52 pages including cover

CSI Communications

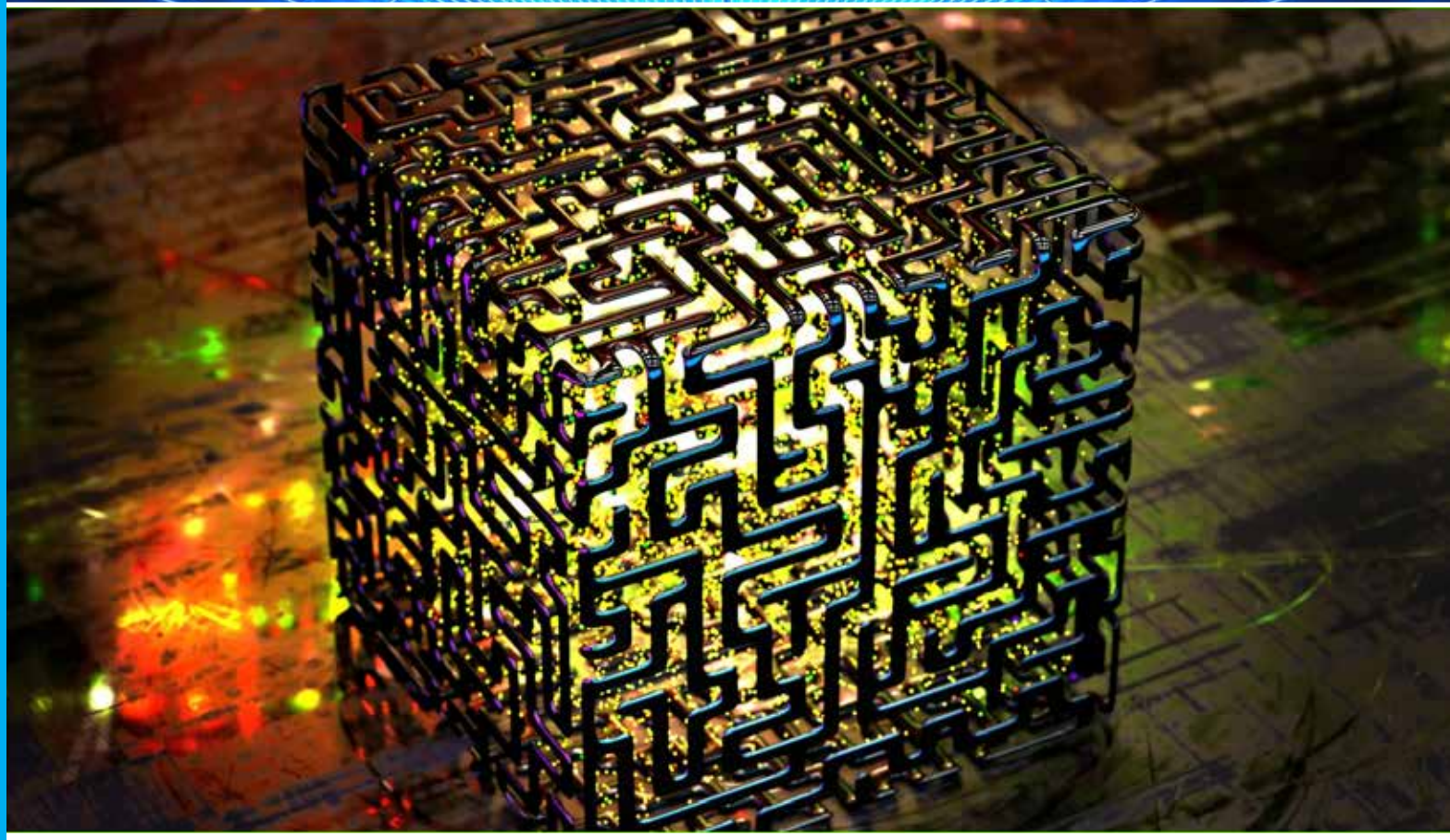
Knowledge Digest for IT Community

VOLUME NO. 44 | ISSUE NO. 3 | JUNE 2020

₹ 50/-

ISSN 0970-647X

QUANTUM COMPUTING



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From the Desk of Chairman, Publication Committee

Dear Fellow Members,

Greetings.

As I mentioned in the last issue, Adyayan was started with a view to encourage students and to motivate them to write innovative articles related IT and related disciplines. Prof A. K. Nayak, IPP, told me that there was an overwhelming response from student community and possibly the journal periodicity needs to be increased! It is a good trend. Students should be motivated to do innovative thinking. We do not expect outstanding articles from these budding scientists. Suffice it as long as we can motivate them. Prof R. K. Vyas, President, and others in CSI are also working in this direction. We invite informative articles preferably from final year students of CSE/IT/Data Science and related disciplines. Once published the concerned students can quote this in their CVs!. Authors may also send informative articles for publication in **CSIC** and research articles for the **Journal of Computing**. Obviously, reviews will be done in all these cases.

A word about Professor John Mc Carthay - one of the founders of Artificial Intelligence.

Professor John Mc Carthy was an American and cognitive scientist who lived for nearly 84 years. (September 4, 1927 – October 24, 2011). He was one of the founders of the discipline of **artificial intelligence** which is gaining in a lot of popularity now-a-days. He not only coined the term "**artificial intelligence**" (AI), pursued the discipline, developed the LISP **programming language** family and introduced time sharing concept. In the initial stages, LISP was used primarily by the AI community owing to its great flexibility. He influenced the design of the **ALGOL** programming language and was very influential in the early development of AI.

I do hope that these contributions of legends in Computer Science/IT will motivate our student community/ members /professionals.

With best compliments

Dr. D. D. Sarma
Chief Scientist (R), CSIR-NGRI, Hyderabad

CSI COMMUNICATIONS

VOLUME NO. 44 • ISSUE NO. 3 • JUNE 2020

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PLUS

Printed and Published by Prof. Akshaya Kumar Nayak on behalf of Computer Society of India, Printed GP Offset Pvt. Ltd. 269, 2nd Floor, A-2, Shah & Nahar Industrial Estate, Sitaram Jadhav Marg, Lower Parel, Mumbai 400 013 and Published from Samruddhi Venture Park, Unit No. 3, 4th Floor, Marol Industrial Area, Andheri (East), Mumbai 400 093. • Email : **hq@csi-india.org**
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Editorial

Prof. (Dr.) S. S. Agrawal
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Dr. Ritika Wason
Editor

Dear Readers

"If you are not completely confused by quantum mechanics, you do not understand it."
– John Wheeler

The above quote *By **John Wheeler**, an American Theoretical Physicist* depicts our current state of understanding to the term Quantum Computing. Simply explained, Quantum Computing is the application of quantum-mechanical phenomenon for performing computation.

We dedicate this issue to understanding and appreciating how Quantum Computing is altering the world of computation. Continuing with our invited series Titbits from the History of Computing –XI by the legendary Prof. V. Rajaraman, this issue discloses, "**The First Database Management System**" This article traces the birth of the first database management system. The first article, "Quantum Computing: New Leap for Technical Age" by Satuluri Naganjaneyulu and K. Vamsi Rudra Varma details the nuances of Quantum Computing like the Qubit. The article, "Quantum Cryptography for the Future Internet" by Gauri Shirkande and Smita Chaudhari discusses the application of Quantum Cryptography for network security. The next article, "Quantum Computing: A New Phase of Computing" by Anaghashree R. K. and Snigdha Sen delves into the working of quantum computing. The next article, "Real-World Applications for Quantum Computing" by S.K. Sonkar elaborates the varied applications and value of quantum computing. The article, "Quantum Computing Made Easy: A Beginner's Guide for Computer Programmer's" by Smita Saxena and Amit Saxena tries to explain the quantum notations to novice programmers. The next story, "Quantum Computing: The Universal Computer" by A. R. Revathi, Shwettha M. And P. Rajalakshmi explains how quantum computing increases the efficiency of the existing digital computers.

The research front showcases, "The Impact of Quantum Algorithms on Computational Problems" by P. Ranjana and Thangakumar Jeyaprakash highlights the fundamentals of quantum computing. The next article, "Quantum Internet using Quantum Teleportation: Quantum Computing Challenges" by L. Jerart Julus, C. Asha Beaula and D. Manimegalai evaluates the concept of quantum teleportation wrt traditional communication. The next article, "Quantum Intelligence in a Quantum World of Computation" by S. Balakrishnan and J. Janet explains how quantum computers are being applied to artificial intelligence and vice a versa.

The technical trends commence from the article, "Emerging Trends in Surgical Robots" by Chinamyee Chaterjee and Nitasha Hasteer refurnishes how surgical robots have come up in a big way and gained importance in the present times. This section also gives an insight to the domain of quantum machine learning. The article, "Quantum Machine Learning: Where Quantum Computing meets Machine Learning" by Pragya Katyayan and Nisheeth Joshi elaborates the same. The security corner showcases the article, "Quantum Computing: Security Corner" by Reshma T. Ladda that highlights how quantum computers can bring disruption to the current security walls.

The issue also reports various webinars and faculty development programmes conducted by various regions of CSI. **The main aim of these webinars was to focus on changing dynamics of education during COVID-19 times.** We applaud all chapters and branches for conducting such activities even in these hard times. Varied student branch activities as well as workshops carried by different regional chapters of CSI like industrial visit and programming competitions have also been reported.

We are extremely thankful to all our contributors as well as readers. May God bless you all with extreme strength and well-being to overcome these hard times safe and sound. Original, plagiarism-free, unpublished articles are solicited throughout the year from CSI members as well as non-members. Our sincere gratitude to the CSI publication committee members, editorial board members, authors and reviewers for their great contribution and support in realising this issue.

Our special thanks to Prof. A. K. Nayak, Immediate Past President, CSI for his constant encouragement, support and guidance in publication of June, 2020 issue.

We look forward to receive constructive feedback and suggestions from our esteemed members and readers at csic@csi-india.org

With kind regards,

Prof. (Dr.) S. S. Agrawal
Chief Editor
Director General KIIT, Former Emeritus Scientist CSIR,
Advisor CDAC, Noida

Dr. Ritika Wason
Editor
Associate Professor, BVICAM, New Delhi

Computer Society of India™
http://www.csi-india.org

President's Desk

From : President, Computer Society of India
Date : 01 May, 2020
Email : president@csi-india.org / Cell : (91) 98105 92760

Dear Members,

I hope you all are safe and trying to cope up with the difficult situation prevailing in country due to COVID-19, I pray to all mighty for your good health and safe stay.

In these difficult times CSI members are fulfilling their duty to connect all members by conducting various online activities, in the form of Webinars & Faculty Development Programmes (FDP) and the response to these activities is overwhelming.

This issue of CSI communication is on the theme Quantum Computing which is of great importance and will lead to technology innovations. In early 1980s physicist Paul Benioff proposed a quantum mechanical model of the Turing machine. Later Richard Feynman and Yuri Manin suggested that a quantum computer has the potential to simulate things much faster than a classical computer. The use of quantum-mechanical phenomena like superposition and entanglement to perform computation is termed as Quantum computing. Computers performing quantum computations are christened as quantum computers. The basic unit of memory in a quantum computer, is a quantum bit or qubit. Qubits are made using physical systems, such as the spin of an electron or the orientation of a photon. These systems are in many different arrangements with a property known as quantum superposition. Thus quantum computer works with particles that can be in superposition. Rather than representing bits, which can take on the value 0 or 1 or both simultaneously. Next generation supercomputers will have the capabilities of quantum computing. Google, IBM and other organizations has started exploring in the field of quantum computing and will be able to use the same very soon. Many researchers had contributed their work in Quantum Computing in this issue. IT Professional involved in various walks of life will be using this technology very soon.

In spite of lockdown during Covid-19 most of our Chapters & Student Branches are quite dynamic & vibrant in organizing quality activities from Local Level, State Level, National Level to International Level Seminars/Workshops/Conferences through online mode. Many of the reports have been published in this issue & few of them could not be published due to shortage of space which shall be accommodated in next issue. I congratulate all the respective organisors & members of the chapters & student branches for their tireless efforts & significant contribution.

In this issue of CSI Communications, the reports of more than 30 events were published & CSI is going to witness a record number of events through webinars in the months of June, July & August 2020. Many more activities are also being conducted by different Chapters, Student Branches & SIGs which reports are not coming to the notice of CSI Communication & to the Members also. I congratulate & sincerely thanks to all fellow brothers involved in conducting such activities for the visibility & development of the Society & request them for communicating the Reports of all such activities so that the same can be published in CSI Communication.

I take this opportunity to seek the active & kind support of the members to make CSI more Dynamic, Vibrant, Productive & Sustainable to achieve the height of excellence.

At this hour of difficulty, CSI has extended it's hand to help the professional & bring them together for the growth of IT, by extending 15% concession in the life membership of CSI the details are available on our portal www.csi-india.org.

I am thankful to all Past Presidents, Fellows & Senior Members of CSI for guiding me to perform my duty. Let us all come together make clean CSI.

Stay Safe, Stay Connected.

With warm regards,

Mr. Ram Krishan Vyas
President, CSI

Titbit from the History of Computing–11

The First Data Base Management System

V. Rajaraman
Emeritus Professor in the Supercomputer Education and Research Centre, Indian Institute of Science, Bangalore. Email: rajaraman.v37@gmail.com

"A generation that ignores history has no past and no future"

– Robert Heinlein

The Cambridge dictionary meaning of titbit is "A small and particularly interesting item of gossip or information".

Prologue

All of us encounter database management systems (DBMS) in our daily life without realising it. Data on all available tickets in every class on all trains is stored in a database maintained by the Indian Railway Catering and Tourism Corporation (IRCTC). When you want to reserve a ticket to travel by train this database is accessed by a DBMS to determine if the requested ticket is available and if yes, it is issued to you and the database is updated. One of the largest databases in the world, Aadhaar, is maintained by the Unique Identification Authority of India and it is queried using a DBMS. In this article I will explore when the idea of a DBMS originated and what was the first such system in the world.

Early computers were mostly used for numerical computing in which processing power provided by the CPU was more important than the size of secondary storage. The need to store large volumes of data was felt only when companies started using computers for routine commercial data processing, called Electronic Data Processing (EDP). Early uses of EDP were in payroll preparation, inventory control, account receivable, billing and similar clerical processing. In the 1950s the only mass storage system that was available was magnetic tape drive and data was input using punched cards. Data in a tape drive could be accessed only sequentially. Master file such as an inventory file was sorted using item code as key and stored in a tape. A card was punched whenever an item was received or issued by the company's store. These cards were sorted at the end of the day using item code as key and stored in a transaction tape. The master file tape was updated by using the transaction tape. Programs were thus closely linked to the way in which data was stored in a computer. Programming was a challenge as the storage capacity of main memories of typical computers used for EDP in the 1950s were of the order of 16 KB and programming was in assembly language. The first major revolution in EDP was the arrival of disk storage that was addressable and provided direct access to any record stored in it using a key. Even though disk storage was invented by IBM in 1956 (the first disk store had a capacity of 5 MB and cost US$ 50,000) it was not commonly available and affordable till around 1960. Even then only experienced programmers could use disk's addressing capability to retrieve records as support from the operating systems of that era to directly access a sector of a disk was lacking.

Advent of Integrated Data Store (IDS)

In 1963 General Electric Company (GE) decided to initiate a project called MIACS (Manufacturing Information and Control Systems) using GE's own computer system GE235 that had a disk drive. GE had many factories manufacturing electrical equipment such as switchgear, motors, and transformers. MIACS was to be used for tracking data on various assemblies, sub-assemblies, and components used during manufacture. The programming systems group was led by Charles W. Bachman and he decided to develop MIACS using GE's own high level language named GECOM and assembly language for time-critical parts of the system. All necessary data was stored on disks. Bachman was an early pioneer in business data processing. It is interesting to learn how Bachman joined GE's data processing group.

When Bachman was attending college, the second world war broke out. He joined the US Army in 1944 and was assigned to the anti-aircraft corps in South West Pacific area. During this assignment he used the fire control computers of 90mm guns. He was discharged in 1946 and joined Michigan State College from where he obtained a Bachelor's degree in mechanical engineering in 1948. He subsequently joined the University of Pennsylvania for a Master's degree in mechanical engineering. To his surprise he found that the course was an evening course for working professionals. He attended day classes at the university's Wharton school of business along with MBA students and learnt about problems in management but did not complete the course. He obtained a Master's degree in mechanical engineering in 1950 and soon after joined Dow Chemicals. After working for a few years as an engineer and manager he migrated to its data processing department in 1957 and became its head. Dow Chemicals ordered an IBM 709, one of the largest computers made by IBM in 1959. In those days IBM was providing only the essential system software and encouraged users to form groups to interchange ideas and write application programs. IBM users' group was called SHARE and it cooperatively developed many application programs. (In fact I remember the first program I wrote in 1957 was for IBM 704 using SHARE assembly language that was better than the assembly language provided by IBM). Bachman was an active member of SHARE and developed a Report Generator program called 9PAC that was very popular. Unfortunately due to financial problems Dow Chemicals cancelled their order of IBM 709. Bachman had made many contacts when he was a member of SHARE and one of them was GE's data processing head. Consequently he joined GE in 1960 in their data processing department.

Charles Bachman
(Photo thanks to Wikipedia)

Bachman found that while developing MIACS the application programmers found it difficult to write programs to access data stored in disks and manipulate them. In 1963 Bachman proposed creation of Integrated Data Systems (IDS) to be interposed between application programs and files stored in disks, namely, the database, to ease application programming. Database designers specified the way in which the records are stored in the disk, their inter-relationships, links, and indices. IDS [1] stored and manipulated metadata (data about data) of the records stored in the disk, their structure and relationships, and ensured their integrity. Application programmers used the data stored in the database by calls to IDS which accessed the database and returned requested data in appropriate format. Thus application programs were relieved of the task of low-level programming to access disk sectors where records were stored and insulated from the details of how and where data were stored. If the physical placement of files stored in the database was altered, IDS would change the metadata. This ensured data independence of programs, one of the most important functions of a DBMS. IDS also ensured some other features that we associate nowadays with DBMS including data integrity. A later version of IDS had a data description language.

Charles Bachman gets the Turing award

IDS, the first DBMS in the world, was successfully implemented in 1965. In 1973 Bachman was given the Turing Award by the Association for Computing Machinery, USA for his "outstanding contributions to database technology". He was the first Turing award winner without a PhD and the first to get it for work related to business data processing. He was one of the few awardees who spent his entire professional life in industry.

Bachman was actively involved as the chairman of the Database Task Group of CODASYL (Committee on Data Systems Languages) that had drawn up the specifications of COBOL (Common Business Oriented Language).This group evolved the standard of what was known as the CODASYL network data model DBMS. It specified the inter-relations of data in a database as linked records. For example, one set of records might contain records of students and another set on departments. The association between students' records and their departments would be represented by a system of pointers linking student records with that of the departments. Programmers had to navigate using the pointers to retrieve the desired data. The task of a database programmer as a 'navigator' was explained by Bachman in his Turing award lecture [2].

Epilogue

The network model of DBMS developed by the Database Task Group of CODASYL was influenced by the work of Bachman and his group on IDS. It introduced many terms used in DBMS such as data definition language, data manipulation language, schema, and data independence of programs. The network model was promoted as a standard in the 1970s and 80s and adopted by many computer companies. IBM, however, had its own model of DBMS called IMS (Information Management System) which was a hierarchical data model. IBM was a dominant mainframe computer manufacturer in the 1960s up to late 1980s with the result that IMS dominated the market until a new model of DBMS called Relational data model came in late 1980s. The most remarkable fact about IDS is that it was supported by computers whose main memory was less than 100 KB in the 1960s. Another remarkable feature of IDS is that its successor IDMS was used in many mainframes and supported by Computer Associates till 2014!

Acknowledgment

I thank Professor Jayant Haritsa for reviewing this article and for his constructive comments that improved it.

References

[1] Thomas Haigh, How Charles Bachman Invented the DBMS, a Foundation of Our Digital World, Communications of the ACM, Vol.59, No.7, July 2016, pp 25-30.

[2] Charles W. Bachman, The Programmer as a Navigator, (Turing Award Lecture), Communications of the ACM, Vol.16, No.11, November 1973, pp s653-658.

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A Padma Bhushan awardee in 1998, he is also a recipient of the Shanti Swarup Bhatnagar Prize in 1976. He is a lifetime contribution awardee of the Indian National Academy of Engineering and the Computer Society of India. (A detailed biodata may be found in en.wikipedia.org/wiki/Vaidyeswaran_Rajaraman).

Quantum Computing: New leap for Technical Age

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Introduction

In modern days computer became essential to the human daily life. Human civilization experienced rapid technological development because of computers. Every sector like banking, service use computers to perform daily activities efficiently. In olden days vacuum tubes are the primary components of computer. They are only used by universities, military facilities and scientific facilities. They occupy huge space equivalent to room and are pretty expensive. Thanks to the invention of transistors size of computers started to reduce. Later with technological advancements like integrated circuits and microprocessors, size of computers decreased and became affordable to public.

Computer chips contain logic gates that are made up of transistors. A transistor can be visualized as a switch which can either allow the flow of current or not. This can be considered as the information made up of zeroes and ones. If transistor allows the flow of the current then it is one or else if it blocks the current then it is zero. Logic gates are formed by the combination of transistors to do the simple math stuff like addition, subtraction, multiplication and division. A large bunch of them can do any complex operations.

As the computer evolution progressed, the computer parts became smaller and smaller day by day. Transistors are reduced day by day reaching atomic level. At atomic level things work differently due to unusual quantum properties. The size of the transistor is reduced to 14 nanometers that is 500 times smaller than the red blood cell. Now the transistors cannot be reduced further to perform its functionality. We reached the physical barrier in our technological progress.

Even though computers hold good computational power to perform complex operations, there are problems that they cannot solve. Their computational power is still not enough to solve certain problems which would take huge time doomed to be impossible. There are problems like molecular simulations, optimization problems cannot be implemented with present computers.

Here comes the Quantum computer, where a problem which might take thousands of years can be solved within minutes. Quantum computer are quite different compared to the classical computers. Computer which is worked based on the Quantum physics are called Quantum computers. Quantum physics describes the way our world works at most fundamental level.

Quantum computers can solve the world's most complex problems that are not in the reach of the traditional computers even including super computers. They work in a different way which allows them to perform calculations that are not possible by the classical computers. Google and IBM are the companies that are in leading Quantum computing technology.

Currently IBM has 18 Quantum computers. IBM offers Quantum computing power to people through IBM Quantum Experience Cloud Platform.

Qubit

In classis computers, the smallest unit of information is called bit. It can be either 0 or 1. In Quantum computers the smallest unit of information is called qubit. Qubits make use of two key principles of quantum physics known as super position and entanglement. A qubit doesn't have to be either 0 or 1. It can be in any proportion of both states at once. This is called superposition. As long as qubit is not observed it can be in any proportion of 0 and 1. Once the qubit is observed to read the value it will be either 0 or 1.

Another property of qubit is entanglement. Entanglement is a phenomenon where two qubits in superposition are correlated with one another. It can be considered as a close connection between qubits where a change in qubit leads to the change of another qubit instantly which is in entanglement no

Fig. 1 : Sycamore (Quantum Computer) developed by Google

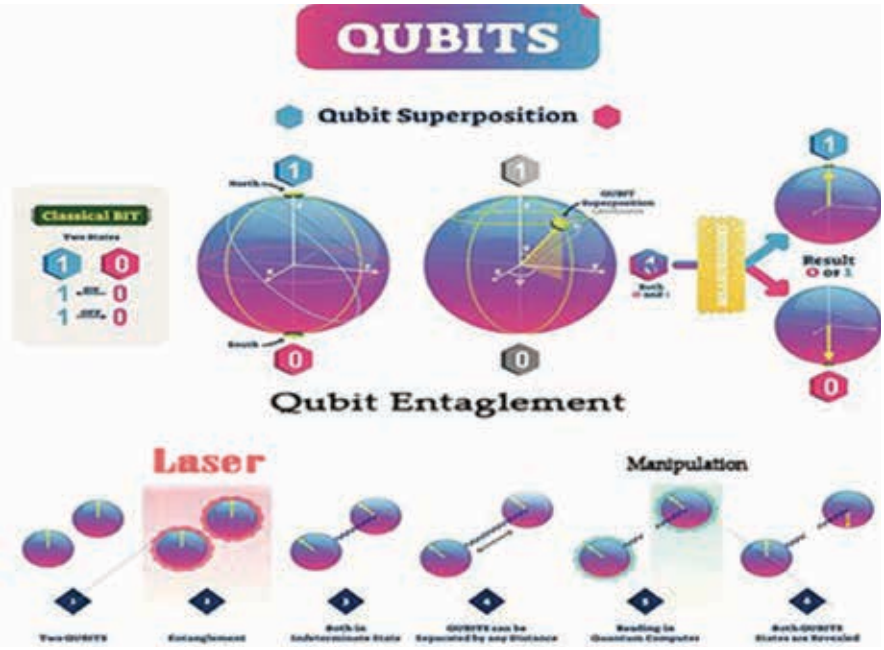

Fig. 2: Qubits

matter how far apart they are. Advantage of this property is that just by reading a qubit helps you to deduce the property of its partner without having the trouble to read it. Using these two principles qubits act as more sophisticated switches helping quantum computer solve the problems that are virtually impossible by using classical computers.

Normally with four bits of data we have 16 combinations and only one possibility can be used at once. However for qubits with superposition, they can be in all 16 possibilities at once. A n-qubit Quantum computer can represent 2^n states at a time and can perform parallel operations on all states at once. With just 50 qubits we can perform calculations on 1 quadrillion states in parallel. Computational power of Quantum computer cannot be compared with classical computer.

Is Quantum computing a threat?

Internet became a part of our daily life. Huge amount of data is transferred in internet every single day. It also includes the sensitive information like personal information of individuals, financial transactions, scientific research data etc. It will become a problem if the data ends up in wrong hands. To avoid this encryption is used to protect the data. We use RSA encryption to protect the data. Even if the information is stolen by eavesdropper they cannot decrypt the data. It is not impossible to decrypt the RSA encryption if you have enough time. It takes around 300 trillion years for classical computers to break 2048 bit RSA encryption. But it will be a different story if we include Quantum computer. Quantum computer can break the RSA encryption within 8 hours. All our modern cyber security strategies will be rendered as useless in face of quantum computer. We need to develop new strategies for cyber security if quantum computing is achieved. New problems will arise whenever there is a new technological development. That doesn't mean that it is a threat or useless. We need to be adaptive and find the solutions to solve the problems. It just means that we should work towards the perfection.

Problems in implementation of Quantum Computer

Though there is considerable amount of real world implementation it is still not completed. There are still obstacles that we need to overcome for successful implementation. Present implementations of quantum computer have computational errors. There are fields which need to be perfected. Integration off additional qubits to quantum computer is not easy. Also maintaining quantum properties for large number of qubits is quite difficult. Computational calculations need to be done within coercion time. Maximum time where qubits uphold the quantum properties like superposition and entanglement upholds is called coercion time. If the bigger problems are given to quantum computer where computation time exceeds the coercion time then quantum properties will not be uphold by the qubits and computational errors will arise. Also if any external forces intervene with the computer, it effects the entanglement property leads to errors. Also certain temperature needs to be maintained for stable working. So quantum computer need to be in an isolated area without any unwanted interferences.

Advantages

Technological development will take a leap if quantum computers are developed

- Quantum computers can solve optimization problems like finding the best route for performing deliveries more efficient than classical computers.
- Though today's data security techniques will threatened by quantum computer, new defensive mechanisms will be invented for data security.
- New insights and patterns from big data can be found by quantum computer which normally not possible for classical computers to detect. In other word data science will be revolutionized.
- Artificial intelligence and machine learning domains will face rapid development with the help of quantum computers.
- Complex Protein folding can be simulated in quantum computer which is not possible in classical computers. So new drugs can be found to cure diseases.
- Predictions like weather conditions and financial risk analysis can be done with ease.

Conclusion

Quantum computing will definitely revolutionize the world without a doubt. But it doesn't mean that they will replace the classical computers. Though classical computers are inferior to quantum computers in some aspects, they are still superior in some aspects compared to quantum computer. There are still obstacles that we should overcome to achieve quantum supremacy which can be

definitely achieved in the near future. Human civilization will definitely take a huge leap in terms of technology if quantum computing is achieved.

References

[1] https://en.wikipedia.org/wiki/Quantum_computing

[2] http://www.mit.edu/~aram/advice/quantum.html

[3] https://archive.org/details/arxiv-quant-ph9708022/page/n3/mode/2up

[4] Abrams D S and Lloyd S, Simulation of Many-Body Fermi Systems on a Universal Quantum Computer, *Phys. Rev.Lett. 79* 2586-2589, 1997

[5] Bennett C H and Brassard G, Quantum cryptography: public key distribution and coin tossing, in *Proc. IEEE Conf. on Computers, Syst. and Signal Process.* pp 175-179, 1984

[6] Aharonov D, Beckman D, Chuang I and Nielsen M, What Makes Quantum Computers Powerful?

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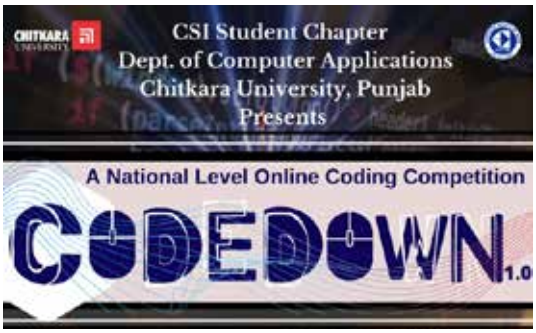
A REPORT

CodeDown 1.0 - National Level Online Coding Competition

Reported by **Jaswinder Singh**



The COVID-19 pandemic has forced each one of us to remain confined to our homes. This situation has especially been a challenge to the students. But if the students are provided with right platform to learn and show their skills, they put forth their better self.

To help the students overcome this situation and to make learning an enjoyable experience, the CSI Student Chapter, Department of Computer Applications, Chitkara University, Punjab collaborated with a technical partner 'Code Quotient' to organize an online coding competition named CODEDOWN 1.0 on 23 May 2020. The competition received an overwhelmed response from students pan India. Students from 20 states & UTs registered for the event.Total 464 students participated in this event.Students Registrations covered following parts of India.

Mr. Jaskaran Batra (Chitkara University,Punjab), Mr. Nihal Singh (Gurukul Kangri Vishwavidyalaya, Uttarakhand) and Mr. Prince Kumar (Chitkara University,Punjab) bagged first three positions respectively.

CSI Student Chapter, Department of Computer Applications, Chitkara University is determined to organize more such events in the future for the benefits of students all over the India.

Quantum Cryptography for the Future Internet

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Quantum Cryptography is one of the emerging fields of network security. With the revolution in the field of computer security, cryptography has become one of the important aspects of security. Quantum computing has increased the processing power of the computer leading to the obsoletion of public-key cryptography. To tackle this issue quantum cryptography is considered to be the solution.

1. Introduction

Quantum cryptography is another approach in cryptography that uses the principles of quantum mechanics. Quantum cryptography is derived from the uncertainty of the public key that is created using photons. Thus, due to uncertainty in the creation of public key and its ability to detect intrusion it gives rise to a stable and secure transmission. Quantum cryptography can secure the network transmissions to a significant level. The development of quantum cryptography has started from 1970[3]. The quantum cryptography is constructed from two principles of quantum physics. They are Heisenberg's Uncertainty Principle and the photon polarization principle.

2. What is the classic cryptography?

Classic cryptography is based on the mathematical algorithms and depends on the complexity of computation that computer requires for factoring large integers into required prime numbers. The security of the messages in this type of cryptography relies on the complexity of that particular problem. As shown in Fig.1, a text message is encrypted using a secret or a private key to convert it into ciphertext at the sender's side. Then this ciphered data is decrypted back to plain text using the same shared key at the receiver's side.

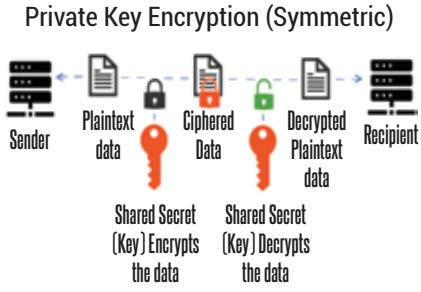

Fig.1 Private Key Cryptography

This secret key is communicated to a receiver through a secure physical channel whereas the ciphered data is transmitted over the insecure communication channel.

An increase in the spread of insecurity has aroused the importance of cryptography to a large extent. Since the symmetric key had certain problems with private key management, it was found to be non-practical. This create the way for development of public-key cryptosystems. In this type of cryptography, two different types of keys were used namely public key and private key as shown in Fig.2.

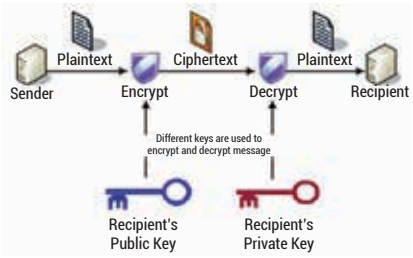

Fig.2 Public Key Cryptography

The public key is distributed over the common public network. The ciphertext can only be decrypted by the private key which is already provided to the intended recipient.

3. Why quantum cryptography?

The disadvantages of classic cryptography have given rise to the need for quantum cryptography. Quantum computers are likely to bring a drastic change in the world of security as they can offer exceptionally large computational power than that of the classical computers.[3]. Problems that required more time to solve the complicated mathematical problem, with the help of quantum computing could be solved within a fraction of seconds. The classic cryptography uses encryption algorithms that are based on mathematical operations. Thus, the security provided by the classical cryptographic method becomes vulnerable and hence less secure. To tackle this problem of insecurity due to an increase in computational power, quantum cryptography came into existence. Due to its property of uncertainty, it makes the key detection more difficult for the external intruder.

4. Principles used in quantum cryptography

Following are the two principles on which Quantum Cryptography depends:

- Heisenberg's Uncertainty Principle
- Principle of Photon Polarization

The Heisenberg Uncertainty principle states that it is impossible to measure the state of a photon of any system without interfering with that particular system.[4] The only unusual thing about this principle of Uncertainty is that it is true only for that particular moment at which you try to measure that state. In short, the system is disturbed when it is interfered with by an external intruder. By the principle of photon polarization, an intruder cannot copy the qubits, i.e., quantum state. If an attempt is made for measuring any property, it will change the other required information.

5. System Architecture for Quantum Key Distribution

Quantum Key Distribution(QKD) is a technique by which a quantum key is generated for cryptography purposes. Fig. 3 shows the system architecture of QKD. The first Quantum Key Distribution protocol named BB84 was proposed by Bennett and Brassard in 1984. The protocol uses four polarization states: vertical, horizontal, diagonal, and anti-diagonal which can constitute two bases, rectilinear or diagonal

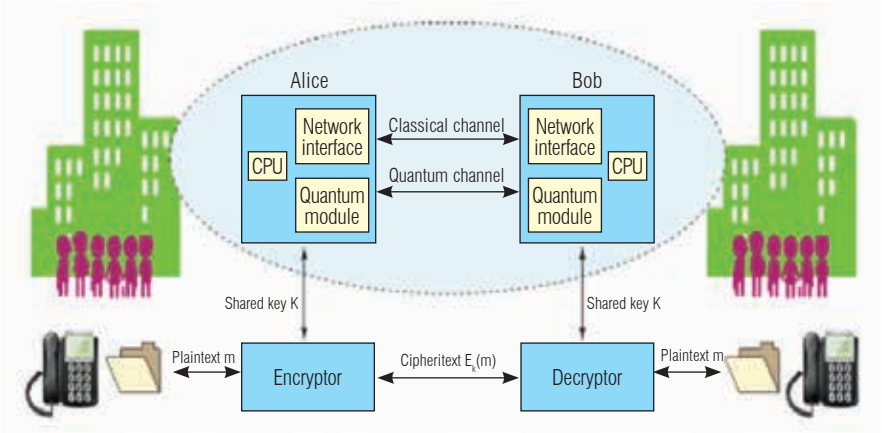

Fig3. Architecture of Quantum Key Distribution

[5]. In this process, the sender sends a message to the receiver with the help of a photon gun to pass a stream of photons, each with a random state of polarization. On the other side, the receiver will select any filter (with linear or diagonal restrictions) and use a photon receiver to measure the pattern of polarization which is either rectilinear or diagonal and stores the results accordingly. While sending a portion of the stream of particles some of the particles will be restricted by the filter and hence the receiver sends the type of measurement to the sender using the out-of-band communication system. The photons that are of correct measurements are interpreted into bits based on their polarization and those with incorrect measurements will be discarded or removed. In this way, the key is formed.

Suppose that Alice and Bob want to share a random key before they cammunicate. Figure 4 shows the quantum key generation. They must first define the orientation type linear and diagonal, to represent 0 and 1, respectively. We call the orientation vertical and horizontal types as key 1, and the diagonal and anti-diagonal as key 2. Alicefirstpreparesa sequence of qubits with random orientation types. She sends the sequence to Bob. Bob then measures them with a random filter basis. If Bob chooses the same orientation type as Alice prepared, they can exactly get bit 0 or 1. As shown in Fig. 4, they have created a random shared key. 100110, and the remaining qubits would be discarded. The shared key that only they know is used for encoding and decoding. We now suppose that an eavesdropper exists, Eva[6]. To get the shared key Eva may steal the sequence and measure them. But the error rate will be higher than the safe one. Therefore, we can determine whether the information is stolen by Eva. In Classical Cryptography, this protocol can be realized by using the classical XOR operation. However, such a realization is insecure under eavesdropping.[2]

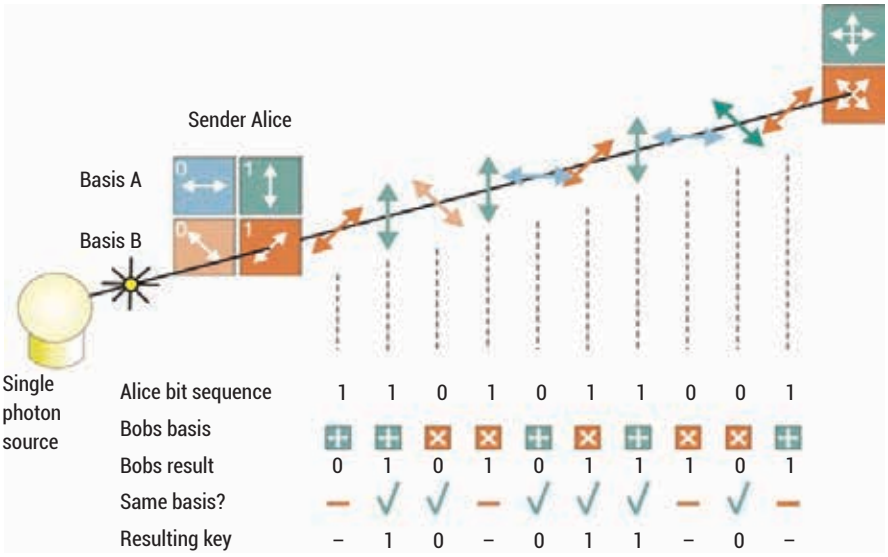

Fig. 4 : Quantum Key Generation

6. Applications

- In particular, quantum cryptography provides security for various applications (e.g., Internet of Things and smart cities) in cyberspace for the future Internet.
- It provides unconditional security and sniffing detection can be done, thus making it best suited for the security of the future Internet.
- Credit card numbers can be encrypted using Quantum Cryptography during transactions.
- Key agreements can be done more securely.

Standard and robust data encryption process.

- Data Signature
- Quantum cryptography can also be used in access control in cloud computing.[2]

7. Conclusion

Quantum cryptography overcomes the drawbacks of classic cryptography that arise due to newly emerging quantum computing. While there have been major advancements in the field of quantum cryptography in the recent years, there are still challenges before quantum cryptography can become a widely used key distribution system for governments, businesses, and individual citizens. These challenges, significantly, include enhancing new hardware to allow better quality and to maintain the quality for longer transmission distances for the exchange of quantum key. The immense progress in the processing power of computers due to the newly emerging concept of Quantum computing and the obsoletion of current technology due to its rapid development will be few important reasons for the research and development of quantum cryptography. Quantum

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Quantum Computing: A New Phase of Computing

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Introduction

Over the years, technology advancement is benefiting human being in numerous ways. One such recent innovation is Quantum computing. It involves the processing of information based on the "laws of quantum physics". Quantum Physics describes the behaviour of atoms, electrons and other fundamental particles. The basic principle behind quantum computation is to control the behaviour of these particles. A quantum computer is not the advanced version of regular computers, it is completely built on a different approach which is quantum mechanics. [1] A normal computer uses strings of bits, and these bits can be either 0 or 1. Whereas in quantum computers, it makes use of qubits or quantum bits. Quantum computing makes use of 2 major quantum-mechanical phenomena, namely:

- Superposition
- Entanglement

Quantum superposition is the ability of quantum systems to exist in multiple states at the same time. Quantum bits has non-binary identity having the combination of 0 and 1 with some probability of being 0 and some probability of being 1. There is certain amount of uncertainty and the precise values of 0 and 1 are not considered. The qubit can represent 0, 1 or both at the same time.

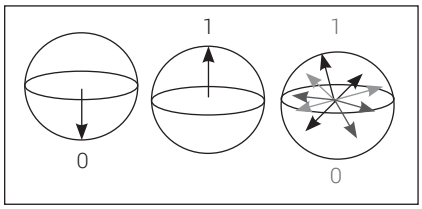

Fig. 1: Quantum Bits – Superposition

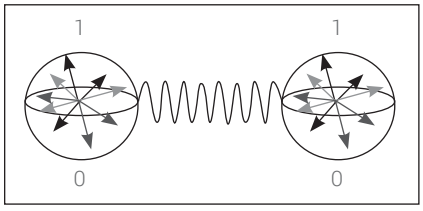

Fig. 2: Quantum Bits – Entanglement

The state of a one quantum particle depends on that of the other quantum particle i.e., there exists a correlation between quantum particles, this is called as the entanglement. Consider an entangled system of two qubits, when one of the qubits is measured say the outcome is either 0 or 1 — immediately it also gives the outcome of another qubit if it was to be measured.

Using these 2 principles, Qubits can behave as a much more advanced version of switches which helps quantum computers solve difficult problems.

Quantum Computing – How it works?

Quantum computing works on the microscopic fact that things don't have to be definite which we see as a part of macroscopic experience. Tiny particles, such as electrons or photons, takes two states simultaneously. For instance, photons can exhibit two different kinds of polarization at a time.

In ordinary life, it is impossible to see this superposition of different states. When the system is observed, this property disappears. For example, when the polarization of a photon or location of an electron is calculated, only one of the final possible alternatives is observed.

Let us consider the problem of solving a maze to understand quantum computing when seen with respect to classical computers.[2] A classical computer tests each possible route in the maze, one at a time before finding the correct path in the maze.

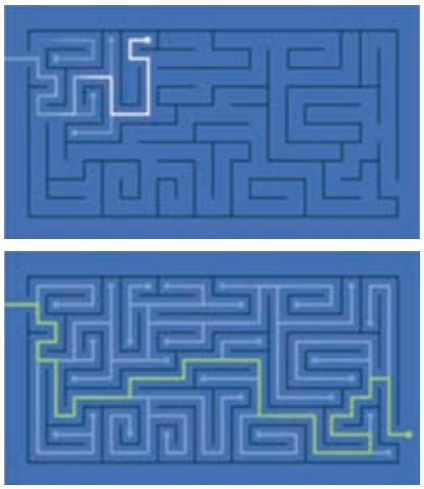

Fig. 3: Maze solution by classical computer and quantum computer [2]

A classical 'n' bit computer can represent and work on only one system state at a time. An 'n' bit computer can represent 2n system states. However, 'n' qubit computer can represent 2 to the power of n system states. It has the capability to perform parallel operations on all these states. Whenever we add just a one qubit to a quantum computer, the number of states it can represent and work increases. To describe a system of 300 qubits, it requires a greater number of states than the number of atoms in the visible Universe.

This exponential increase in power along with the entanglement of qubits aids the quantum computers to solve certain problems with more efficiency. Coming back

Table 1 : n bit computer v/s n qubit computer

n	No. of system states in 'n' bit computer (2n system states)	No. of system states in 'n' qubit quantum computer (2^n system states)
10	20	1,024
20	40	1,048,576
35	70	34,359,738,368
50	100	1,125,899,906,842,624

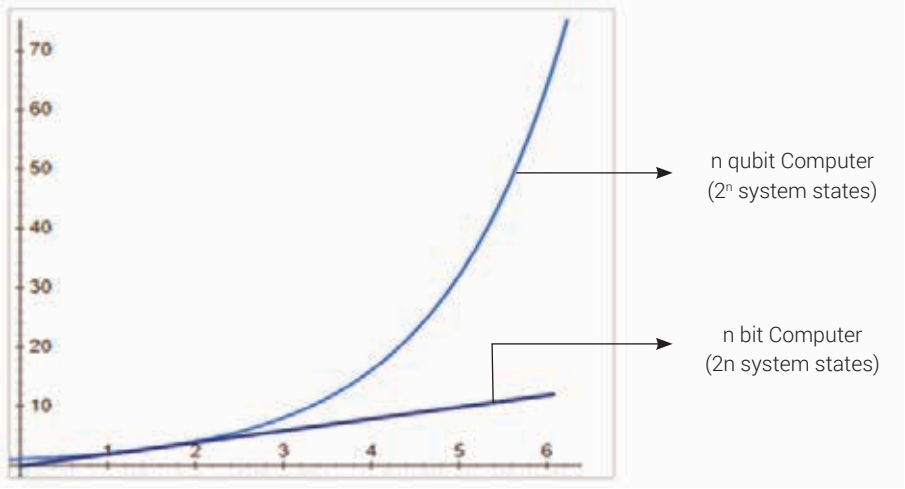

Fig. 4: n bit computer v/s n qubit computer system states in a graph

to the maze problem, quantum computer uses entangled quantum states to find the correct route quicker with very little amount of calculations. A quantum computer finds all possible routes at once.

Quantum computers will even leverage solutions for the problems where patterns cannot be seen due to insufficient amount of data or possibility for discovering the answer is extensive for a classical computer to find it.

Quantum Computing – Difference with Supercomputers

Supercomputers have more advanced performance features when compared to classical computers and are built on the similar mechanics in an advanced way, whereas quantum computers are built completely on a different platform of quantum physics. A supercomputer can perform the tasks done by quantum computers of up to 20 qubits. Beyond which the quantum supremacy is attained.

In the field of quantum computing, when the programmable quantum device could solve a problem, which cannot be solved by a conventional computer then it is called as quantum supremacy.

Quantum Computing - Applications

Quantum computing is now getting ready to come front for reality. It is not just limited to maze problem but also to build future quantum technologies. They have the potential to impact many aspects of our lives including security, healthcare, internet and so on.[4]

Quantum computers will change the view of data security. In the domain of cryptography, private keys are used in the encryption of messages. It can be generated from quantum uncertainty. With this the attacker could not secretly copy the key perfectly because of uncertainty. If the attacker wants to hack the key, they should break the laws of quantum physics. The method of quantum encryption is already being tested by banks and other organizations across the globe.

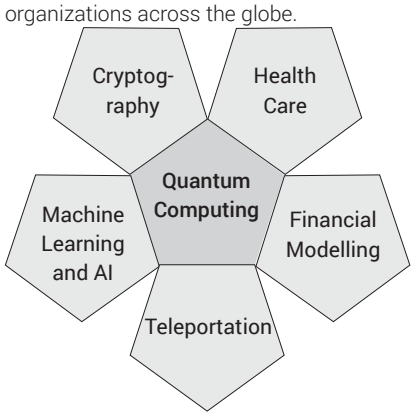

Fig. 5: Quantum Computing Applications

Quantum computing has its application spread to Health care as well. Usually the trial and error methods are used is the process of drug development which is expensive, risky and a completely challenging task. The design and analysis of molecules for drug development is a major problem today because calculating all the quantum properties of all the atoms in the molecule is a computational tough task even for the supercomputers. In this situation quantum computers can perform better since it operates based on the quantum properties which the molecules are trying to simulate. Researchers believe that the usage of quantum computing for understanding the drugs, and its reactions on humans can be an effective & efficient way.

The quantum computers can also help in tackling the current situation of global pandemic COVID 19.[5] This pandemic has made a deep impact on humankind in the matters of health, economy and other societal impacts. Various interactions between the biomolecules need to be analysed during the process of drug development. This analysis requires more and more computational power. Nowadays, companies can run millions of operations on classical computers and supercomputers. But they are limited to an only certain size of molecules. Quantum computers renders the potential to bridge this large computational capability gap. As the quantum computer takes up this problem, it will be able to perform operations on larger molecules, this makes way for advancements in pharmaceutical industry.

Data is the fuel for machine learning. To maximize the learning efficiency of a system we need to feed more and more diverse data. We don't have shortage of content, but we need more powerful computers to process petabytes of data. Quantum computers can empower machine learning by giving platform for AI based programs which search through large datasets, and analyse them. The power of Artificial Intelligence is already seen and now quantum computing adds more computing power for the developing world of AI. With this the AI systems can understand better and offer efficient machine learning & provide better solution for larger problems.

In financial industries it is required to know the better investment techniques based on risk associated, expected returns and other marketing factors. Now we are running, "Monte Carlo" simulation successfully on conventional computers but this requires extensive computer time. By using quantum technology, the complex massive computation can be performed efficiently, this improves the quality of solution and also reduces the time required. The financial leaders in the business handle money in billions, and a small improvement in investment gains them a lot.

Teleportation is the process of transferring data from one point to another without physically transmitting it. The quantum particles can get entangled across space and time such that changing one particle it impacts the other and this creates a channel for teleportation. The demonstration of quantum teleportation is successfully done in labs, and this makes way for future quantum internet.

The applications of quantum computing are not confined to these five domains, it expands over vast domain range. Quantum computers can solve the most computationally complex problems in the real world.

Quantum Computing – Recent Trends

IBM has developed 18 quantum computers. It has considerably larger share in quantum computers, with Google having 5 quantum computers and Honeywell having 6 such computers. The quantum computer developed at IBM is named as "IBM Q", which nowhere looks like a classical computer.[6]

Fig. 6. The IBM Q quantum computer [6]

The idea of having a personal quantum computer is not feasible since these computers are equipped with hefty cooling equipment around them. Instead, we can remotely experience IBM's quantum computer via cloud services. The quantum services are not just limited to those who understand the phenomena of quantum physics; thus, IBM is now aiming to render such services to common people as well. To enable this the standard recipes are prepared which is a package of computational services and calls it as "Circuits".

The new business approach by IBM is called, "Circuits as a service". When quantum circuits are combined with ordinary software, quantum services can be made more accessible. With all these IBM is in the path of annually doubling the performance of quantum computers.

Another massive progress in quantum computing was attained when Google proposed its quantum supremacy. Google announced that their 54-qubit Sycamore processor was able to solve a calculation in 200 seconds for which the world's most powerful supercomputer would take approximately 10,000 years. This was a gross overestimate and later IBM said that the supercomputer would take around 2.5 days.

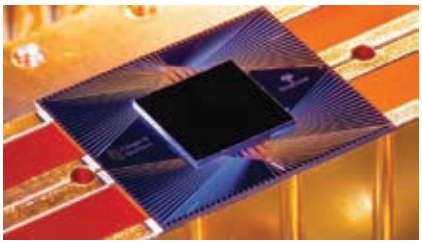

Fig. 7: Google's Sycamore processor [3]

The companies like Google, IBM, Microsoft, Intel and Honeywell along with the start-ups like IonQ, Rigetti etc. are working silently towards the development of quantum computers making it more realistic and available.

Quantum computing is not having all the factors in its way. It still needs to overcome some barriers [7] such as:

- The quantum computers are costly. Thus, having an attempt to commercial quantum computers IBM has proposed a "subscription" model for on demand access.
- Algorithms and codes designed for classical computers cannot be used for quantum computers to get better speed and efficiency, so new algorithms must be designed to work in quantum computers. The quantum algorithms generation takes time, research and more efforts. An example for such algorithm is "Quantum Factorization Algorithm" by Peter Shor of AT&T Bell laboratories.
- Quantum computers are extremely complex machines and building that is a tough task. These powerful computers work at -273°C which is close to absolute zero temperature.
- The two main pillars of quantum computing are superposition and entanglement without which the speed cannot be achieved. If any computer disturbances modify the overlapping qubits then it comes down to classical states, and we are a then left with normal computer that can only server few algorithms.
- Creating a quantum computer with more than few dozens of quantum bits is difficult since the quantum states used to create those qubits are fragile.

Another point to note in quantum computing is to define its efficiency. So far, the main factor considered defining efficiency was, "time taken" to solve a problem. But having only one factor being considered is not advisable. Hence, researchers from NASA's Ames Research Center, Google and Oak Ridge National lab came up with another factor in defining efficiency that is, "energy required". [3] They performed the experiment on Google's quantum computer NISQ and conventional supercomputers by designing a quantum simulator called, "qFlex". The Mandrà's team implemented the simulator on Electra supercomputer at Ames and also on world's most powerful supercomputer Summit at Oak Ridge. The energy required on different machines are as follows, Electra took 97 MWh, Summit required 21 MWh and NISQ quantum machine used only 4.2×10^{-4} MWh.

Conclusion

The quantum computers improve the quality of people's lives by making way for the creation of better technologies. Quantum computing has crossed its infancy and is in its toddler hood. The upfront companies are working to bring quantum computing to the state of maturity.

It is foreseen that in the next 2 to 3 years investments will happen in the areas of improving quantum computers, and the world will see the rise of even more powerful computers. Quantum computers do not replace the classical computers instead it helps to solve the difficult problems that are virtually impossible using classical computers.

References

[1] A beginner's guide to quantum computing https://www.youtube.com/watch?v=QuR969uMICM

[2] How it Works: Quantum Computing https://www.youtube.com/watch?v=WVv5OAR4Nik

[3] Quantum computers vastly outperform

supercomputers https://physicsworld.com/a/quantum-computers-vastly-outperform-supercomputers-when-it-comes-to-energy-efficiency/

[4] Top Applications of Quantum Computing https://analyticsindiamag.com/top-applications-of-quantum-computing-everyone-should-know-about/

[5] How quantum computing can help in tackling global pandemics such as coronavirus https://www.expresscomputer.in/guest-blogs/how-quantum-computing-can-help-in-tackling-global-pandemics-such-as-coronavirus/55229/

[6] IBM now has 18 quantum computers in its fleet of weird machines https://www.cnet.com/news/ibm-now-has-18-quantum-computers-in-its-fleet-of-weird-machines/

[7] Will Quantum Computing Really Change the World? https://analyticsindiamag.com/will-quantum-computing-really-change-the-world-facts-and-myths/

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Quantum Computing made easy: A beginner's guide for computer programmers

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Quantum Computing is the most discussed topic in today's time and also the most hyped topic. It is also the most misunderstood topic, mainly due to its relationship with Quantum mechanics. Also the quotes like "If you think you understand quantum mechanics, you don't understand quantum mechanics" (attributed to Richard Feynman although not validated) have created a lot of misunderstanding and demotivation. Although Quantum Computing has its roots in quantum mechanics, quantum computing can be understood with the perspective of a computer programmer. This approach can make the understanding of quantum algorithms and their application to solve the problems a lot easier. We need to understand the basic Quantum mechanics principles like superposition, entanglement and Quantum mathematics principles involving linear algebra. So Quantum mathematics based on the principles of quantum mechanics leads to quantum computing. Computer Science students who are very keen to do quantum programming can start programming the quantum computer by understanding the basic principles of quantum phenomenon and its usage in quantum programming without fearing the long mathematical equations like Schrödinger equations and spooky action at a distance.

A digital computer understands the binary language and stores information in a series of 0's and 1's. Information, such as numbers, text and images etc. can be represented in binary. A bit can be set to either 0 or 1. A quantum computer uses a slightly different basic block called qubit. Each qubit can not only be set to 1 or 0, but it can also be set to 1 and 0. But what does that mean exactly? This is possible by using a basic principle of quantum mechanics called superposition. Quantum superposition in qubits can be explained by flipping a coin. The coin will land in one of two states: heads or tails but superposition can be understood as a state when the coin is in air and can be imagined in superposition state of 0 and 1. Another interesting phenomenon is Quantum entanglement is known to be the exchange of quantum information between two particles at a distance. Einstein called the phenomenon a spooky action at a distance. Quantum superposition is the uncertainty state being in several states at once whereas quantum entanglement is a state where entangled particles remain connected so that actions performed on one affect the other even when particles are separated by great distances.

Dirac notations

There are two types of vectors in Dirac notation: ψ is a column vector denoted as $|\psi\rangle$ and $\psi^\dagger$ is a row vector denoted as $\langle\psi|$. The bra represents row vectors and is denoted by $\langle\ |$ and the ket represents column vectors and is denoted by $|\ \rangle$. $|\psi\rangle$ is a unit column vector called a ket vector. $\psi^\dagger$ is obtained by applying complex conjugation to the elements of the transpose of ψ.

The bra vector and the ket vector, when put together form a bra-ket $\langle\psi|\psi\rangle$ which is nothing but the inner product of vector ψ with itself which is 1.

$$[1 \quad 0] = \langle 0|, [0 \quad 1] = \langle 1|, \begin{bmatrix}1\\0\end{bmatrix} = |0\rangle, \begin{bmatrix}0\\1\end{bmatrix} = |1\rangle$$

The quantum states that encode the values of zero and one are represented as shown below as the matrices and their corresponding bra and ket vector. The computational basis is simply the two basis states composed by any of the two distinct quantum states that the qubit can be in and is conventionally denoted with $|0\rangle$ and $|1\rangle$ in the case of qubits.

Qubit representation

Qubits are typically represented by "kets". The vector representation of a single qubit is:

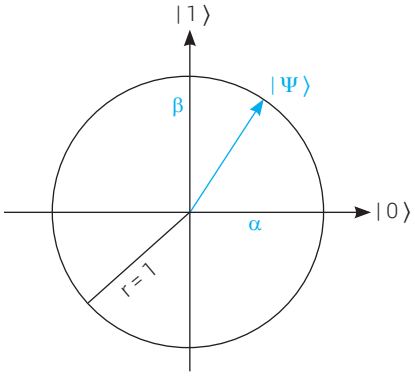
$$|\Psi\rangle = \alpha\,|0\rangle + \beta\,|1\rangle$$

Here α and β are the complex probability amplitudes of the qubit which determines the probability of measuring a $|0\rangle$ or a $|1\rangle$. While measuring a qubit, whose state will yield the classical value of either zero ($|0\rangle$) with a probability of $|\alpha|^2$ or one ($|1\rangle$) with a probability of $|\beta|^2$ such that:

$$|\alpha|^2 + |\beta|^2 = 1$$

(as per Max Born rule)

It can be represented as a vector of unit length 1 in the Cartesian system.



Multiple Qubits

The combined state of multiple qubits is the tensor product of all the qubits. We can also denote multiple qubits in Bra-ket notation as $|0\rangle\otimes|1\rangle$, for example. As a shorthand, we can omit the ⊗ and simply write $|0\rangle|1\rangle$. As an even shorter notation, we can write just a single ket, $|01\rangle$

$$|01\rangle = |0\rangle \otimes |1\rangle = \begin{bmatrix}1\\0\end{bmatrix} \otimes \begin{bmatrix}0\\1\end{bmatrix} = \begin{bmatrix}1\times\begin{bmatrix}0\\1\end{bmatrix}\\0\times\begin{bmatrix}0\\1\end{bmatrix}\end{bmatrix} = \begin{bmatrix}0.0\\1.1\\0.0\\0.1\end{bmatrix} = \begin{bmatrix}0\\1\\0\\0\end{bmatrix}$$

Quantum Gates

Quantum gates are similar to the classical gates with a compulsory condition that quantum gates must be reversible and they act on qubit instead of classical bit. Quantum logic gates are represented by unitary matrices with a condition that the number of qubits in the input and output of the gate must be equal.

Thus Quantum gates transform these states vectors and if represented in form of matrices are just matrix operations. All the gates can be represented as matrices as shown in the figure. There is also a ket notation of all the gates.

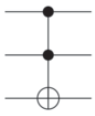
Operator	Gate(s)	Matrix
Pauli-X (X)		$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$
Pauli-Y (Y)		$\begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}$
Pauli-Z (Z)		$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$
Hadamard (H)		$\frac{1}{\sqrt{2}}\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$
Phase (S, P)		$\begin{bmatrix} 1 & 0 \\ 0 & i \end{bmatrix}$
$\pi/8$ (T)		$\begin{bmatrix} 1 & 0 \\ 0 & e^{i\pi/4} \end{bmatrix}$
Controlled Not (CNOT, CX)		$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$
Controlled Z (CZ)		$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -1 \end{bmatrix}$
SWAP		$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$
Toffoli (CCNOT, CCX, TOFF)		$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$

Image source: https://en.wikipedia.org/wiki/Quantum_logic_gate

Quantum program or quantum algorithm

Quantum algorithm is a circuit made by a combination of quantum gates. Quantum algorithms work by applying quantum operations in the form of quantum gates on qubits. Quantum program executes on a quantum processor called QPU (Quantum processing unit). A QPU implements qubits in many ways like superconducting qubits, Quantum dots, Trapped Ion, Photonics, topological, NMR based qubits etc.

One such superconducting qubits based QPU which is free to access is implemented by IBM and is available through their cloud service at https://quantum-computing.ibm.com. Using this link a free IBM account can be created. As of now, IBM provides free access to the ibmq_16_melbourne v2.1.0 15(a 16-qubit quantum processor).

The qubits are arranged in a topology as shown in the figure:

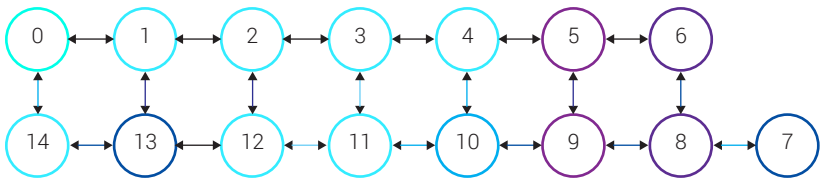


Image source: An initial layout on IBM Q device

The direction of arrows is very important as the circles represent qubits and the arrows represent the ability to apply a physical CNOT gate between the qubits.

Following is the implementation of a basic algorithm in an IBM Quantum Computer. A simple quantum circuit for entangled state is to be designed. Bell states represent the simplest form of entanglement where measurement of one qubit will assign a value to the other qubit immediately.

$$|\psi_e\rangle = \frac{1}{\sqrt{2}}(|00\rangle + |11\rangle)$$

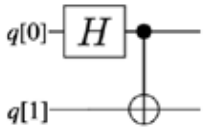
Hadamard gate is a 1-qubit rotation.

$$H = \frac{1}{\sqrt{2}}\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

The CNOT gate flips the second qubit (the target qubit) if and only if the first qubit (the control qubit) is $|1\rangle$.

$$\text{CNOT} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

This quantum algorithm is of fundamental significance to quantum computing because it creates a maximally entangled 2-qubit state called a Bell State.



We can call this circuit a quantum program or quantum algorithm for implementation of entangled state of two qubits q[0] and q[1].

$$\text{CNOT}(H \otimes 1)|00\rangle = \frac{1}{\sqrt{2}}(|00\rangle + |11\rangle)$$

Suppose there is a large list of N items and we need to locate one unique item w out of the list of N items. Using a classical search

algorithm, one has to check an average N/2 of these locations, and in the worst case, all N of them to find w.

On a quantum computer we can find the marked item in roughly √N steps using Grover's algorithm which is a quadratic speedup.

In simple way, we can represent a function $f(x)$=0 for all unwanted values & for all unmarked items and $f(w)$=1 for our required value which is a surprise box at location w.

First we choose a binary encoding of the items x, $\in \{0,1\}^n$ so that $N=2^n$. Now we can represent it in terms of qubits on a quantum computer.

The most important part is to define oracle matrix U_f to act on any of the simple, standard basis states $|x\rangle$. Quantum Oracle is a black box used extensively in quantum algorithms for the estimation of functions using qubits.

$$U_f|x\rangle = (-1)^{f(x)}|x\rangle$$

We see that if x is an unmarked item, the oracle does nothing to the state. However, when we apply the oracle to the basis state $|w\rangle$ it maps $U_f|w\rangle = -|w\rangle$.

Suppose we have N=4 possible elements, i.e. $|00\rangle$, $|01\rangle$, $|10\rangle$, $|11\rangle$ and we need to find Oracle for $|w\rangle$=$|01\rangle$.

$$U_f|s\rangle = U_f\frac{1}{2}(|00\rangle + |01\rangle + |10\rangle + |11\rangle) = \frac{1}{2}(|00\rangle - |01\rangle + |10\rangle + |11\rangle)$$

Following the above logic, one can straight forwardly construct the oracles for $|w\rangle$=$|01\rangle$.

The full circuit for the Grover search for element at $|01\rangle$ position is given as per the circuit shown below where $|0\rangle$ is the initial state of both qubits. q[0] and q[1] are quantum bits or qubits and c2 represents two classical bits register. The identity ID gate is used just to maintain the symmetry of the circuit otherwise the Hadamard gate (H) will go below X gate and it will become difficult to understand. The last two are measurements which will collapse the quantum state to measurable classic states. Similarly Oracles for $|00\rangle$, $|10\rangle$ and $|11\rangle$ can also be designed.

The first gate in most of the cases is Hadamard because it is required to bring a qubit into a superposition state. By default, qubits are originally in the $|0\rangle$ state. After applying a Hadamard Gate to a qubit there's a fifty percent chance the qubit, when measured is zero and a fifty percent chance that it will be one.

The circuit is the IBM workspace. On the right side, there is a circuit composer where one can drag and drop a quantum gate and automatically a qasm code is generated on the left and vice versa.

Implementation of Grover algorithm

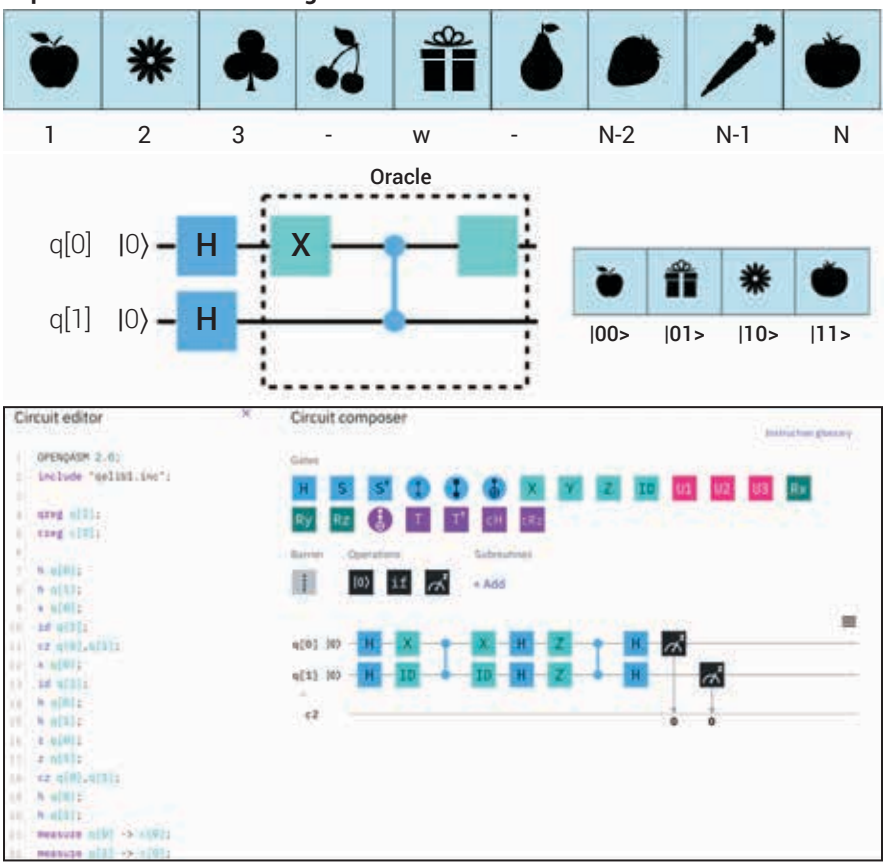


Image source: Quantum circuit designed using IBM workspace

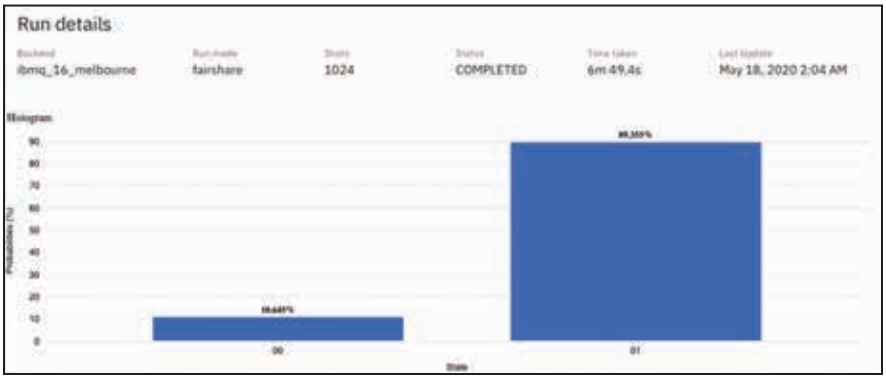


Image source: Quantum circuit designed using IBM workspace

Results: The output on a quantum computer is probabilistic. So one needs to execute the same code many times known as **shots** to confirm the result. Thus the result with maximum probability can be the correct result. For the sample run, results show 10.645% times result was $|00\rangle$ and 89.355% times the result was $|01\rangle$. So we conclude that $|01\rangle$ is the correct result.

Other platforms

There are other programming platforms available on cloud like Rigetti's pyquil (https://www.rigetti.com/), DWave's leap(https://www.dwavesys.com/quantum-computing) and LIQUi> by Microsoft (https://www.microsoft.com/en-us/research/project/

language-integrated-quantum-operations-liqui/) etc. So computer programmers can register in any quantum computing cloud environment and start writing quantum computing code.

There is a Quantum algorithm Zoo (http://quantumalgorithmzoo.org) where one can find a comprehensive catalog of quantum algorithms and their description.

Acknowledgment

The authors are thankful to IBM for providing free access to the Quantum computer through cloud service at https://quant.um-computing.ibm.com/.

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Contd. from page 12

cryptography is still in its initial stage and hence proves to be important from the future point of view. This technology has the potential to make a valuable contribution to various online transactions and for different official organizations for maintaining security. These characteristics can solve the critical security issues for the future Internet. Quantum cryptography will have a remarkable and revolutionary effect on mankind even if some of its possibilities were fulfilled. Quantum cryptography, though, is not yet being implemented, studies show that its ability to contribute to a superior level of security and applications in the field of security, makes it best suited for encryption.

References:

[1] Wiesner, S., "Conjugate coding" SIGACT News, 1983, 15, p. 78-88

[2] LirongQiu, Xin Sun, and Juan Xu. Categorical quantum cryptography for access control in cloud computing. Soft Computing,22(19):6363–6370,2018.

[3] Petros Wallden and Elham Kashefi. Cybersecurity in the quantum era Communications of the ACM, 62(4):120–120, 2019.

[4] Sharbaf, M. S. (2009). Quantum Cryptography: A New Generation of Information Technology Security System. 2009 Sixth International Conference on Information Technology: New Generations.

[5] C. Chen, G. Zeng, F. Lin, Y. Chou and H. Chao, "Quantum cryptography and its applications over the internet," in IEEE Network, vol. 29, no. 5, pp. 64-69, September-October 2015.

[6] "Encyclopedia of Cryptography and Security" Springer Science and Business Media LLC 2018

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Quantum Computing: The Universal Computer

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"A generation that ignores history has no past and no future"

– Robert Heinlein

Introduction

In this generation everyone wants to use advanced things and make their works easier and faster. The computers that we're using are completely based on the classical phenomena of electrical circuits. Conventional computing commonly called classical computing relies on electrical circuits to compute and perform operations based on the classical phenomena. Here the information is stored in bits using electrical charge. Computers made our jobs easier but to make it more efficient the concept of quantum computing was introduced.

Quantum computing is similar to classical computing only a few differences between them make it different from the other. This was introduced in order to make it more efficient and faster as people can use it comfortably. This is built on the phenomenon of quantum theory. Likewise the information in quantum computers is stored as a quantum bit or qubit. The processing here is done in the quantum processing unit or QPU where the qubits are coordinated as said in [1].

Concepts

The word "quantum" in quantum computing is derived from "quantum mechanics" which operates by performing the law of quantum mechanics. All computing devices suspect on a rudimentary ability to store and operate the information as confirmed in [2]. In present-days system operates by taking the individual data that has been stored in a form of binary 0's and 1's. Quantum computing supports the quantum mechanical phenomena to control the information which is done through the quantum bits or qubits (quantum bits).

Properties

Some of the properties that have been considered in quantum computing are superposition, entanglement and interference.

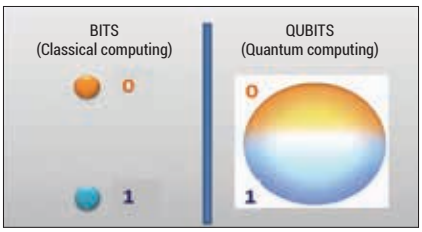

Figure 1: structure of Bits VS Qubits.

- **Superposition:** The capable of superposition is that two things can interact with each other without overlap. Quantum computing works based on the principle of superposition in which particles represent qubits that takes the value as 0, 1 or both concomitantly. For instance let us consider the toss of a coin which can be head, tail or both simultaneously.

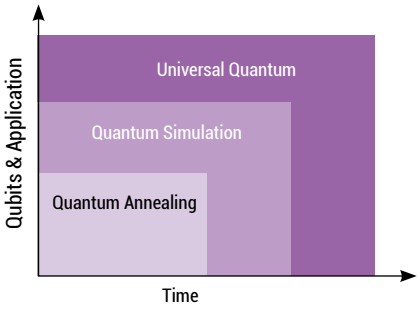

Figure 2: Classification of quantum computing

- **Entanglement:** It is the one which takes the objects and relate them by entangling them permanently. Adding the qubit to the quantum computing that is, suppose 60-cubits are considered which can examine the two to the power of 60 states concomitantly that help to find the solution to a problem quickly and efficiently with lesser calculations.
- **Interference:** It is used to control quantum states and amplify the signals that are leading toward the proper answer, while cancelling signals that are resulting in the incorrect answer

Bits vs Qubits

Classical computing operates by storing the data in two states 0's and 1's. Make sure that it can remains in 0 to 1 at a time but not both. This is the major difference while comparing the classical computing with quantum computing. Quantum computing store the data in qubits instead of bits. Quantum mechanism can operate by running both 0's and 1's simultaneously. Classical computing is difficult to find the solution, it may take long time whereas quantum computing takes just a minute to solve it. Consistently, the combination of two qubits in this state can be demonstrate the four values of 00, 01, 10 and 11 synchronously as said in [3]. From Figure 1 it is clearly understood that bits can be either 0 or 1 but not both at same time although in qubits it can remains simultaneously.

Classification

Quantum computing consists of three types as represented in Figure 2 which differ by the amount of qubits involved and number of possible appeal, as well as the time required to build.

Quantum Annealing

Quantum annealing is designed by Canadian company D-Wave, but it hard to find that whether it has any real "quantumness". Quantum Annealing is the best approach to solve the optimized problem. It is one of the least powerful which is the restricted form of

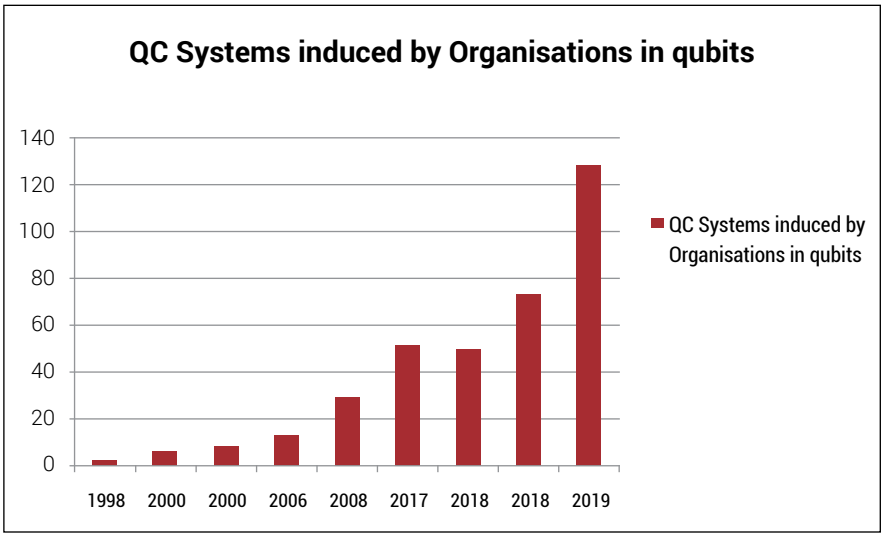

Figure 3: Growth of QC

quantum computing. They are easy to build. One of the drawbacks in quantum annealing is that it can perform one specific function. Computational power of quantum annealer is same as traditional computers as said in [4].

Quantum Simulation

Quantum simulation inspects a distinct problem in physics which is far away from the capacity of classical system. Simulating complex quantum phenomena might be one among the foremost important applications of quantum computing. Quantum chemistry, material science, optimization problems, sampling and quantum dynamics are the area where quantum simulations are applied. They have high computational power.

Universal Quantum

Universal quantum is more powerful and substantially applicable, but they are difficult to build. Universal quantum makes use of machine at any massive complex computation to find the solution quickly. They are used to solve the annealing equations. Quantum AI permits the machine learning which is faster than classical computing. Secure computing, Machine learning, Cryptography, quantum chemistry, material science are the some of the application of universal quantum. They have very high computational power.

Quantum Computing Growth

The Figure 3 represents the growth of Quantum Computing systems induced by organizations over 20 years in terms of qubits. As it shows, although in the year 1998 the count is very less it was still employed by many firms such as IBM, MIT, Oxford, Stanford, Berkeley. In the year 2000 Technical University of Munich and Los Alamos National Laboratory used nearly 5 and 7 QC systems respectively. The increase in the years 2006 to 2017 is progressively increasing to 50 units. The years starting from 2018 till now has shown the growth of QC systems used in organizations rapidly.

Challenges

Quantum computing is hard to build and thus have only solved insignificant problems.

Some of the requirements for quantum computing suggested by David DiVincenzo, of IBM are

- They are scalable which increase the number of qubits.
- It is universal gate set.
- Quantum bits are easy to read.
- Decoherence time is slower than quantum gates.

One major problem is having the components of the device during a coherent state, because the slightest interaction with the external world would cause the system to decohere as said in [5].The difficulty for optical approaches are harder as these timescales are orders of magnitude lower and an often cited approach to beat it uses an optical pulse shaping approach.

Applications

The quantum computing has a wide range of applications to which it can be applied. They are

1. **Artificial Intelligence:** AI is the technology that makes things to think and take decisions and learn from past experiences like normal human beings. So, the basic operation of a machine is to gather information and compute the probability for each action based on the choices already taken. In this way quantum computing aids AI to grow more easily. Figure 4B shows the neural network in AI using quantum computing.
2. **Weather Forecasting:** Here quantum computing is used to predict the weather based on the factors that deal with the climate. Conventional computers would

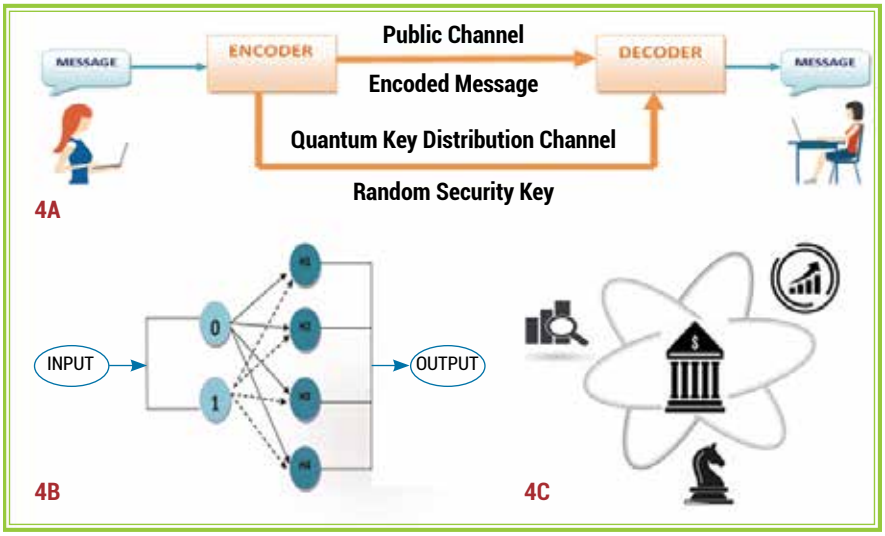

Figure 4 : Application of Quantum Computing (4A. Cryptography in QC; 4B. Neural Network in QC; 4C. Financial Modelling using QC)

take a long time to perform this thus by using the QC computers this action can be performed quickly. It will be helpful to take precautions where people in places where disasters happen can be saved.

3. **Cryptography:** cryptography is a technology where the important information can be transmitted secretly by hiding it within a message as shown in Figure 4A. The 2 process involved in this are encryption and decryption where the codes have to be cracked to get that information. More than digital systems, quantum computers can do the processes efficiently and have many methods for the quantum encryption process
4. **Financial Modelling:** Business people face a lot of issues regarding the profits and outcomes that the organization is handling. To do this task analysts have now turned to quantum computing as they are more beneficial than digital ones as depicted in Figure 4C. Quantum offers many ways for finding the path-dependent steps for the possibility computation.

Pros and Cons

Quantum Computing is well-known for its features still a few disadvantageous exists as shown in Figure 5.

Quantum Computing	
Merits	**Demerits**
▪ Faster process data in much faster speed. ▪ Parallel processing. ▪ Ability to solve scientific and commercial problems. ▪ Gives more accurate results. ▪ Less power is required. ▪ Increase data security.	▪ It requires a noise free and cool environment. ▪ Produce lots of heat. ▪ They need new algorithm to reach its potential hard to build. ▪ They are expensive. ▪ Difficult to control the quantum particles.

Figure 5 : Pros and Cons

Conclusion

To sum up, it can be said that Quantum Computing was proposed to make the already present digital computers a more efficient one.

By doing so, the computations and operations can be made quickly without wasting much time of the user. Some properties in quantum computing are superposition, entanglement and interference. This is now the evolving technology that is employed in almost all areas because of its advantages. As said above it has a variety of benefits to be applied in every field for different purposes.

References

[1] https://www.newscientist.com/question/what-is-a-quantum-computer/

[2] https://interestingengineering.com/the-race-for-quantum-supremacy-7-reasons-why-people-are-so-excited-about-quantum-computers

[3] https://www.dwavesys.com/quantum-computing

[4] https://physicsworld.com/a/quantum-computers-vastly-outperform-supercomputers-when-it-comes-to-energy-efficiency/

[5] https://hackernoon.com/quantum-computing-explained-a114999299ca

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The Impact of Quantum Algorithms on Computational Problems

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Quantum computing was originally proposed by Nobel Laureate Richard Feynman, is a new kind of computer built of quantum mechanical elements. It obeys the quantum mechanical laws and used for simulating quantum mechanics that would be impossible on a classical computer [1]. As Quantum Computing in one of the hot topics in the field of research, is a need for Quantum algorithms which has a high performance than the existing classical algorithms. The goal of this article is to discuss the impacts on quantum computing algorithms which is faster than the classical algorithms applied for computational problems.

Keywords: Quantum Computing, Quantum Algorithms, Classical Algorithms.

Introduction to Quantum Algorithms and its applications

One of the main principles in designing the algorithms is to reduce the number of computational steps in solving the solution.

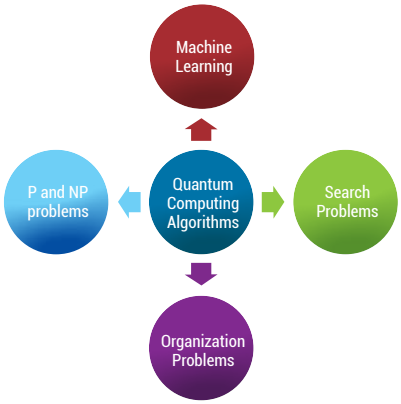

Fig. 1: Quantum Algorithm for Computational Problems

To solve the computation problem faster [3][4], Based on Church -Turing thesis, the algorithmic design procedure follows the following steps

- Reduce the implementation time in each step of the algorithm.
- Perform several parallel steps in an algorithm.
- Reduce the number of steps in an algorithm.

Global Architecture of Quantum Computer:

The running time of the program will be measured using the asymptotic complexity such as execution time and memory space usage with the problem size. The problem size varies rather than fixed size. For measuring such problem using quantum computing, a quantum circuit model is used which is a sequence of elementary quantum operations called quantum gate and applied to the number of quantum bits (QUBITS). It was proved that the problems that cannot be solved in polynomial time in classical computers were able to solve in polynomial time with Quantum computers [2]. Fig. 2 represents the Global architecture [7] of Quantum Computer

Quantum Algorithms for Search and Optimization problems

The most important and mainly applied problem in the field of computer science is search problems. Gover's algorithm solves the search problem using a black box function and produces the algorithm complexity in terms of O(√N). For the same problem, when they have implemented using classic algorithms it has the complexity in terms on O(N) [5]. Later they evaluate the quantum solution of the problem and proved it is optimal.[6]

Quantum Algorithms in Solving P and NP problems

There are two main complexity classes. The P is the class of problem solved by classical computer quickly where the NP is the class of problems where classical computers cannot solve it quickly. Quantum computers solve decision problems

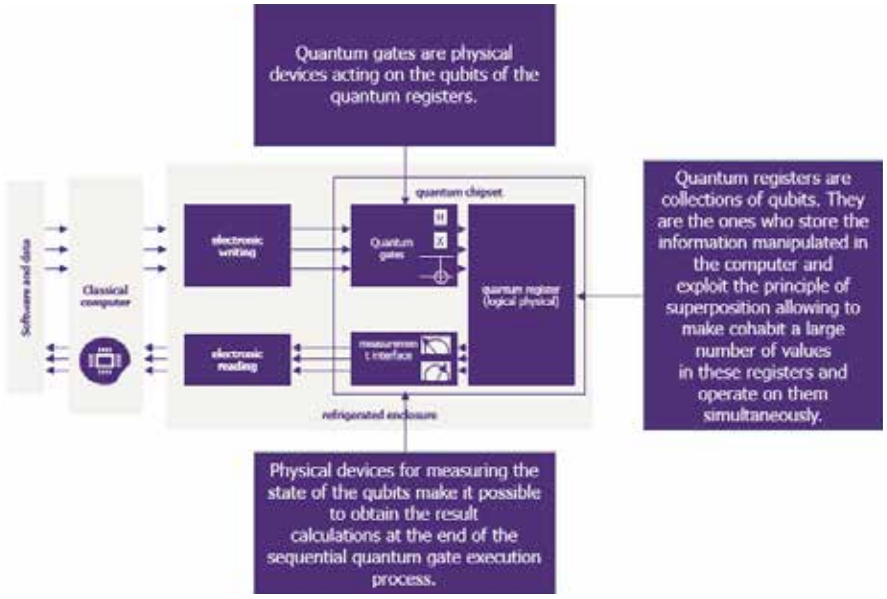

Fig. 2: Global Architecture of Quantum Computer [7]

efficiently. Bounded error Quantum polynomial Time (BQP) contains all the problems that are in P and solves problem that classical computer cannot solve in P. BQP fits into the classical complexity classes as shown in figure. It is also proved that the quantum computing solves the NP Complete problem in polynomial time using quantum algorithms.[9]

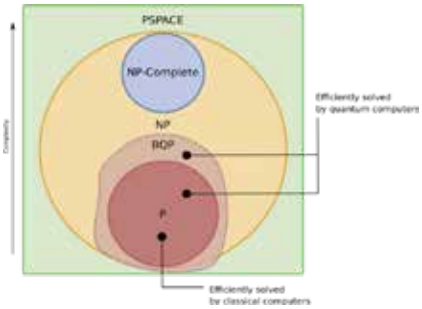

Fig. 3: Quantum algorithms in Complexity classes [8]

Quantum Machine Learning Algorithms

Machine learning algorithms involves problems of classifying large number of vectors in high dimensional spaces. Classical algorithm takes polynomial time based on the number of vectors and the dimension of space.

Quantum computers performs well for machine learning algorithms. Quantum machine learning takes logarithmic time for the same vector and dimensional space. The data set used for machine learning algorithms are converted to quantum data set which will be applied to quantum algorithms. The main advantage of quantum machine learning algorithm is to reduce the reduced complexity in terms of time.[7]

Conclusion:

Quantum computing can be able to generate patterns that are not able to generate by classical computers. A quantum computing algorithm in Quantum machine is always more powerful than classical algorithms. In this article, we have discussed the impacts of Quantum computing algorithms on computational problems such as search and optimization problems, decision problems, Class P and NP problems and Machine learning problems also.

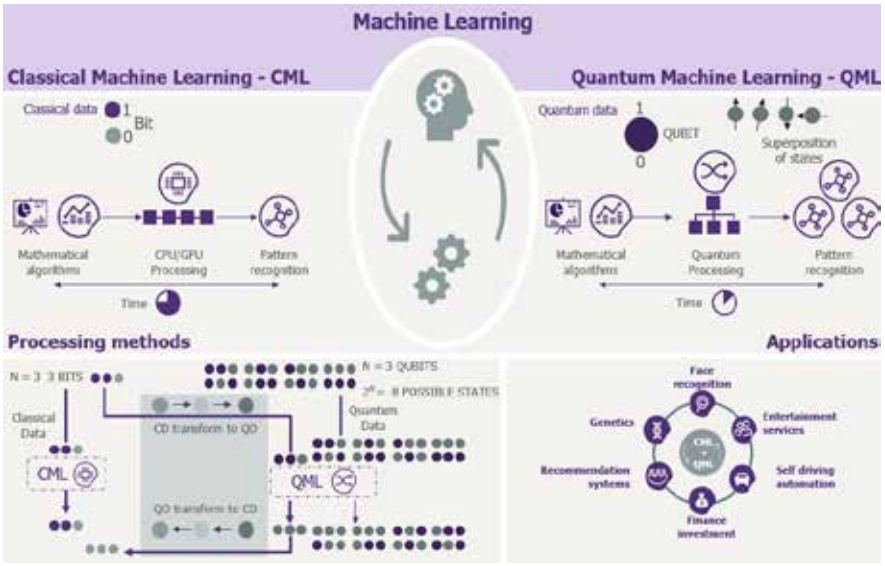

Fig. 4: Classical Machine Learning versus Quantum Machine Learning [7]

References:

[1] R. P. Feynman, "Simulating Physics with Computers," International Journal of Theoretical Physics, vol. 21, no. 6/7, pp. 467-488, 1982.

[2] Montanaro, A. Quantum algorithms: an overview. *npj Quantum Inf 2*, 15023 (2016). https://doi.org/10.1038/npjqi.2015.23

[3] E. Bernstein and U. Vazirani, 1997, Quantum complexity theory, *SIAM Journal on Computing* 26(5):1411-1473.

[4] D. Simon, 1997, On the power of quantum computation, *SIAM Journal on Computing* 26(5):1474-1483.

[5] Grover, L. Quantum mechanics helps in searching for a needle in a haystack. *Phys. Rev. Lett. 79*, 325-328 (1997).

[6] Boyer, M., Brassard, G., Høyer, P. & Tapp, A. Tight bounds on quantum searching. *Fortschr. Phys. 46*, 493-505 (1998).

[7] Riahi LOURIZ, Sep 25, 2019,Highlighting Quantum Computing for Machine Learning

[8] Fred Bellaiche, 2018, On quantum computing and cryptography

[9] Masanori Ohya, Igor V. Volovich,New quantum algorithm for studying NP-complete problems,Reports on Mathematical Physics, Volume 52, Issue 1, 2003, Pages 25-33, ISSN 0034-4877. ■

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Quantum Internet using Quantum Teleportation: Quantum computing challenges

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Introduction

The idea of quantum computing has enlivened a totally different age of researchers, including physicists, engineers, and computer researchers, to generally change the view of data innovation. For the two eras the quantum community has made many experimental trials and it has significantly achieved a greater height in the past few years [1]. The researchers had a great challenge in building up a quantum system and it is tested to its edge using the integration of cloud. The quantum computers have a greater capability of challenging the fast-classical system in solving many intractable problems. The computing system uses a qubit having two quantum states and they are discrete in nature. As the computing intensity is oversimplified there is an exponential growth in quantum computer scales with the quantity of qubits that can be implanted and interconnected inside.

Properties of Quantum Computer
Teleportation: The transmission between two distinct location is possible with quantum states. There is a need of communication channel and entanglement.
Entanglement: Two or more qubits can become connected with the end goal that the condition of one qubit is subject to the others.
Decoherence: The environmental noise intercepts the quantum states and corrupt the signal.
Superposition: Quantum mechanics are adapted to the probability theory.

Fig. 1: The properties of Quantum mechanism benefited by quantum computers

The spin state of an atomic nucleus is used for encoding the information in the quantum computer. Figure 1 shows the properties of quantum mechanism used by quantum computers for a speed of process.

Quantum Internet

The network is connecting all the remote quantum nodes through quantum communication channel. The interconnection of quantum gadgets by means of the Quantum Internet is possible. In fact, the Quantum Internet is fit for supporting functionalities with no immediate partner in the traditional world for example, secure interchanges, dazzle processing, an exponential increment of the quantum registering power, and propelled quantum detecting methods. At a first sight, the structure of the Quantum Internet may seem like a trifling assignment [2]. An old-style bit encodes one of two totally unrelated states, being in just one state whenever. Conversely, a qubit can be in a superposition of the two premises. The basic components of communication are having a transmitter (source), Receiver (destination) and a communication channel [5]. In quantum mechanics the photons can be mapped with the photons and it can be transmitted through fiber or free space. The quantum signals are affected by attenuation and the signal gets distorted. The distorted signal cannot be retrieved, this is the major drawback in Quantum computing. To rectify this drawback the signal has to be measured and re-transmitted. This method is very challenging and a new idea called quantum teleportation is emerged.

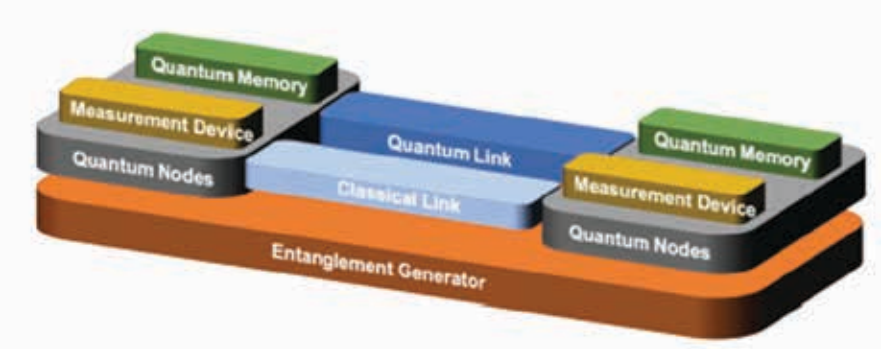

Fig. 2: Physical layers of a Quantum Internet [2].

The quantum internet has different layers like classical communication system. Figure 2 shows the physical layers of quantum internet. The source and destination consist of three components quantum nodes, quantum memory and measurement devices. These three layers are present over the entanglement generator. The error correction methods cannot be applicable for quantum transmission, so the quantum error correction is done through entanglement distribution system [3].

Quantum Teleportation

The experimental demonstration is tested between 500-1400 kilometers of transmission. Two parallel resources are used for quantum teleportation [4]. The classical methods to transmit bits and other link to transmit entangled pair of qubits shared between the sender and the receiver.

Table 1: Quantum Vs Traditional Communication [4].

	Quantum Communication	Conventional Communication
Traditional message (bits)	Dense Coding	Internet
Quantum message (qubits)	Quantum internet	

Table 1 relates the difference between the conventional and quantum communication. The traditional messages are transmitted in the form of bits and quantum message in the form of qubits.

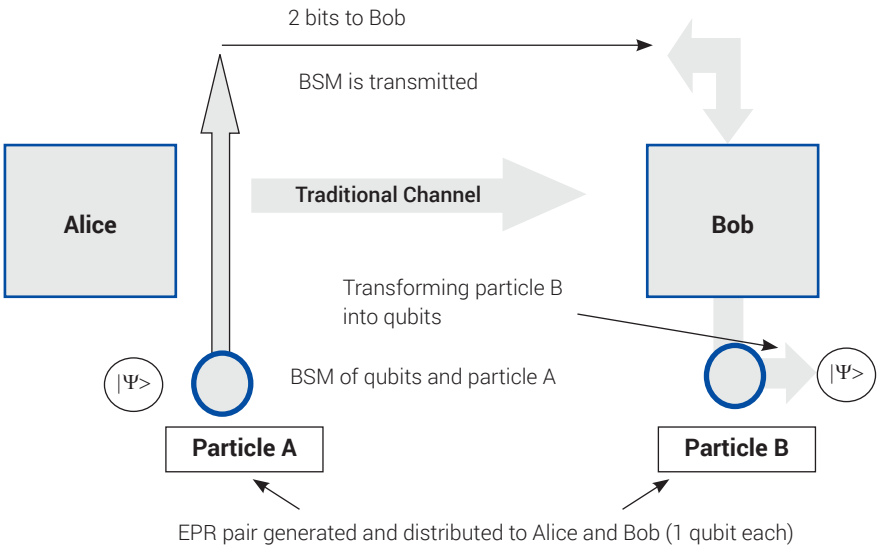

Fig. 3: Quantum Teleportation between Alice and Bob.

Fig. 3 shows the quantum teleportation between Alice and Bob. The transmission takes place with four stages of operation between Alice and Bob. The first step is to generate EPR pair and distributing these pairs from Alice to Bob [6]. The Bell-state Measurement (BSM) of particle A qubits is measured. Two traditional bits are received at Bob through the traditional channel. Integrating the traditional and Quantum possessions is very challenging in quantum networks. If the entanglement is broken new EPR pairs are generated and transmitted.

Conclusion

All computing leaders started to build their own qubit processors. The IBM in 2017 built and tested its own 50 qubits processor. The Google tested its 72 qubits processor and many other companies like Intel, Alibaba are in the quantum race. The emerging quantum computers and quantum internet will change the industry, commerce, military activities of the world.

References

[1] H. Thapliyal and E. Muñoz-Coreas, "Design of Quantum Computing Circuits," in IT Professional, vol. 21, no. 6, pp. 22-26, 1 Nov.-Dec. 2019.

[2] A. S. Cacciapuoti, M. Caleffi, F. Tafuri, F. S. Cataliotti, S. Gherardini and G. Bianchi, "Quantum Internet: Networking Challenges in Distributed Quantum Computing," in IEEE Network, vol. 34, no. 1, pp. 137-143, January/February 2020.

[3] Córcoles, A. D., Kandala, A., Javadi-Abhari, A., McClure, D. T., Cross, A. W., Temme, K. & Gambetta, J. M. (2019). Challenges and Opportunities of Near-Term Quantum Computing Systems. arXiv preprint arXiv:1910.02894.

[4] Cacciapuoti, A. S., Caleffi, M., Van Meter, R., & Hanzo, L. (2019). When Entanglement meets Classical Communications: Quantum Teleportation for the Quantum Internet. arXiv preprint arXiv:1907.06197.

[5] Jerart Julus, L, Manimegalai, D, Sibi Chakkaravarthy,S, 2019, 'FBMC-based dispersion compensation using artificial neural network equalization for long reach-passive optical network', International Journal of Wavelets, Multiresolution and Information Processing, (World Scientific Publishing Company), Vol. 17, No.2.

[6] E. Muñoz-Coreas H. Thapliyal "Quantum circuit design of a t-count optimized integer multiplier" IEEE Trans. Comput. vol. 68 no. 5 pp. 729-739 May 2019.

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Artificial Intelligence in a Quantum World of Computation

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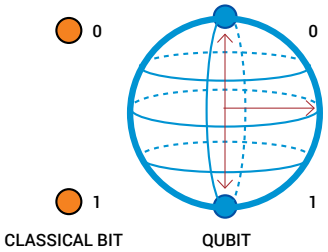
Quantum Computation is the "scientific field that reviews how the quantum conducts of certain subatomic particles (for example photons, electrons, and so forth.) can be utilized to perform calculation and in the long run huge scope data processing". Quantum Computing is a computation device that utilizes quantum mechanical wonders, for example, superposition and entanglement, to perform procedure on information. The quantum processing field was first presented by Yuri Manin in 1980 and Richard Feynman in 1982. This article provides a very brief introduction about traditional and quantum computers, overview of quantum systems, quantum computation components and algorithms, quantum computing for artificial intelligence and artificial intelligence for quantum computing.

Quantum Computing is a beautiful combination of "quantum physics, computer science, and information theory". Quantum Computers (QCs) function in a different manner from regular computers. It should be able to solve specific types of problems in seconds that would take normal computers thousands of years. QCs are currently in the domain of academic research. Google and IBM also have active research programs.

1.1 Traditional Computers Vs Quantum Computers

Traditional Computers follow the binary system. Here, data is represented by binary digits (bits), which can be either 1 or 0. And every element within the computer must be in a state of "1" or "0" at all times. The computer executes instructions by transitioning between different combinations of "1" and "0", but only one combination can be active at a time.

A Quantum Computer is any gadget that utilizes quantum mechanical marvels



to perform calculations and control information. Quantum Computers is a superposition of quantum bits. A quantum bit (Qubit) can be both 1 and 0 at the same time. This state is called superposition.

1.2 Overview of Quantum Systems

A quantum system is a "portion of the whole Universe (environment or physical world) which is taken under consideration to make analysis or to study for quantum mechanics pertaining to the wave-particle duality in that system".

Quantum systems are described by a wave function and it is denoted by a symbol 'ψ'. For a given potential (V(x)), we discover all answers for Schrödinger's condition. These arrangements structure a premise of a vector space called a Hilbert space.

2. Quantum Computation Components and Algorithms

2.1 Quantum Computation Components

A traditional, as well as a quantum computer, essentially consists of 3 parts:

(i) "Memory - which holds the current machine state,
(ii) Processor - which performs elementary operations on the machine state, and
(iii) Input/output - which allows setting the initial state and extracting the final state of the computation".

"Quantum gates" are the fundamental calculation parts for QC. They are altogether different from gates in classical computation systems.

2.2 Quantum Computation Algorithms

In this section, we broadly classify quantum algorithms according to their area of application. And also we will discuss quantum algorithms for graph theory, number theory, and machine learning and so on. Quantum algorithms utilize a "few explicit highlights of the quantum world for instance quantum superposition to get from classical inputs through entangled states to classical outputs more effectively than classical algorithms".

Quantum algorithms use a combination of algorithmic paradigms specific to quantum computing. These paradigms are the "Quantum Fourier Transform (QFT), the Grover Operator (GO), the Harrow Hassidim-Lloyd (HHL) method for linear systems, variational quantum eigen value solver (VQE), and direct Hamiltonian simulation (SIM)". The complete list of algorithms in this article, classified according to their application areas, can be found in Table 1.

3. Quantum Computing For Artificial Intelligence

The utilization of "quantum algorithms in artificial intelligence techniques will support machines' learning capacities". This will prompt upgrades in the turn of events, among others, of predication frameworks, including those of the financial industry.

"Quantum machine learning can be more efficient than classic machine learning, at least for certain models that are intrinsically hard to learn using conventional

Table 1: Overview of Quantum Algorithms

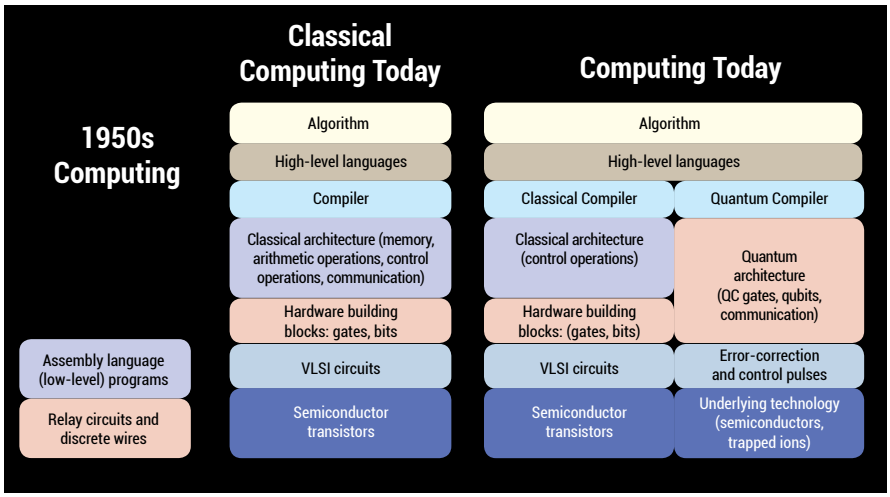
Class	Problem / Algorithm	Paradigms used	Hardware	Simulation Match
Inverse Function Computation	Grover's Algorithm Bemstein-Vazirani	GO N.A.	QX4 QX4, QX5	Medium High
Number-theoretic Applications	Shor's Factoring Algorithm	QFT	QX4	Medium
Algebraic Applications	Linear Systems Matrix Elements Group Representations Matrix Product Verification Subgroup Isomorphism Persistent Homology	HHL QFT GO QFT GO, QFT	QX4L ESSEX N.A. None QX4	Low Low N.A. N.A. Med-Low
Graph Applications	Quantum Random Walk Minimum Spanning Tree Maximum Flow Approximate Quantum Algorithms	N.A. GO GO SIM	VIGO QX4 QX4 QX	Med-Low Med-Low Med-Low High
Learning Applications	Quantum Principal Component Analysis (PCA) Quantum Support Vector Machines (SVM) Partition Function	QFT QFT QFT	QX4 None QX4	Med N.A. Med-Low
Quantum Simulation	Schrodinger Equation Simulation Transverse Ising Model Simulation	SIM VQE	QX4 none	Low N.A.
Quantum Utilities	State Preparation Quantum Tomography Quantum Error Correction	N.A. N.A. N.A.	QX4 QX4 QX4	Med Med Med

computers." However, "We still have to find out to what extent these models appear in practical applications" – by Samuel Fernández Lorenzo, a quantum algorithm researcher.

Some ways quantum computing could change the future of artificial intelligence:

(i) Solve complex problem quickly
(ii) Handling of large Datasets
(iii) Building better models
(iv) Integration of multiple datasets
(v) Combat fraud detection
(vi) More accurate algorithms

The regular expansion that quantum computers offer AI and machine learning isn't lost on business people, who are occupied presently learning approaches to misuse the specialized blend.



4. Artificial Intelligence for Quantum Computing

Every quantum computer experiences decoherence, but quantum computers that are successful at delaying and minimizing decoherence perform better. That's why, when discussing a quantum computer and its ability to do computation, we need to discuss how well it does at preventing decoherence.

To quantify that, the parameters T1 and T2 are particularly important:

- T1 helps to quantify how quickly the qubits experience energy loss due to environmental interaction (energy loss would result in a change in frequency, which would make coherent qubits experience decoherence).
- T2 helps to quantify how quickly the qubits experience a phase change due to interaction with the environment, again a cause of decoherence.

Evolutionary algorithms could be useful to "compile" quantum circuits in order to generate equivalent circuits characterized by better values of T1 and T2. Pattern recognition techniques could be used to identify critical sequence of quantum gates in circuits and replace them with suitable collections of gates in order to improve T1 and T2.

5. Conclusion

Quantum computing is promising field. The reason for quantum computing is to help and broaden the capacities of customary processing. Quantum computers are intended to perform undertakings considerably more precisely and proficiently than ordinary PCs, giving engineers another instrument for explicit applications. Despite the fact that quantum figuring has significant hindrances their latent capacity has numerous applications that exceed the expenses. A portion of the applications incorporate cryptanalysis, PC models of climate frameworks or of complex concoction responses and issues which include an incredible large number of factors.

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Dr. S. Balakrishnan (CSI Membership No. 2060000034) is a Professor and Head, Department of Computer Science and Business Systems at Sri Krishna College of Engineering and Technology, Coimbatore, Tamilnadu, India. He has 17 years of experience in teaching, research and administration. He has published over 15 books, 3 Book Chapters, 21 Technical articles in CSI Communications Magazine, 1 article in Electronics for You (EFY) magazine, 3 articles in Open Source for You Magazine and over 100 publications in highly cited Journals and Conferences. Some of his professional awards include: Faculty with Maximum Publishing in CSI Communications 2017-2019, International Data Science Writer of the Year 2019, MTC Global Outstanding Researcher Award, Contributors Competition Winner July 2019, August 2019 and September 2019 by DataScience Foundation, with cash prize of £100, 100 Inspiring Authors of India, Deloitte Innovation Award - Cash Prize Rs.10,000/- from Deloittee for Smart India Hackathon 2018, Patent Published Award, Impactful Author of the Year 2017-18. His research interests are Artificial Intelligence, Cloud Computing and IoT. He has delivered several guest lectures, seminars and chaired a session for various Conferences. He is serving as a Reviewer and Editorial Board Member of many reputed Journals and acted as Session chair and Technical Program Committee member of National conferences and International Conferences at Vietnam, China, America and Bangkok. He has published more than 19 Patents on IoT Applications.

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On behalf of CSI Publication Committee

Prof. A. K. Nayak
Publisher

Viewing the Covid-19 and Lockdown situation in the country, the ExecCom of CSI has decided to give 15% DISCOUNT in new enrollment of Life Membership of CSI till 31st August, 2020.

Dr. Vipin Tyagi
Hon. Secretary, CSI

Emerging trends in Surgical Robots

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Surgical Robots are those robots that are used by medical professionals to assist them in surgeries. They are primarily used for minimally invasive surgeries and have shown potential in being used for laparoscopic as well as open surgeries [2]. The first-ever surgical robot developed was the Arthrobot by James McEwen and Dr. Brian Day in 1983. This robot was designed to position a patient's leg on voice command [1]. Later on, two more robots were developed- PUMA 200 and 560 for positioning a needle in a brain biopsy via CT and prostatectomy respectively [3]. This sparked newer developments in this field and led to three robots being approved by FDA, AESOP for endoscopy in 1994, ZEUS for minimally invasive surgery in 2000, and DaVinci for laparoscopy in 2001[4]. Nowadays surgical robots are used for many types of surgical procedures such as cardiac, thoracic, urologic, gastrointestinal, orthopedic, etc.

Over the past three decades, there have many advancements seen in surgical robots in the form of new robots that are coming out every year with latest technologies and innovations with them. Some of which have been discussed in this article.

DaVinci System - Developed by Intuitive Surgical, it is one of the most popular medical robots worldwide [5]. What makes this robot unique is its use of surgeon console, patient, and vision cart in its system, which allows surgeons to easily yet effectively perform the surgery by allowing easy control of the instruments via robotic arms, better look of the anatomy of the affected area in 3-D, making it an optimal choice for surgeries [6].

Senhance - A console robotic system comprising of an open remote-controlling station, connection joints, 3D HD screen and glasses, and 4 surgical arms [7]. Even though its working principle is similar to the DaVinci system, it is still limited to traditional laparoscopy. The main advantage of Senhance is its ability to support haptics and novel eye-tracking software.

CyberKnife - A robot developed for Stereotactic Surgery and Body Radiation Therapy [12]. It is designed for removal of tumours by killing cancerous cells presented in the affected region of the body by making use of real time image guidance to locate the region and deliver the treatment. It uses real-time motion management that allows the robot to efficiently deliver the radiation even if the position of the targeted area changes at that time, increases overall accuracy, feasibility and safety of the overall treatment.

Revo-I - It is a surgical robot developed by South Korea and is similar to DaVinci System in terms of the overall structure [9]. The main advantage of Revo-I is the Hepatic Feedback that allows it to be used for cholecystectomy and gynaecologic procedures. Moreover, it is stated to have a structure with longer build life as the company states that the reusable instruments have twice the usability life than DaVinci's instruments.

Flex - It is a robot designed for better accessibility to the organs located deep inside the body [7]. It is used for transoral and gynaecologic surgeries and was recently discovered to have the capability to conduct rectal cancer resection. It composes of segments attached with cables giving the system the flexibility it needs for operating, along with a 180-degree rotating camera, 6 LEDs, and a joystick controller with 2D visual feedback. Its advantages are having the capability to perform a variety of transoral surgeries whilst occupying a fraction of the space as compared to other robots.

Mako – A robot primarily designed for conducting orthopaedic surgeries for the lower region [10]. It is used by surgeons to perform total and partial knee replacement and total hip replacement. It makes use of CT-based 3D rendering of the anatomy of the affected. This allows the surgeons to easily plan before and during the surgery and decide the suitable implants, their positioning etc making it ideal for bone resections, thereby increasing overall accuracy, safety, injuries and makes faster recovery possible.

Renaissance - It is a robot used for spinal surgery [8]. The main advantage that it offers is the ability to create a blueprint for the surgery, which is unique for every patient, increasing accuracy, reduces complications, and faster recovery for people with spinal issues like scoliosis surgery, making the Renaissance ideal for biopsies, spinal fusion, and kyphoplasty.

Monarch - Designed for lung endoscopy, it makes use of a telescoping design that allows the bronchoscope to reach tighter spaces, via a video game controller design for providing better control and management to the surgeon [11]. It makes use of a camera which allows the surgeons to have a deeper look at the anatomy of the affected lung and features better navigation of the endoscope by making use of electromagnets, pattern recognition and kinematic data. It also boasts of a unique control where the surgeon can "park" the robot to fix the position of the endoscope, this helps in providing better focus and intervention over the affected are, making it ideal for biopsies ,lung cancer treatment etc.

Miniature - A robot for minimally invasive colon resection surgeries for conditions like Crohn's Disease, colon cancer, etc. [8]. It is a revolutionary piece of technology as unlike conventional surgical robots that operate using robotic arms, this robot can operate by completing inserting it in the patient's abdomen via a small incision, this eliminates the need of an operating room as it is capable of performing the surgery using the existent techniques.

CorPath - A robot designed for cardiovascular treatments [13]. It features robot assisted control of the instruments for better management of the instruments. It also makes use Rotate on Retract Technology for quick navigation, Radiation Shield and Power Vision Monitor with 4K resolution for enabling better view of the region without any hassle.

Endomina - A robot designed in Brussels, Belgium. It has obtained Conformité Europeené status in Europe and is currently

waiting for United States of America's Food and Drug Administration's approval [7]. It is designed for endoscopic suturing and anterior-posterior apposition in the stomach. It consists of a triangular platform with camera-fitted graspers. Its main advantage is better control and management of the instrument as it makes use of a unique tightening system that allows delivery of the necessary force to create a suture, improving accuracy, safety, and feasibility of the overall surgery.

NeoGuide - Specially designed for the treatment of colon related problems [7]. It makes use of a computer-aided mapping system during the surgery for better accuracy and precision as it allows the surgeon to trace the lumen of the colon, making the robot applicable for lower GI endoscopy and interventions. Due to this, it has many advantages such as application of less force on the colon wall that results in a reduction of the colonic looping phenomena that is responsible for 90% of the pains the patient gets after a colonoscopy, it also improves identification of pathological anomalies and enables colonoscopy without any sedation.

Challenges

Even though surgical robots have received praise for their versatility and functionality, but they have also faced criticisms as well due to the following challenges.

Economic Challenges - Many robots such as DaVinci, Senhance, etc are known for their exorbitant price tags. These prevent many hospitals from buying such robots especially those situated in rural areas. This causes the market to suffer as it causes the sales to go down.

Technical Challenges - Many surgeons have prevented themselves from using surgical robots due to the technical difficulties associated with it. The majority of the difficulties associated with it are due to the lack of training given to them. Problems such as lack of human-robot interaction due to tool dexterity, lack of hand-eye coordination, poor force and haptic feedback, reduced sensory perceptions, limited workspace area, etc [14]. Various incidents have been reported in the past such as robotic arms hitting a lady patient's face during a hysterectomy accidently grasping a tissue and not leaving it during colorectal surgery, pinching and bursting a blood vessel etc during hysterectomy etc, resulting in injuries, grave accidents and in some cases, even deaths [15]. Such incidents prevent hospitals from investing in them.

Overcoming the Challenges

To combat the challenges faced by such robots, companies have started searching for many solutions and innovations to overcome the challenges. To combat the economic challenges companies started releasing budget versions of their robots such as DaVinci X in 2017 [5]. Apart from this, newer technologies are also developed to reduce tool dexterity such as Embedded Actuations, Link-Based, etc. Apart from this, many alternatives are also being developed such as capsule robots that can be inserted inside the affected area to explore and understand the affected area's anatomy. Another alternative is Microrobots, they are proven to be more effective than surgical robots for minimally invasive surgeries, therapy, monitoring blood pressure, material removal, etc. However, they are not adopted due to battery and tracking problems for which research is under process for finding an optimal solution [14].

Conclusion

In the past few years, surgical robots have emerged to become one of the fastest growing sectors in Medical Science. Initially intended to only act as an assistant to a surgeon in minimally invasive surgeries, now they have grown to become an integral part of the medical line. The main credit behind development goes to a number of advantages associated with them, such as faster recovery time, reduces overall stress over the surgeons by ensuring more accuracy, precision, efficiency, functionality, control and management of the instruments during the surgery as compared to other conventional surgeries, and increases overall safety, feasibility and effectiveness of the surgery. Despite the challenges faced by them, we can't deny the fact they are an integral part of Medical Science and have resulted in causing an overall improvement in terms of safety and other factors, and these are going to increase in future, in my opinion as researchers, scientists, scholars and companies around the world are tirelessly working to overcome the difficulties so that more hospitals invest in such robots and more people are benefitted from it.

References

[1] Rubin, A. (2019, August 20). The History of Robotic Surgery. Retrieved April 8, 2020, from https://www.flushinghospital.org/newsletter/the-history-of-robotic-surgery/

[2] Robotic surgery. (2020, February 04). Retrieved April 7, 2020, from https://www.mayoclinic.org/tests-procedures/robotic-surgery/about/pac-20394974

[3] Ashrafian, H., Clancy, O., Grover, V., & Darzi, A. (2017). The evolution of robotic surgery: surgical and anaesthetic aspects. *BJA: British Journal of Anaesthesia, 119* (suppl_1), i72-i84.

[4] Kaye, A. D., & Urman, R. D. (2017). Historical Overview of Robotic surgery. In *Perioperative management in robotic surgery*. Cambridge: Cambridge University Press.

[5] https://www.davincisurgery.com/da-vinci-systems/about-da-vinci-systems). Retrieved April 2020

[6] About the daVinci Surgical System. Retrieved from https://www.uchealth.com/services/robotic-surgery/patient-information/davinci-surgical-system/

[7] Khandalavala, K., Shimon, T., Flores, L., Armijo, P. R., & Oleynikov, D. (2020). Emerging surgical robotic technology: A progression toward microbots. *Annals of Laparoscopic and Endoscopic Surgery, 5*, 3-3. doi:10.21037/ales.2019.10.02

[8] 3 Amazing Advances in Robotic Surgery: Tri-City Medical Center. (2018, December 29). Retrieved April 13, 2020, from https://www.tricitymed.org/2017/04/3-amazing-advances-robotic-surgery/

[9] Meerecompany. (n.d.). Retrieved April, 2020, from http://www.meerecompany.com/en/our-business

[10] Mako Orthopedic Robot. (n.d.). Retrieved April, 2020, from https://www.unitypoint.org/peoria/mako-orthopedic-robot.aspx

[11] Monarch Robotic-assisted Bronchoscopy - Auris Health. (n.d.). Retrieved April, 2020, from https://www.aurishealth.com/procedure/bronchoscopy/features

[12] How it Works. (2020, March 10). Retrieved April, 2020, from https://cyberknife.com/cyberknife-how-it-works/

[13] How it works. (n.d.). Retrieved May,

2020, from https://www.corindus.com/corpath-grx/how-it-works

[14] Simaan, N., Yasin, R. M., & Wang, L. (2018). Medical technologies and challenges of robot-assisted minimally invasive intervention and diagnostics. *Annual Review of Control, Robotics, and Autonomous Systems, 1*, 465-490.

[15] Rozof, K. (2017, October 11). Freak Accidents Increase in Da Vinci Robot Surgery. Retrieved May 13, 2020, from https://thomasjhenrylaw.com/blog/dangerous-drugs-devices/freak-accidents-increase-in-da-vinci-robot-surgery/

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Themes for CSI Communications

Month & Year	Theme	Month & Year	Theme
July, 2020	**Virtual Reality**	October, 2020	**Robotics**
August, 2020	**Open source software**	November, 2020	**Deep Learning**
September, 2020	**Digital Twins**	December, 2020	**Industry 4.0**

Quantum Machine Learning-Where Quantum Computing Meets Machine Learning

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Machine learning tools are considered potent resources for analyzing data and determining data patterns. Fired by increased computing power and advanced algorithms, it is becoming more and more potent with time. Since quantum computing has the capacity to see data in an unbelievably unique way, it can find counter-intuitive patterns in data that are way difficult for classical systems. Quantum machine learning has come up as a field that joins the benefits of machine learning with the advances of quantum computing. This article introduces the area and throws some light on its necessity in our lives, along with its advantages. We also describe a few algorithms briefly in simple terms to give the reader an insight into their working.

Introduction:

Humans have started looking for a pattern in data much before the advent of computers. Ptolemy matched the motion of stars to a geocentric cosmos model. He explained the motion of planets based on the pattern of data. In the 16th century, Kepler observed the trend of the elliptical movement of planets in the solar system with the sun at one of its focus by analyzing patterns from data of Copernicus and Brahe [1]. After that, such astronomical data analysis gave birth to loads of critical mathematical techniques from solving linear equations to polynomial interpolation, learning optima through gradient descent, and fitting of least squares. The 19th and early 20th century saw the rise of varieties of mathematical techniques for discovering patterns in data by analyzing it. Then in the mid-20th century, came the age of digital computers, which paved the way for automating procedures of data analysis. The world has witnessed the exponential advancement in computer power in the past half-century. It has given an idea of implementing data analysis methods based on linear algebra like principal component analysis and regression. This gave rise to more complicated purposes of learning like support vector machines. As digital computers progressed speedily, novel machine learning methods also came into existence. In the 1950s, perceptron was implemented and artificial neural networks came into existence. The 1960s to 1990s saw advances in deep learning. Most of the important machine learning algorithms were discovered in the 1990s. After that, there has been no significant advancement in the field, apart from using different permutations and combinations of data and algorithms along with varying computational power. Due to this, machine learning has become more of an optimization problem [2]. The rise of quantum computing and quantum information processing provided a new dimension to the field of machine learning by empowering it with the unbelievable pattern-finding capability of quantum mechanics. Classical computers and deep learning models are known to recognize patterns they can produce. Since the quantum information processors can process data that is tough for classical computers computationally, it is a good chance that they can see data patterns that are difficult for classical computers. With this article, we wish to throw some light on the nuances of quantum machine learning, differences with classical machine learning, its relevance in today's world, and future aspects along with advantages and disadvantages. We aim to introduce a beginner with this field and encourage them to read further in this direction.

What is QML?

Quantum machine learning is a young but rapidly growing field where machine learning works on the concepts of quantum mechanics. Its aim is development of quantum algorithms that are capable of performing machine learning [3]. The disciplines of machine learning and quantum computing can be combined in four ways, as shown in figure 1 [2].

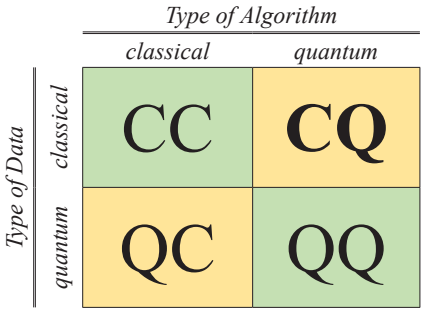

Fig. 1: Four approaches to combine the fields of machine learning and quantum computing.

In the above figure, the first letter is for the system under observation, i.e., the data being used in the experimentation, and signifies if it is quantum or classical. The second letter means what type of device is used for the processing, whether it is a conventional system or a quantum system. This permutation combination leads to four different approaches. CC- processing classical data on classical computers, CQ- processing classical data on quantum computers, QC- processing quantum data on a classical device, and QQ- processing quantum data on a quantum device. The

CQ setup, where quantum devices process classical data, is mostly used by researchers. The datasets, which are observations from classical computers, include images, text, or macroeconomic variables taken by quantum computers for analysis. Quantum computers are known to find an unusual pattern in data that are not possible classically. Qubits, the fundamental units of processing in quantum computers, have the capacity to hold data that is unimaginable by their classical counterparts. In terms of speed and pattern finding, quantum computing is much more promising than classical computing. Hence, it is expected to get near-perfect results than classical computers could ever generate on such datasets. The CQ approach mainly aims at developing quantum algorithms for data mining tasks. In light of various strategies proposed by the research community in the past decades, the most focused ones are either translating existing machine learning algorithms in quantum language or developing genuinely new algorithms inspired by principles of quantum computing.

Types of Quantum Machine Learning:

Similar to machine learning, there are two types of quantum machine learning:

- Supervised learning
- Unsupervised learning.

When the learning algorithm uses labeled data to learn before it uses its learning on unlabeled data, it is called supervised learning (eg., quantum support vector machines, etc.). When the learning algorithm finds patterns in sample data on its own, the phenomena are called unsupervised learning (eg., hierarchical clustering, quantum manifold embedding, etc.). Learning algorithms, be it statistical or non-statistical or supervised or unsupervised, are supposed to generalize their learning in a suitable manner. Their learning should be valid beyond the training data. However, without prior knowledge, achieving a learning model that is equally answerable to all types of problems within proper computational time is a bit doubtful.

Some Quantum Machine Learning Algorithms:

The underlying problem of supervised learning algorithms is classification. Judging by the feature vectors and corresponding labels provided in the training dataset, learning algorithms try to offer classes to the testing data. However, the main problem of unsupervised learning is clustering. Since they don't have any training dataset, they try to find similarities and patterns in the dataset on their own. Based on these similarities, the learning algorithms build different clusters of similar elements/data. Many machine learning algorithms have found their places in the quantum world; here, we are discussing two widely used and recognized algorithms- k-NN and SVM, in layman terms.

Quantum Version of k-Nearest Neighbor:

KNN is a simple standard way of performing pattern classification. With a training set of labeled feature vectors and an unlabeled input vector, the algorithm tends to select the label for the input vector that frequently appears amidst its k nearest neighbors. It assumes that similar examples are encoded with close feature vectors, and it is the case most of the time. Inner product, Euclidian, and Hamming distance are the usual distance measures here. Also, in k-nearest neighbors, the selection of 'k' is the most crucial as it influences the result. Too high value for 'k' can lose the local information, and the result can be biased by majority values present in the training dataset whereas a too small 'k' value might give a result that is more noise-prone [4]. Algorithms like k-NN are based on the distance metric to evaluate the two feature vectors. Hence, for translating this algorithm in its quantum version, the focus is on the efficient evaluation of classical distance by the quantum algorithm. Fidelity (or overlap) of two quantum states can be used as a similarity measure, as proposed by Aimeur, Brassard, and Gambs [5]. The quantum version of k-NN is said to have a quadratic speed-up in comparison to its classical competitors.

Quantum Support Vector Machine:

We all know Support Vector Machine as a kernel-based classifier, which is inherently a binary classifier. It is known for performing linear discrimination between elements of two classes by finding a hyperplane in such a way that all the training samples of two separate classes assemble on its either side. A strong classifier for the dataset gives a maximum margin between data and hyperplane. Its capability of generalization to nonlinear hyper-surfaces via kernel function is one of the greatest powers. SVM has the ability to be carried out with a complexity logarithmic in vector size and size of the training set on a quantum computer. The very first QSVM was discussed in the early phases of the 2000s [1]. It is a paradigmatic example of a quantum machine learning algorithm. The input data can have various sources, but once it is available to a quantum device, it is processed with quantum phase estimation and matrix inversion. This algorithm accelerates exponentially where classical sampling algorithms take polynomial time [6].

Difference between Machine Learning and Quantum Machine Learning:

Although there isn't any significant difference between the two approaches apart from one being based on classical mechanics and the other being quantum mechanics-inspired at its core. This fact alone brings about a big difference in both methods. Traditional machine learning uses classical bits, which has a limited scope of storage values. They can only store either 0 or 1 at any time, but quantum bits (or qubits) used in quantum machine learning can save both 0 and 1 at any given time (Fig. 2). As a result, the value of a qubit state is not just limited to two discrete values; it can store much more information than that i.e. = 2^n. So, that makes quantum machine learning capable of analyzing and storing more data than classical machine learning.

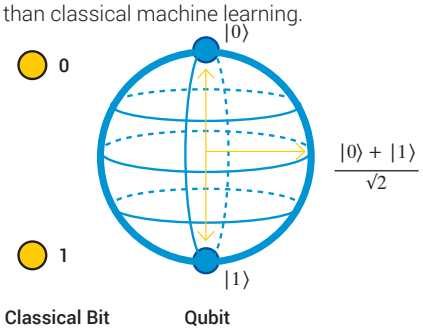

Fig. 2: Difference between classical and quantum bits- a classical bit can store either of the two values, i.e., 0 or 1; while a qubit can store 0, 1 or both 0 and 1 at the same time. The arrows on the Bloch sphere show range of values $|0\rangle$ and $|1\rangle$ a qubit can store.

Machine learning algorithms are usually utilized for computing large amounts of data, while quantum machine learning intelligently enhances such capabilities. It analyzes

quantum states and quantum computers to find a better result.

Need for Quantum Machine Learning:

Quantum computing and it's way of analyzing data have brought a fresh way of looking at problems. With phenomena like superposition and entanglement exhibited by quantum data, joint probability distributions are generated. Classical computational resources would be exhausted in an attempt to store and represent such results. Quantum machine learning, similarly, analyzes data to great depths, and it can be generalized in a better way as well. Hence, quantum machine learning is the need of today and the necessity of the future. With the complexity and size of data increasing every day, such strong computing methods would be a requirement in the coming days.

Advantages of Quantum Machine Learning over Classical Machine Learning:

A lot of applications based on machine learning perform repetition of complex mathematical computations. The actual advantages of quantum machine learning are dependent on several factors like network architecture, design selection, implementation criteria, and software. However, the common five advantages of quantum machine learning are [7]:

1. *It speeds-up training time*- properties of quantum computers like superposition, entanglement, and coherence are capable of processing information in ways classical computers can not and hence quantum computers gain a square root speed-up on classical computers.
2. *It is capable of handling a complex network structure*- the quantum adiabatic approach permits the formation of deep learning networks to be much more complicated than possible in classical computers.
3. *It automatically adjusts network hyperparameters*- to model parameters deep learning uses hyperparameters like the number of hidden layers, epochs, and hidden nodes; learning rate; and size of the kernel. It is not an easy task to tune the network for optimal performance, but quantum computing promises to automatically take care of it by adjusting hyperparameters.
4. It is capable of performing complex tensor and matrix multiplications at high speed.
5. *It achieves true objective function goals with quantum tunneling*- classical computers use gradient descent to optimize neural networks. Still, they face the problem of local minima because of the local and deterministic behavior of the gradient search. However, a quantum computer has a phenomenon called quantum tunneling that allows optimum global solution.

Conclusion:

Quantum machine learning is a research-friendly branch of science where we can get the advantages of machine learning algorithms using quantum techniques. It is where computer science meets quantum physics. In this article, we attempted to introduce the topic to a novice in the most basic terms. In this world where data is generating at an unbelievable speed by the hour, we need to analyze them with speed to catch up and maintain the authenticity of results too. Quantum machine learning is one way of achieving the best results in reduced time as per research. Its unique way of analyzing data and finding patterns makes it an essential tool in the area of data science. We hope this article encourages the reader to explore the topic further.

References:

[1] Biamonte, J., Wittek, P., Pancotti, N., Rebentrost, P., Wiebe, N., & Lloyd, S. (2017). Quantum machine learning. Nature, 549(7671), 195-202.

[2] Schuld, M. & Petruccione, F. (2018). Supervised Learning with Quantum Computers. Springer.

[3] Online website/blog/article/: https://towardsdatascience.com/quantum-machine-learning-a-faster-clustering-algorithm-on-a-quantum-computer-9a5bf5a3061c

[4] Schuld, M., Sinayskiy, I., & Petruccione, F. (2015). An introduction to quantum machine learning. Contemporary Physics, 56(2), 172-185.

[5] Aïmeur, E., Brassard, G., & Gambs, S. (2006, June). Machine learning in a quantum world. In Conference of the Canadian Society for Computational Studies of Intelligence (pp. 431-442). Springer, Berlin, Heidelberg.

[6] Rebentrost, P., Mohseni, M., & Lloyd, S. (2014). Quantum support vector machine for big data classification. Physical review letters, 113(13), 130503.

[7] https://amitray.com/five-key-benefits-of-quantum-machine-learning/

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About the Authors

Pragya Katyayan (Membership No: 01387950) is a Ph.D. student at the Dept. of Computer Science, Banasthali Vidyapith (Deemed to be University), Rajasthan, India. Her doctoral research explores quantum dynamics for natural language processing tasks. She has completed her M.Sc. in Computer Science in the year 2018 from Banasthali Vidyapith. Her master's dissertation was in the field of natural language processing. She has published a few research papers and book chapters in journals and books of repute. Before her M.Sc., she has worked with Microsoft, India as a Consultant on projects involving NLP. She also has a Bachelor's degree with honors in Computer Science and an MBA from Banasthali Vidyapith. She is a student member of the CSI. Her research interests are natural language processing, quantum computing, quantum information processing, Machine learning, deep learning, and artificial intelligence.

Dr. Nisheeth Joshi (Life Membership No: L1500159) is an Associate Professor in the Dept. of Computer Science, Banasthali Vidyapith, Rajasthan, India, and has over 13 years of experience in teaching and research. He did his Ph.D. in 2013 in the area of machine translation evaluation. He is the recipient of the prestigious ISTE-U.P. Govt. National Award for Outstanding Work Done in Specified Areas of Engineering and Technology-2019. He has over 100 publications in journals and conferences of repute, four copyrights, three books, two MOOCs, and two technology transfers to his credit. He has also been a mentor and consultant to various startups working in the area of Cognitive Computing, Natural Language Processing, Speech Processing, Multimodal Information Retrieval, and Machine Translation. His research interests include natural language processing, machine translation, quantum information processing, and artificial intelligence.

Quantum Computing Security Corner

Reshma T. Ladda
Asst. Professor (K. B. Joshi Institute of Information Technology, Pune), Email: reshma.miniyar@gmail.com

Quantum computing is a rapidly growing area of computer science which is bringing in paradigm shift to the base of cybersecurity. Quantum computing will help to change the way we process credit cards, store data, the way websites are secured and daily communications. But it can also bring disruption in current security walls.

Introduction of Quantum Computing

Quantum computing works with state of 0 and 1 like traditional binary computer system. This facilitates work on millions of computations in parallel, thereby, increasing the speed of multi task processing. Many area of today's market such as drug discovery, stock market prediction, gene sequencing, and, of course, cryptography — a key component of cybersecurity.

Quantum Technology can solve many complex problems much faster than ever before and will have intense effect on the global economy.

Beside the numerous benefits, quantum technology, like any other emerging technologies, can also have many risks. The most harmful risk is to Cryptography mechanism.

Quantum Security Corner

Today's important need is to develop new devices and new methods to overcome the threat of quantum computing to cybersecurity. This is called Quantum Security Corner.

Quantum security mainly divided into four parts

1. QRNG (Quantum Random Number Generation): This method ensures that encrypted keys are very strong and are not easy to predict. So that keys cannot be hacked easily or decrypted. This means, more the random numbers used, more the secured data will be.
2. QRNE (Quantum-Ready Network Encryption): This method allows encryption system to combine quantum safe solution.
3. QKD (Quantum Key Distribution): In this method to enhance the secrecy of encryption keys and to boost up the trust of the organization, photons (particles of light) are used.
4. QRAs (Quantum Resistant Algorithms): This type of algorithms decreases the risk of hacking because they are specially designed algorithms to fight against general, well known quantum attacks.

Some other Security Measures: Users should follow some basic thumb-rules to ensure security to their data.

- **Be Active always**: User must follow frequent quantum risk assessments to understand security level of any organisation and to ensure that organisations are ready to survive in post quantum era. Organisation must always be ready to handle the quantum attacks. They must update their security walls and should adapt new technologies to build strong and fully secured database system of the organisation.
- **Ensure Quickness:** Organisations must ensure that their existing encryption solutions are crypto-agile and can upgrade quickly in new cybersecurity landscape. Apart from readily available algorithm of quantum computing they should develop customised algorithm.
- **Use of advanced Cryptography:** Try to develop new advance cryptography method which is hard to break the security system even for quantum computer.

By installing these security measures in the right way, at the right time, users can protect their data in the quantum world.

This protection act not only ensures staff, customers and assets are protected, and it also delivers a host of benefits from moderating the risk of cybersecurity incidents to increasing customer loyalty and trust through forward-thinking innovations.

References:

- Quantum-Proof Cryptography & Its Role In Security: https://analyticsindiamag.com/quantum-proof-cryptography-its-role-in-security/
- The Impact of Quantum Computing on Cybersecurity: https://www.okta.com/blog/2019/07/the-impact-of-quantum-computing-on-cybersecurity/
- The journey towards Quantum-Safe Security: https://www.idquantique.com/the-journey-towards-quantum-safe-security/
- Is quantum computing the end of security as we know it?: https://techbeacon.com/security/quantum-computing-end-security-we-know-it

About the Author

Mrs Reshma T. Ladda (Membership No: F8000999) working as Asst. Professor (K. B. Joshi Institute of Information Technology, Pune). Her area of Interest is Current trends in Computer Science and IT. She is a lecturer with an experience of 10 years teaching in Computer Science at Graduation and Post–Graduation level. Worked with reputed institutions including Maharshi Karve's KB Joshi Institute of IT (Pune), Aptech Institute (Bangalore), Deogiri College (Aurangabad) Proficiency in teaching C, C++, Core JAVA, Web Designing, Data Structure, Operating System, e–Commerce. She published multiple research papers on different forums, covering various current trends in computer science and information & technology.

International Web Conference on "Impact of Covid-19 on Education System"

Organized by Region-VI

Reported by **Mr. Pradeep Rathi,** Regional Vice President, Region-VI

(Inset Top to Bottom) Mr. Pradeep Rathi, Dr. Smita Kaskar, Professor (Dr.) Ratnadeep Deshmukh, Editor-In-Chief, CSI Journal of Computing and Vice Chancellor Professor (Dr.) Pramod Yeole

On initiative of Mr. Pradeep Rathi, Regional Vice President (Region-6) an International Web Conference on "Impact of Covid-19 on Education System" was organized with Dr. Bahasaheb Ambedkar Marathwada University (BAMU), Aurangabad and in association and support of CSI Aurangabad Chapter. For the said conference Wikimedia India and IETE were associate partners. The said conference was jointly sponsored by Industry giants Larsen & Toubro, 3i Zone, D-Link Academy, FEAST Software and Academic Institutions who are also CSI Student Body Colleges Chh. Sahu College of Engineering and MIT Group of Institutes, Aurangabad and J. T. Mahajan College of Engineering, Faijpur, Jalgoan to name a few.

The International Web Conference on "Impact of Covid-19 on Education System" was attended by 9,200 delegates from 26 states of India and 16 international countries. The panel of speakers consisted of eminent personalities from Government Sector, USA, Italy, Japan , Industrialists and Indian Academia. In the history of CSI since its inception in 1965 this conference has been the biggest and most successful conference. Prof. A.K. Nayak, IPP, Mr. Pradeep Rathi, RVP-6 and Professor Ratnadeep Deshmukh (CSI NC Member-2019-20) were the torch bearers on behalf of CSI for the conference.

The conference from inception to implementation was organized in 12 days in consultation with all CSI Student Body Colleges in Aurangabad Region and Dr. Ulhas B. Shinde, Chairman,

Mr. Pradeep Rathi (RVP-VI, CSI and Founder & Mentor-in-Chief, 3i Zone)

Vice Chancellor Professor (Dr.) Pramod Yeole and (Inset Top to Bottom) Prof. A. K. Nayak, Immd. Past Paresident, CSI, Mr. Pradeep Rathi, Professor (Dr.) Ratnadeep Deshmukh, Editor-In-Chief, CSI Journal of Computing and Dr. Rahul Deshmukh

Prof. A.K. Nayak, Immd. Past Paresident, CSI (and Inset Top to Bottom) Mr. Pradeep Rathi, RVP-VI, Dr. Kakarwal and Professor (Dr.) Ratnadeep Deshmukh, Editor-In-Chief, CSI Journal of Computing

CSI Aurangabad Chapter. Dr. Ratnadeep Deshmukh and Dr. Sachin Deshmukh of BAMU were the Convener and Chairman Welcome Committee of the conference respectively.

Prof. Pramod Yeole, Vice-Chancellor, BANU was the President of the conference, Prof. (Dr.) P.M. Khodke, Central Project Advisor, NPIU, Government ofIndia was the Chief Guest of the conference and Prof. A.K. Nayak, IPP of CSI was the Guest of Honor for the conference. First of all Professor Ratnadeep Deshmukh, Convenor, presented preamble along with aims, objectives and goals of the conference. Prof. Promod Yeole emphasized that Change-is-Constant, he also highlighted the challenges of digital infrastructure and networks and suggested that post Covid-19 there shall be a phenomenal rise and increase in collaborative education. Prof. (Dr.) P.M. Khodke spoke on education going to be high breed consisting of a combination of physical and virtual classrooms, adoption of virtual Labs for undertaking experiments and learning and adopting free class room concept. Prof. Nayak spoke on how our traditional education system is not prepared for Covid-19 like situation, he laid emphasis on way forward now would be to have virtual Universities and examination halls to have online examinations.

The conference that two tracks. Session-I Theme was "Process

Prof. Pravin Wakte, Pro-VC, BAMU (and inset Top to Bottom) Mr. Pradeep Rathi, Dr. J.W. Bakal, Professor (Dr.) Ratnadeep Deshmukh, Editor-In-Chief, CSI Journal of Computing & Dr. Dipa Dharmadhikari

Professor (Dr.) Ratnadeep Deshmukh, Editor-In-Chief, CSI Journal of Computing (and Inset Top to Bottom) Mr. Pradeep Rathi, Dr. Kakarwal and Prof. A. K. Nayak, Immd. Past Paresident, CSI

of Education" and Session-II Theme was "Technology in Education". The eminent speakers who spoke in the two sessions were Prof. A.K. Nayak (IPP, CSI), Dr. S. Laxmivaraharan (Professor Emeritus, University of Oklahoma, USA), Mr. Ramesh Unnikrishnan (Director, AICTE), Prof. Pankaj M. Koinkar (Takushima University, Japan), Prof. Sunil G. Bhirud (VJTI, Mumbai), Dr. Rahul Deshmukh (IIT Bombay & President – All India Wikimedia), Mr. B.A. Damahe (Jt. GM Corporate Training, L&T), Mr. Naishadh Paleja (Fouder Director, FEAST Software), Mr. Dilip Dharurkar (Industrialist, Aurangabad) and Mr. Pradeep Rathi (RVP-6, CSI and Founder & Mentor-in-Chief, 3i Zone).

Mr. Rathi spoke on how after outbreak of Covid-19 the entire world has changed and we can now define pre Carona world and post Carona world. He highlighted that after lockdown is over the world will never going to be same and will not go back to normal. As per Mr. Rathi the new normal post Carona would be highly dependent on use of technology and how we would socially distance and interact with each other. Mr. Rathi spoke on the six technologies that will shape future of education being (1) Custom Learning Experience, (2) Cloud Computing, (3) Speech-To-Text Options, (4) Virtual & Augmented Learning Experiences, (5) 3D Printing and (6) Learning Analytics. As per Mr. Rathi in times to come these six technological approaches will change the entire traditional approach to education. He highlighted that in simple words, technology will provide teachers and learners with a new and enhanced way of interacting during the learning process.

For the Valedictory Function of the conference Prof. Pravin Wakte (Pro-Vice Chancellor, BAMU) was President and Prof. (Dr.) J. W. Bakal President IETE, New Delhi was Guest of Honor. After successful completion of the conference apart from 9,200 delegates who attended the conference over 2000 people who could not attend the conference have viewed the conference proceeding on YouTube. ■

A webinar "Post lockdown IT Career and R&D"

Conducted by CSI Raipur chapter

Reported by **Dr. Umesh Kumar Pandey**, CSI Raipur Chapter Chairman

Prof. Dr. A K Nayak
Padt President CSI India

Mr. Mukesh Kumar
RVP Section IV CSI India

Mr Divayanshu Verma
Sr Manager Intel RnD

Dr. Umesh Kumar Pandey
Chariman,
CSI Raipur Chapter

Dr. Bhawana Narain
State Student Co-ordinator, Chhattisgarh

Prof Dr Sanjay Kumar
Ex Chariman
CSI Raipur Chapter

CSI Raipur Chhattisgarh chapter organized a webinar on title Post Lockdown IT Career and R&D on date 24 may 2020. Total registration received for the webinar 110 whereas approximately 40 participants were present.

COVID-19 is expanding continuously and worsening the situation globally. Now it is realized that we have to live with this pandemic scenario. To discuss career and R&D opportunity post lockdown, Mr. Divyanshu Verma were present in the webinar.

Webinar session started with Professor Nayak who brought various aspect of the changes going to be happen in the society. Mr Mukesh Kumar gave a glimpse of industrial requirement which need to be address in changed scenario of post lockdown.

Mr. Divayshu Verma from intel gave a global aspect of industrial development. Mr. Verma said that this is the time to think about the industrial development 4.0 because world is looking towards India. Mr. Verma discussion focused on machine learning and deep learning application to solve various problem and how artificial intelligence is used to compose new thing without human intervention.

Prof. Sanjay Kumar raised issue of security concern in artificial intelligence. Dr Bhavana Narain gave vote of thanks to the guest, dignitaries and participant for sparing their time. The webinar was anchored and organized by CSI Raipur chairman Dr. Umesh Kumar Pandey.

Two Days National Webinar on Emerging Technologies for Higher Education "Post Covid-19"

Organized by: **Department of Computer Science and Technology Central University of Jharkhand and CSI Region-V**

Reported by **Dr. S. C. Yadav**, Chairman, CSI Div. V

Technical Collaboration: CSI Division-V - Research and Academic

Two-Days National Webinar was inaugurated by Prof. N. K. Yadav "Indu", Vice Chancellor, Central University of Jharkhand; and Chief Guest of the event Prof. A. K. Nayak, IPP, CSI in the auspicious presence of Prof. Sarang Medhekar (Chairman) Dean, School of Natural Sciences and Prof. Subhash Chandra Yadav (Convener) Head, Department of Computer Science and Technology, Central University of Jharkhand, Ranchi with more than 150 Participants from the academia, corporate world.

(Inaugural session : Prof. N K Yadav "Indu", Prof. A K Nayak, Dr. Subhahs Chandra Yadav and Ms. Chetana Das)

The main focus of the webinar was intended to explore the, obstacles behind digital higher education, the effectiveness / new normals of this blended learning, offering elements of online learning and to explore how these technological changes will contributes to the education. With motto to enrich the knowledge of students and teachers about the fast growing, emerging technologies for higher education.

Prof. S. Medhekar, Prof. Sunil Kr. Pandey (Director, ITS, Ghaziabad), Dr. Vivek Tiwari (Asst. Professor, IIIT, Naya Raypur), Mr. Shadab Hussain (Data Scientist, Bangloore), Mr. Raghav Raghvendra Singh (Analytics, APAC, Singapore)

National Webinar on "As You Sow, So Shall You Reap"

Reported by **Prof. Sudipta Sahana**, Student Branch Coordinator, JIS College of Engineering

On the 25th of April 2020, a National Webinar was held on As you Sow, So shall you Reap, by the CSI Student Branch of JIS College of Engineering, Kalyani, West Bengal. The speaker for the evening was Shree Venugopal Lakshmipuram. The objective of the session was to motivate the entire countrymen who are bewildered and depressed presently with the distressing rapid spread of the COVID 19 pandemic worldwide, and now steadily surging in India. The session commenced with the welcome address by Dr Partha Sarkar, Principal of JIS College of Engineering. Dr Aniruddha Nag, Chairman, CSI Kolkata Chapter explained about CSI activities. The event is witnessed with 240 participants. The audience was highly pleased to be a part of such an event and heaped praises and wanted to have some more events like this. After the session, Mr. Sudipta Sahana, Student Branch Counsellor, CSI Student Branch, JIS College of Engineering, shared his experience. Shree Venugopal Lakshmipuram was digitally presented with a token of appreciation by Dr Partha Sarkar and Dr Sila Singh Ghosh, Registrar, JIS College of Engineering, Kalyani. The session concluded with a Vote of Thanks given by Dr Sila Singh Ghosh.

Lucknow Chapter Webinar Program

Organized by **Lucknow Christian College in association with CSI Lucknow Chapter**

Reported by **Mr. Arvind Sharma**

Webinar on "Are we heading towards the end of cloud computing?"

Dept. of Computer Science of Lucknow Christian Degree College organized a webinar in association with Computer Society of India, Lucknow Chapter on 30 May, 2020 at 5:30 pm. The theme of this webinar was "Are we heading towards the end of Cloud Computing ?". Prof. Bharat Bhasker, Director, IIM Raipur was the Key Note Speaker. Shri R.K. Vyas, President CSI presided over the function and the Opening Remarks were offered by Prof. A.K. Nayak. The programme started with prayers and after that Dr. (Mrs.) Pronoti Singh, Principal (offtg.) of the college welcomed the Guests. In his opening remarks Prof. Nayak emphasized on quantum computing and explained how the Cloud Computing might get replaced with the advent of Nano Technology. Shri R.K. Vyas stressed on the point that the need of technological advancements is inevitable and so is the change in technology. He also said that the events like this should be organized frequently as the next Annual Convention of CSI is going to be held in Lucknow.

In his address Prof. Bharat Bhasker explained in very simple and convincing manner the Cloud Technology, how it works and the benefits of this technology. During this he explained the importance of real time computing and why the delay of even one second can not be accepted. Then after establishing the working knowledge of Cloud Computing he explained the need for edge computing and future of Edge Services. It was the wisdom of the speaker that he could explain the complex topic in simple words in such a way that even the non technical persons attending the webinar were satisfied to get an insight in the latest technology. Mr. Arvind Sharma, Incharge of the Dept. of Computer Science, Lucknow Christian Degree College offered the vote of thanks.

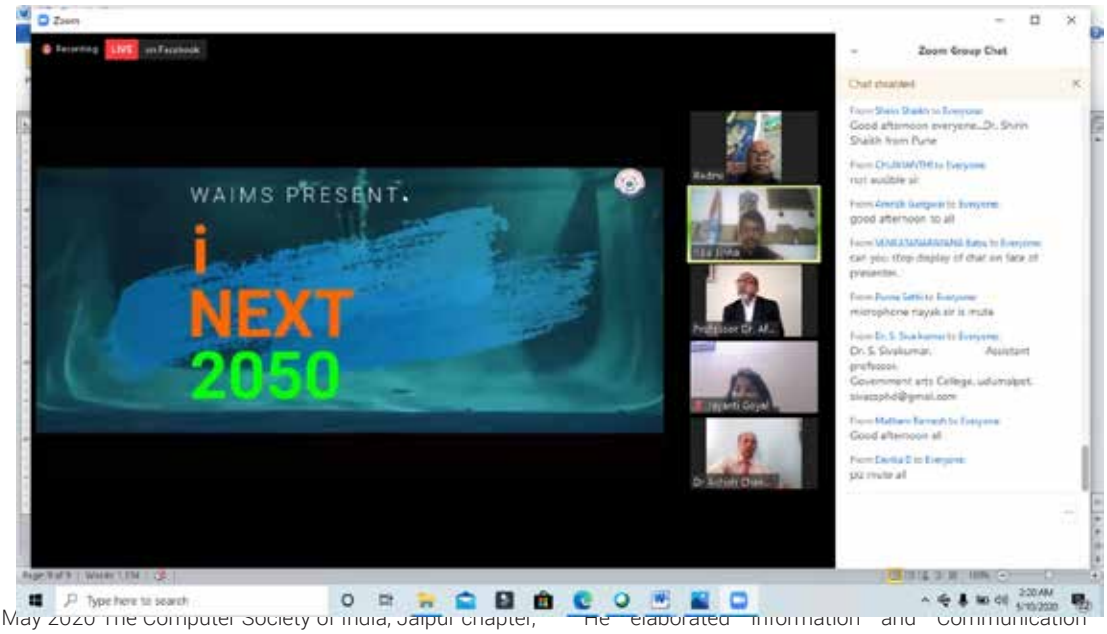
The webinar was attended by approx. 200 persons including Faculty, Students, Experts, CSI Members, couple of State Student Coordinators from different cities of UP including Lucknow, Bihar, Punjab, Delhi etc. The Regional Dy. Director, Asst. Directors of Indira Gandhi National Open University, Lucknow also attended the meeting.

AWS Core Services (Cloud Computing)

The Webinar was conducted by CSI BBDNITM Student Branch and it was managed by CSI Student Council of Dept. of CSE and IT (BBDNITM-054) in association with TWINS CLOUD. Mr. Prem Srivastava (CEO TWINS CLOUD) was the speaker of the webinar. It was conducted on GOOGLE MEET on 10/05/2020 from 2:00-4:00 pm. The webinar was attended by 185 attendees. It was inaugurated with the Welcome of our guest including CSI Chair Patrons Director BBDNITM Prof. Dr. Bhavesh Kumar Chauhan and HOD IT Prof. Dr. Manuj Darbari Sir, CSI Branch Coordinator , Hod CSE Prof. Dr. Diwakar Yagyasen Sir, CSI Branch Counselors Prof. Shadab Siddiqui and Prof. Zulfikar Ali Ansari Sir then anchors introduced the Speaker of the event and the panel was handed over to him. Later on we conducted a Q/A round then vote of thanks and thus we ended the webinar. Target audience included HODs, Dis, Professors, Staff and Students of BBDGEI and other institutes as well.

International Webinar on Futuristic Information and Communication 2050

Reported by **Prof. (Dr.) Ripu Ranjan Sinha** , Chairman, CSI Jaipur Chapter, Rajasthan



Jaipur 10th May 2020 The Computer Society of India, Jaipur chapter, in association with World Academy of Informatics and Management Sciences, Council for Sustainable Peace and Development and Innovation society of India organized an international webinar on Futuristic Information and communication Technologies under the Dynamic Leadership of Prof. (Dr.) Ripu Ranjan Sinha and his very eminent team.

The international webinar was addressed by many intellectuals who shared their wisdom on the of scenario of Futuristic Information and communication Technologies. Dr. Ashish C Swami MC Member of CSI Jaipur Chapter and Dr. Jynati Goyel, Treasurer of CSI Jaipur, Dr. Navneet Sharma and Convener- Dr. Akash Saxena addressed the welcome note for all the delegates and participants of the webinar.

Prof. A. K Nayak, immediate past President Computer Society of India, Prof. (Dr.) Ripu Ranjan Sinha Jaipur Chapter Chairman, Prof. Dr. Aftab Anwar Sheikh, Principal Poona College of Arts and Sciences Poona, Col. Pawan Kumar Sachan Sena Medal and Bar , Ourishi Thembia Lagos Nirgria, Mr. Abdul Dewale Mohammed Executive and Group President Global South Economic Forum United Kingdom, Lockesh sharma Dazzle Aviation Service Private Limited inaugurated the webnair.

During Presidential Address Prof. A. K. Nayak spoke about Future Information Technologies and its impact and challenges for forthcoming IT Human Resource. Computer Society of India is Pioneer in the India as Computer professionals and He elaborated the concepts of Future Artificial Intelligence and technologies and also congratulated entire team of Jaipur chapter of CSI for conduction of the webinar. Followed by Presidential address Prof. Ripu Ranjan Sinha Jaipur Chapter Chairman welcomed all the delegate, Speakers from CSI and other Intellectuals of sponsoring Body.

Prof. Sinha addressed the webinar as first webinar in the historical journey of CSI Jaipur Rajasthan with the vision of futuristic Information and Communication Technologies he also reported about all the action activities of CSI Jaipur. The webinar was attended by near about 1867 participants 1000 in Zoom room and live on Facebook and Youtube Live.

He elaborated Information and Communication Technologies involving the development, maintenance, and use of computer systems, software, and networks for the processing and distribution of data foften, in the context of a business or other enterprise. The term information technology in its moderns sense first appeared in a 1958 article published in the harvard business review; authors Harold J. Leavitt and Thomas L. Whisler commented that "the new technology does not yet have a single established name. We shall call it Information Technology (IT)."

He express his concern on global lockdown and COVID 19 impact as global Pandamic as huge human loss in human mankind in 21st century. He predicted 9 future technologies 2050 that's called Futuristic ICT in coming future i.e.

- **Internet will be free for everyone**
- **Self Driving Cars**
- **Intercontinental railways can be a reality**
- **World population will cross 960 crore**
- **Increased number of cyber attacks**
- **Personal aircrafts for short journeys**
- **Cancer can be cured easily**
- **AI will be everywhere**
- **Human will inhibit on mars**

During Event a Journey of i-next 2050 launched by Prof. A.K Nayak and invited intellectuals to be the part of this innovative journey in this this web-series shall get benefited for the forthcoming human resource under the vision of Prof. Ripu Ranjan Sinha. The I-NEXT Web Series shall be a platform for for india and rest of the world and will full fill the requirement of ict professionals, startup, corporate world, ngo, society.

In this webinar 68 Resource Person and 10 Country Key Note address conducted mainly from United Kingdom, Rwanda, Uganda, Nigeria, South Sudan, Egypt, Jordon and across the india. Shri Jyant Bhide presented Vote of thanks and congratulated all CSI jaipur Team and given Best-wises to Prof. Ripu Ranjan Sinha Specially for his wonderful efforts.

One Day National Webinar on Digital Marketing

Organised by Indian Institute of Business Management and CSI Patna Chapter

Reported by **Prof. Ganesh Panday**, Dy. Director, IIBM

A one day National Webinar on Digital Marketing was organized by Indian Institute of Business Management, Patna in Technical collaboration of Computer Society of India Patna Chapter on 17th May 2020 at 11 AM onwards. The function was inaugurated by

Prof. U. K. Singh, Fellow Life Time Achievement awardee of Computer Society of India. & Director General of Indian Institute of Business Management & Dr. Zakir Husain Institute group of Institution.

The welcome address & theme presentation was delivered by prof. A. K. Nayak., Past President, Computer Society of India. Dr. Bhagwan Singh, Professor of Department of Business Administration, Central University of Jharkhand, Ranchi delivered the key- note address. Prof. Subhash Chandra Yadav, Professor & Head, Dept. of Computer Science & Technology,, Central University of Jharkhand, Ranchi and

Prof. Vijay Agrawal, Professor-Incharge, Department of Management Studies, Birla Institute of Technology, Mesra (patna Campus} were participated as Invited Speaker. Prof. MD. Shams Raza, Regional Vice President of Region-II of CSI also spoke on this occasion.

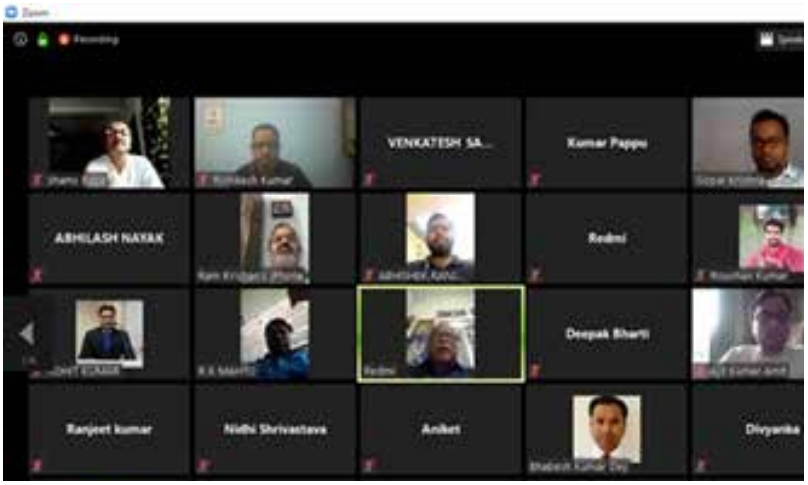
The vote of thanks was presented by Prof. Ganesh Panday, Dy. Director of Indian Institute of Business Management, Patna where as the webinar was coordinated by prof. Gopal Krishna, the State Student Coordinator of CSI & Prof. Rohit Kumar, Asst. Professor, IIBM, Patna. All together more than 500 delegates were registered for the event....

Webinar on Big Data

organized by IGNOU PSC 0516P, St. Xavier's, Patna in association with CSI Patna, Chapter

Reported by **S.Raza**

Webinar on Big Data is organized by IGNOU PSC 0516P, St. Xavier's, Patna in association with CSI Patna, Chapter on 10.05.2020 by 12 noon using ZOOM platform. Keynote address was delivered by Mr. Ajit Kumar Ajit, CEO of Agilitics, Singapore. Session was inaugurated by Mr. R. K. Vyas, President CSI, theme presentation was given by Prof. Dr. A.K.Nayak, IPP, CSI and addressed by Dr. Abhilash Nayak, Regional Director, IGNOU Patna, and Mr. Shams Raza , RVP-II CSI, Mr. Gopal Krshnan, SSC, Bihar CSI presented vote of thanks. Session was also attended by approx 200 MCA, MBA Students of IGNOU & IIBM and CSI Student members and faculties of IGNOU & IIBM.



Allahabad Chapter Webinar Programs

Reported by **Prof. Ratnesh Mishra**, Chairman, CSI Allahabad Chapter

Report on Webinar Series-06

CSI Allahabad Chapter organised a Webinar Series 6.0, hosted by Prof. Ratnesh Mishra, Chapter Chairman and Prof. Narendra Gupta, Chapter Secretary welcome to all participants and speaker by Ratnesh Mishra, Chapter Chairman. The topic of this program was "An Analysis of Relation Between Computer and Sanskrit ", which was delivered by speaker Dr. Tarun Sharma, Professor, PG College Atarra, Banda U.P. In this program speaker talked about the relation between computer and Sanskrit, Sanskrit is the best language for computer programming. Being some familiar with computer programming, a natural language for computer programming is to make it easier for people to talk to computers in their native tongue and spare them the pain of learning a computer friendly language like assembly/C/Java. All the environments related to Sanskrit Language, Computer Programming Language and Natural Language, Processing so that the Sanskrit Scholar can be categorize the promises of the language suitable for NLP as an Artificial Intelligent (AI}.Man Machine conversation is an important field of artificial intelligence, human used different language i.e. Hindi, Sanskrit, English to express their felling these languages are such developed language that human not only communicate bare facts in these language bit express their inner thoughts. NASA researcher, published in the spring issue of Artificial Intelligence magazine in 1985 (Volume 6 Number 1), entitled Knowledge Representation in Sanskrit and Artificial Intelligence. And in last not least speaker said and invite to M.tech and PhD students for research in this topic Design a Compiler for a programming language based on Sanskrit. You can write minimum Operating System and Define Micro-operations for Computer Hardware System that is based on Sanskrit. Then start the question session, in this session participated by Mr. Vijay Pandey, Dr. Vijay Agarwal, Mr. Suraj, Mr. Manish, Mr. Himanshu Agarwal Dr. Avinash Dwivedi. Conclude the program and votes of thanks by Dr. G.P. Sahu (Past Chairman, CSI Allahabad Chapter). Programme attended by Dr. A. K. Nayak, Mr. Arvind Sharma, Dr. Dushyant Singh, Dr. Anshu Tiwari, Mr. Vijay Pandey, Dr. Vijay Agarwal, Prof. Sheel Shalini.

Report on Webinar Series-05

Host: Prof. Ratnesh Mishra, Chapter Chairman and Dr. Narendra Gupta, Chapter Secretary welcome to resource person and participants by: Mr. D. K. Dwivedi (Patron CSI Allahabad chapter). "**Block chain and then Data Confidentiality**". Prof. A. K. Nayak said CSI Allahabad Chapter is now vibrant Chapter and given congratulation and blessing for webinar series 2020. Speaker Dr. Greg Adamson, Professor, Melbourne University, Australia talked about the Block chain and then Data Confidentiality; In duration of covid-19, lockdown, blockchain is very useful techniques for sellers and purchaser. We need a way for the payee to know that the previous owners did not sign any earlier transactions. The only way to confirm the absence of a transaction is to be aware of all transaction. There are thousands of block chain "use cases" around the world today: Crypto currencies, Supply chain, Industry transformation: renewable energy distribution, Registers, of facts, of things, of activities, Smart contracts. Digital Risk Innovation provides cyber security advice and solutions to financial services, health, government and supply chain companies seeking to manage risk in digital strategies.

Report on Webinar Series-04

Mr. Arvind Sharma (Vice President Region-I) congratulate to CSI Allahabad Chapter for start the webinar series. In this webinar series, topic was Inventory and Cost Management System of ERP in IFFCO. which was delivered by Mr. Gaurav Gopal (Chief Manager, IT Services) Iffco, Phulpur Prayagraj, UP. Speaker talked about Normal Inventory Items are normally not procured under Capital Budget. Codes can be created from the New Codification System and are inserted in ERP as well. Unit of Measurement (UOM) - Assignment is done in the New Codification System. Approval is done by the competent authority Organization Assignment. This will allow the Item to be used in other Organizations as well. This is done after the approval of the new item code creation. The actual costing process for calculating the cost of the material may be Period moving average cost (PMAC), Period weighted average cost (PWAC), Perpetual weighted average (PPAC), Last transaction (LSTT) Last invoice (LSTI).

Report on Webinar Series-03

Prof. R. K. Vyas (CSI President, India) said CSI Allahabad Chapter is now energetic Chapter and given congratulation and blessing for webinar series 2020. In this webinar series speaker was Dr. Avinash Dwivedi (Professor JEMTEC Gr. Noida). "Advancement of web technology and health awareness" Web Development is the Base of Internet by Arpanet in 1969.which is Different versions of WebWeb 0.0 – Developing the Internet Web 1.0 – The shopping carts & static web (Tim Berners-Lee the first implementation of the web) Web 2.0 The writing and participating web 3.0 Semantic Web 4.0 "Mobile Web" Web 5.0- Open, Linked and Intelligent Web = Emotional Web.

How to live Healthy

Do exercise (Pranayam mandatory),Eat Healthy, Try to consume food grains once in a day Consume sufficient water in proper manner, Jal khabe means : Do not drink water but eat means drink water sip by sip. Do not drink cold water, Excrete waste material in proper manner, Water & Health, We can keep 70 percent disease away from us by taking 3-4 liter water in proper manner. Drink 2-3 glass Luke warm water (sip-sip) stale mouth. Drink sufficient amount of water just before 30-40 minutes before your meal. Drink water at least 1 hour after the meal. Drink water using glass in slow manner. Take 1 glass of water in one hour. Do not drink water after 9 pm. Have a glass of milk at sleeping time. Sleep at least 2 hour after your dinner.

Chennai Chapter Webinar Programs

Reported by **Dr A Prema Kirubakaran**, Hon Secretary, CSI Chennai Chapter

Dr. Anbu Rathinavel delivering the presentation

CSI Chennai Chapter in association with ACM Chennai Chapter and IEEE Computer Society, Madras Chapter conducted a webinar program on "Design Thinking" on Saturday 11th April 2020 from 6.00 PM to 7.15 PM.

Dr. A Prema Kirubakaran, Hon Secretary of CSI Chennai Chapter welcomed the participants and introduced the speaker Dr Anbu Rathinavel, Head, School of Design Thinking, and Chief Design Officer@ Intellect Design Arena. 174 participants from India and abroad attended the webinar and found it informative.

Dr. Anbu Rathinavel began the session by stating that design thinking is all about the correct mindset & attitude. He emphasised on the steps involved in design thinking and stressed that the focus should be on the following parameters:

1. To keep customer in the middle (Be customer centric)
2. To be focused on the future (future focused)
3. To create values
4. To empathize, engage in dialogues, listen and observe

Various examples on great design thinking were illustrated from simple pin concept to Mumbai dabbawalla's concept (six sigma example). He explained the difference between traditional thinking and design thinking, various methods to approach design thinking.

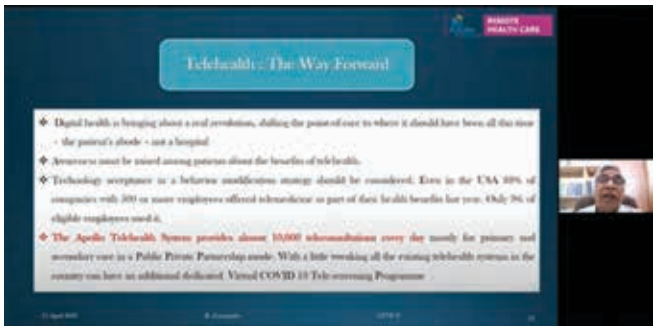
Dr. Anbu also illustrated on how to visualize "people" differently. E.g. If the number of participants is 174, then there not 174 data points but there are 174 minds/souls. It is their emotions & experiences that matter. Thus, we lead to human - centricity of Design Thinking. He also pointed out that people should be trained on mindset of Design Thinking & not only on process. He also cursorily spoke on Design Thinking processes & Tools to solve problems.

The webinar presentation ended with Q & A session. Mr. P.V. Subramanian, Chairman Chennai chapter gave a vote of thanks.

Webinar on Deployment of Telehealth: A perspective for Technologists (in the context of Covid-19 pandemic)

CSI Chennai Chapter in association with Telemedicine Society of India, Telemedicine Society of India, Tamilnadu, Apollo Remote Health, ACM Chennai Chapter and IEEE Computer Society, Madras Chapter and IEEE Technology and Engineering Management, Madras Chapter conducted a webinar program on Deployment of Telehealth: A perspective for Technologists (in the context of Covid-19 pandemic) on Wednesday 22nd April 2020 from 6.00 pm to 7.15 pm.

Mr. P. V. Subramanian, Chairman of CSI Chennai Chapter welcomed the participants and introduced the speaker Prof. K. Ganapathy, Director, Apollo Telemedicine & Networking Foundation & Apollo Telehealth Services, Past President, Telemedicine Society of India & Neurological Society of India. 182 participants attended the webinar and found it interesting and informative.



Prof. Dr. K Ganapathy delivering the presentation

Prof. K. Ganapathy started the session by explaining how telemedicine apps are being used to diagnose illness amid corona virus concerns. The word "Quarantine" was explained with an example from an article published in 1348 in a newspaper.

He listed the seven elements to be considered before any medicine consultation namely:

1. Context,
2. Identification of Registered Medical Practitioner and Patient
3. Mode of communication
4. Consent
5. Type of Consultation
6. Patient Evaluation
7. Patient Management

A video demo of patients treated through video conference was discussed. He talked about the challenges in introducing Telemedicine. 'they include:

1. Rapidly expanding use of telehealth in the absence of a telehealth program
2. Time taken to establish the necessary technology infrastructure
3. Recruit virtual providers and provide training on best practices to educate patients,
4. Negotiate coverage with payers e.g. PPP with State governments, insurance companies
5. Resources to be mobilized to build infrastructure and capacity

He suggested as the way forward the following:

1. Begin the telemedicine program
2. Existing Telehealth systems can mentor and handhold new medicine systems on a war footing note
3. At least 1000 secondary / tertiary hospitals in the private sector can have basic operational telehealth units within the next hundred days

Prof. K. Ganapathy concluded the session by stating "The success binding of digital with health that emerged as digital health is growing now, by providing solutions to many issues."

The webinar presentation ended with Q & A session moderated

by Mr. H R Mohan, Past President CSI and Chairman ACM Chennai Chapter who also gave closing remarks and thanked the speaker.

URL for video recording of this webinar on tele-health: https://bit.ly/3cJxDQn

Mr. Siddharth Singh, the author during the Q&A session with Mr. H R Mohan

Computer Society of India, Chennai Chapter in association IEEE Computer Society, Chennai Chapter, ACM Chennai chapter organized a web conference on "Skill Enhancement / Re-skilling during the Lockdown" on Saturday 2nd May from 4.00 p.m. to 8.19 p.m.

We invited abstract of papers on the theme "Skills enhancement/ Reskilling during the lockdown period" from members, professionals and faculty members across the country. Dr S Sridhar, Former VC of KN Modi Univ & Chief Executive of Sbyte Technologies assisted in selecting 30abstracts out of 42 received by the announced deadline. The shortlisted authors were asked to submit the full paper along with presentation in PPT. Seven out of 26 papers received were shortlisted by reviewers drawn from Anna University, Rajalakshmi Engineering College, Great Lakes Institute of Management and management consultants who evaluated the papers on various parameters such as Concept, Design Architecture, Conclusion, Implementation and Originality. 287 participants from various parts of India attended the web conference and found it informative.

Mr. P V Subramanian, Chair, CSI Chennai welcomed the participants and introduced Dr. S. Sridhar, who set the context to the conference theme by highlighting the major parameters of enhancing the skills during the lockdown period and also suggested on how to overcome this constricted situation.

The first Key Note Address was delivered by Ms. N. Dhamayanthi, Associate Vice President (Talent Development), HCL Technologies. She elaborated various methodologies to improve the skills during this lockdown. She presented a positive note to reskill and restructure their skills for a better survival, now and after the pandemic crisis.

After the first key note address, paper presentations were made by the seven selected authors and their presentations were evaluated by Mr. Anantha Padmanabhan, Treasurer, CSI, Chennai.

After the paper presentation, the second key note address was delivered by Dr. Badri Narayanan Gopalakrishnan, co-founder and director, Infinite Sum Modelling Inc, Seattle, USA. He observed that because of the ongoing Covid crisis, the global economy has crippled, with all sectors taking a big hit. Particularly sectors like tourism, travel, recreation and hospitality/food services may never be the same again for years to come. He expected about 5-10% fall in GDP in countries like India based on our global economic modeling assessments. In this scenario, he observed that digital transformation is thriving and evolving as an important driver for the recovery and adjustment to the new normal.

He concluded his speech by stressing on the following points:

1) While industry should be more innovative and work on both solutions to the ongoing crisis and evolving sustainable business models for the future, the government should support them and invest in skill development and income security.
2) Professionals and students should work seriously on reskilling and industry preparedness. We can come out of this crisis stronger and more successful than ever if all of us work on these strategies together.

Towards the end, Mr. Anantha Padmanabhan announced the winners of the paper contest.

Mr. Siddharth Singh, Student of Aditya Birla World Academy won the first prize carrying a cash award of Rs 3000.

Dr. Karthik Palaniappan, Founder and CEO of August Academy won the second prize carrying a cash award of Rs 2000.

Dr. G Ayyappan, Associate Professor, School of Computing, Bharath Institute of Higher Education and Research, Chennai won the third prize carrying a cash award of Rs. 1000.

All the paper presenters will also receive e-certificates.

Mr. H. R. Mohan, Past President, CSI and Chairman, ACM Chennai, moderated the Q&A sessions of the keynote addresses and all the presentations made by the authors. He ended the conference with a closing remarks and thanking the speakers, authors, organizers and participants for the success of the first web conference organized jointly by all the three Computer Societies.

Any one interested to know more details of the web conference can email to info@csichennai.org.

Webinar on "Personal Finance for Techies"

Computer Society of India, Chennai Chapter in association IEEE Computer Society, Chennai Chapter, ACM Chennai Chapter organized a webinar on "Financial Planning for the Techies" on Saturday 10th May from 6 p.m. to 7 p.m.

Mr. P .V. Subramanian, Chair, CSI Chennai welcomed the participants and introduced the speaker Mr. Ranganath Muthu, CFP, Financial Transformation Coach for Expatriates and Salaried Professionals. 110 participants participated in the Webinar and found the presentation interesting and useful.

Mr. Ranganath Muthu started the session by explaining the current scenario of technology becoming obsolete sooner than before, employees being laid off at middle-age, people living longer, how part-time work becoming the new normal etc. and stressed the importance of proper financial planning by taking the services of a trusted financial advisor.

He explained the meaning of financial planning, steps an individual and her family should take to achieve financial independence. These include managing cash flows, having an emergency fund, protecting oneself with term life insurance and health insurance, investing for financial goals like higher education and marriage for their children and retirement planning.

The webinar presentation ended with Q & A session moderated by Mr. H R Mohan, Past President CSI and Chairman ACM Chennai who also gave closing remarks and thanked the speaker.

The video recording of this webinar on "Personal Finance for Techies" is available at https://bit.ly/3fYPipz

One week Online FDP on Emerging Trends in Computer Science & IT

Reported by **Narinder Kaur**, Assistant Professor, BVICAM

One week online FDP on "Emerging Trends in Computer Science & IT" was organized by IEEE Delhi Section & IIPC (AICTE) of Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi from 25th to 29th May 2020, in collaboration with IEEE Computer Society (Delhi Section), CSI Delhi Chapter and ISTE Delhi Section and Brain Mentors Delhi.

India is facing great challenges in every sector due to the outbreak of COVID-19 pandemic. However, in this melee, education sector has come up with different digital tools and technologies to cope up with such situation. BVICAM conducted its second online webinar in continuation of its FDP series, to promote awareness on emerging research trends in the domain of CS & IT. The objective of the FDP was to nurture the research aptitude and competency development of the young research scholars and faculty members doing research. FDP also covered two days workshop on Machine Learning and Deep Learning with Python by Brain Mentors Pvt. Ltd on 26th and 27th May 2020.

The FDP began with the inaugural session on Digital Transformation in Higher Education by the esteemed Chief Guest of FDP Prof. R. K. Shevgaonkar, Vice Chancellor, Benett University, Greater Noida, also Former Director, IIT Delhi and Former Vice Chancellor, Pune University, Pune. Also present in the inauguration ceremony were Prof. Prerna Gaur, Chairperson, IEEE Delhi Section and Prof. M. N. Hoda, Director, BVICAM.

This FDP was conducted in 10 interesting and knowledge imparting sessions including four different sessions of workshop. Different technical sessions covered during FDP were – How to be Happy in Difficult Times by Dr. Shankar Goenka, WOW Factors, Faridabad; Project based Learning and Higher Order Thinking Skills by Dr. P. S. Grover, Delhi University, Delhi; Awareness of IPR and Patent Filing by Mr. Awab Habib Fakih, AIKTC, Mumbai; Technology Transformation from Academia to Industry by Mr. Gaurav Arora and Ms. Baishakhi Banerjee, India Mentors, Delhi; IoT and Cloud Computing Enabled VANETs by Dr. R. S. Rao, AIACT&R, Delhi and Exploring Remix to Implement Smart Contract by Dr. Mayank Agarwal, G. K. V. Haridwar.

Sessions covered during two days workshop were based on Machine Learning with Python and Deep Learning with Python, both sessions conducted by Mr. Ravi Kant, Brain Mentors Pvt. Ltd. Delhi. In these two sessions, participants learned a lot about machine learning and deep learning models and performed hands-on using Covid-19 datasets having number of active cases, recovered cases etc. in different states of India.

This FDP was being the most innovative event, aimed to provide an open exchange of ideas that gave all the participants an opportunity to learn about emerging trends in research and benefitted their academic career growth. The FDP observed active participation from various research scholars and faculties with positive outcomes. It attracted over 90 participants, including participants from ABES College of Engg, Ghaziabad, BIT Meesra, Annamalai University, National P. G. College, Lucknow, SD Bansal College, Indore, Shri ShankaracharyaTechnical Campus, Bhilai, Pune University, iNurture Bangalore, Trinity College, Delhi, Amity University, UP, Maulana Azad National Urdu University, DY Patil International University, Pune - to name a few along with International participants from Saudi Arabia.

Last day of the FDP witnessed Valedictory Session in the benign presence of Chief Guest Prof. K. K. Aggarwal, Noted Academician, Chairman NBA, N. Delhi and Founder & Former Vice Chancellor, GGSIP University, New Delhi; Dr. A. Murali M. Rao, Chairman, IEEE Computer Society, Delhi Section; Mr. R. K. Vyas, President, CSI and Prof. M. N. Hoda, Director, BVICAM. Prof. K. K. Aggarwal expressed his appreciation on the success of FDP with the active participation of all the participants and a wide variety of topics covered during five days of FDP. Dr. A. Murali M. Rao appreciated the way BVICAM conducted this online FDP and congratulated all the participants and BVICAM team for its success. Prof. M. N. Hoda also shared his experiences on this webinar and thanked all the speakers for conducting interactive sessions, resolving all queries of the participants during their sessions and overall making it a successful event with fruitful outcomes. All the participants were awarded with certificates of participation. The entire FDP was coordinated by Dr. Vishal Jain, Associate Professor, Mr. Manish Kumar, Assistant Professor and Mr. Uttam Singh, Assistant Professor, BVICAM. Dr. Vishal Jain expressed his vote of thanks to all the attendees for making this event a huge success of its own kind.

Online Workshop on "Data Science & Visualization Using Python"

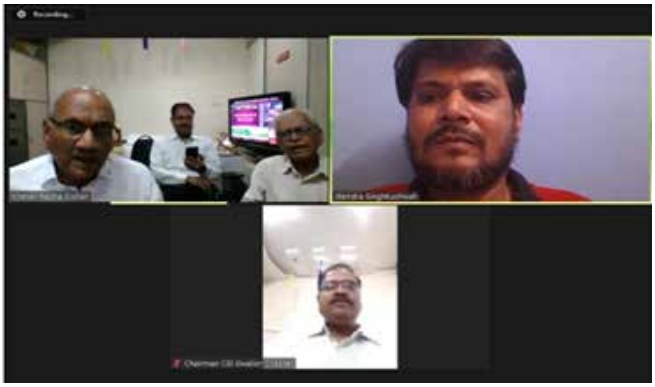
Reported by **Mr. Jitendra Singh Kushwah**, Assistant Professor, ITM Group of Institutions Gwalior

Three days workshop was conducted on "Data Science & Visualization Using Python" on 24th – 26th May, 2020 in association with The Institute of Engineers (India) organized by CSI Gwalior Chapter, Gwalior(MP).

In Inaugural function, Mr. Jitendra Singh Kushwah, Assistant Professor, ITM Group of Institutions Gwalior, Mr. Jayant Bhide, Regional VP, Region-3 CSI, Mr. Dilip Hayaran, Chairman, CSI Gwalior Chapter, Mr. R.k. Khetan, Member, IE Gwalior and CSI Chapter, Mr. Prabhat Bhargava,President IE Gwalior and Er. Khanwilkar, Secretary IE Gwalior Chapter along with Mr. Makhija Treasurer, CSI Gwalior Chpter were present. Our Regional director Mr. Jayant Bhide encouraged the participants for the workshop and suggest to us to conduct this type of workshop in future for the faculties & students. Mr. Bhide also welcomes our expert and other dignitaries. Inaugural function hosted by Mr. Khetan, Member IE Gwalior Chapter. 852 candidates were registered for the workshop. So, huge response reflect in the workshop from all over India.

Mr. Jitendra expert of this online workshop continue this workshop and ask some questions to the participants regarding Data Science to know knowledge of participants. In this session, he gave introduction of Data Science and its need in the current scenario, Applications of Data Science, Steps involved in Data Science, Data Visualization, Its usability in data science. In these days, Mr. Jitendra taught analysis of dataset, visualizes the data after analysis using Python editor Jyputer. all the sessions were hands-on. Students were enjoy all the sessions and ask many questions. Mr. Jitendra covered theoretical and practical sessions of all the topics successfully online using ZOOM app.

FeedBack: At the end of the day, Online Feedback form fill by



the participants. According to feedback form, students strongly appreciated to Mr. Jitendra Singh Kushwah. His presentation skill, knowledge, problem solving method etc. was excellent. Participants also interested to conduct this type of workshop again by Mr. Jitendra.

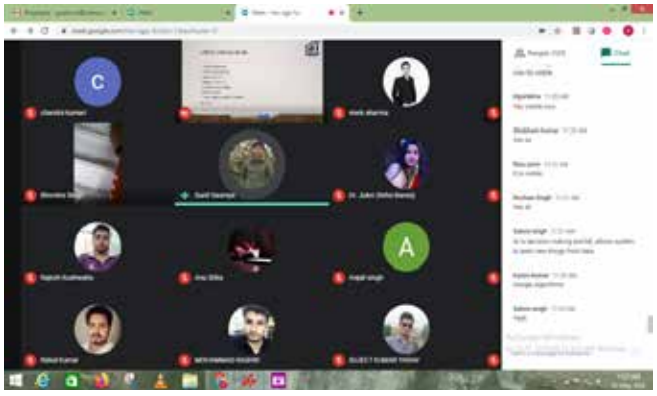
In valedictory function, Mr. Jayant Bhide Regional VP, Region-3 CSI, Mr. Dilip Hayaran Chairman, CSI Gwalior Chapter and Expert Mr. Jitendra Singh Kushwah were present. Vote of thanks given by Mr. Dilip Hayaran. He thanked the dignitaries, Academicians, Industry Professionals, Students and the members of CSI Gwalior Chapter for the support to make the entire workshop a grand success. At the end of the valedictory function, Mr. Jitendra share his view about three days workshop. He said that participants response was really over whelming in spite of being a COVID-19 and they were participated in all the activity very interestingly. In this session, participants also share their view about the workshop and expert.

Report of the Webinar on "Introduction to Machine Learning with Python"

Organized by CSI Patna Chapter

Reported by **Gopal Krishna**, SSC, Bihar

1st May 2020; Computer Society of India, Patna Chapter successfully conducted a webinar on "Introduction to Machine Learning with Python". The webinar was inaugurated by Prof. A K Nayak, the Immediate Past President of the Computer Society of India, and Director of IIBM. The keynote speaker of this session was Dr. Sunil Saumya, Assistant Professor of IIIT, Dharwad, Karnataka. He focused on the tools and applications of the machine learning. The webinar was also addressed by Prof. Shams Raza, Regional Vice President, CSI Region-2 and Dr. Julee Banerji. This webinar was hosted by Gopal Krishna, State Student Coordinator of Computer Society of India and Assistant Professor of NSIT through Google Meet. The webinar was attended by teachers and students from various colleges of India. Some of these notable ones were NSIT, IIBM, Patna Women's College, College of Computer College of KV, LN Mishra Diploma Patna etc. Rajesh Kumar of Gaya College of Engineering, Triloki Nath and Pradeep Kumar of NSIT, Rakesh Kumar of LNMI, Deepa Sonal of Patna Women's College also participated actively in this webinar.

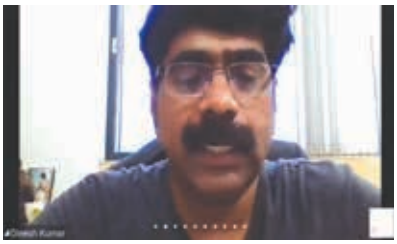


CHAPTER REPORTS

KANCHEEPURAM CHAPTER

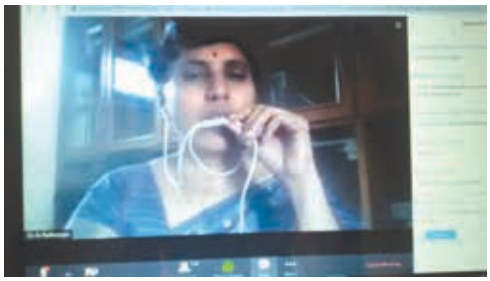
The Computer Society of India, Kancheepuram chapter organized a National level Webinar on 29th of April, 2020 (11.00 am to 12.30 pm). It was a good way to make use of the time in the quarantine period. The webinar was about "Cyber Security -2020". Nearly 135 professionals have registered from all over India and got benefited. Dr. Rajeswari Mukesh Chairman-KPM welcomed the guest speaker Dr. B. Muthukumaran, Head – Cyber Security, HTC Global Service India Pvt. Ltd and the participants for the webinar. The Session started with an appreciation from the speaker for their eagerness to know about the Cyber Security even in the lockdown period. The participants got to know about cyber-attack, information security, threat intelligence and management, threat, threat agent, thread actors, tactics, techniques, and procedures, thread modeling, DREAD, cyber threat intelligence and other topics. The participants got the opportunity to clear the doubts based on Cyber Security and everyone enjoyed the session as it was interactive. Finally, Dr. M. Senthil Kumar, Secretary CSI KPM proposed the vote of thanks. The Webinar was successfully completed with the support of Dr. M. Murugan, Vice Chairman, CSI-KPM.

COIMBATORE CHAPTER



The first webinar by CSI Coimbatore Chapter was held on 30.04.2020, at 3 pm with overwhelming registrations of more than 600. The speaker was Dr. U. Dinesh Kumar, Professor of Decision Sciences, IIM Bangalore, and the topic was "Artificial Intelligence Demystified."

The chairperson of CSI Coimbatore Chapter, Dr. G. Radhamani welcomed all the participants and introduced the Keynote Speaker Dr. U. Dinesh Kumar. The introductory speech signalized the essentiality of artificial intelligence in complex decision making which ensured the audience's attention from the start. The Chairperson emphasized that Dr. U. Dinesh Kumar is one of the top 10 educationists in India in data analytics, whose research interest includes Business Analytics and Big Data, Artificial Intelligence, Machine Learning, Deep Learning Algorithms, Stochastic models (Reinforcement Learning Algorithms), Reliability, Optimization, Six Sigma and Performance Based Logistics.



Prof. Dr. Dinesh started with a quote by Oliver Wendell Holmes in 1897, "The man of the future is the man of statistics (data)", indicating the importance of data in years to come. Professor further added the reason behind the purchase of Nest- Smart Thermostat maker by Google and explained multidimensional interdisciplinary analytics from the Industry 4.0 perspective. The presenter had an interactive discussion on machine learning with rule-and-behavior-based systems, Bayesian and statistical algorithms and deep neural networks. The attendees raised the questions as well answered the questions asked, through chat and raising hands which obviously proved the attendees attention.

Analytics projects were discussed, with business and social contexts. He also explained Components of analytics like Descriptive, Predictive and Perspective analytics with the current Covid-19 scenario. He was insisting how AI is more important for small and medium business. He also mentioned the application of AI in various domains like Robotic process automation, gaining cognitive insights from data and Engaging with customers through chatbot. A case study on "Akshya Patra – Unlimited Food" was also discussed. His talk concluded with the final thoughts that Innovation will be driven by Analytics and Covid-19 would drive more companies to adopt analytics. This in turn will bring a huge demand for people knowledgeable in AI and Data Science.

In the Q&A session, the attendees requested tools for analytics, reinforcement learning, logistic regression, decision on uncertain environment, AI based feature selection, AI with Agriculture, employment status due to AI, use of tensorflow and NLP in social media, risky jobs and AI, etc.

Mr. N. Duraiswamy, Secretary, CSI-Coimbatore Chapter proposed vote of thanks and also mentioned that Dr. Dinesh has opened up the opportunity for the emerging technocrats to implement AI in small industries and business.

FROM CSI STUDENT BRANCHES

REGION-III

Sagar Institute of Research Technology & Science, Bhopal

24-4-2020 – Webinar on How to prepare yourself to slow down IT Sector due to COVID-19

Devang Patel Institute of Advance Technology and Research, Anand

7-5-2020 - Webinar on Fun with Programming in Python

REGION-III

G H Patel College of Engineering & Technology, Vallabh Vidyanagar

25-2-2020 - Alumni talk on Entrepreneurship and how to use social media to market your start-up

REGION-V

Anurag Group of Institutions, Hyderabad

11-5-2020 Webinar hands-on event on Machine Learning – Regression

REGION-V

New Horizon College of Engineering, Bangalore

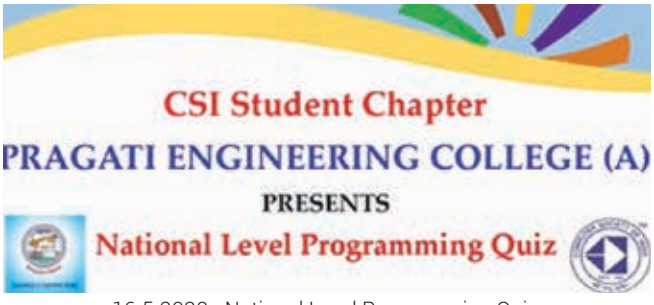
8-2-2020 - Workshop on Ethical Hacking

8-2-2020-Motivational Talk on Emotional Intelligence for smart in studies

New Horizon College of Engineering, Bangalore

25-2-2020 - Coding Contest on Logic Building

Pragati Engineering College, Surampalem



16-5-2020 - National Level Programming Quiz

FROM CSI STUDENT BRANCHES

REGION-V

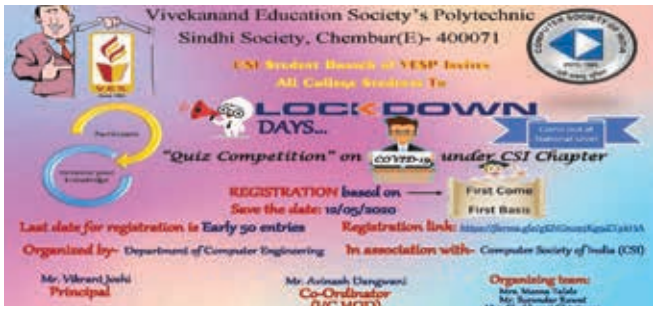
GMR Institute of Technology, Rajam

11-2-2020 - Guest Lecture on Cyber Security

7-3-2020 - WEB CODE on the eve of Women's Day

REGION-VI

V.E.S. Polytechnic, Chembur, Mumbai



12-5-2020 - National level COVID-19 Quiz Competition

REGION-VII

Sathyabama Institute of Science and Technology, Chennai

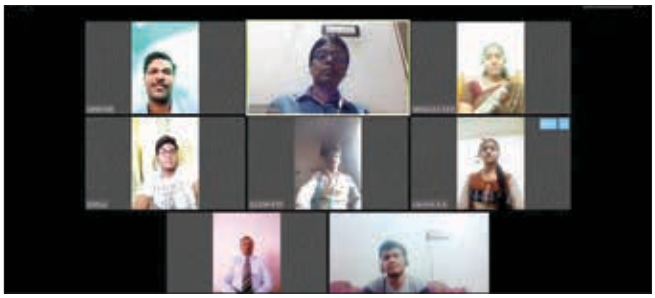
11-3-2020 & 12-3-2020 - Workshop on Essentials of Web Development using PHP & MYSQL

REGION-VII

Shri S S Shasun Jain College for Women, Chennai

10-5-2020 - Webinar on Machine Learning Algorithm, Applications & Trends

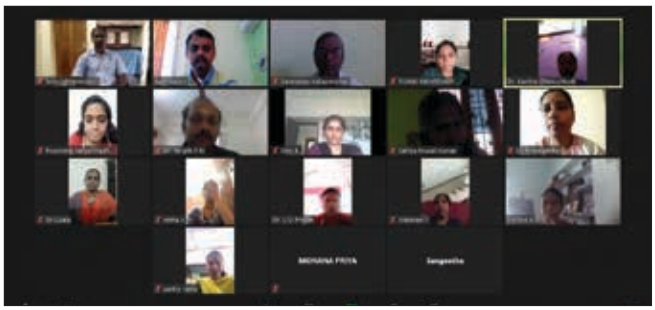
K.L.N. College of Engineering, Pottapalayam



27-4-2020 to 29-4-2020 Technical Expert talk Series

SRM Valliammai Engineering College, Kattankulathur

28-4-2020 - Personal Branding and Etiquette's by Ms K Srividhya



11-5-2020 to 15-5-2020 - FDP on Fundamentals of Digital, Computation and Cryptography

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Regd. No. MCN/316/2019-2021
Posting Date: 10 & 11 every month. Posted at Patrika Channel Mumbai-I
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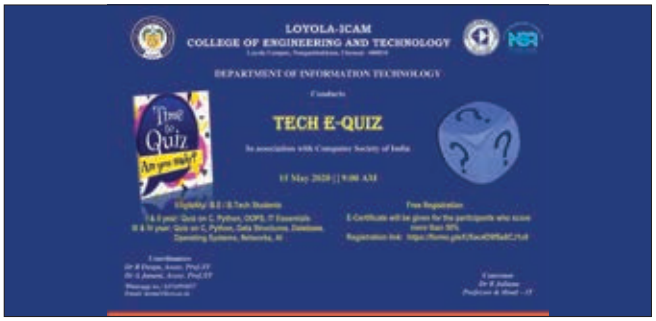
FROM CSI STUDENT BRANCHES

REGION-VII

National Engineering College, Kovilpatti

7-5-2020 - Webinar on Chatbot using AI

Loyola ICAM College of Engineering and Technology, Chennai



15-5-2020 - online quiz event, TECH E-QUIZ

Student branches are requested to send their report to sb-activities@csi-india.org with CC to admn.officer@csi-india.org

Chapters are requested to send their activity report to chapter-activities@csi-india.org with CC to admn.officer@csi-india.org

Kindly send **High Resolution Photograph** with the report.