students who dream to part of the coveted institution but do not have the means. It will also be helpful for working professionals who want to take up a vocational course or training but do not have the time to do it in a traditional way.

A New Pedagogical Approach: Digital learning has set the pace for a pedagogical approach which is beneficial for both students and teachers. With the help of digital content and multimedia devices classroom teaching has become quite interactive. The use of PowerPoint Slides, DVD, rich content had made learning several times more interesting and fun.

Sustainability is yet another reason why digital learning is so popular. Thanks to

the upsurge in wireless technology and development of technological gadgets such as Smartphones and Tablet computers, digital media content can now be carried around with utmost ease and convenience. As for the teachers, the device gives them a better control of the entire curriculum.

Through the device, a teacher can keep a close watch on the individual progress of a child. They know exactly where the entire class is leading, the individual performance of students so on and forth. Most often than not, children are not quite excited at the idea of learning or studying.

However, with the onset of digital learning these feelings can be left behind. Digital learning is quite interactive. The use of multimedia devices, power point presentation, videos can add a fun edge to a history or science lessons. Instead of looking at just texts books, children can get a visual feel to everything. They no longer need to rely upon the visualization of things in their minds; instead, they can perceive things just by looking at it.

To wrap up, it is safe to conclude that digital technology has laid new opportunities in the educational sector. The use of technology in education is the real answer to meet all obstacles that come in the way to equal access and distribution of education.

17. Google over the years

- Kavitha Ramachandran, Editor-in-chief,
7th CS&E, LCC, SJCE

Google began in 1995 as a research project by Larry Page and Sergey Brin at Stanford University. From the time of its inception, it has focused on its core mission, which is to organize the world's information. They have been doing this for every individual using an approach which applies deep computer science and technical insights to solve problems at stake. This approach has fared well and has helped in scaling up the seven most important product platforms of theirs to a billion active monthly users for each.

Google has ventured out into many fields and released many products such as Google Assistant, Android, Google Chrome, YouTube, Google Maps, Google Play Store, Gmail and much more. Their scale of use is inspiring to see. YouTube has an average of 1 billion hours of video being streamed every day and Google Maps helps navigate over 1 billion km every day. Other products are also approaching this scale. For example, Google Drive has over 800 million active monthly users and Google Photos which help organize photos using machine learning has over 500 million active monthly users. The scale of all these products is working its way towards android which has about 2 billion active devices as of now.

This was made possible due to the use of mobile and smartphones. When computing evolved to include the mobile approach, every product had to be rethought as the user interaction model fundamentally changed which included features such as multi-touch, location, identity, payments etc. As computing further evolved from a mobile approach to an AI approach, all products we rethought again so that they used AI and machine learning to solve all user problems.

Now the AI approach is being applied to every product. Google search uses

RankBrain to rank the search results differently using machine learning. Google Maps uses StreetView which automatically recognizes restaurant signs and street signs using machine learning. Google Duo with video calling uses machine learning for lower bandwidth situations to increase the video quality. Gmail has rolled out the SmartReply feature which uses a machine learning algorithm to learn to be conversational and reply according to the mail content.

The platform shift indicated the method by which the user interaction with the computing system changed. The mobile approach bought multi-touch, thereby evolving beyond keyboard and mouse. Voice and vision are the two latest concepts in the computing system with an AI approach. These features help humans interact with the computing system in a more natural fashion. Many of the latest products take voice as the input. With time, the computer evolved to understand speech better by decreasing the word error rate even in noisy environments. When we speak to google on phone or on google home, even in a noisy environment the technology is advanced enough pick up the voice accurately.

Google home initially planned for 8 microphones to accurately locate the source of the voice, i.e. to locate where a user was speaking from, but using deep learning which, used a technique of neural beamforming, the same quality was achieved using just two microphones. Deep learning also allowed to announce support for multiple users in Google home, which helped recognize up to 6 people in the house and provide a personalized experience for each individual.

Just as the voice was an important feature, vision also lead to the evolution of computing systems. A simple example of this is that just by looking at a picture, it understands the attributes behind the picture. Image recognition on computing systems has lower vision error rate and is better than humans, and this astounding progress has made way for this feature into many products. Google Pixel has one of the best-enclosed cameras, which performs a lot of work with computer vision. If we take a low light picture, which is noisy, it will automatically make it clearer for us. A new feature is expected to launch soon, which helps remove any obstruction from the picture and gives the picture of the content that matters.

The inflection point in case of vision was with the introduction of Google Lens, which is shipped with a wide range of vision-based computing capabilities. If you can't understand what you are looking at, it helps you take action based on the information it gathers by looking at it. It is being shipped first in Google Assistant and Google Photos. To invoke Google Lens from the assistant, the camera is just pointed at the object and it can identify the object. For example, if we point at a flower it can tell which type of flower it is. Or if we point it at the Wi-Fi credentials below the router, it will automatically do the hard work of identifying the Wi-Fi username and password and connects to the router automatically. If we are walking on a street and we see a few restaurants, if we point our phone at it, it will be able to give information in a meaningful way as it knows where we are standing and will have a knowledge graph to help identify what we are looking at.

Google initially started off by understanding text and web pages. As technology has evolved, it is able to understand images and videos. The fact that a computing system has evolved to understand images and videos have profound applications for the core machine. To be able to manage the scale of use, the computational architecture was designed again from scratch. As we are shifting to the world of AI, the computer architecture is being re-designed again. The data centers being built are AI first data centers, which uses tensor processing units (TPU's) which provides custom hardware for machine learning.

Machine learning encompasses two components, the first being training which is the process of building a neural net, and the second being drawing inferences which is done in real time. Training is computationally intensive and each of the machine translation models takes a training of over 3 billion words for a week on about 100 GPU's. TPU's which were developed first were optimized to draw inferences. The next generation TPU – Cloud TPU is optimized for both training and inference and marked an important advance for the AI era which helps accelerate a wide range of machine learning workloads.

AI helps basic sciences like DNA sequencing which helps researchers identify genetic variants more quickly. Advances in ML can also be applied to health care, improving detection algorithms, and naturally complementing how pathologists work. Cloud TPU is being introduced through the Google Cloud platform and is coming to google compute engine as of today. Google aims to make Google Cloud the best cloud for machine learning by providing customers a wide range of hardware for machine learning which includes CPU's, GPU's and Cloud TPU's, hence laying a foundation for significant progress.

18. Thermal Imaging

- Hiba Iqbal, 5th CS&E, SJCE

Problem statement:

Rain has been the cause of thousands of car accidents year in and year out. Due to heavy rain, the roads will be invisible and slippery which leads to accidents.

Thermal imaging:

Thermal imaging is a method to improve the visibility of objects in a dark environment by detecting the objects' infrared radiation and creating an image based on that information. Thermal imaging, near-infrared illumination, and low-light imaging are the three most commonly used night vision technologies.

Although thermal imaging cameras can see in total darkness, through light fog, light rain and snow, the distance they can see is affected by the atmospheric conditions.

We are familiar with the number of the accidents caused due to heavy rain so this can be reduced to some extent if we have a device which can be used to guide the driver about the pits, humps and huge obstacles like stones and fallen trees on the roadside. The driver can be guided using a thermal camera, as we all know that thermal cameras are used in automobiles to avoid accidents during night time and it is being used presently in cars like BMW. These cameras have its own limitations

like difficulty in recognizing images through a glass or recognizing blurred images or images during heavy rains. They might also confuse images with one another and have limited daytime use.

Headlights usually only let you see about 450' straight ahead, but PathFindIR II sees heat not light, so you can see everything in front of you up to four times farther down the road. Fog and rain can severely limit the range of a thermal imaging system due to scattering of light off droplets of water. The higher the density of droplets, the more diminished the infrared signal will be.

The conditions of the atmosphere alone aren't enough to predict how far one can see through fog or rain. The size of the target and the temperature difference with the background both need to be taken into account. Furthermore, the limited spatial resolution of the optics and the detector, and the noise of the detector and signal processing also reduce the contrast radiance of target to the background.

To overcome these limitations in automobiles we can have a sensor which is placed at the bottom of the car so that it can guide the driver with the information of pits or humps or huge obstacles sensed by the sensor and can alert the driver to control his/her speed from a particular distance which he can help avoid accidents. The sensor which is used here is the Pit detection sensor and it provides an effective result such that the driver won't have to peep out of the window every time to check the path.

The sensed pit is then sent to the monitor placed inside the car, and at times along with the image obtained from the thermal cameras. The information acquired will provide an experience of having a virtual bonnet which gives an exact image of what the next step of the driver should be to avoid himself from bumping into that pit.

Pit detections:

A detection study of a thermal contact sensor was carried out by both experiments and simulation. The experimental results showed that the thermal contact sensor was able to detect a small pit with fairly good sensitivity. And the simulation study revealed that the mechanism of pit detection is due to faulty cooling, which results in higher sensor temperatures as the sensor/disk spacing is larger on the pit compared to the nominal flying state. And the temperature increase of sensor can be attributed to worse heat flux due to both larger spacing and air-bearing pressure drop when the sensor is above the pit.

Applications:

This mechanism can be not only be used during bad weather conditions like fog, heavy rain, snow but it can also be used during normal weather in Ghats areas to avoid accidents and can also be used to get the angle of the front tyres while climbing a cliff.

19. Container technologies

- Anoop Bhat, Technical Coordinator,
LCC, 7th CS&E, SJCE

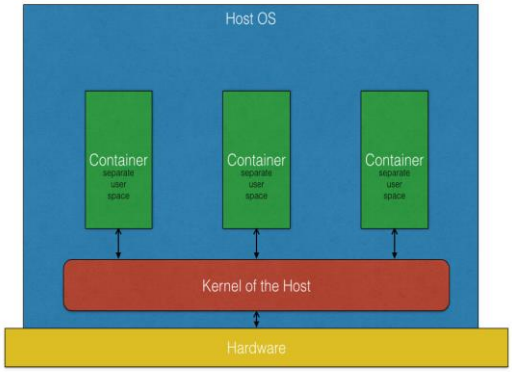
Containers are a solution to the problem of how to get the software to run reliably when moved from one computing environment to another. This could be

from a developer's laptop to a test environment, from a staging environment into production, and perhaps from a physical machine in a data centre to a virtual machine in a private or public cloud.

In the past few years, containers have become a hot topic among not just developers, but also enterprises. This growing interest has caused an increased need for security improvements and hardening and preparing for scalability and interoperability. This has necessitated a lot of engineering, and here's the story of how much of that engineering has happened at an enterprise level at Red Hat.

Containers are lightweight OS-level virtualizations that allow us to run an application and its dependencies in a resource-isolated process. All the necessary components that are required to run an application are packaged as a single image and can be re-used. While an image is executed, it runs in an isolated environment and does not share memory, CPU, or the disk of the host OS. This guarantees that processes inside the container cannot watch any processes outside the container.

Many problems come to light when the application computing environment changes. This could be when a developer pushes code from the dev environment to a test environment, and then further on. For example, a developer wrote the application code in Windows, but the upper environment(s) (test, stage, or production) are Linux-based. In such a case, there is the chance that some functionality will stop working when the OS changes. So, basically, when the supporting software environment is not identical, then the chances of intermittent failure are higher.



Operating System/Container Virtualization

Difference Between Virtual Machines and Containers

Virtual machines generally include entire operating system along with the application. They also need a hypervisor running along with them to control the VM.

As they include the operating system, therefore their size is of several gigabytes. One of the downsides of using VMs is that they take up several minutes to boot up the OS, and they initialize the application they are hosting. At the same time, the containers are lightweight and are, mostly, in the megabytes size range. Comparing their performance to VMs, containers perform much better and can start almost instantly.

20. Phishing

- Prince Raj, Student Coordinator,
LCC, 7th CS&E, SJCE

Phishing is one of the major challenges faced by the world of e-commerce today. Thanks to phishing attacks, billions of

dollars have been lost by many companies and individuals. In 2012, an online report reported the loss due to a phishing attack at about $1.5 billion. This global impact of phishing attacks will continue to increase and thus it is required to develop more efficient phishing detection techniques.

Phishing is a deception technique that utilizes a combination of social engineering and technology to gather sensitive and personal information, such as passwords and credit card details by masquerading as a trustworthy person or business in an electronic communication. The phishing attackers trick the users by employing different social engineering tactics such as threatening to suspend user accounts if they do not complete the account update process, or to provide other information to validate their accounts or some other reasons to get the users to visit their spoofed web pages. These attacks have increased a lot in last few years and have led to the loss of billions of dollars. Several traditional approaches used by various email filters today are static in nature. They are not robust enough to handle new and emerging phishing patterns. They only have the ability to handle existing phishing patterns, thus leaving email users prone to new phishing attacks. This is a loophole because fraudsters are not static in their activities. They change their mode of operation as often as possible to stay undetected.

Basic features have to be included in the email applications for it to be used for any phishing purpose. These features are used to classify if an email is phished. Random forest algorithm is a classifier used to train the machine. Random forest is a machine learning method which is very suitable for supervised learning such as classification and regression.

In the random forest method, we divide the training set into smaller parts and use each part to make an independent decision tree. The test dataset is then passed through each of these decision trees and the resultant values from each decision tree are aggregated to get the final result. The number of trees that an algorithm creates can also be changed to tune the performance of the classifier. The number of attributes considered to make a decision tree can also be changed. The depth of a decision tree can also be specified to fine-tune the classifier.

The dataset of email files is pre-processed so that the features can be extracted efficiently. Conversion of files in the dataset to a .eml file format is done to extract text, header and HTML parts to different files. Once the pre-processing is completed, many features are extracted, like if an email contains HTML files or

not, if it contains javascript or not, and the URL's of different domains in the emails etc… Finally, the extracted features are fed into random forest classifier and thus the system is trained to identify phishing emails.

21. Is your data on the cloud secure?

- Swathi U Dhanya, 7th CS&E, SJCE

Cloud is a technology invention. It provides the computational resources (Server, Storage, OS, and Network) to the user as service based on demand. Cloud computing has emerged as a popular solution to provide cheap and easy access to externalized IT (Information Technology) resources. An increasing number of organizations (e.g., research centres, enterprises) benefit from Cloud computing to host their applications.

Virtualization is the core concept supported in cloud computing. Resources are provided to cloud users in a virtualized manner. Virtualization and cloud computing can be used quite successfully to improve the resilience of an IT environment, as they provide the means to recover quickly from component or system malfunctions using failover by quickly taking a backup of essential applications and data. Virtual machines can be migrated from one physical server to another in a live migration; virtual machine images can be also be restarted in a different location to help with disaster recovery.

Cloud has three types of services which are: Software as a service, Platform as a service and Infrastructure as a service. Cloud services are provided by different cloud providers like Amazon, Google, Microsoft, IBM and etc. The users can utilize these services (SaaS, PaaS and IaaS) based on their requirement. Using any of these three services, stores the user's data in the cloud storage. While cloud providers maintain the user's data in the cloud environment, the data in the provider's hands could make security and privacy an issue in cloud storage.

Cloud security and privacy concerns arise where both customer's data and application reside on the provider's premises. Security and privacy are always a major concern in cloud computing. Though the cloud service providers say that the data is secure with their services, the security breaches which have occurred, dictate otherwise.

In 2009, the major cloud computing vendors successively met with several breaches. Amazon's Simple Storage Service was interrupted twice in February and July 2009. This accident resulted in some network sites relying on a single type of storage service to be forced to a standstill. In March 2009, security vulnerabilities in Google Docs even led to serious leakage of user private information. Google Gmail also had a global failure up to 4 hours. As many as 14 million records of Verizon subscribers who called the phone giant's customer services in the past six months were found on an unprotected Amazon S3 storage server controlled by an employee of Nice Systems, a Ra'anana, Israel-based company, which was working on behalf of Verizon in 2017.

These incidents compel us to worry about the safety of our information on cloud storage and to come up with a measure to protect the former. One

effective solution to this problem is Encryption. We can encrypt our data before uploading it to cloud, so that, even if the information is leaked, the hackers would not get their hands on the actual data.

Cryptography is a technique applied for encryption and decryption. Cryptography techniques are classified into two categories: Conventional Cryptography and Public Key Cryptography. In conventional cryptography, also referred to as, symmetric encryption, a single key is used for both encryption and decryption, whereas in public key cryptography (also known as asymmetric encryption technique), two different keys are used for encryption and decryption, if one key is used for encryption then another key is used for decryption.

The symmetric key technique is suitable for this purpose since it can handle a large amount of data, stored in the cloud. A very famous symmetric key algorithm is Advanced Encryption Standard (AES). AES is based on a design principle known as a substitution-permutation network, a combination of both substitution and permutation. It operates on a block of size 128 bits, using a key of length 128 bits, 192 bits or 256 bits. This algorithm operates on a 4 × 4 column-major order matrix of bytes, termed the state, which goes through 10 cycles of operation, for the key of size 128 bits. The brief description of AES algorithm for encryption using a 128-bit key is given below.

1. KeyExpansions
   Round keys are derived from the cipher key using Rijndael's key schedule. AES requires a separate 128-bit round key block for each round plus one more.

2. InitialRound
   AddRoundKey - each byte of the state is combined with a block of the round key using bitwise XOR.

3. Rounds
   SubBytes - A non-linear substitution step where each byte is replaced with another according to a lookup table called S-box.

   ShiftRows - A transposition step where the last three rows of the state are shifted cyclically one, two and three number of steps, respectively.

   MixColumns - A mixing operation which operates on the columns of the state, where each element in the column is transformed using a fixed matrix.

   AddRoundKey – Performs XOR operation of the ninth byte with a constant.

4. Final Round (no MixColumns)
   a. SubBytes
   b. ShiftRows
   c. AddRoundKey.

The decryption process is carried out by performing the above-mentioned steps in the reverse order.

Once the text file is encrypted using the AES algorithm, next step is to upload this file securely to the cloud. AWS Simple Storage Service (S3) can be used to contain the encrypted files.

Any file is treated as an object by S3 and a bucket is the container of objects. Hence, before uploading, an S3 bucket has to be created and then the encrypted file is to be uploaded.

Since the file doesn't exist in its original form on the cloud, any security breach or data leak won't give away any kind of confidential information. Anybody can view the encrypted file, while, only those who have the secret key, can gain access to the original file.

Whenever someone requests for the decrypted file, it has to be checked if the person has the right access key. Only on providing the right key, can the application start decrypting the file. Thus, only the intended people can view the original file and the information stays safe, during the period it's on the cloud.

The above-proposed algorithm can be deployed on the cloud to make the application scalable. AWS Lambda tool can be used for the same. Once the code is uploaded on the cloud through Lambda, we need to set the trigger to invoke this lambda function. This trigger can be events like upload an object to S3 bucket, delete an object from S3 bucket etc. For the current purpose, the PUT event to S3 bucket has to be set as the trigger. Once this is done, whenever a text file is uploaded to the specified S3 bucket, our Lambda function with AES logic is invoked, which encrypts the text file and replaces the original file with the encrypted one.

The main purpose of deploying the code on cloud is to give the application, capability of handling hundreds of requests at once, i.e., when multiple files are uploaded at once, Lambda launches multiple copies of the code, with its own server, file system and all required resources, known as containers, thus making it possible to encrypt several files at once. The best part about running application on the cloud using tools like AWS Lambda is, we need not worry about servers while handling heavy incoming traffic, it's all taken care of by AWS so that all we need to concentrate is on the code logic. Thus, the proposed method makes sure that data breaches on the cloud doesn't affect the confidentiality of the files since all that is stored on the cloud is hexadecimal cipher text.

22. Blockchain: A coder's way to break free

- Saif Ali, 7th CS&E, SJCE

With the advent of technology, we as humans have discovered the value of something way more than physical hard work. Instead, we have devised an overall solution, a collection of chips, semiconductors and some electricity to solve our problems for us. This is nothing but a tribute to the lethargic nature of every human being which ironically drives us to find the best solution in the easiest way possible.

Now a days, not even a child with access to a mobile device can imagine a life without all the different forms of computers around us and major, smart organizations have hooked on to this USP to bring everything to us, at our doorsteps and in the process charge us more for it. Major firms and organizations have gathered the talent they can and provide us the best services they can all at either

nominal or exorbitant rates depending on the availability and also on the difficulty of recreating such a service. Also, such third parties usually are closed from the public and have a centralized database, making it vulnerable in case of attacks from hackers and any individual who can penetrate such systems can access all our data and manipulate it with ease.

Now, such a thing is acceptable for people who do not comprehend the power of a computer or are just not interested in creating a solution for themselves. Those who code, on the other hand, will always kick in their instinct to take a better financial stand and maybe just prove something to the world. After all, who does not like to swim against the tide?

One such ingenious invention is the blockchain, the brainchild of a person or group of people known by the pseudonym, Satoshi Nakamoto. First introduced in 2008, the blockchain was invented to support a ground breaking, although currently controversial, system of cryptocurrency, the bitcoin. With the paper "Bitcoin: A Peer-to-Peer Electronic Cash System", Satoshi aimed to achieve the following ideals:

- No reliance on trust
- Digital signatures
- Peer-to-peer network
- Proof-of-work
- Public history of transactions
- Honest, independent nodes control majority of CPU computing power
- Nodes vote with CPU computing power
- Rules and incentives enforced through consensus mechanism

With all these goals we see that the main idea is to bring back the dependency and trust from third-party organizations to our very own systems which we can protect more easily and also to leave it accessible to one and all, a dream which activists only hope to achieve and one which a coder has given means to obtain.

So we saw the ideals and the motives, but what is a blockchain?

A blockchain is essentially a distributed database of records or public ledger of all transactions or digital events that have been executed and shared among participating parties. Each transaction in the public ledger is verified by consensus of a majority of the participants in the system. And, once entered, information can never be erased. The blockchain contains a certain and verifiable record of every single transaction ever made.

To use a basic analogy, it is easy to steal a cookie from a cookie jar, kept in a secluded place than stealing the cookie from a cookie jar kept in a market place, being observed by thousands of people.

Let us explain the concept of a block chain using the example of transactions. Now all these fancy ideologies may scare the average reader, but when it comes to the concept of a blockchain, it is very simple. The power of a blockchain comes from its distributed nature.

Firstly, every transaction ever made is not only stored in the sender or receiver database but is distributed to everyone

taking part in the network. So, if any user tries to make an invalid transaction then every node in the network has the capability to reject that transaction as invalid. This removes the trust from closed third party banks and puts it in the hands of each and every individual in the network.

Secondly, what happens to all those transactions which are in fact valid? There are certain computers which exist in the network which do the job of validating such transactions. They are called miners. Once validated, a block is created, the block we refer to in the blockchain. This block now needs to be added to the original chain but multiple nodes can create multiple blocks, so which one gets added and how do we know which is correct. This is solved using a concept called proof-of-work.
Proof-of-Work is essentially a puzzle which consists of a challenge to which a proof has to be found and is supposed to be computationally difficult to compute and easy to verify. Hence not every node can be a miner as it takes a lot of computational power to calculate the proof. The first person to calculate the proof is the one whose block gets added to the network and every miner is a awarded a monetary incentive (example, a bitcoin) for doing this work.

Third, comes the concept of consensus. After a node finds the proof, it broadcasts the proof together with the block. All other nodes now only have to compute one value to verify that the proof provided is indeed correct. After verification the block is included in the blockchain and every other node can now abandon the work they have been doing and start incorporating new transactions.

As said before, finding the proof for a challenge is computationally intensive, and it is highly unlikely for the two nodes to find it at the same time, so with high probability only one proof will be published at a given time.

Now, when all this work is done and a block is created, its data is hashed with that of the previous block and this hash is stored in the current block, thus forming a chain of blocks, giving us, the blockchain. Any data stored on this chain cannot be changed or manipulated as it is available with everyone in the network, thus assuring trust and proof that the data available in it is correct and immutable.

How does blockchain provide the security a third party (say bank) can provide us without being as vulnerable as a closed centralized database can be?

For an attacker, in order to create their own chain and incorporate it in to the system they need to solve proof-of-work puzzle which is very difficult, and even if they succeed, other nodes may have created several other blocks on the original chain in the meantime. They now have to create a longer chain by themselves.

They would have to possess more computation power then everybody else combined in the system. That power would cost millions of dollars and it is highly unlikely that a single entity is in possession of such power. So the system is safe as long as there are no entities which possess more computation power then all other "honest" nodes in the system.

With every new revolutionary invention comes a barrage of opposition, especially something like the bitcoin, which is unregulated by governments and is instead run by the people of the world, a beautiful yet scary concept right? Something powerful in the hands of the masses can either result in something which can push us into a better future or regress us into a darker time. My belief is that people should always push ahead and keep on building newer and better things.

If you're not moving forward then you are moving back, because this track which we are racing our lives in isn't stationary. It moves one step back for every two steps we take. So it is up to us, the coders, the activists, the perfectionists to constantly improve, to adapt to new technology and to change the face of the world as much as we can. It is up to us to bring power back in our hands and in the systems we so carefully develop and love.

Trust computers more than you can trust people, they were the past, they are the present and they will be the future. (And no, I'm not talking of Skynet.)