IEM

INSTITUTE OF ENGINEERING & MANAGEMENT

Good Education, Good Jobs

COMPUTER SOCIETY OF INDIA

ESTD. 1965

IEM CSI TechPulse

2020

INSTITUTE OF ENGINEERING & MANAGEMENT, KOLKATA
COMPUTER SOCIETY OF INDIA (CSI)
STUDENT BRANCH

CONTENTS

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Prof. (Dr.) Lopa Mandal, IEM, Kolkata

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Computer Society of India is the first and largest body of computer professionals in India. It was started on 6th March 1965 by a few computer professionals and has now grown to be the national body representing computer professionals. It has 72 chapters across India, 511 students branches, and 100,000 members.

Editorial

IEM CSI Student Branch is a professional society formed at Institute of Engineering & Management (IEM), Kolkata, and accredited by Computer Society of India (CSI) since 1st April 2018. The present issue of IEM CSI TechPulse is the 2nd issue of the annual magazine published by IEM CSI Student Branch. It highlights different events organized by the student branch including international conference, seminars and other student activities. The magazine also provides the opportunity to its members to showcase their writing skills on different technical topics of recent trends and related social aspects. The sincere and dedicated works of the student members in organizing different events of the student branch has also been recognized in the magazine.

In spite of lockdown during Covid-19 IEM CSI Student Branches is quite dynamic & vibrant in connecting all members for different student branch activities including organizing Local to International Level Webinars/Workshops/Conferences through online mode.

I congratulate all the respective organizers & members of the student branch for their tireless efforts & significant contribution. I would like to thank all the authors and the members of the editorial board for their contributions in the magazine and look forward to get their cooperation in future as well.

I am thankful to the authorities of Institute of Engineering & Management for their constant support towards different activities of the student branch. We also express our gratitude to the Computer Society of India for their cooperation in smooth functioning of the branch.

A special thank goes to Prof. (Dr.) Satyajit Chakrabarti, Director,
Institute of Engineering & Management, for his
constant support and encouragement throughout the process.

Prof. (Dr.) Lopa Mandal
Editor, IEM CSI TechPulse
Student Branch Counsellor, IEM CSI Student Branch

MESSAGE FROM THE PRESIDENT

Our sole aim is to help our students achieve academic excellence through both excellent teaching and professional experience. The IEM CSI Student Branch is a platform meant to nurture our students to bring out their full potential and prepare them to face the IT world head-on. In the current dire situation of the world, the IEM CSI student branch has the capability to help out through contributing to the technological aspect to combat the crisis and help the society at large.

Prof. (Dr.) Satyajit Chakrabarti
President, IEM Group

MESSAGE FROM THE DIRECTOR

The IT-industry is ever-evolving so it is mandatory to stay on toes with the recent technologies. The CSI Student Branch of IEM is aimed at giving the students a head-start from the mass competition by refining their knowledge and skills at par with industry demand… and beyond. In the light of recent chain of unfortunate events, despite being held back in their homes, our students of the IEM CSI student branch are trying to contribute to the wellness of the world by working in open source projects and online events concerning the pandemic and natural calamities. I congratulate all the members associated with this branch for their wholehearted initiatives.

Prof. (Dr.) Satyajit Chakrabarti
Director, Institute of Engineering & Management, Kolkata

MESSAGE FROM THE PRINCIPAL

Our students have proven over the years that they are the Crème de la crème of the competition that is growing brutal every year. To meet with the extraordinary requirements of the IT industry, we have created the CSI Student Branch of IEM. Its primary objective is to hone the skills of the students as well as introduce them to the IT-world through the eyes of seasoned professionals. Technology is an immensely powerful tool in this era, especially in times of natural crisis. Due to the sheer size of the huge number of people affected by the pandemic, our students are fired up and helping out in every small way possible. I wish good luck to every endeavor of the IEM-CSI student branch.

Prof. (Dr.) Amlan Kusum Nayak
Principal, Institute of Engineering & Management, Kolkata

REPORTS ON
IEM CSI STUDENT BRANCH ACTIVITIES
(2019 - 2020 SESSION)

IEM-CSI Student Branch is a professional society that has been formed at IEM, Kolkata and accredited by CSI from April 1, 2018.

The motivation of Computer Society of India is about knowledge sharing, technology and skill upgradation.

The IEM-CSI student branch is coordinated by Prof. (Dr.) Lopa Mandal, and involves a large number of student members from different departments of IEM. The student branch mainly focuses on the knowledge sharing and skill upgradation on cutting edge technologies regarding Computer Science and related technologies. Keeping the goals in mind, the branch has organized many events. During the process of opening the student branch, an induction program was organized by Professor (Dr.) Lopa Mandal, Student-Branch-Counsellor (SBC) of IEM-CSI-Student Branch in 2018. The-then Chairman of CSI Kolkata Chapter, Shri Subir Kumar Lahiri and CSI HQ Representative Shri Subimal Kundu graced the occasion and interacted to the students to explain the basic objective and be--nefits of the society member.

Another program was organized on the occasion of the Society being approved. It was an hour long session, where the members of the Society where told about the different upcoming events of society and students for different leadership positions were identified. After the commencement of the meeting , the ID cards of the student members where distributed by Student-Branch-Counsellor (SBC) of IEM-CSI-Student Branch.

MAGAZINE LAUNCH PROGRAM OF IEM-CSI STUDENT BRANCH

On 12th April 2019, the IEM-CSI student branch of launched their 1st Technical magazine, IEM-CSI TechPulse for the year April 2018 – March 2019. Prof. (Dr.) Satyajit Chakrabarti,

Director of IEM graced the magazine launch ceremony with his words of wisdom and inspiration for the students of the branch. He looked forward to another year of blooming achievements in technology and adventures over new horizons with the able leadership of Dr. Lopa Mandal, Student Branch Coordinator (SBC) of the branch and guidance of teachers and experienced professionals. A good number of students were present in the ceremony including the magazine committee members of IEM CSI TechPulse. Students were recognized and applauded for their contributions towards the branch.

Fig.1: Dr. Satyajit Chakrabarti, Director IEM, delivering Speech in the Annual General meeting of 2018-2019 session of IEM-CSI student Branch

Fig. 2: 1st issue of the magazine IEM TechPulse published by IEM-CSI student branch is launched by the the Director of IEM. Student head Ms. Tania Bera

Fig. 3: Students who were recognized for their contribution towards the student branch along with the Director, Dr. S. Chakrabarti, Student Branch Coordinator and Editor of the magazine Dr. L. Mandal and Chief Graphics Designer of the Magazine Ms. Aishika Chakraborty

The International Conference on Ethical Hacking - eHaCON 2019

The 2nd International conference organized at Institute of Engineering & Management in association with IEM-CSI student branch was eHaCON 2019: International Ethical Hacking Conference. The conference consisted of four technical sessions, four keynote speeches, two-day workshops along with two-day online coding competition on ethical hacking. eHaCON 2019 Program Committee, comprising distinguished members from academia and industry of India and abroad worked hard to organize the technical program successfully.

Fig. 4: International Ethical Hacking Conference (eHaCON) 2019 in Collaboration with CSI and other sponsors.

Fig. 5: Prof. Dr. Satyajit Chakrabarti President, IEM-UEM Group

Fig. 6: Prof. Dr. Sajal Dasgupta, VC, UEM

Fig. 7: Prof. Dr. Satyajit Chakrabarti
Director, IEM

Fig. 8: Keynote speech by Keynote speeches by Mr. Atul Agarwal,
APT Softwares Pvt. Ltd.

Fig. 9: Keynote speech by Mr. Sandip Sengupta,
Indian School of Ethical Hacking

Fig. 10: Prof. Dr. Mohuya Chakraborty
Head of the Department,
Inormation Technology, IEM

Fig. 11: Keynote speech by Mr. Nirupam Chaudhuri, NASSCOM

Fig. 12: Panel Discussion on "Present Security Scenario in Digital India" Members: Mr. Sandeep Sengupta, Mr. Diptiman Dasgupta and others.

Fig. 13: The august gathering of eHaCON 2019

LECTURE SESSION ON INTRODUCTION TO MACHINE LEARNING

On 24th July,2019, the CSI student branch of IEM organized a lecture session on Machine Learning. The invited speaker was Ms. Munmun Chakraborty, Principal Engineer at CDAC, Kolkata, who has gained twelve years of experience in field of Image Processing and Pattern Recognition. Machine Learning is one of the premier topics in the world of technology. It is an application of artificial intelligence that provides a system the ability to learn and improve from experience without any explicit programming. Web Search Engines, Spam detectors, Database mining and Contour mapping are just a few of the many applications of Machine Learning. Ms. Munmun Chakraborty enlightened the audience on the several core components of Machine Learning like regression, genetic algorithm, k-means clustering and Support Vector Machines. She took the students on an erudite journey on the real-world applications of Machine Learning. She also explained how to handle, sieve and compartmentalize Data using this technology. It was a great learning experience for the students who participated such an enlightening academic lecture. The event turned out to be an immense success.

Fig. 14: Ms. Munmun Chakraborty addressing the audience

Fig. 15: Dr. Lopa Mandal, SBC, IEM-CSI student branch is felicitating Ms. Munmun Chakraborty

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LECTURE SESSION ON INTERNET STANDARDS AND POLICIES

An invited session was organized by the IEM CSI Student Branch dated 2nd September 2019 on "Internet Standards and Policies" by Mr. Sushanta Sinha, Learning sub-function head and Consultant, TCS and Mr. Anupam Agrawal, ISO SC7 Secretariat and Consultant, TCS. The initiative was undertaken by IEM CSI Student Branch and its coordinator, Prof. Dr. Lopa Mandal, as part of a series of invited talk sessions, to make students aware of several emerging technologies and to enable them to interact and gather insight from senior most professionals from the IT industry. The session was held within the Science Auditorium on 2nd September 2019, in the IEM Gurukul Campus, to a packed crowd of students from several streams, teachers and professionals. Prof. Amlan Kusum Nayak, Principal of IEM Kolkata, also attended the session and interacted with the guests and the students. Mr. Sinha and Mr. Agrawal started off the session by stating the importance of Cybersecurity, IoT Security and the looming threat of Cyberwarfare in today's highly interconnected and data driven world. They presented their lecture without delving too much into corporate jargon, but in a very interactive and easy to follow manner, and thus appealed to the curiosity of the students. They further spoke upon how one can start researching and subsequently write their very own RFC, to be officially drafted by the Internet Engineering Task Force (IETF) that may be ratified to become a formal standards document. They encouraged the students to be involved in the increasing participation from India, in the standardization of Internet Technologies and how that has conceived the Indian IETF Capacity Building Program (IICB). Their lecture ended on a high note and the students benefitted immensely by being introduced to the ISOC Kolkata and the IETF. The students were made known about the demand for skilled application layer developers, cryptographers and network Principal Dr. A.K. Nayak and Dr. L. Mandal.

Fig. 16: Mr. Sushanta Sinha throwing light on the intricacies of Machine Learning

Fig. 17: The Team that made this event a grand success with Dr. Mandal, Mr. Agarwal, Mr. Sinha and Dr. Nayak.

The event was extremely well-received by the students who found the lectures to be both insightful and absolutely engaging. The Lecture turned out even bigger success than expected.

TECHNICAL ARTICLES
Are Online Transactions Really Secure?

RITWIK PAL
CSI ID No.: 01496403

The 21st century has bestowed us with lots of boon that has taken mankind across seas of progress by leaps and bounds. The most relishing out of them to throw light upon is ONLINE TRANSACTION. The world 'online' definitely suggests that one needs an active and working internet connection to perform the transaction. Just a wait of a click or a tap and loads of money gets transferred from one part of the world to maybe another. But a recent survey has dug out the fact that only 51% of the entire country's population use online banking channels, whereas the rest of the respondents do not trust online transactions or even they don't hold a debit card because they fear ATM frauds. The sole reason behind this is that our country is still technically much backward with respect to other metro countries of the world. Many of us still prefer to stand in a queue before bill payment counters, money withdrawal counters at banks or mobile recharge shops. They are even ready to pay for extra service charges but are not willing to do the same task conveniently sitting at their home with their smart phones in their palm or PCs and laptops in their desks.

But, are you really aware of the fact that online transactions are really one hundred percent safe to indulge in with absolutely zero chances of any kind of frauds, provided that you make such transactions through verified third-party applications or the bank's original website. The frauds that you often hear of, that keeps you away from online transaction are solely due to foolishness of the customer, that includes responding to spoof SMS or e-mails or answering to fraud calls where the callers give their identity as bank employees or representatives. Please do not share your bank account number, debit or credit card details, OTPs ever to any unknown or known person over telephone, text messages or media of any form because the person whom you are sharing to might not possess any harmful intention, but tapping of phone calls and messages by a third person or a hacker is very easy nowadays.

As I was saying how secure online transactions are and why there are zero chances of intrusion or frauds. This is being well taken care of by the newest of technology called 'Secure Sockets Layer', or simply SSL which is a networking protocol designed to secure communication between a client and a server that are communicating over an insecure network, like the internet. SSL uses a combination of public key encryption, private key encryption and other cryptographic functions to secure a connection between two machines communicating over the internet. There are various forms of SSL encryption, such as 56-bit, 128-bit, 192-bit, 256-bit. These classifications are made based on the key size. The most used keys for e-commerce, banking websites are 128-bit and 256-bit all over the world. What happens is that when we hit the 'Pay' or 'Confirm' button while making any kind of transaction over the internet, the online password or OTP that we

have entered, which results to a significantly huge number of possible combination that has an estimated cracking time of 1.02 X 1018 years and 1.872 X 1037 years in case of 128-bit SSL encryption and 256-bit SSL encryption respectively whereas the hacker gets a window of only 10-15 seconds at maximum when the bank processes our payment and acknowledges us. You can also check for SSL certification that is provided in any website that deals with online transaction. If the website lacks SSL certification, it's wiser not to make any kind of transaction through that website. So, cracking online passwords or OTPs are just next to impossible.

With the changing time, security should have stronger encryption to secure the internet users from cyber-attacks. Hackers are continuously evolving in breaking weak and old encryption. The stronger the encryption technique, the more your data will be safe. So, when technology is gifting us with so much convenience, we must try to appreciate and accept that, possessing a bit of technical know-how's. Do as much and as many online transactions as you want, technology has got your back!

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- Various research articles about Web Security and its application.

Author: Ritwik Pal

Short Description:
Though being an Engineering student, I have always craved for creative writing since early stage of my student life. Currently, I am a 4th year B.Tech student of Institute of Engineering and Management (IEM), Kolkata with Computer Science & Engineering discipline. My highest qualification till date is Diploma in Computer Science & Technology, completed in the year 2017. Besides my engineering course, I have a keen interest on network and cyber security domain and have also worked on some projects. As far as my objective or aim is concerned, I would like to explore deeper into the world of networking and cyber security and work in this domain. My hobbies include playing video games, coin collection, article writing and reading magazines, articles and research papers.

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IoT and its Smart Application

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Internet of Things (IoT) term represents a general concept for the ability of network devices to sense and collect data from around the world, and then share that data across the Internet where it can be processed and utilized for various interesting purposes. The IoT is comprised of smart machines interacting and communicating with other machines, objects, environments and infrastructures. Now a days every persons are connected with each other using lots of communication way. Where most popular communication way is internet so in another word we can say internet which connect peoples. Internet of Things (IoT): Big Data challenges The explosive increase in the number of devices connected to the IoT and the exponential increase in data consumption only reflect how the growth of big data perfectly overlaps with that of IoT . And therefore, many architectural design challenges have arisen for the delivery of big data services based on the IoT. The number of IoT devices: With growth forecasted in the number of connected "things" and expected to reach billions world-wide, there will be masses of devices which may be a data source, and which may be subject to third party control; Risk of IoT device malfunction: With a great number of IoT devices and manufacturers it is reasonable to assume there will be many occasions where IoT devices malfunction in various ways;

Update frequency: Though some devices will produce data reports at a low frequency there may be substantial quantities of data streaming from more sophisticated Internet connected things.Healthcare Most healthcare systems in many countries are inefficient, slow and inevitably prone to error. This can easily be changed since the healthcare sector relies on numerous activities and devices that can be automated and enhanced through technology. Additional technology that can facilitate various operations like report sharing to multiple individuals and locations, record keeping and dispensing medications would go a long way in changing the healthcare sector . A lot of benefits that IoT application offers in the healthcare sector is most categorized into tracking of patients, staff, and objects, identifying, as well as authenticating, individuals, and the automatic gathering of data and sensing. Hospital workflow can be significantly improved once patients flow is tracked. Additionally, authentication and identification reduce incidents that may be harmful to patients, record maintenance and fewer cases of mismatching infants. In addition, automatic data collection and transmission is vital in process automation, reduction of form processing timelines, automated procedure auditing as well as medical inventory management. Sensor devices allow functions centered on patients, particularly, in diagnosing conditions and availing real-time information about patients' health indicators

CONCLUSION:

The IoT can best be described as a CAS (Complex Adaptive System) that will continue to evolve hence requiring new and innovative forms of software engineering, systems

engineering, project management, as well as numerous other disciplines to develop it further and manage it the coming years. The application areas of IoT are quite diverse to enable it to serve different users, who in turn have different needs.

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BLUE GENE

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1.   BACKGROUND

In December 1999, IBM announced the start of a five-year effort to build a massively parallel computer to be applied to the study of bio molecular phenomena such as protein folding. The project has two main goals: to advance our understanding of the mechanisms behind protein folding via large-scale simulation and to explore novel ideas in massively parallel machine architecture and software. This project should enable bio molecular simulations that are orders of magnitude larger than current technology permits. Major areas of investigation include: how to most effectively utilize this novel platform to meet our scientific goals, how to make such massively parallel machines more usable, and how to achieve performance targets with reasonable cost through novel machine architectures. Here comes the idea of Blue Gene.

2.   INTRODUCTION

Blue Gene is a computer architecture project designed to produce several supercomputers that are designed to reach operating speeds in the PFLOPS (petaFLOPS = 1015) range, and currently reaching sustained speeds of nearly 500 TFLOPS (teraFLOPS = 1012). By using the higher computation process we can understand the importance of various biological processes such as Protein Folding. Exploring more about Bio-molecular structures the medical researchers can conclude more deep knowledge about diseases. It is a cooperative project among IBM(particularly IBM Rochester and the Thomas J. Watson Research Center), the Lawrence Livermore National Laboratory, the United States Department of Energy (which is partially funding the project), and academia.

3.   OVERVIEW

3.1 WHY BLUE GENE?

Blue Gene is a computer architecture project designed by IBM to produce several next-generation supercomputers, designed to reach operating speeds in the peta-flops range, and currently reaching sustained speeds over 360 teraflops. It uses low power processors, which allows a large number of processors to be packed in a given volume (2048 processors in a rack), with aggregate heat dissipation staying within air cooling limits. Furthermore, it

uses system-on-a-chip technology to integrate powerful torus and collective networks, and uses a novel software architecture to support high levels of scalability. While BG/L offers the promise of making massively parallel systems accessible, promising results have been reported on a 512 node prototype. It is a fast computer architecture playing an important role in the understanding of important biological process. Various highly calculative intensive tasks are done by this technology. It can control massively parallel computing system such as Protein folding, bio-molecular mechanism etc. Learning more about bio molecular mechanisms is expected to give medical researchers better understanding of diseases, as well as potential cures.

3.2   Why the name "Blue Gene"?

- "Blue": The corporate color of IBM
- "Gene": The intended use of the Blue Gene clusters – Computational biology, specifically, protein folding

3.3 Blue Gene Projects

Four Blue Gene projects:
- Blue Gene/L
- Blue Gene/C
- Blue Gene/P
- Blue Gene/Q

Blue Gene/L can acquire a peak speed of over 590 tera-FLOPS and a total memory of 68 terabytes. The full system has 106,496 dual-processor compute nodes. Nodes are configured as a 32 x 32 x 64 3D torus and each node is connected in six different directions for nearest-neighbor communications. Multiple global barriers and interrupt networks allow fast synchronization of tasks across the entire machine within a few microseconds.The project has two main goals: to advance the understanding of bio-molecular mechanisms via large-scale simulation, and to explore novel ideas in massively parallel machine architecture andsoftware.

Blue Gene/C (Cyclops64) is a sister computer project of Blue Gene/L. It is now named as Cyclops64. It is the first massively parallel supercomputer designed in a chip. The Blue GeneC gives the programmer adequate freedom to write high-level structural software. But it is quite difficult to write some efficient coding on Blue Gene C. The theoretical peak performance of this is 80 gigabytes.

Blue Gene/PThe design of Blue Gene/P is a technology evolution from Blue Gene/L. It is the second generation of the Blue Gene supercomputer. Each Blue Gene/P Compute chip contains four PowerPC 450processor cores, running at 850 MHz. The cores are cache coherent and the chip can operate as a 4-way symmetric multi-processor (SMP). The memory subsystem on the chip consists of small private L2 caches, a central shared 8 MB L3 cache, and dual DDR2 memory controllers. It is at least seven times more energy efficient than any other super-computer, accomplished by using many small, low-power chips connected through five specialized networks. The chip also integrates the logic for node-to-node communication, using the same network topologies as Blue Gene/L, as but at more than twice the bandwidth.

Blue Gene/Q has achieved a performance peak of 20 megaflops in 2011. It has enhanced the performance as its frequency. It becomes more energy efficient. The Blue Gene/Q is a 5-rack, 5120 node IBM Blue Gene/Q. Each node consists of a 16-core 1.6 GHz A2 processor, with 16 GB of DDR3 memory.It will continue to expand and enhance the Blue Gene/L and /P architectures with higher frequency at much improved performance per watt.

4.   SYSTEM SOFTWARE ARCHITECTURE

It is a combination of Standard and custom solution. The I/O nodes execute
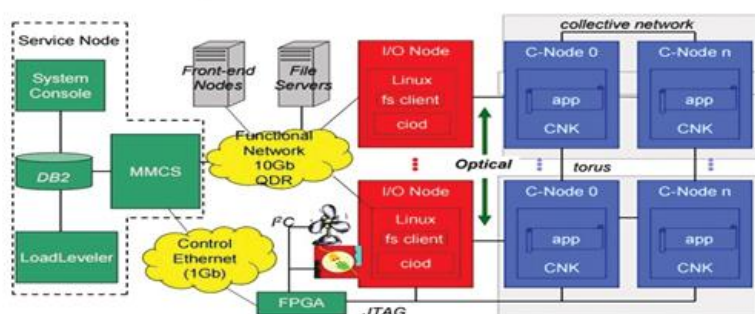a version of linux kernel.
The Software architecture divides into three functional entities,
arranged hierarchically:
1.   Computational Core
2.   A control Infrastructure
3.   A system Infrastructure

5.   ADVANTAGES
•   Scalable
•   Less space (half of the
      tennis court)
•   Heat problems most
      supercomputers face
•   Speed

Blue Gene System Architecture

6. AREA OF IMPLEMENTATION

Useful in highly calculative intensive task as:

- Problem involving Quantum Physics
- Weather Forecasting
- Climate Research
- Molecular modeling
- Physical Simulation
- Protein Folding

7. CONCLUSION

President Obama recognized IBM and its Blue Gene family of supercomputers with the National Medal of Technology and Innovation.The influence of the Blue Gene super computer's energy-efficient design and computing model can be seen today across the Information Technology industry.Today, 18 of the top 20 most energy efficient super computers in the world are built on IBM high performance computing technology. Blue Gene has some unusual features, but IBM has tried as much as possible to anchor the system to more mainstream technology. Blue Gene would influence the way in which mainstream computers of the future are built. Staying on the beaten path is the best way to take advantage of technology that's improving fastest, and it also makes it easier to create products out of the Blue Gene research.

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IMPACTS OF ML AND AI ON THE SOCIETY: A SURVEY

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ABSTRACT

We are moving to an era where automated machines have become an integral part of our lives. Artificial Intelligence will dominate various fields like health, academics, finance, weather forecasting, journal ranking, and production of automated cars, research work, image recognition and sound identification. In this survey paper, the impacts of ML and AI on the society and its applications in various fields have been illustrated.

INTRODUCTION

Today machines are in the process of learning and becoming an integral part of our lives. Artificial Intelligence will dominate various fields like health, academics, finance. In the fields of psychology and medicine, AI will assist in diagnosis by enhancing the capabilities of doctors and healthcare professionals. In sectors like weather forecasting and agriculture, AI and machine learning will provide information that would help in preventing natural calamities and lead to increased productivity. In the transportation sector, AI is gradually taking over and we are moving towards a generation where driverless cars will be available. AI has the ability to analyse mass data at a fast rate and can help in ranking of journals .AI can train on old scientific papers and make discoveries humans have missed, thus improving the research quality. A GAN type of AI trained on images can generate new images having realistic features from different varieties of pictures. Various AI and machine learning algorithms aid in differentiating various music and sound sources. It also helps in movie recommendation with use of data analysis. AI embedded cameras help in face recognition and other purposes. AI also has its impact on several fields of engineering. The objective of this paper is to explore the above-mentioned fields which are experiencing substantial improvement in terms of quality and efficiency because of AI.

FIELDS OF APPLICATION

1. Education
2. Business
3. Brain Computer Interface
4. Gaming
5. Automated Cars
6. Weather Forecasting
7. Face Detection And Recognition
8. Image And Speech Processing
9. Health And Genetics
10. Spam Mail Detection
11. Journal Ranking
12. Sound Identification
13. Generative Adversarial Networks
14. Publication Of New Research Papers

1.1   EDUCATION

This section investigates the emergence of artificial intelligence in higher education. It gives us an insight on the emerging technologies which are used to improve the way of learning and how the institutions teach and evolve. This section also highlights some challenges faced by the educational institutions while adopting these technologies and explores further avenues for research   .

To analyse the student learning outcomes, three techniques are used. These include Technology Enhanced Learning (TEL), faculty experience and assessment method. TEL highlights the application of technologies to learning and teaching.TEL in form of different types of educational software is gradually taking over the educational system. Students can learn various subjects at their own pace and they can spend extra time on the exercises, thus decreasing the dependency of a student on a teacher at the individual level. Students can learn through audio, video based programs and various web pages available on the internet, which are the types of the Web 2.0 technology, in an interactive manner thus making the learning process more hands-on. These applications allow learners to interact with each other within a virtual learning environment. Individual grades analysis using data analytics assist the student in their learning process. AI can customize the study materials of a course according to learner's needs and provides the required feedback and encouragement.

In recent years, big data is being explored through Educational Data Mining (EDM) and Learning Analytics (LA). EDM is a research field which primarily deals with machine learning, data mining and statistics to generate information from universities and intelligent tutoring systems. EDM seeks to develop and improve methods for exploring this data, in order to gain a perception on the learning methods of the student. EDM has contributed to theories of learning in educational psychology and the learning sciences. Both EDM and LA deals with data-driven approaches and share the goal of improving the education system. Brain computer interface (BCI) devices are capable of measuring the concentration level of students. The latest developments in non-invasive BCI and AI are gradually leading to the replacement of teachers with teacher-robots. For instance, IBM's Watson can provide an automated teacher presence for the entire duration of a course.   .

The key differences between EDM and LA are as follows

Differences	Learning Analytics	Educational Data Mining
1. Techniques	Statistics, visualization, social network analysis, sentiment analysis, influence analytics, discourse analysis, concept analysis, and sense-making models	Classification, clustering, Bayesian modeling, relationship mining and discovery with models
2. Origins	Semantic Web, intelligent curriculum, and systemic interventions	Educational software, student modeling, and predicting course outcomes
3. Emphasis	Description of data and results	Description and comparison of the data mining techniques used
4. Type of discovery	Leveraging human judgment	Automated discovery
5. Data used	Pedagogical, administrative and other types of data	Mostly administrative data
6. Goals	Influence education practice	Inform education practice

Table 1.1: Differences between EDM and LA from conference paper on Educational Data Mining: preliminary results at the University of Porto by Stretch, Moreira, Soares

The four most frequently practised methods used in EDM, are: (i) Prediction Models, (ii) Relationship Mining, (iii)Structure Discovery, and (iv) Discovery with Models. In prediction method, one develops a model from which a single aspect of the data can be inferred (the predicted variable) from a combination of other aspects of the data (the predictor variables). Prediction models are used to predict the value in a context where the label for the construct cannot be obtained directly. This model can be used to predict a student's performance rate. A type of classification used in EDM is latent knowledge estimation. In latent knowledge estimation, a student's knowledge of a particular skills is assessed by his pattern of correctness. The work in the area of latent knowledge estimation emerges from the Artificial Intelligence, User Modelling and Psychometrics. This provides the instructor with valuable information regarding the student's knowledge. This helps in deciding the student's curriculum which will ultimately enhance his efficiency. Some of the algorithms used in latent knowledge estimation are Bayes Nets and Bayesian Knowledge Tracing algorithms.
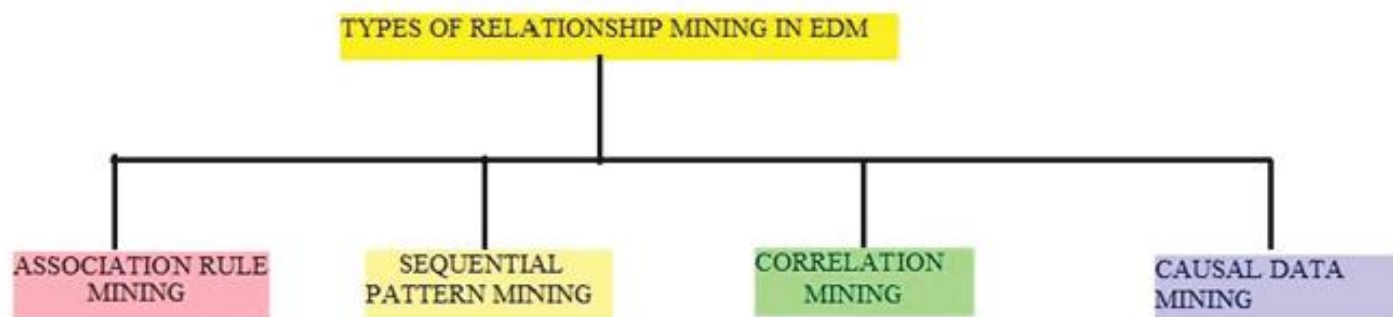
Fig 2. Flowchart showing the types of relationship mining in EDM

Fig1.1.1. Flowchart showing the types of relationship mining in EDM

In EDM four types of relationship mining are used. They are: (i) Association rule mining, most used in business data, (ii)Sequential pattern mining, used in bioinformatics, (iii) correl-ation mining, usually practiced in statistics, and (iv) Causal data mining, a combination of data mining and statistics ,analyses student collaboration behaviour. Causal data mining helps to identify the causes which lead to the poor performance of a student. It also helps to analyse the impact of study on various factors. Structure discovery algorithms attempt to find structure in data without any prior idea of what requires to be found. Common structure discovery algorithms include domain structure discovery algorithms, factor analysis and clustering. Domain Structure maps items to specific skills across students. To do so, often the Q-Matrix approach is adopted

In discovery with models, a model of a phenomenon is developed often using prediction and clustering. This model is then used as a constituent in a second analysis.

Learning analytics largely deals with human interpretation and visualization of data whereas EDM focuses on automated methods. Prediction models, Structure Discovery and clustering are prominent in both EDM and LA communities. The most common example is the automated analysis of textual data. Text analysis and text mining are leading areas in learning analytics .

In adaptive intelligent educational systems a User Model (UM) is constructed individually for each student. The system records interactions between the student and itself. The stored information is analysed using machine learning algorithms and the attributes about the user knowledge state and learning style are obtained. In this system the educators can obtain detailed information about the students by examining student's UMs using management system. The software is customised for the student that he can prepare himself by clicking on the adaptive navigation links of instruction pages. Such customised programmes developed by complex computing systems through AI serves people of all ages and abilities and has a nearly humane approach for the learner, thus redefining institutes of higher education. To help people with disabilities, solutions for human-AI interaction are also available thus helping educators and learners in the learning process. Some of the disadvantages of the latest development are:

- Since large numbers of students are enrolling for the online open courses, assisting the students becomes a tedious task for the course instructors   .

- It is essential to avoid succumbing to the agenda of companies who are in search of bigger markets   .

- Finite focus on one technology solution without adequate evidence-based arguments for MOOCs can become a distraction in education and is perilous for the financial sustainability of these institutions   .

However, the advantages outweigh the disadvantages to a large extent. Artificial Intelligence helps students to pursue education with reduced financial burden. As a result students are pursuing higher education in large numbers. This in turn is creating an impact on universities. Students with internet access can enrol online from anywhere across the globe, resulting in mass enrolment. The academic workforce is gradually being substituted by intelligent machines. Universities can curtail their expenses by hiring teachers / instructors on contract thus reducing employment of full-time expensive teaching faculties. The latest developments in non-invasive brain-computer interfaces and AI are gradually leading to the replacement of teachers with teacher-robots.   .

Artificial Intelligence is helping students to pursue education with reduced financial burden. Advancement in technologies is gradually encouraging students to pursue higher education in large numbers.   .

1.2   BUSINESS

In this section we analyse the impacts of ML and AI on business.

The impact of AI on business and employment will give rise to interconnected organizations where decision making will be based on analysis of "big" data. This will lead to an increase in the global competition amongst firms. People with internet access can avail goods and services from anywhere across the globe.

The most significant benefits of ML and AI on business are:

1.   Simplifies Product Marketing and Assists in Accurate Sales Forecasts ML helps businesses by simplifying product marketing and making accurate sales forecast. ML offers huge advantages to sales and marketing sector, with the major ones being -

o   Massive Data Consumption from Unlimited Sources
o   Rapid Analysis Prediction and Processing
o   Interpret Past Customer Behaviors

2.   Simplifies Time-Intensive Documentation in Data Entry
Using predictive modelling and machine learning algorithms, machines can efficiently perform time-intensive data entry tasks.

3.   Improves Precision of Financial Rules and Models
.Loan underwriting, portfolio management and fraud detection are some of the benefits of ML in finance. Due to continual data assessments, anomalies can be detected thus helping to improve the precision of financial models.

4.   Increases the Efficiency of Predictive Maintenance in the Manufacturing Industry. ML algorithms help in designing highly efficient predictive maintenance plans which will minimize the chances of unpredicted failures.

5.   Better Customer Segmentation and Accurate Lifetime Value Prediction
Due to advancement in AI technologies, the world has moved to data-driven marketing where the consumer is given personalised solutions based on data analysis of his behavioural pattern, and forecasting probability of his conversion to paid version. This benefits business as the consumer feels engaged and chances of his conversion to paid version becomes high. Businesses can play the beginning game during trial runs itself and decide on business strategies.

6.   Recommending the Right Product
With the help of data analytics, ML models analyses the purchase history of a customer and identify those products which interests the customer. The algorithm will look for hidden patterns amongst the items using unsupervised learning. It will group several products into clusters. These will enable enterprises to create a superior product-based recommendation system which will motivate the customers for product purchase.

All these applications make machine learning a top value-producing digital innovation trend. Furthermore, ML enables businesses to discover patterns from large and diverse data sets. Businesses can now analyse huge sets of data, using machine learning algorithms, to interpret business interactions and take evidence-based actions. This results in an improved product management system. Therefore, considering ML as a strategic initiative can be a lucrative decision. However, deployment might carry certain business risk. Therefore, it is better to approach investment decisions with utmost care. **23**

1.3 BRAIN COMPUTER INTERFACE (BCI)

The artificial neural networks (ANN) imitate the neural connections and information processing that takes place in the nerve cells of the human brain (biological neural networks or BNN). ANN consists of mathematical frameworks. The inputs and outputs of ANN share a complex, non-linear relationship. The layers of nodes of ANN store the processed data. A given node receives weighted inputs from a previous layer, performs an operation to adjust a net weight, and passes the result to the next layer. This is done by forming large matrices of repeatedly applied mathematical functions connecting nodes, and expansion of features at each node. Improvements in algorithms that permit new network architectures, availability of huge digital training datasets, parallel processing and growth in computing power have resulted in formation of deep-learning neural networks (DLNN). The DLNN contains a much larger number of layers of nodes than the ANN. Invasive BCI research helps in repairing damaged sight. It also provides new functionality for people with paralysis. The Epoc Neuro-headset, which is a BCI embedded technology, can detect facial expressions, brain performance and emotional states and allows users to create mental commands through the use of the headset. Architecturally, the DLNN networks imitate the BNN of the human eye. They possess the ability of image recognition and classification tasks and have proved themselves to be better than humans in several cases.   .

1.4 GAMING

The importance of Artificial intelligence in computer games is profound. A non player character also referred as a non-person character (NPC) is a character which is not controlled by any player.

In order to achieve the important aspects of NPC's persona the following models are used:
- Personality Model
- Mood Model
- Relationship Model
-

The NPC has its own thinking capabilities as per the adaptive algorithm created by the developers. The NPC is made, matched with the player's gaming strategies. The artificial intelligence controllers in games helps in the process of decision .It is achieved by using a reactive intelligence bound by the underlying relationship between objects and players in the gaming world. There are some AI solutions which have an inbuilt capacity to learn patterns and make predictions. An example is AlphaGo, the software developed by DeepMind, the AI branch of Google.

Games like "Go" and "Chess" surpass the best human players.

1.5 AUTOMATED CARS

Google has been using AI for its search engines and maps. From automated gears to vehicle backup sensors, the new car parts are being built on AI technologies. Self driven cars are vehicles which do not require human drivers any more to manoeuvre the car and hence are popularly known as autonomous or driverless cars. Some major companies, such as Tesla, Mercedes, and Google, have made production of self driving vehicles a top priority for development. Remarkably, a mining corporation in Western Australia has already taken benefits of self-drive technologies.

1.6   WEATHER FORECASTING

High-impact natural calamities, such as hurricanes, tsunamis, thunderstorms and earthquakes cause huge infrastructure damage, property loss, and fatalities. Also some high-impact events, such as the impact on savings through renewable energy, can positively impact society. Due to greater observational capabilities and increased computing power, prediction of these events has improved. Artificial intelligence, data science technologies, machine learning and data mining help to bridge the gap between numerical model prediction and real-time guidance by improving accuracy. AI techniques also help to extract otherwise unavailable information from forecast models by fusing model output with observations. Applying AI techniques along with a physical understanding of the environment improves the weather prediction   skill.   .

1.7   FACE DETECTION AND RECOGNITION

Nowadays, cameras can detect facial expressions of a person. This has been possible due to the advances in artificial intelligence. Similarly individual's photo can be identified because of advanced machine learning algorithms. These algorithms have been developed using Bayesian analysis of image differences and probabilistic similarity measures. Face matching techniques include Eigenface matching, Bayesian face matching and dual eigenfaces.

1.8   IMAGE AND SPEECH PROCESSING

Deep learning which is a subcategory of machine learning plays an integral role in image classification and speech recognition. Machine learning also helps in:

1.   Semantic Information Processing
2.   Language understanding
3.   Speech processing
4.   Retrieval of information

1.9   HEALTH AND GENETICS

Fig.1.9.1: Five applications of ML in Healthcare.
Image courtesy:https://www.allerin.com/blog/5
-interesting-applications-of-ml-in-healthcare

Machine Learning algorithms are helping doctors and healthcare specialists in detecting and analysing the abnormalities and diseases in human bodies. Big data is helping doctor to personalise a patient's treatment options. The algorithms provide insights about the risks and susceptibility of a patient to a disease. The machine also suggests precautionary measures depending on the patient's response to medical treatment.

Machine Learning algorithms are aiding the scientists in drug discovery and experimentation process. They can analyse and predict the behaviour of a drug on a test subject, helping in turn to improve the drug performance.

Surgical robots, which have ML embedded technologies, provide help to surgeons with high definition imagery and extended flexibility to reach out in crucial areas. Clustering algorithms and data mining act as tools to helps to find genes that are related with a disease. **25**

1.10 SPAM MAIL DETECTION

With the development of ML, spam mail filters are implementing the algorithms of neural networks to eliminate spam mails. Spam mails are separated from normal emails by classification. The junk mails are identified and marked as spam by the neural networks and machine learning algorithms.

1.11 JOURNAL RANKING

Various research journals can be ranked depending on their impact factor. Using the tools of data analytics, machine learning algorithms and artificial intelligence huge datasets containing information about the journal are analyzed and ranked automatically.

1.12 SOUND IDENTIFICATION

Different sound can be separated from a mixture of sounds using cocktail party algorithm. Gaussian mixture models (GMM) are used for text-independent speaker identification. Using the tools of data analytics, machine learning and artificial intelligence, various sound sources can be identified, separated from each other and analysed.

1.13 GENERATIVE ADVERSARIAL NETWORKS (GAN)

Generative Adversarial Networks, popularly known as GANs, have taken the machine learning world by storm since its discovery in 2014. Generative adversarial networks (GANs) are a class of artificial intelligence algorithms. They are used in unsupervised machine learning. They are implemented by a system of two neural networks contesting with each other in a game-theoretic framework. Initially, these were able to produce high quality and super accurate fake images which were then unprecedented in the literature. Nowadays, GANs are used in a multitude of applications like generating fake video, images, privacy-preserving information, text-to-image conversion and many more. Since GANs are very new in the domain of deep learning, a lot of possibilities still remain unexplored.

## 1.14 PUBLICATION OF NEW RESEARCH PAPERS

Recently, an AI was trained on old scientific papers. It was able to make new discoveries which humans had missed for a long time. In a study published in Nature on 3rd July, 2019, researchers from Lawrence Berkeley National Laboratory trained an AI on scientific papers for connections humans had missed. The algorithm used in the AI was Word2Vec. It is an unsupervised algorithm. Though the algorithm was not trained on materials sciences, still using only word associations it was able to provide future thermoelectric materials which can be better than the ones currently used.The algorithm linked words which were found to be closer. It even linked those words which were associated with thermoelectric concepts but had never been mentioned explicitly in any paper. This algorithm can spot the missing link that is deceptive to the human eye. Researchers are hoping medical research and drug discovery can be done with this algorithm.

CONCLUSION

Until recently, artificial intelligence was related to science fiction movies and books. However, we are now in the midst of ever-changing technology where advancement is faster than we could ever comprehend.With current research activities in this field, further interesting avenues are surely to open up that would be beneficial to mankind and would lead us to an intelligent world than ever before.

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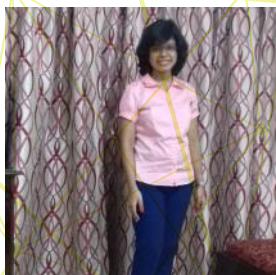
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