ARTIFICIAL INTELLIGENCE
THROUGH THE AGES

2017

X-CRYPTUS

ST. XAVIER'S COLLEGE
(AUTONOMOUS) KOLKATA

DEPARTMENT OF COMPUTER SCIENCE

X-CRYPTUS
VOLUME I

A TRIBUTE TO
ALAN TURING

1912-1954

"

THOSE WHO CAN IMAGINE ANYTHING,
CAN CREATE THE IMPOSSIBLE.

"

CONTENTS

THE EDITORIAL BOARD

MESSAGE FROM
THE PRINCIPAL

REV. FR. DR.
J. FELIX RAJ S. J.

It gives me great pleasure to be a part of the release of 'X-Cryptus', the annual magazine of the Department of Computer Science. It is the inaugural volume, compiled by an editorial board comprising the students and the professors of the department.

The magazine contains articles submitted by students, professors and experts in the field, interviews, and focuses on a cover feature in the many years of Artificial Intelligence. 'X-Cryptus' strives to portray the technological advancements happening in the city as well as in the country. I wish this volume to be the beginning of many more to come in the years ahead.

The release of the magazine is paired with the annual departmental fest, 'eXabyte'. The technical fest organized by the department had proved its success in 2016, and I wish them all the success in their ventures now.

I take this opportunity to congratulate the faculty and the students of the Department of Computer Science, and wish them blessings and benevolence of God in all their future endeavours.

A first edition is always an exciting and adventurous prospect. The publication of X-Cryptus makes that prospect a reality. I congratulate the department for the relevance and topicality of the theme of this first edition. It signifies the department's commitment not only to the rigorous academic and intellectual standards but also its intent to be continuously contemporary, updated and relevant.

In today's academia, research and publication are of paramount importance. X-Cryptus is a platform that provides students with an opportunity to learn and develop the skills of research and writing. I wish the department, the professors and all the students, all the very best o this very laudable academic effort.

PROF. BERTRAM DA SILVA

MESSAGE FROM THE
DEAN OF SCIENCE

I am pleased to be a part of the Department of Computer Science's very first issue of their magazine, X-Cryptus and take this opportunity to congratulate all the members of the department. The theme of the magazine, "Evolution of Artificial Intelligence through the Ages" promises to be an exciting one.

The magazine showcases the interest of the department beyond their set curriculum. I hope the magazine shall become an annual feature of the Computer Science Department.

Best wishes

PROF. DR.
TAPATI DUTTA

MESSAGE FROM THE
HEAD OF THE DEPARTMENT

PROF.
SHALABH AGARWAL

It gives me immense pleasure to announce the release of the inaugural issue of our departmental magazine, 'X-Cryptus' on the occasion of Exabyte 2017, the annual technological event presented by the Department of Computer Science, St. Xavier's College, (Autonomous) Kolkata.

The focal theme for this issue of the magazine is the 'Evolution of Artificial Intelligence through the Ages'.

Students from various departments have contributed articles pertaining to the technologies and sciences of computers. The magazine also includes articles from eminent personalities from the I. T. industry and other spheres, sharing their insights on the role and importance of information **technology** in their respective professional domains. Our students also interviewed Prof. Kenneth Regan of the State University of New York at Buffalo, who shared with them his experiences and work from his accomplished research.

The tireless efforts and unfailing enthusiasm of our dynamic editorial and design team culminated in this year's edition of 'X-Cryptus'. I congratulate them for their zeal and constant endeavours. I express my heartfelt gratitude to Rev. Fr. Dr. J. Felix Raj, S. J., our Principal for his continuous **encouragemen**t, guidance and support. I also sincerely think our entire departmental faculty and especially to Prof. A. Acharya, Prof. J. G. Dastidar and Prof. S. Mukherjee, for their constant efforts and support without which such an undertaking would not have been possibl

"An ideal leader does not tell people what to do; instead he shows people what to do."

This is what I learnt from my professor, Shalabh Agarwal, the Head of the Department of Computer Science, who has inspired me in all my achievements in the tenure of the last two and a half years that I have spent in St. Xavier's College (Autonomous), Kolkata.

I want to thank our Principal, Rev. Fr. Dr. John Felix Raj, S.J., our Vice-Principal (Arts & Science), Prof. Bertram Da Silva and our Dean of Science, Dr. Tapati Dutta for their unconditional guidance and support. I also want to thank Prof. Shalabh Agarwal for always supporting and encouraging us in our every effort towards the magazine and Prof. Partho Mukherji for always being there for the Student Editorial Board whenever they needed a direction regarding any matter. I can never thank the Teacher Editors, Editor-in-chief, Sayudh Roy and the entire student editorial board, enough, for their hard work and dedication shown towards X-Cryptus, Volume I.

FROM THE STUDENT CONVENOR SARTHAK GUPTA

Artificial Intelligence challenges the distinction between man and machine. It is the element of technology that is set to take over the reigns of the world. We hope that we have done justice to our theme.

We started planning X-Cryptus: Volume I back in 2016, right after the success of our inaugural departmental fest, Exabyte 2016. We faced new challenges everyday, right from deciding on the theme, to approaching eminent personalilites for their valuable articles, right upto finally getting the issue ready. However, our efforts would have been futile without the constant support of our Fr. Principal, Vice Principal and our Dean. I would also like to extend my heartfelt gratitude to our HOD, Prof. Shalabh Agarwal and the rest of our professors for their constant support and unwavering faith in us through the course of this magazine. I would finally like to thank each and every member of my Student Editorial Board without whose tireless efforts, this magazine would not have been possible. I hope this magazine interests and enriches its readers. We hereby present to you,
X-Cryptus: Volume I.

1 ABOUT

THE DEPARTMENT

Ever since Computer Science was first introduced as an additional subject in class XI in the year 1995, the department has come a long way. The B.Sc. degree with Honours in Computer Science was introduced in the year 1998. The college was one of the pioneer institutes to start the course under the University of Calcutta. Ever since it was introduced, the college maintained a strict record of producing the University toppers for consecutive years till 2008, after which St. Xavier's College became an autonomous institute. The year 2005 marked the introduction of M.Sc. in Computer Science as the first autonomous course of the college and among all colleges under the University of Calcutta.

The department has always produced quality professionals and research fellows working both in India and abroad. It has maintained its repute by keeping itself involved in the speedy evolution of technology and the unending drive for innovation. The students of both undergraduate and postgraduate courses are well placed through on-campus and off campus placement drives. Students have been placed in reputed IT companies like Odessa Technologies, CTS, IBM, RS Software etc. Many of the students opt for higher studies and have enrolled themselves in the reputed Universities/Institutes of our country like the IITs, NITs etc. Some of them have been selected for scholarship programmes in international universities such as Oxford University, Manchester University, Kings College UK etc. The students of our department have continued to bring us glory by successfully publishing papers in well acclaimed peer reviewed journals and presenting papers in national and international conferences.

The curriculum is prepared to suit the requirements

of the industry and research organisations and is continuously upgraded. Seminars, workshops and invited lectures are organised on a regular basis to keep up with the latest trends and technologies. The professors enthusiastically contribute to the academic and research fraternity by publishing papers in peer-reviewed journals and presenting research papers in many international and national conferences. Professors are also involved in research projects sponsored by UGC and other agencies, adding academic value to the Department.

HIGHER STUDIES

■ M.Sc.
■ IIT
■ MBA
■ Jobs

The department is actively involved in the development and implementation of ICT facilities in the college. Some of the faculty and staff members have immense contribution towards the ICT advancement of the college. Thus, the department reaches out beyond its academic commitments to facilitate the overall functioning of the college with respect to the utilisation of technology, both in teaching, learning and administrative operations.

The department is committed to nurturing students in all dimensions, be it the academic or the entrepreneurial. It has but one aim, and that is, to hone the talents of students walking through the gates with the words "Department of Computer Science" inscribed on their identity cards, so that they emerge as successful Computer Science professionals.

eXabyte 2016

The inaugural tech fest of St. Xavier's College (Autonomous), Kolkata, eXabyte 2016, presented by the department of Computer Science, was held on 6th and 7th January, 2016 on the premises of St. Xavier's College (Autonomous), Kolkata. The entire event turned out to be a grand success and has set a lofty benchmark for all such tech based events throughout the state. There was participation from as many as 17 colleges and 167 participants, competing fiercely over a range of as many as 10 highly stimulating events.

The event kicked off with a short; yet crisp opening ceremony on the afternoon of the 6th of January. There was a melodious musical performance by the members of the department of Computer Science to start off proceedings and welcome the distinguished guests who took time out of their busy schedules to grace this event. The distinguished guests comprised of Professor Basab Chowdhury, Vice Chancellor of West Bengal State University, as the Chief Guest, Professor Amlan Chakraborti, Associate Professor and Co-ordinator at A.K. Chowdhury School of I.T., Calcutta University, as the guest of honour, Rev. Fr. Felix Raj, Principal, St. Xavier's College (Autonomous), Kolkata, Professor Bertam Da Silva, Vice Principal of Arts and Science departments, St. Xavier's College (Autonomous), Kolkata and Professor ShalabhAgarwal, Head of the Department, Computer Science, St. Xavier's College.

The lighting of the ceremonial lamp by all the esteemed dignitaries marked the official start of eXabyte 2016. This was followed by the Welcome Address by Professor Agarwal and the Inaugural Address by Rev. Fr. Felix Raj. Their inspiring words worked as a major source of encouragement to all present.

This led to the end of the Opening Ceremony and the first part of the day's proceedings. The next part of proceedings planned for the afternoon included two seminar sessions. Professor Basab Chowdhury, Chief Guest, delivered the keynote address; followed by Professor Amlan Chakraborti, guest of honour, who delivered the technical address. Their brilliant discourse left the entire auditorium speechless and completely enamoured. This concluded proceedings for day 1 of eXabyte 2016.

Day 2 of eXabyte brought with it a flurry of excitement as all the competitive events got underway. There were colleges throughout the state who sent their contingents to take part in the fest. A day of very high levels of competition ensued as the participants fought it out gallantly in all the events which ranged from technical events like coding and debugging to lively mind engaging, events like Treasure Hunt. There was also a very distinguished panel of judges for each of the events to ensure that high standards were maintained and the events were officiated in perfect fashion.

The events finally drew to a close and the fest eventually culminated in the Closing Ceremony. The Closing Ceremony started off with a brilliant dance performance by students of the Department of Computer Science. Then the teachers of the Department of Computer Science presented the awards to the prize winners.

This finally brought eXabyte 2016 to a close. It turned out to be a perfect success and exceeded all expectations. It was indeed an exceedingly mind engaging event and it is hoped that this is only the beginning of many more such successful editions in the years to come.

Our esteemed guests who graced the various events of Exabyte 2016 were

- o Prof. Anal Acharya
  Computer Science Professor
  St. Xavier's College, Kolkata

- o Prof. Debabrata Datta
  Computer Science Professor
  St. Xavier's College, Kolkata

- o Team Xquizit

- o Fr. Dejus John Retnam
  Head of the Deaprtment
  Multimedia and Animation
  St. Xavier's College, Kolkata

- o Prof. Zaid Al Baset
  Sociology Professor
  Head of Debating Society
  St. Xavier's College, Kolkata

- o Mrs. Fernaz Mogrelia
  Senior School Teacher
  Advisor to the Debating Society
  Loreto House

- o Mr. Akash Mondal
  Braindrops

PRIZE WINNERS

QUIZ
WINNERS – Rudra Prasad Chakraborty and Rajarshi Nath,
Bengal Institute of Technology
RUNNERS UP – Anik Dasgupta and Aditya Agarwal,
Jadavpur University

CODING & DEBUGGING
WINNERS - Snehashis Pal, Madhura Bannerjee and Kalyan Majumdar,
St. Xavier's College (Autonomous), Kolkata
RUNNERS UP - Pramod George Jose, Saikat Das and Prasenjit Dey,
St. Xavier's College (Autonomous), Kolkata

LOGO DESIGNING
WINNER – Pallab Kanti Mukherjee,
St. Xavier's College (Autonomous), Kolkata
RUNNER UP – Adreeta Chakraborty,

DEBATE
WINNERS - Debayan Mitra and Yashoroop Dey,
St. Xavier's College (Autonomous), Kolkata
RUNNERS UP – Saurya Sengupta and Moyuree Mukherjee,
Presidency University

BEST SPEAKER FOR THE MOTION
Yashoroop Dey
St. Xavier's College (Autonomous), Kolkata
BEST SPEAKER AGAINST THE MOTION
Debayan Mitra,
St. Xavier's College (Autonomous), Kolkata

PHOTO EDITTING
WINNER – Subham Roy,
University of Engineering and Management, Kolkata
RUNNER UP - Pallab Kanti Mukherjee,
St. Xavier's College (Autonomous), Kolkata

WEB DESIGNING
WINNER - Md Rafi Akhtar,
University of Engineering and Management
RUNNERS UP - Anirban Das and Shiladitya Sengupta,
Jogesh Chandra Chaudhuri College

T-SHIRT DESIGNING
WINNER – Subham Roy,
University of Engineering and Management, Kolkata

MACRO PHOTOGRAPHY
WINNER – Agniprava Nath,
Asutosh College

GAMING
WINNERS - Aditya Ray, Aritra Pal, Indranil Santra, Arnab Das and Debanjan Choudhury,
St. Thomas' College of Engineering and Technology
RUNNERS UP – Abhirup Nandy, Ishanneel Chaudhuri, Soumik De, Utsa Chattopadhyay and Soura Sena Das,
Ramakrishna Mission Vidyalaya, Narendrapur

BEST PLAYER - Aditya Ray,
St. Thomas' College of Engineering and Technology

TREASURE HUNT
WINNERS – Avni Khetawat, Sohini Basu and Sanjana Gopal,
Loreto College Kolkata
RUNNERS UP – Deepshikha Agarwal,Rituparna Paul and Arka Sengupta,
Seth Anandaram Jaipuria College

2 ARTIFICIAL INTELLIGENCE
THROUGH THE AGES

We start back from the 1950s, with Asimov's three rules of Robotics. The starting point of artificial intelligence cannot be pinpointed to one specific time period. However, an applicative study of artificial intelligence can be made with respect to the three laws of robotics developed by Isaac Asimov which were formally introduced in one of Asimov's short stories "Runaround", written in 1942. Alan Turing's theories, which form an integral part in the foundation of AI came almost a decade after this. Isaac Asimov had not examined the theoretical aspects of his work, initially intended to be science fiction. However, it had deeper annotations beyond the bookshelf.

The three laws of robotics, as formulated by Asimov are: A robot may not injure a human being or, through inaction, allow a human being to come to harm. A robot must obey the orders given to it by human beings except where such orders would conflict with the First Law. A robot must protect its own existence as long as such protection does not conflict the First or Second Laws. After Asimov's later work dealt with robots gaining control over governments and civilizations, he added a fourth or zeroeth law: A robot may not harm humanity, or, by inaction, allow humanity to come to harm.

An idea of evaluating a machine's ability to showcase intelligence that would prove indistinguishable from the intelligence exhibited by human beings was later developed by Alan Turing in 1950, which came to be known as the Turing Test. The test had a human evaluator, who would compare and contrast answers given by a human being and a machine, all the while being confined so that he or she cannot tell the two candidates apart. It would be standardized, that is, the questions and answers could only be

provided in on screen, so that the human candidate could not have the advantage of speech and hearing. The evaluator would then reckon not how correctly the machine answered the questions, but how closely the machine's answers would match those of the human's. This could be determined by the evaluator, who is shut off from both the human and machine candidates, by how narrowly the two answers matched. Turing theorized that the machine could mirror seventy percent of the human's answers after five minutes of the process.

The question he asked was, could machines prove to be successful in the imitation game? This laid the foundation for and consolidated the underlying theory of artificial intelligence. There were several programs developed which passed the Turing test.

ELIZA, developed by in 1966 by Joseph Weizenbaum, and PARRY, developed in 1972 by Kenneth Colby, passed the test. Till the twenty-first century, they prove to be the precursors of a malware program called "CyberLover", which preys on Internet users asking them to reveal personal information about the user, promising them romantic relationships with other (fake) users.

In the 1960s and 70s, the world saw the age of the first robots. How would it feel like if we had a machine which would efficiently carry out any instruction given to it? Would it not be amazing to have a machine designed to embody the features and habits of a human being? Well, the same instincts pioneered the development of the first robots in the 1960s, Shakey and Freddy.

Shakey was the first general purpose robot developed by Charles Rosen and his team, which was capable of segmenting a given instruction into the basic blocks on its own. Thus, the users were not required to instruct the robot for every step to carry out a task. Shakey was programmed using the second level programming languages and was integrated with a planner with a few predefined tasks, like moving from one location to another or opening or closing a door. When given a command, the robot would perform the predefined actions in a sequence to achieve the required goal. Thus, the scope of the predefined actions limited its usability. From the physical aspect, Shakey was a tall robot with television cameras, collision/"bump" detectors, an antenna for radio link, sonar range finders and onboard sensors.

The development of Shakey resulted in significant advancements in AI and robotics. It led to the development of the A* search algorithm which is used in path finding and graph traversal algorithms and Hough transform feature which was used in image processing.

1970s saw the development of another important robot, called Freddy by Donald Michie and his team. Freddy is considered as a landmark in the history of robotics as it was one of the earliest robots to be built with vision, intelligence and manipulation systems which would be reprogrammed for learning new tasks. Freddy was designed with a rotatable platform supported by independent wheels, a video camera, 3D scanners to perceive and detect parts to be manipulated and bump sensors connected to the computer which controlled the robot. The robot was capable of performing tasks like assembling simple toy models and ringing pegs. However, the major disadvantage was that unlike Shakey, Freddy had to be instructed regarding every step of the task individually by the user to achieve the required goal.

In the 21st century, robots have gained more importance in the industrial and commercial sector as they are capable of performing the jobs that were dangerous for human beings.

Technology witnessed the onset of the development of the fifth generation of computers first during the 1980s. Designed to allow the system to interact with the users in their natural language rather than using only commands for giving machine instructions, these computers were developed to increase their importance in human lives. They are still being developed further even today, to meet the ever increasing demands and expectations.

The introduction of the Ultra Large Scale Integration(ULSI) technology from Very Large Scale Integration(VLSI) technology has been crucial in the development of the fifth generation computer. This generation has seen the true development of artificial intelligence where ideas such as parallel processing hardware, superconductor technology, multimedia based interfaces and even voice recognition are being incorporated into the systems. With the advent of quantum computation, nano and molecular technology in the field of computer science, the importance and scope of computers has been increased dynamically. The users can use high level languages such as C, C++, Java, etc. to interact with the systems. Game playing, neural networks and development of an efficient system which was capable of making real life decisions are some of the other highlights of this generation of computers.

The vision of designing a system which could make real life decisions and interact with humans led inspired the formation of an artificial neural network based on the model of the central nervous system. These networks were formed to help in the evaluation of functions which were dependent on a large number of unknown inputs. The network is chiefly characterised by three things:

● Architecture - defines the peripherals involved and the relationship between them
● Activity Rule - defines how the peripherals would respond to one another
● Learning Rule - defines how the relationships within the network will change over time to adapt to the changing interactions amongst the peripherals.

Technologies such as neural networks are of significant importance in sectors like computer vision, voice recognition and handwriting tests where achieving the desired results using pure computer coding is difficult, as considering a random, predefined pattern as input would limit the scope of usability of the technology.

Michael Dertouzos, director of the Laboratory of Computer Science at MIT, spelled out his vision of a future in which computers recede into the background as enabling tools. "I don't want us to be slaves to our machines," he declared. "I want our machines to serve us." He launched Project Oxygen in June 2000, convincing six global business partners to promote "pervasive human-centered computing". The research is oriented squarely toward applications rather than pure technology. Project Oxygen is an ongoing research project in MIT. It consists of handheld terminals and computers embedded in the environment and dynamically created networks that connect these devices.

In future, computation will be human centered. We will not have to carry our devices with us at all times, instead configurable generic devices, either handheld or embedded in the environment will bring computing to us, wherever we are and whenever we need it. We will communicate naturally through speech and gestures that convey our desires and leave it to the computer to carry out our will.

To support highly dynamic and varied human activities, the Oxygen system must have the following qualities:
●Pervasive: must be everywhere, reaching out to the same information base
●Embedded: must live in our world, sensing and affecting it
●Nomadic: must allow users and computers to move around freely
●Adaptable: flexible and spontaneous
●Powerful, yet efficient.
●Intentional: must allow people to handle devices based on intent rather than address.
●Eternal: It must never shut down or reboot. Components may come and go but Oxygen, as a whole, should be ever present.

The two main oxygen device technologies are:

E2Is (Enviro2Is): Embedded in offices, buildings, homes and vehicles, E2Is enable us to create intelligent spaces. E2Is are populated by camera and microphone arrays, large area displays and other devices which enable us to

communicate using speech and vision, without being aware of any particular point of interaction.

H2Is: Handheld devices provide mobile access points for users, both within and without the intelligent spaces controlled by E2Is. H2Is accept speech and visual input, and they can reconfigure themselves to perform a wide variety of useful functions and support a range of communication protocols. H2Is can serve as cellular phones, radio , television or PDAs. H2Is can conserve power by offloading communication and computation onto nearby E2Is.
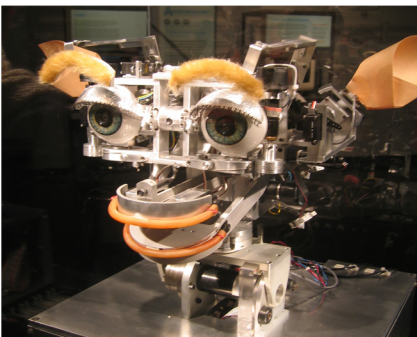
The late 1990s and the 2000s saw the rise of social robots. A social robot is an autonomous machine that, with motor and sensor capabilities, is able to interact and communicate with humans or other physical entities following a code of conduct dictated by social norms. With the development of better Artificial Intelligence,

Kismet now resides at the MIT Museum, in Cambridge, Massachusetts, United States

the next natural step was communication with human intelligence-recognition of social cues.

One of the first working robots which could express emotions was Kismet, developed in 1997 by Dr. Cynthia Breazeal and her team for her doctoral research in expressive social interactions between humans and humanoid robots. Kismet branched out from a project called Cog, undertaken in MIT in 1994 to build a "thinking robot". It was fully integrated with the ability to recogise affective communicative intent, visual processing capabilities, a canonical babbling mechanism and a low-level visual processing and attention system. The goal was to develop a machine that could process visual and auditory cues and express emotional response to them by learning proper social rules. Kismet was literally the baby step towards advanced social AI.

Kismet was designed to resemble a parent-infant communication. Structurally, it was a robotic face with a pair of eyes with inset cameras and motor controlled eyebrows, lips, ears and a moveable neck that could make it lean in or lean back. Humanoid robots generally are best suited for social interactions with humans. Unlike conventional robots which are only programmed to work in an environment too hostile for humans, social robots need to have a high level of autonomy, i.e. it must be able to interact with a human on the

human's terms without being specifically instructed to do the same. These pose challenges like human language recognition, facial expression and everything that we humans do instinctively because we cannot program instinct. So, to have a robot behave like a child trying to learn from its parent, in 1997 was quite an achievement.

The early 2000s also saw the development of tactical robot armies like the Centibots which were little tortoise like robots which were designed to be sent into an area to survey it before sending in people for rescue or assault operations. Androids like ASIMOV were also developed with exceptional locomotive capabilities.

Recommendation technology is an information filtering platform that was developed to help predict the 'preferences' of a user in a given environment. This technology has been seen to have significantly impacted the social life as it was gradually adopted by most search engines and the e-commerce companies. It is also helpful for programmers to find alternatives solutions to problem thereby achieving their goals more efficiently.

This technology uses a recommender system which produces a list of recommendations for the user, pertaining to his current search query. The four commonly implemented forms of the technology were Collaborative filtering, which filters recommendations on the basis of the user's search patterns; Content based filtering, which uses the user's last searched queries and returns similar options; Social/Demographic filtering, which returns queries made by friends or locals and lastly Contextual, to match the user's current content. In general, all types of recommender system are implemented using platforms categorisingnon traditional data. These predictive models are developed by combining the data retrieved from different environments.

Recommendation technology became increasingly important in the industrial sector as it helped increase the revenues of ventures such as Amazon, Netflix and many more. It has been accounted for procuring almost thirty percent of the revenue of these companies. This became possible as these systems transformed the Internet based sites into a personal, adaptive system which personalised content on the basis of the user's taste.

After looking at the success achieved by the technology in the industrial sector, a similar platform was developed for people, Commons. This platform was used to compare and recommend people who share similar ideas and interests. It essentially replaces objects with people. The users are first required to answer a series of questions, based on which the final results are obtained and the recommendations are made. Commons has been considered to be one of the most efficient forms of systems

possibly generated as it eliminates the two integral problems of the others systems. These problems were scalability i.e., the number of options is discrete for people against items and sparsity i.e., the initial test is required for providing the user his first set of recommendations thereby preventing a cold start.

2010 saw the advent of something which was for the video game aficionados.

Imagine the technology behind controlling and interacting with your console without the need of a game controller. Does that sound familiar? Yes, we are indeed talking about Kinect, a line of motion-sensing input devices developed by Microsoft, for Xbox 360.

Release poster for XBOX 360 Kinect, which was launched in November 2010

It was codenamed Project Natal during its development, before being finally released for Windows 7, in 2011. It is based around a webcam-style add-on peripheral, possessing a natural user interface of gestures and spoken commands. Kinect operates on range camera technology,

developed by the Israeli brand PrimeSense. The system could interpret specific gestures, making complete hands-free control of electronic devices possible by using an infrared projector and camera, and a special microchip to track the movement of objects and individuals in three dimensions.

Let us backtrack and ponder on the idea of range camera technology, or range imaging. The idea we are dealing with is that of machine vision. The steps conquered in machine vision are acquiring an image, processing the image, analysing and finally understanding the image. And this is where artificial intelligence comes into play. The computer goes through the process of recognition, whose sub-processes include recognition, identification and detection. It then goes through motion analysis, where an image sequence is analysed to estimate velocity.

The next step is scene reconstruction, where, given images of a scene, a 3-D model of the scene is reproduced.

The final step is image restoration, where sensor noise, motion blur, etc. are removed.

Kinect is described by Microsoft personnel as the primary innovation of the software technology which enables advanced gesture recognition, facial recognition and voice

recognition. According to information supplied to retailers, Kinect is capable of simultaneously tracking up to six people, including two active players for motion analysis with a feature extraction of 20 joints per player.

iOS is a mobile operating system launched by Apple Inc. in 2007. The OS has undergone significant changes since its introduction with each upgrade providing something new for its users, Siri being one of its most significant integrations. Siri is a major branch of Artificial Intelligence which was introduced into the market in 2011.

iOS 5 was the fifth version of iOS, released in the markets in the year 2011. This upgrade was characterised by several modifications and new features. Siri, which has been described as a virtual assistant, was introduced to replace Voice Control which was present in the older versions, allowing the OS to make recommendations to the user apart from only connecting calls. It uses the language and search queries of the user to return personalised recommendations and answer questions. The other features included iCloud, a cloud based service which became available for its users; new home screen apps, wireless synchronisation and a new notification center. The iOS 6 upgrade saw the removal of Google Maps and YouTube and the introduction of an in-built, vector-based Maps application. Siri was also improvised with the app now being able to make reservations, notifying the users about updates on Facebook and Twitter and providing sports figures. It was also made available on many new devices apart from the iPhone 4S. The other important upgrades included new privacy settings for the users and addition of Facebook as one of the native apps of the OS.

iOS 7 provided complete multitasking between all its apps with the introduction of a layered interface. No new major upgrades were made on Siri. The app was redesigned to with a new translucent interface, the option between male and female voices and better control over the system settings. This feature mainly improved the general environment of the OS, upgrading the App Store, Camera and Music and introduced the Touch ID, a sensor which requires the user's thumbprint to unlock the device.

The eighth major release of iOS, iOS 8 was released in 2014. Siri was now programmed to provide a better virtual experience with a higher accuracy rate. It supported over 20 languages and could be used to make any purchases on iTunes, identify the song the device was presently playing and audio commands could be used to activate it when connected to a power source. This release improved photo editing, messaging, typing and notification center options, introduced HomeKit to control external devices using Siri and HealthKit, a

health app.

The latest upgrade, iOS 9 was released in 2015. Siri was upgraded to provide the users with personalised search options in advance, detect the current on-screen apps, set reminders for the users and detect the documents added at any point and display them. The Messaging, in-built Notes, Camera apps were improved and the interface provided the users with better multitasking options. 3D touch has been added only to iPhones 6S and 6s plus to provide shortcuts and faster navigation.

With the evolution of artificial intelligence humans are crossing boundaries of innovation. In a way, they are recreating versions of themselves who do the work better, faster and more logically. It is one of the most interesting things in the world, to watch how we would behave had we had faultless machines for brains.

While the tools of artificial intelligence help us overcome the hurdles of inconvenience, they open up new floodgates of thoughts. We gain a more efficient way of life thanks to technology, and technology can improve itsef by imitating the issues faced in real life. In a way, the relationship between man and machine is symbiotic.

INTER VIEW

KENNETH W. REGAN

ASSOCIATE PROFESSOR
DEPT. OF COMP SC. & ENGG.
UNIVERSITY AT BUFFALO
STATE UNIVERSITY OF NEW YORK

Prof. Kenneth Regan of the State University of NY, Buffalo visited St. Xavier's College along with Prof. A. Chakrabarti of University of Calcutta on August 11, 2016 and met Fr. Principal in presence of Prof. Shalabh Agarwal, HOD Computer Science Department. He informally discussed about his research interest.

What developed your interest in the field of Computer Science?

It was the romance of the Princeton Institute, Einstein, and the giants there. It was sixty miles from New Jersey. So I had my heart setup on Princeton and doing mathematics and physics research. I have a lot of other interests including languages, literature even music; but technical research was always my first love and I should add, I also was a junior chess player. But I never intended to do chess as a profession. So it was very much the quest for knowledge, as it has always been, and the freedom to pursue it.

What are the projects you are currently working on?

I am currently working on three things:
(i) Computational Complexity
(ii) Human decision making at chess
(iii) Choice cheating at chess
Computational Complexity theory is my regular field of study. It is what I have done

since thirty years. I have got degrees in mathematics from Princeton and Oxford. Oxford did not have a computer science department at that time but then I managed to complete radical computing. Computational complexity theory is the science of how more computers need to solve problems, average memory and other resources they must commend.

You've seen the best of what US has offered for Computer Science and you have seen how computer science is taught in India. What can you say about the comparison between the two types of teaching?

When I was in Pune for the National Seminar, two of the speakers made a big point about the need of education for knowledge. They told me that a lot of teaching is to the book rather than coping up new ideas. I gave a 20-hour mini course here to the first year university graduates and I had the idea that it was going to be a mix of students: some who are having prior

Human Decision Making (At Chess) - Research Prospectus

Kenneth W. Regan, University at Bufalo CSE

I have designed a predictive-analytic model that projects the probabilities that humans will choose various decision options, given hindsight values of their worth. Plugging in values given to chess moves by strong computer programs makes the model work for chess, but that is the only chess-specific content. What else besides chess can be done with a model whose general task is "Converting Utilities Into Probabilities"? Why has it been so effective as to be deemed useful in court testimony in chess-cheating cases and covered by the New York Times, NPR, and the Wall Street Journal? Chess may be complex, but on mass scale, human players still follow simple mathematical laws.

What It Is: A predictive-analytic model for human decision making. The domain is move-choice at chess. The only chess-specific content is numerical values given to the various move choices by strong chess computer programs run to high depth. These represent hindsight utility values for the choices. The goal is to determine how frequently a fallible (human) agent can find the foresight that produces good hindsight results.

What It Does: The general problem solved is "Converting Utilities Into Probabilities." The model outputs, for each possible move, the probability that an agent having certain skill parameters will select it. This enables forecasts of certain aggregate statistics, importantly with projected confidence inter- vals. Then actual player scores on these statistics provide "Intrinsic Performance Ratings" (IPR's), hypothesis tests relevant to cheating cases, and other quantitative results.

What It's Good For: Skill assessment, prediction of results, cheating detection, player feedback and training, evaluation of other skill rating systems, probing human behavior tendencies, and general problems in rational-choice theory, psychometrics, statistical methodology, and scientific modeling.

Current Composition: Four jointly authored research papers, all presented at professional inter- national conferences, three with wide scope (data-mining and AI). Original software is over I0,000 lines of C++ code for data management and statistical analysis, plus 2,000 lines of Perl to collate the data. Over 60GB of textual data taken on desktop PC's, 30 million pages at 2k/page; over I million moves, plus I0 million in quicker mode covering nearly all major events in chess history.

I. Results So Far:

I. Training data shows a strong linear correlation between the computed "Intrinsic Performance Ratings" (IPR˙s) and the players˙ ofcial ratings on the Elo system used by the World Chess federation (FIDE). In Elo, a beginner may be rated 1200, a club regular 1600, a master 2200, and the world champion near 2800. This correspondence has been mostly steady since the 1970˙s, contrary to wide belief in over 100 points of "rating inflation" [Regan-Haworth, 2011]

2. Other evidence that human skill at chess has been improving over time, analogous to athletics, with possible import for other intellectual fields. [Regan-Haworth-Macieja, 2011]

3. IPR˙s show the efect on performance of faster time controls and other tournament formats and conditions. The correspondence to Elo makes the meaning of these computed ratings more robust than in other performance judging fields.

4. Human performance (at chess) has intrinsic lower bounds on its variability, represented by the projected error bars. Preliminary indications are that actual performance varies more on a per-event than a per-game or per-move basis.

5. Distributional studies of player performance, including cheating tests and controls for them. Official and unofficial involvement in prominent cheating cases, including sworn testimony.

2. Applications:

Within Chess:
Skill assessment—overall and in various kinds of positions such as endgames, tactical play, positional play, attack, defense, ahead, behind. Player training. Forecasting the capacity to improve one˙s skill. Stability of the rating system. True growth curve of player strength—the belief that Elo ratings "lag" for developing players has led to artificial imposition of "rating bonuses"; controversy about them may be intrinsically resolvable. Objectively-assessed effects of faster time controls and playing two or more games in a day on quality of play. Cheating testing.

Standard representation of computer analysis and comparison of different chess programs. Historical ratings.

Outside Chess: The model applies in any situation where an agent must choose one of several alternatives, each of which has a prescribed or hindsight determined value that is not directly perceived:

I. Multiple-choice tests, especially scored by value of answer rather than zero for all but one answer.

2. Trader aptitude, including insider-trading detection and gauging fidelity to particular advisors.

3. Other games, any in which options can be given authoritative (hindsight) numerical evaluations.

4. Fraud detection in general, based on the chess-cheating methodology.

3. General Scientific Impacts:

I. Big Data aspects: Several model-design features have been inferred from data. These include discovery that the average error per move made by human players, when plotted against the overall advantage in position for one side, scales up afne-proportionally to it. Log-log scaling flattens this plot and tunes the model. Other examples are a persistent 58%-42% frequency split between two moves tied in value at high depth, and comparison of statistical fitting methods.

2. The model fits large-scale human behavior to a single simple equation.

3. Scaling law analogizes to argue that humans perceive financial diferences in proportion to the benefit or overall size of a transaction. Efect is less pronounced in games played by computers.

4. The parameter-fitting task lends itself to a wide range of fitting methods: Bayesian; maximum-likelihood; frequency fitting; clustering; minimizing various fitting scores or distances. The model and data provide multiple criteria for judging closeness of fit. Providing a natural application that discriminates fitting methods may be the most immediate general import of this work.

5. Particular human tendencies, such as time-(mis-)management, risk-taking, reliability, and ag-gression can be quantified and graphed.

6. Psychometric measures and issues, such as separating answer prediction from skill assessment.

4. Research Opportunities:

1. Expand the model to represent more features (currently implementing depth-of-calculation).
2. Tune the model to yield robust results on smaller data sets (current).
3. Compare and evaluate diferent statistical fitting methods in this test-bed (current).
4. Apply model to multiple-choice tests, compare to current psychometric measures (2013).
5. Develop relations to other cognitive models and decision-making applications (2013).
6. Other social-science investigations, and general modeling issues in machine-learning (2013).
7. Applications within chess, such as compiling IPR's from current and historical events, evaluating
past controversies, player forecasting and training, tournament format analysis (ongoing).
8. Potential wider applications, including transaction integrity and risk analysis.

4 GUEST ARTICLES

INFLUENCE OF INFORMATION TECHNOLOGY IN EVERYDAY LIFE

SUBRATA CHATTERJEE

DIRECTOR OF OPERATIONS
REGION INDIA

ALSTOM T&D INDIA LTD.

It is wonderfully simple to write on contemporary topics like the one I am taking up, 'Influence of Information Technology in Everyday Life'. But then before writing on anything some research is required and for that I relied on the simplest & most successful tool available today, 'GOOGLE'. Hope I am not seen as endorsing Google over its competitors but then it's imperative to be honest to the reader so I disclosed the source. I typed the word 'Information Technology' in the search tab and found few enriching words and I was happy to see that my vision of the theme was same as what I was seeing on Google and hence it stood authenticated. I will start with the meaning of word Information Technology, as I have learnt that if a word is used too often then people stop knowing its meaning hence is always good to have a reminder.

"Information technology (IT) is the application of computers to store, retrieve, transmit and manipulate data, often in the context of a business or other enterprise. IT is considered a subset of information and communications technology (ICT)".

If I put this simply, Information technology is the science of processing information and then communicating it for consumption. It is all about speed and ease. Hence we are trying to understand how this speedy processing of information and ease of communication impacting our everyday life.

I was not too happy with the word 'manipulate' used in the definition and would prefer to replace it with 'calculate'. But then very soon I realized that it hardly matters as machines only do the processing, manipulation or calculation is up to the users and hence here begins our role.

In my interpretation, Information & Technology are two words which in their individual capabilities have a vital impact on our daily lives. And this is not today; it is something which has been happening since the human race started progressing and evolving. Progression is linked to doing something 'better and different from past'. To do that one needs two important friends standing by their side, 'Information' & 'Technology'. A valid question can be 'How?' Information is required to know and understand the present and the past, to understand what had worked and what did not and Technology is required for building the superstructure from the foundation which has been put in place by the 'information'. Every development requires information, we build complicated systems and at times we use first of a kind technologies but everything follows the same sequence and you can trust me on that.

First there are inputs and specifications (information) helping us in putting our vision on papers and then technology takes the driver's seat to turn it into reality and to bring what is on paper into the real world. Therefore information and technology always go hand in hand (IT).

Spending some part of my life in the last century helps me a little bit more in seeing how the world has changed and evolved. Recently I got a chance to watch the movie 'The Imitation Game'. In the movie you see Benedict Cumberbatch (playing Alan Turing – pioneer English computer scientist) struggling and going mad in an attempt to break German codes during World War II and in that pursuit he invented an almost computer like machine as the codes generated by Germans were also by a machine called Enigma. But in the end they only succeed in deciphering the codes once technology met information (which was awareness of the fact that the German message contained words like 'Heil Hitler') and using it rest of the information was decoded. So it is IT which wins in the end and takes us through.

We grew up reading Arthur C Clarke and watching Star Trek, Twilight Zone; an era that believed that 2000 will be apocalypse and will change the world forever. At the midnight of 2000 we thanked God that we were still alive but didn't realize that all the fictions were right, the world did change but it was not an instantaneous change. Instead a journey of change started.

In the era of cold war which ended in 1990s the innovation was totally focussed on defence developments and everyday life was given the leftovers, most of super computers were designed for defence use, most innovative tools and techniques were finding only use in defence and space research. But after the cold war ended everyday life came to the forefront. Now the latest mantra is 'ease of use'. Every technology is intended at making life simple. This brought information technology to driving seat. It was realized that teleportation device from Star Trek can wait sometime as the race between America & USSR had stopped and we can instead focus on making sure that information can travel from source to consumer as fast as possible.

But then after spending sometime in this age of IT we will have to think about the influence it is causing on our lives. IT has emerged as 'overpowering' because it focussed on ease of use and bringing things closer, but there are few realities to be remembered. Evolution is something which is happening each day. Hence information and technologies have to be used in conjunction with intelligence. When simplicity enters our daily life there are high chances that it can make us lazy too. Sitting at one place, I can do anything I want simply by using my mobile

phone but this is not an equilibrium status unless the time saved thus is used to doing something better. Things that require higher intelligence and greater effort else this is going to pull us back. Moving in rounds doesn't take us anywhere. IT gives a platform to move fast hence this speed is to be utilized to cover longer distances and scaling new heights and not for reaching midway destination and resting. This is going to be a big challenge in next 5 years.

Being from the Power Industry, I have seen how the industry has transformed under the influence of Information Technology, gestation period for projects have reduced by 80% to 100%. A substation which was built in 36 months, 10 years ago is now expected to be finished in 15 to 18 months. We are moving from conventional substations to digital substations which require lesser space and are environment friendly. Substation operations are now fully automated. Information is available on touch of buttons with SCADA. Power flows are managed digitally through Load Dispatch centres sitting at single locations. The next big thing coming our way is making industrial activities digital, i.e. more efficient and faster and simplified. So pursuit is on and hopefully with the support of technology and digitization we will make a better world.

THE INFLUENCE OF TECHNOLOGY ON PUBLIC ADMINISTRATION

B. P. GOPALIKA

IAS
PRINCIPAL SECRETARY

DEPT. OF FOOD PROCESSING
INDUSTRIES AND HORTICULTURE

The foundation of a successful democracy largely depends on the bureaucracy of the nation. With the steady development of technology over the past few decades, technology has found its way into the administrative systems of nations worldwide. In India, technology has been widely adapted in the public administrative setups for bureaucratic day to day functioning. In this process the administrative functioning has become more efficient and time bound and the standards of service delivery to the citizens have resulted considerable improvement.

Primarily I believe that technology has helped in increasing the transparency and the accountability of the government. The Information Technology Act, 2000 laid down the foundations of e-governance through providing legal status to e-Communications. This allows filling of any form, applications, issues and grants for licenses and permits using an electronic form. This has helped in providing the citizens with an efficient administrative system wherein faster processing of the applications has been achieved. This has also helped in reducing complaints regarding harassment and corruption amongst the concerning bodies, lesser compilation time and better database management at the apex level.

Influence of technology is the field of Public Administration involves a vast area. With limited scope, I would like to mention a very few of those:-

a)   With the implementation of the Right to Information Act, 2005, public authorities are on demand, required to share information, provide services to citizens within a scheduled time frame and obviously to be dealt promptly. With the introduction of computerization in the government offices, it has been easy to retrieve information promptly with utmost accuracy and meet the delivery deadlines dictated by the act.

b)   E-processing of government files has also started which allows easy preservation and immediate access to records. This also ensures that file records cannot be tampered in an unauthorized manner and thereby it increases accountability. e-Processing does away with having to go through old files, thus making access to information fast and accurate, hence improves the process speed.

c)   e-Payment system has been introduced in most of the Government Departments to facilitate faster transactions, easy modes of payments and prevent fraudulent transactions as far as possible since each transaction is made directly into the recipients' registered bank account directly which has resulted considerable decrease in person presence in almost all the Government programmes and ultimately has resulted decrease of fraudulence and misuse of money.

d)   With the introduction of e-Tender, wide participation has been ensured as eligible bidders can now participate in the bidding from anywhere, any time. This has resulted in selecting suitably qualified and experienced bidder quoting the best price. Also the transparency of the process has helped reduction of human contacts and thus has eliminated corruption to a considerable extent.

e)   Availability of Government documents like Acts, Ordinances and rules as well as the orders and circulars passed and issued by the central and state Governments as well as the honorary courts of India are now readily available in the public domain by their publication in various portals and websites. As the portals and websites are publicly hosted in the internet, citizens can access to these acts and orders anytime and anywhere. This increases the awareness of the citizens' own right and allows them to demand better services and help prevent human exploitation that has been witnessed in the past.

f)   Technology has helped in improving the government-citizen interaction nationally and the government-government interactions at the state levels. Data sharing between the administrative bodies have also become easier. Availability of multichannel information at any point has largely helped in taking unbiased decisions. Simplified database management and data analysis systems along with a widespread online technology allows the citizens to avail the governmental policies and facilities to a greater extent than it had been even a few years ago.

g)   Use of technology in various Citizen Centric services has yielded a considerable positive outcome. Citizen Centric service like Birth Registration, Death Certificate, Trade License, Building Plan sanction, availability of information has shown a sea-change in recent past.

h)   Another aspect of use of technology is radical improvement of communication in recent years. Use of mobile, Internet, Network connectivity has made the entire world into a Global Village. This has not only improved the performance of administration but also helped in documentation of required data and other important aspects.

I. T. PROFESSIONALS

PIJUSH BHAUMIK

HCL
GREAT BRITAIN

CAMBRIDGE
UNITED KINGDOM

What could be the dream of every child born and raised in Kolkata?

To be an engineer from a reputed engineering college and choose Computer science/IT as a career— Great choice!!!

What follows after this……..?

Nowadays, the young generation gets involved with a globally mobile lifestyle during their formative years while planning for university studies and aim for the first valuable work-experience abroad. For many, experiencing globetrotting before settling down at home becomes sought after. However when it is time to pack up and head back, the reality of repatriation turns out to be not as easy as expected.

After graduation students mostly opt for joining major Indian IT consulting firms whose revenue/margins swing based on their overseas customer base. After a few years these consultants realise the Indian IT giants' operating model and start thinking that they can directly work for the companies abroad. Either way the professionals spend late offshore-hours working hard, but the overseas counterpart gets the real benefit.

It becomes really disappointing when the IT professionals crave an overseas lifestyle and thus start thinking of settling down abroad. The grass is always greener on the other side of the fence.

What other options could they have? Choose Kolkata as a place to continue? Why not? I have seen many IT professionals in Kolkata working for multinational giants as small or big contractors, managing entire IT support or working on intellectual property rights and selling the same.

IT as I understand, is a concept; and irrespective of location this concept remains the same. We work in financial sectors, retail, telecommunication, education etc. to automate/upgrade or maintain various systems.

I find minimal difference in the ticketing system to book an airlines/train/bus ticket in India, UK or US but probably due to better infrastructure buses and trains run quicker and on time in developed countries; which has got nothing to do with IT. So the service we get here in India is perhaps not at par.

Banking system is also probably the same. Personally I have been working for various banks globally like Citibank, Deutsche Bank, Lloyds Bank, Indian Overseas Bank. The internal processes may vary based on their own regulatory requirements but from end customer's perspective the processes are more or less the same. Once again we can't blame IT for not getting the desired custome services from our banks in India.

The fact that most of us would agree is that we don't have the best quality of infrastructure, education system, career opportunities. The quality of life is improving at an appreciable rate but it is still not the best one, and when someone gets an option he/she is happy to switch. Maybe he/she is not planning to settle abroad but eager to experience life there. Undoubtedly, expat life can be very exciting and challenging. The experience of life abroad teaches new skills and enhances capabilities. It creates valuable memories which become a treasure for future years.

It is extremely impressive to see that the current young generation in India is computer literate. I don't believe everyone would need to be a Computer Engineer or IT professional but having the knowledge is very important. I feel very glad to see that even elderly people (in their 70s or 80s) in the UK or US have laptops or ipad. They use these gadgets in their daily lives - banking online, checking the weather report online, shopping online or making plans for a visit to their grandchildren.

IT is perhaps the fastest changing industry where things evolve almost every day. After being part of the industry for more than 20 years, even now I can't think of a day when I haven't come across something new.

We must appreciate the concepts like Software as a Service (SaaS), Agile or Iterative approach to execute projects, Test Driven Development (TDD), 'Internet-of-Things' (IoT) etc. I am sure IT professionals from Kolkata are all equipped with such new things but I would suggest that we focus more on practical implementation and impact to real life rather than gathering knowledge from web sites. I have seen many Indian IT professional, master the concept IoT but I suppose the general awareness from practical implementation perspective is to some extent missing compared to cities of the developed countries.

It is a shame that IT professionals working from Kolkata or other cities in India are involved in developing such critical, high tech applications on banking, retail industries etc. for customers overseas but our own city or country as a whole does not get the benefit (apart from the margin the Indian IT service company makes).

Is that a fault of the professional working from Kolkata? Not at all – the professionals working from Kolkata have already taken a bold and right step to operate from home and add value to the society. The big question here is whether our environment, culture and society supports such a bold initiative; or is always busy in playing blame games to highlight what is not happening in the city?

There is a slight difference between 'doing the right things' and 'doing the things right'. I think it is important for the young generation to choose the right career option and on time before it becomes too late. The status 'immigrants' changes to 'permanent residents' over a period of time depending on the countries' immigration policies. The individuals would need to decide which way they would like to go. The concept of IT/automation remains the same all over the world. Due to obvious reasons we can be more flexible and get a better life-style (yes, the postfix style to life is significant) in the 'land of opportunities'. On the other hand being in our home city we can ensure we grow on our own land and get the benefit of our own society.

I still believe that India has the fastest growing economy in the world. I am very sure things would change with all of our support to ensure that our future IT professionals make a choice to live and operate from home.

After all home is home, Right?

Good luck…

THE RELEVANCE OF TECHNOLOGY IN MEDICINE

DR. BISWAJIT BANERJEE

GENERAL PHYSICIAL
DIABETOLOGIST

MBBS (CAL)
DFID (CMC VELLORE)
FELLOWSHIP IN DIABETES (CMC VELLORE)
CERTIFIED PHYSICIAN
DIABETES CARE
(HARVARD MEDICAL SCHOOL)

To start with, let me tell you that medicine today is heavily assisted by technology. We have come a long way from the days when medicine practice focussed only on symptoms, rather than the investigative and test-oriented approach we have now.

As a medical practitioner, you have to go through two steps, one being diagnosis, which finally moves on to treatment. Let us look at stethoscopes. It is an integral tool of diagnosis. With the help of technology, we have moved on from primitive stethoscopes to more advanced ones.

We had previously used mercury machines for measuring blood pressure (they were termed mercury manometers). We now have digital blood pressure machines, which can be seen as a victory on both the technological and the medicine sides.

Investigation, in the past, used to be based on chemical reactions. Diagnoses were made based on colour change, etc. Now, everything is digital. We have cell counters for blood. We use something known as an auto analyser, which has reduced man power from the investigative process.

We cannot forget the revolutionary diagnostic equipment which are in heavy use these days. We now have the concepts of CAT scan, MRI scan, echo cardiography, digital X-ray, 3-D ultrasound, 4-D ultrasound. The 3-D and 4-D ultrasound systems show the live movements of a baby within its mother's womb.

One of the biggest advancements medicine made, thanks to technology, is in tele-medicine. Suppose there are four doctors situated in Kolkata, Chennai, Delhi and Mumbai. With the help of tele-conferencing, they can study the history and the reports of patients, and together come up with a solution.

Now, let us talk about the role of technology in the therapeutic section of medicine. There has been a great leap in the working of the machines which manufacture tablets and pills. Earlier, there used to be humans helping out in the process, but now, the entire approach is technology-oriented. The machines themselves determine what percentage of the ingredients are required, how to mix them, bringing the substance into tablet form, packaging of the pills as they come out in thousands.

Recently, technology has found a major usage in the operation theatre. Laparoscopic surgery is very widely practiced these days. We make three keyholes, and through one, we insert a camera, while the laparoscopic instruments

are inserted into the other two. The surgical process is then viewed in an outside screen. Another advancement in the surgical hemisphere is laser surgery. It is employed when surgery needs to be done in the prostate. Finally, you will be interested to know that we also have robotic surgery. The surgeon controls the robot, which does the surgery.

Cardiology has received great help from technology too. Previously, a failure of the heart would mean death, but now, we have pacemakers. Even pacemakers went through degrees of advancement. Previously, there only used to be external pacemakers, which guaranteed a short life to survivors. Now, we have internal pacemakers, which not only ensure the patient lives, but allows him or her to go as far as trekking up mountains. We have stories of how athletes with pacemakers did brilliantly in World Cup football.

There is a concept called invasive cardiology. Coronary angiography, coronary bypass, stenting wouldn't have been possible had technology not had a role to play.

Previously, when people went for open heart surgery, doctors had to employ a machine called heart-lung machine. Since you cannot operate on the heart with blood coming in the way, the machine cleared the blood from the path of the surgeon. With the heart being bloodless, ice was put into it, and the machine bypassed the heart and coordinated the flow, the pulses. After the surgery, the ice would be cleared, the blood would be reinitiated, and the heart would start functioning again. But, now, we have beating heart surgery. The heart-lung machines do not have any use now. Let us not forget dialysis machines. Through this technological advancement, we can help victims of kidney failure.

Now, with all of this in our hands, people often wonder, that if technology is growing more and more relevant in the practice of medicine, does the culture not lose its essence with the loss of manpower?

The answer is no. Medicine would never reach the heights it has reached today, had there not been technology to refine the path. Technology is a tool which is used to make medicine scale greater heights, and which ultimately, makes the world an easier place to live in.

TINY YET TERRIFIC

DR. P. K. CHAKRABARTI

ST. XAVIER'S COLLEGE (AUTONOMOUS), KOLKATA

Sitting before the writing desk as I was preparing to write, I immediately remembered the above ad-caption by the then existing company "Murphy Radio Corporation" which ushered in a new age of electronics. It was about a transistor Radio, very small in size but sonorous and vibrant in the audio output. That's why there was the advertisement by the company. In a surprisingly brief span of time, this branch of physics saw so much of development and breakthrough such that it began to be recognised as a separate branch of study. I am proud and take pride in associating myself with the revolutionary development of the different branches in electronics.

I will introduce today and talk about an electronic miracle which speaks of the great mystery, novelty of human brain ---- it is about the fabrication of an IC in the name of IC 555, a versatile timer IC whose limit of application is only set by the user's imagination.

I will be talking now about the varieties of the timer ICs which have flooded the commercial market, so much popular they have now become that they have been industrially standardised.

IC 555 is a very frequently used timer IC of bipolar version; it has a twin in the name of 7555 having the same purpose, identical pin configuration (fig. I) but of C-MOS version having some additional fruitful features to our advantage. There is still a third member belonging to the Timer family specified as IC 556 and it is really a dual 555 in the same package.

In fig. (Ia) we have shown the pin configuration in TO-5 package, in fig. (Ib) the pin configuration in dual-in-line package (DIP) is shown for the same purpose. IC 555 or IC 7555 is either put into the TO-5 package socket or DIP socket. The fig. 2 shows the pin configuration of IC 556.

fig. (1b)

fig. 2

TO-5

fig. (1a)
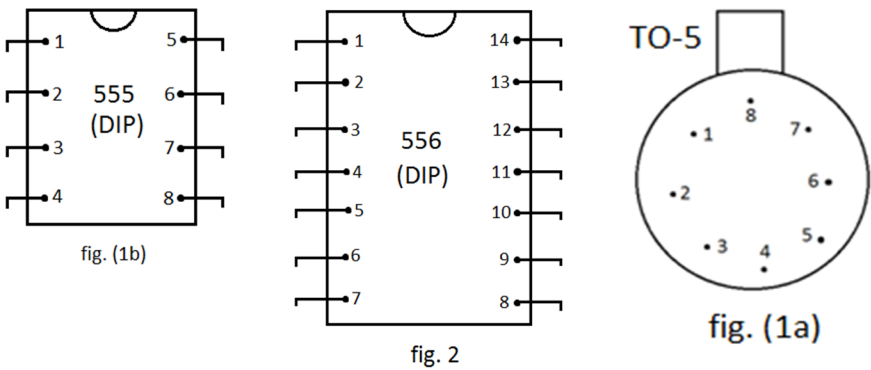
What basically is a timer IC?

A timer IC consists of a combination of a relaxation oscillator, two compara-tors C_1 and C_2, an R-S flip-flop and a discharge transistor T. (fig. 3)
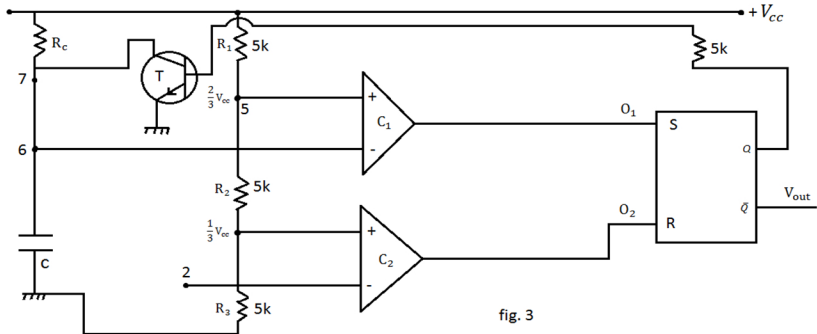

fig. 3

Know your timer IC 555 (or 7555) (fig. 4) and IC 556 (fig. 5):

The first member of the timer-IC family was born around 1960 in a small manu-facturing company of Signetics Corporation as a bipolar version 555 which was almost immediately followed by a few other enthusiastic companies to complete the series of the existing versions now available in the market. Little did its design-ers think that their small brain child will become soon a big marvel of science.
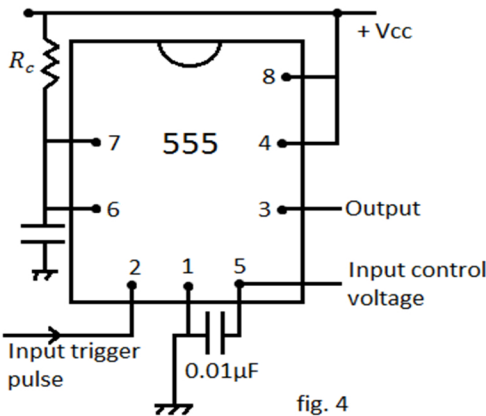

fig. 4

1. Ground
2. Input trigger pulse
3. Output
4. Reset terminal connected to + line
5. Through 0.01µF to ground
6. Threshold voltage
7. Discharge voltage

The size as small as that of the tip of right-hand thumb but in performance un-parallel, timer IC 555 can, in fact, be rightly said to be tiny yet terrific. We will now gradually unfold the interior decoration, explain the mystery and excitement in the monolithic design of the IC timer.
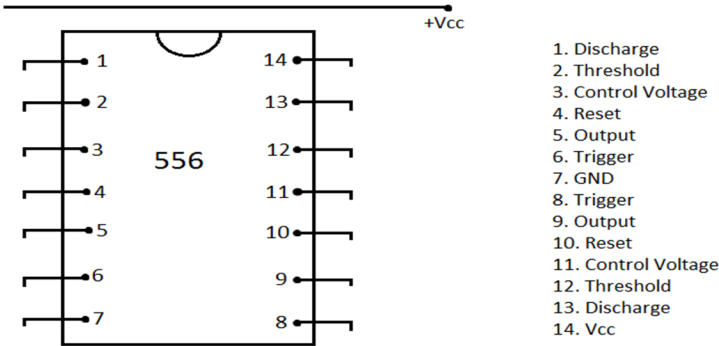

fig. 5

1. Discharge
2. Threshold
3. Control Voltage
4. Reset
5. Output
6. Trigger
7. GND
8. Trigger
9. Output
10. Reset
11. Control Voltage
12. Threshold
13. Discharge
14. Vcc

Interior decoration of the design:

Each and every nook and corner of the design is stuffed with splendid ideas from start to finish. Let us now see the inside of the timer IC and set to herald the brilliance of the design.

The whole story is a one-act play, its first scene is the action of a flip-flop, fig. (6).

fig. 6
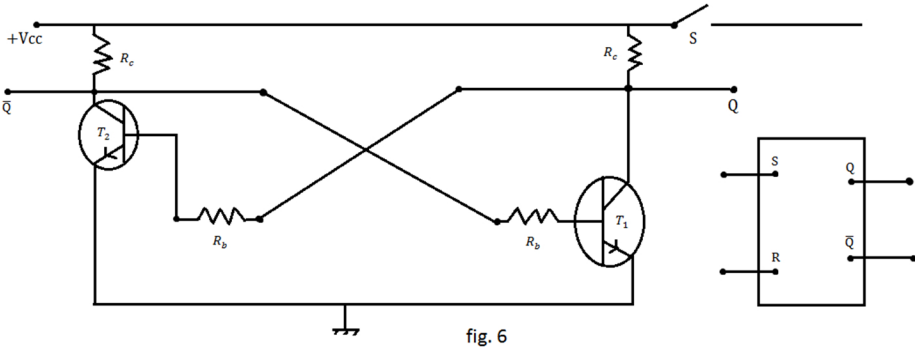
The two transistors T_1 and T_2 are cross-coupled and latched. As the power is switched ON, the two transistors start conducting but not exactly identically even though they are of the same make and made by the same company; one conducting slightly more or less than the other. Suppose the transistor T_1

conducts slightly more than T_2. Then T_1 will be pushed to full conduction state much more rapidly than the other.

So at the instant when the collector of T_1 is at ground potential $Q=0$, the base of T_2 being at zero potential $Q'=I$. Out of the two terminals Q and Q', one terminal, say Q' is externally available. So the Truth table of the flip-flop is given in the following table fig. (7).

The first row represents that the output of TI is zero but the output of T2 is high. During the next half, the table turns and the output of the transistor TI is high ($Q=I$) and that o the transistor T2 is low ($Q'=0$). The second situation of the transistors TI and T2 is said to set the flip-flop. In the next half after a series of operations taking place, the flip-flop is said to reset.

Q	$\bar{Q}$
0	1
1	0

fig. 7

To explain this scene of the one-act play, we refer to the fig. (3) where we have shown the kernel and essential features of the design. Focus on the discharge transistor T which is the kernel of the design and it beautifully sets and resets the flip-flop being determined by the R_c, C pair of values, thus incorporating the concept of Time.

Another important part of the circuit consists of a series ladder of resistances, three 5kΩ used here connected between Vcc and the ground, causing voltage drops equal to $(I/3)$Vcc and $(2/3)$Vcc serving as the reference voltages (also called input control voltage) to the comparators C_1 and C_2; these two are fixed voltages at the non inverting terminals of the comparators while threshold voltages V_{Th} appear at the inverting terminals of the comparators via terminals 2 and 6 which compare with reference voltages to decide whether to switch on or not.

OVER ALL PERFORMANCE OF THE MAGIC DEVICE

When the flip flop sets and re-sets: The two complementary output terminals Q (inside the flip-flop and not externally accessible), Q' alternately activate; the terminal 3 is externally available as output terminal. When it sets, Q is high, Q' is low. Q is connected to the base of the discharge transistor T and so the capacitor C discharges through T and threshold voltage V_{Th} attains zero value and then charging is ON and threshold voltage V_{Th} rises. When V_{Th}, while rising, slightly exceeds the control voltage (at terminal 5), the capacitor discharges through T. Q now becomes low, Q' is high, situation reverses. When Q is low, the capacitor C charges and then discharges at regular intervals of time, called timer's time.

How does mathematics look into the problem? A timer may be used in three modes:
1) Mono-stable mode
2) Astable mode
3) Bi-stable mode(Not so frequent)

1. Mono-stable mode: Also called one shot timer, here an external trigger pulse initiates the operation of the timer.
The trigger pulse is applied to the terminal 2 and while going negative has a value less than $(1/3)Vcc$, the lower comparator C_2 has a high output and resets the flip flop.
The equation for the charge growth in the capacitor is:

$$iR_c + q/C = Vcc$$
$$R_c . dq/dt + q/C = Vcc$$
$$dq/dt = -(q/CR_c - Vcc/R_c)$$
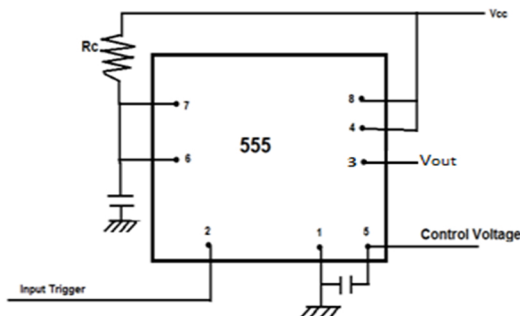
Put,

$$q / CR_c - Vcc/R_c = x$$
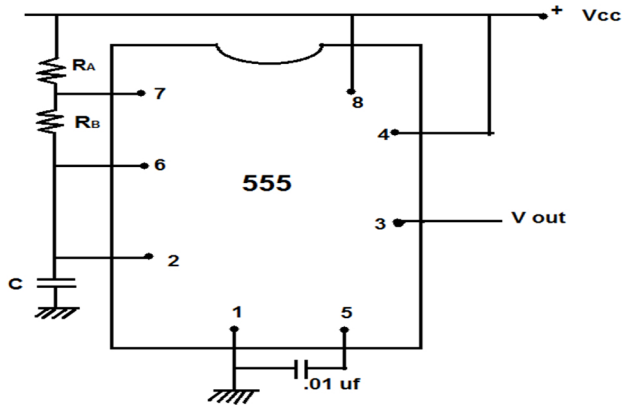$$dq/dt = CR_c \, dx/dt$$
$$dx/x = -1/ C R_c \, dt$$
$$\ln x = A \, e^{(-t/CR_c)}$$
$$q = CVcc \, (1- e^{(-t/CR_c)})$$

Let t=T when q= C / (2/3Vcc)
Therefore, T= $CR_c \ln 3$ => T = 1.1 CR_c

2. Astable mode: Here, there is no need of any external trigger. The terminal 2 is connected to terminal 6. Charging takes place through $(R_A + R_B)$ and discharge takes place through R_B only(given figure).

Charging: $Ri + q/C = Vcc$

$(R_A + R_B)i + q/C = Vcc$

$dq/dt = Vcc/Re - q/CRe$, $Re = (R_A + R_B)$

The charge oscillates between $C/ 1/3Vcc$ and $C/ 2/3Vcc$. So, we get the charging equation as

$2/3 e^{(-t/C Re)} = 1/3$

$t_1 = CRe \ln2 = 0.693 CRe$

Called ON time.

OFF-time t_2:

It is given by the discharge equation as

$dq/dt + q/CR_B = 0$ $\Rightarrow q = A e^{(-t/C R_B)}$

At, $t=0$, $q = 2/3 CVcc$ $\Rightarrow A = 2/3 CVcc$

Thus, $q = 2/3 CVcc \ e^{(-t_2/C R_B)}$

$1/3 CVcc = 2/3 CVcc \ e^{(-t_2/CR_B)}$

$t_2 = 0.693 CR_B$

$T = t_1 + t_2 = 0.693(R_A + 2R_B)C$

$f = 1/T = 1.44/(R_A + 2R_B)C$

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STUDENTS ARTICLES

MAN AND MACHINE

"For God's sake, let us be men
not monkeys minding machines
or sitting with our tails curled
while the machine amuses us, the radio or film or gramophone.
Monkeys with a bland grin on our faces."

-D.H.Lawrence, Selected Letters.

In a distant age, in a distant land, a man lived alone in a village on the edge of the forest. He did not have a family to call his own, but the villagers formed his extended family. He spent mornings hunting in the forest, afternoons chatting and evenings gambling, in the villagers' company.

One fine day, the man, while hunting in the forest for forage in the form of pigeons and an occasional rabbit, the man came across a baby leopard in the bushes. The forest had very few leopards, the man knew, but this was the first leopard he had seen, the spots dazzled him. He took it home.

The leopard became the man's sole companion thereafter, and he just couldn't take his eyes off the leopard's green eyes. He began walking 7 miles across the forest to the nearest village to bring the leopard milk every day. His hunting treasures now found the leopard's stomach, and the joy of watching it eat satiated the man's hunger. When the leopard grew a little older he started taking it to his hunts. The leopard made his job a lot easier, he gave a growl whenever he smelled some prey, and carried the prey back home between his teeth.

The man was so engrossed in his new mate that he forgot his old companions completely. They talked about him animatedly, suggesting his mind had been cajoled by the Devil in the skin of the leopard, but these deliberations never crossed the ever-shut door and windows of the man's hut. The leopard slowly reached its fully grown stage, and spent most of his time licking the man's legs and arms, a hungry look across his eyes, but the man never cared. He saw God and the universe in those eyes, looking at those eyes was the only thing he did all day now. One day the leopard pounced on its master in his sleep, tearing him apart. It couldn't find much flesh though and left the hut with the man's Humerus firmly grasped between its teeth.

You must be wondering where this tale fits into the theme "Man and Machines". Ah well, keep wondering!

As the self-manned satellite Juno lands on the planet Jupiter, more than 600 million kilometres away, I stay amazed by man's infinite ability to reach every milestone, thinking the unimagined, doing the impossible. When Man needed a source of light more dependable than fire, Edison invented light bulbs. When Man needed to communicate faster and further, Bell brought out the telephone. When Man needed a faster mode of transport, Benz brought out the first gasoline-run automobile. When Man needed to communicate even faster Tomlinson introduced the world to the phenomenon of Email. The discovery of Internet proved eventually to be the ultimate fuel for further technological advancements, the new age of Machines, an age where the even the Sun seems conquerable.

The rise of Machines has revolutionised the world and the beings in it. The use of modern Machines has now refined and facilitated high-scale industrial and agricultural production processes. New Machines have changed the way we watch movies, listen to music, read texts, and even the way we shop for vegetables! And Man is largely responsible for this phenomenal rise in Machines today. But this leads us to the biggest question we are facing presently with regard to Machines, are we breeding Machines to license the downfall of Man and humanity in the next decade? As robots replace humans as waiters in restaurants in Japan, and as ear-phones and mobile phones make conversation between people on the endangered list, are we wilfully strolling towards a Machine dominated world where Man's obsession with Machines and its neglect of his own species ultimately leads to its downfall in the near future?

There is no doubt about the fact that Machines have made our lives easier, more eventful, more exciting. Machines have helped us to achieve the impossible, make the Man the most advanced species ever. So,a complete full-stop to the use of Machines to lengthen the age of Man and prove futuristic science fiction wrong is impossible. So what do we do to ensure perfect harmony between Man and Machines in future to touch the still untouched, bring light to the still dark secrets of the Universe.

The answer is a controlled, restricted interaction between Man and Machines, ensuring Man's dearest child can grow in complete harmony, and not end up threatening its creator in future. Make robots, but don't let them replace human labour. Nothing can replace the beauty of Man, it has a heart and a resourceful brain which itself created the microscopic chips without which robots are nothing

but a scrap of metal. We should not become humans engrossed in our gadgets all day, devoid of new creative ideas. Rather we should use Machines in a restricted environment to revolutionise the world and find new ways of glorifying humanity. In this world where humanity is draining in the name of religion and democracy every single day, we must ensur that Machines do not take away our humanity, our very identity.

And now I come back to the short tale I recounted at the beginning. Take the man as the entire human race, the leopard as the race of Machines. The man raised the leopard with utmost care, sacrificing all his time and the company of other humans, only to be devoured by the leopard. The man should have noticed the eyes of the leopard when it licked him, but he did not care.

Let Man not make the same mistake with his brainchild, Machines...

Debdut Mukherjee
Batch of 2018
Department of Economics

STRING MATCHING WITH FINITE STATE AUTOMATA

A string matching or pattern matching problem is to find all the occurrences of a pattern string (a sequence of characters) in a text string (another sequence of characters).

String searching algorithms, also called string matching algorithms, are an important class of string algorithms that try to find a place where one or several strings (also called patterns) are found within a larger string or text. Let Σ be an alphabet (finite set). Formally, both the pattern and searched text are vectors of elements of Σ. The Σ may be a usual human alphabet (for example, the letters A through Z in the Latin alphabet). Other applications may use binary alphabet ($\Sigma = \{0,1\}$) or DNA alphabet ($\Sigma = A,C,G,T$) in bioinformatics. We assume that the text is an array $T[1..n]$ of length n and that the pattern is an array $P[1..m]$ of length m and that m<=n. The character arrays T and P are often called strings of characters. We say that pattern P occurs with shift s in text T (or equivalently that the pattern P occurs beginning at position s+1 in text T) if 0<=s<=n-m and $T[s+1....s+m]=P[1..m]$. If P occurs with shift s in T then we call s a valid shift otherwise we call s an invalid shift. The string matching algorithm is the problem of finding all valid shift with which a pattern P occurs in given text T.

The first computer programs to use pattern matching were text editors. At Bell Labs, Ken Thompson extended the seeking and replacing features of the QED editor to accept regular expressions. Early programming languages with pattern matching constructs include SNOBOL from 1962, SASL from 1976, NPL from 1977, and KRC from 1981. The first programming language with tree-based pattern matching features was Fred McBride's extension of LISP, in 1970.

There are many exact string matching algorithms. Nearly all of them are concerned with how to slide the pattern. Few of them are listed below :

• Brute Force Algorithm
• Searching with automation
• Rabin Karp Algorithm
• Shift OR Algorithm
• Morris Pratt Algorithm
• Knuth- Morris Pratt Algorithm
• Colussi Algorithm
• Forward DAWG Matching algorithm
• Boyer Moore Algorithm

String matching has found its uses in:-

1. Intrusion Detection(Security) - Security is a big issue for all networks in today's enterprise environment. Hackers and intruders have made many successful attempts to bring down high profile company networks and web services. Many methods have been developed to secure the network infrastructure and communication over the Internet, among them the use of firewalls, encryption, and virtual private networks. Intrusion detection is a relatively new addition to such techniques. Intrusion detection methods started appearing in the last few years. Using intrusion detection methods, you can collect and use information from known types of attacks and find out if someone is trying to attack your network or particular hosts. The information collected this way can be used to harden your network security, as well as for legal purposes. Intrusion detection is a set of techniques and methods that are used to detect suspicious activity both at the network and host level. Intrusion detection systems fall into two basic categories: signature-based intrusion detection systems and anomaly detection systems. Intruders have signatures, like computer viruses, that can be detected using software.

2.   String matching in detecting plagiarism - Management of large collection of replicated data in centralized or distributed environments is important for many systems that provide data mining, mirroring, storage, and content distribution. In its simplest form, the documents are generated, duplicated and updated by emails and web pages. Although redundancy may increase the reliability at a level, uncontrolled redundancy aggravates the retrieval performance and might be useless if the returned documents are obsolete. Document similarity matching algorithms do not provide the information on the differences of documents, and file synchronization algorithms are usually inefficient and ignore the structural and syntactic organization of documents. For this purpose the S2S matching approach is used The S2S matching is composed of structural and syntactic phases to compare documents.

3.   String matching in Digital Forensics- Digital forensic text string search tools use for matching, indexing algorithms to search digital evidence at the physical level to locate specific text strings. They are designed to achieve 100% query recall. Given the nature of the data set, this leads to an extremely high incidence of hits that are not relevant to investigative objectives.

4.   String matching in Bioinformatics - Bioinformatics is the application of information technology and computer science to biological problems, in particular to issues involving genetic sequences. String algorithms are centrally important in bioinformatics for dealing with sequence information. Modern automated high throughput experimental procedures produce large amounts of data for which machine learning and data mining approaches hold great promise as interpretive means. Approximate matching of a search pattern to a target (called the "text" in string algorithms) is a fundamental tool in molecular biology. The pattern is often called the "query" and the text is called a "sequence database", but we will use "pattern" and "text" consistent with usage in computer science. While exact string matching is more commonly used in computer science, it is often not useful in biology. One reason for this is that biological sequences are experimentally determined, and may include errors: a single error can render an exact match useless, where approximate matches are less susceptible to errors and other sequence differences.

5.   Text Mining Research - Text mining includes tasks designed to extract previously unknown information by analyzing large quantities of text, as well as tasks geared toward the retrieval of textual data from a large corpus of documents (Sebastian, 2002; Fan et al., 2006; Sullivan, 2001). Several information processing tasks fall under the umbrella of text mining: information extraction, topic tracking, content summarization, information visualization, question answering, concept

linkage, text categorization/ classification, and text clustering. These are defined as follows:

a. Information extraction: identifies conceptual relationships, using known syntactic patterns and rules within a language.

b. Topic tracking: facilitates automated information filtering, wherein user interest profiles are defined and fine-tuned based on what documents users read.

c. Content summarization: abstracts and condenses document content.

d. Information visualization: represents textual data graphically (e.g. hierarchical concept maps, social networks, timeline representations).

e. Question answering: automatically extracts key concepts from a submitted question, and subsequently extracts relevant text from its data store to answer the question(s).

f. Concept linkage: identifies conceptual relationships between documents based on Transitive relationships between words/concepts in the documents.

g. Text categorization/classification: automatically and probabilistically assigns text documents into predefined thematic categories, using only the textual content (i.e. no metadata).

h. Text clustering: automatically identifies thematic categories and then automatically assigns text documents to those categories, using only textual content (i.e. no metadata)

6. String matching Based Video Retrieval - String matching can be effectively used to retrieve fast video as it uses the content based video retrieval in contrast with the traditional video retrieval which was slow and time consuming. String based video retrieval method first converts the unstructured video into a curve and marks the feature string of it. Approximate string matching is then used to retrieve video quickly. In this method the characteristic curve of the key frame sequence is first extracted followed by marking the feature string and then approximate string matching is used on the feature string to get fast video retrieval.

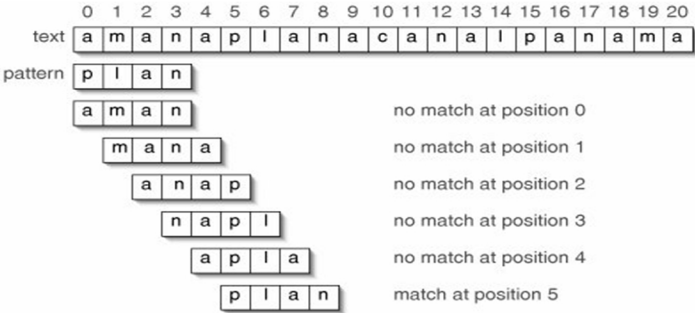7. In every particular search we do on any electronic gadgets be it online or offline.

How can we actually match strings or patterns?

We can do that with ALGORITHMS...
So, what is STRING MATCHING ALGORITHM?

In computer science, string searching algorithms, sometimes called string matching algorithms, are an important class of string algorithms that try to find a place where one or several strings (also called patterns) are found within a larger string or text.

Let Σ be an alphabet (finite set). Formally, both the pattern and searched text are vectors of elements of Σ. The Σ may be a usual human alphabet (for example, the letters A through Z in the Latin alphabet).

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Sushmita Mondal
Trina Dutta
Batch of 2017
Department of Computer Science

Draw the Lines

Pride goes before destruction and greed destroys everything. Machines were created to meet man's need. But, we have blurred the line distinguishing need and greed and now we don't know how to define either of them. Apart from having everything at the touch of our finger tips, advancement in technology is doing nothing but heightening the loneliness of man. Thousands of people are dying due to suicide every year and thousands of children are dying due to poverty every day worldwide.

We have lost it- lost our sense of right and wrong. We look at what is good to be boring and what is evil to be charming. We have interchanged the positive

pole with the negative pole and there is nothing but darkness-not in the electrical circuits, but in the heart of man. We are not willing to accept our loss, but we are trying to cover every patch of darkness with machinery lights knowing well enough that it's not going to shine for long.

From Newton to Faraday to Einstein, everyone has contributed to inventing greater things —"machines"- for the good of mankind. But, men have crossed the lines and have used it for their own selfish benefits and boom-lights out! 1905 is called the Year of Science. It marked the beginning of creation of machines which were to going to change the world. Consequently, more blood has been shed in the 20th century than the rest 19 centuries put together. U.S.A, Russia, China, South Korea and obviously the Middle Eastern countries are well on their way to do something much more remarkable in the 21st century.

It's a dark world we live in and we are fooling around. Computers, mobile phones and television sets offering its own wide world of social networking sites, games and entertainment has tempted and deceived us into living in our own fantasy worlds and we are constantly losing touch with reality. I am not discouraging the use of machines, but I am encouraging to draw the lines at the right places and to use them wisely.

The world needs a leader of great stature. A leader who will match Lincoln in his diplomacy, be cut off the same cloth as Vivekananda's charisma, posses the determination that defined Gandhi and display the incredible courage that was like second nature to Mandela. One can also look upto the leaders of people, like Jesus Christ or many others who have graced this world in their quest to make the world a better place for everyone.

In this digital age, all these qualities that were possessed by great leaders of the past have lost significance in the eyes of man. We need to draw the lines at the required places- the line of resistance, the line of confidence and the line of dependence. Make this world shine with the light of the Truth. Then others will cross their lines to join your side.

Saptarshi Paul
Batch of 2017
Department of Chemistry

Natural Language Processing

Natural Language Processing or NLP, in short, is an adavanced field of Computer Science. It is essentially a subject of Artificial Intelligence that is concerned with the interaction between machines and humans in human(natural) language. NLP aims to enable machines to derive meaning from human language and respond to them sensibly. Before we get deeper into this topic, we have to acquaint ourselves with two terms:

• Natural Language : A natural language is any language that humans use to communicate with each other using speech or writing. Examples of natural languages are English, Chinese, Bengali, etc.
• Artificial Language : Artificial languages are languages of a typically very limited size which emerge either in computer simulations between artificial agents, robot interactions or controlled psychological experiments with humans. They have not been devised by certain individuals or groups but are the result of distributed conventiontalization processes, much like natural languages. Examples include programming languages such as C, C++, Java, etc.

History of Natural Language Processing

Natural Language Processing was in its infancy when Alan Turing, the legendary computer scientist had started work on devising the Turing test, in 1950, as a criterion for machine intelligence. Now, the Turing test is one of the first ways ever thought of to tell intelligent machines from ordinary machines. It is basically an experiment where one human engages in a natural language conversation with another human and a machine, with the knowledge that one of the respondents is a machine. The conversation takes place using a series of texts. If the subject fails to discriminate between the human and the machine, the machine is said to have passed the test.

Since then, NLP has evolved with the invention of chatterbots such as ELIZA, PARRY, Racter and Jabberwacky in the 1960s and the 1970s. Later, with the steady increase of computational power and the advances made in machine learning, NLP adopted a stochastic and probabilistic model. That is, NLP began relying on previous data on the human usage of language to enhance a machine's understanding of natural languages.

Why NLP? : The reason we can't do without it

Always evading our attention, NLP is everywhere where we have modern computer technology. As humans, we rely heavily on the Internet for information. That's one of the reasons why we need to design machines that can process general text in natural language and extract useful information from it. Consider the example below:
An earthquake struck Indonesia today - a strapping 7.7 magnitude earthquake that struck early today off the northern coast of the island of Sumatra. It caused minor damage and there are no reports of any deaths, although electricity was interrupted in several places.
The useful information that an NLP powered machine would be able to extract are Location(Indonesia), Magnitude(7.7), Region(northern coast of Sumatra) and Deaths(Nil).

Information extraction is just one of the many uses of an NLP powered machine. Other uses include Automatic summarization, Machine translation, Natural language generation, Parsing, Question answering, Sentiment analysis, Speech segmentation, Word sense disambiguation, Speech processing, etc.

What is Text Processing?

Processing raw textual data into parts by analyzing and then utilizing them to render required data. This includes the following :
• Morphological Analysis : Running -> Run + ing (Breaking up in parts to get meaningful data)
• POS Tagging : Ram/NP goes/VB to/TO school/NP .. (NP = Noun Phrase, VB = Verb)
• Stemming : Running -> Run (Identifying the root of the word to find a meaning)
• Parsing : S -> NP + VP (Identifying sentence structure S = Sentence ,VP = Verb Phrase)
Machine Translation in Text Processing translates one Natural Language to another. (Eg : Translating an English Sentence to a Bengali Sentence using a Translation Software which is powered by NLP).

Speech Processing

Speech processing is the study of speech signals and the processing methods of these signals. The signals are usually processed in a digital representation, so speech processing can be regarded as a special case of digital signal processing, applied to speech signal. Speech Processing can be real-time or offline. NLP is used to classify millions of documents into an assorted logical manner. This process is known as Document Classification. Gathering information from textual data is known as Information Extraction. Both the above are achieved by separating all the textual information in a logical way.

Sentiment Analysis is another application of NLP where-by gathering textual information given by the user is used to analyse the mood patterns and sentiments of the user. Recommendations given to the user based on user behaviour is achieved using NLP, this process is known as Collaborative Filtering. Semantic Web search also uses NLP to achieve its tasks.

NLP Research

Currently extensive research work is being carried on in the following topics :
• Semantic Web Search
• Sentiment Analysis/Opinion Mining
• Machine Translation
• Advanced Speech Processing Applications
• Social Network Analysis
• Collective Intelligence

Natural language processing is an imperative component of every subject concerned with Machine Learning, Artificial Intelligence, et al. Currently ongoing research aims to build robust and reliable interfaces for human-computer interaction. Two of the most prominent organizations/institutes that aim to make breakthroughs in this domain are Google and MIT CSAIL (Computer Science and Artificial Intelligence Laboratory at the Massachusetts Institute of Technology). The objectives of NLP research at Google can be understood from the quote from their Research (research.google.com):

"Natural Language Processing (NLP) research at Google focuses on algorithms that apply at scale, across languages, and across domains. Our

systems are used in numerous ways across Google, impacting user experience in search, mobile, apps, ads, translate and more.
Our work spans the range of traditional NLP tasks, with general-purpose syntax and semantic algorithms underpinning more specialized systems. We are particularly interested in algorithms that scale well and can be run efficiently in a highly distributed environment."

Hence, good NLP algorithms are also indispensable for helping big businesses (such as e-commerce portals) analyse customer needs and build better and more helpful PDA's for humans, which are aided by Google. Researchers at MIT CSAIL accept that "NLP has become a practical discipline that we access and manage on-line information." However, they also believe that current research is mainly at a rudimentary stage and that research in this domain has extensive potential. NLP is, thus, important for building a tuly intelligent Web.

Anurag Roy,
Ashin Guha Majumder
Batch of 2017
Department of Computer Science

TOURING PROBLEMS IN CHESS USING PROGRAMMING LANGUAGES

This article throws some light on touring of knight in a 8x8 chess board using computer programming languages. It can be used to introduce the concept of "Hamiltonian circuit" or "tour of a graph" and "backtracking problems". We will find that the formalism that we develop on the way is useful even for understanding the other classes of chess puzzles.

Chess pieces, with their variously defined moves, are a rich source of puzzles in recreational mathematics. Chess puzzles include touring puzzle where with a given piece with some moves defined, construct a tour of the entire chessboard with that piece. The only nontrivial case of this for a standard chess piece is the knight's tour. The knight's tour problem is the mathematical problem of finding a knight's tour. We will create a program using programming languages in computer to find a knight's tour. We focus on the problem of the knight's tour, and its formulation in a manner that helps us consider general variations - such as changing the shape and size of the board.

A knight's tour is defined as a sequence of moves of a knight on a chess-board such that the knight visits every square only once. If the knight ends on a square that is one knight's move from the beginning square (so that it could tour the board again immediately, following the same path), the tour is closed, and otherwise it is open.

The Touring Problem

Description on the moves of a knight

The famous knight's tour problem asks whether a knight can tour an entire 8×8 chessboard visiting each square exactly once. Here, a knight can move in any of 8 ways, provided that the final destination is within the board. In each of these ways, one coordinate of the knight's position changes by 2 units, and the other coordinate changes by 1 unit. If the two directions are labelled up/down and left/right the eight moves are:

- Up two steps, right one step
- Up two steps, left one step
- Right two steps, up one step
- Right two steps, down one step
- Down two steps, left one step
- Down two steps, right one step
- Left two steps, up one step
- Left two steps, down one step.

From the above listing of moves, it is clear that the knight's move is symmetric, in the sense that if a knight can move from a square A to a square B in one move, it can also move from B to A in one step. The above diagram illustrates the movement of knight in a chess board.
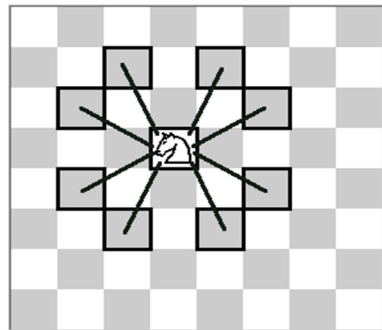
Construction of the Knight's Move Graph

The mxn knight graph is a graph on mxn vertices in which each vertex represents a square in an mxn chessboard, and each edge corresponds to a legal move by a knight (which may only make moves which simultaneously shift one square along one axis and two along the other).
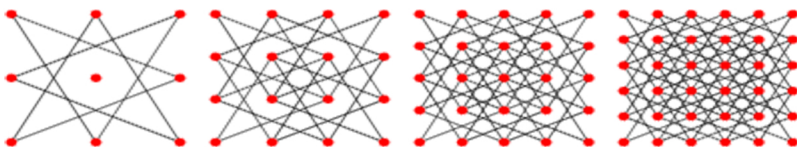
Hamiltonian Circuits

A Hamiltonian circuit or tour of a graph is a path that starts at a given vertex, visits each vertex in the graph exactly once, and ends at the starting vertex. For an m×n board, label the columns (vertical lines) 1, 2, ….. n from left to right. That is, the left most column is labelled 1, the next is labelled 2 and so on. Similarly label the rows 1, 2, ... m from bottom upwards. That is, the lowest row is labeled 1, the row above that is labelled 2, and so on. Every square is identified with an ordered pair, the first entry giving the column number, and the second entry giving the row number. Thus, the left most bottom square is labeled (1, 1) and the right most bottom square is labelled (n, 1). The right most top square is labelled (n,m) and the left most top square is labelled (1,m). Let us now construct the knight's move graph for the 3 × 3 board. The vertices are:

(1, 3) (2, 3) (3, 3)
(1, 2) (2, 2) (3, 2)
(1, 1) (2, 1) (3, 1)

The edges are as follows:
• Between (1, 1) and (3, 2).
• Between (3, 2) and (1, 3).
• Between (1, 3) and (2, 1).
• Between (2, 1) and (3, 3).
• Between (3, 3) and (1, 2).
• Between (1, 2) and (3, 1).
• Between (3, 1) and (2, 3).
• Between (2, 3) and (1, 1).

We observe that:
• The vertex (2, 2) has no edges incident on it.
• Every other vertex has precisely two edges incident on it.
In fact, we can redraw the graph as a cyclic graph by making the vertices (1, 1), (3, 2), (1, 3), (2, 1), (3, 3), (1, 2), (3, 1) and (2, 3) the vertices of an octagon in that order, and our edges as simply the sides of that octagon. The graph is termed cyclic because the whole graph is a Hamiltonian cycle – by just starting at any vertex and moving along the graph we get a Hamiltonian cycle. Thus we observe that, although a tour of the entire 3 × 3 board is not possible, a closed tour of the board obtained by removing the middle square is possible. We note that redrawing the graph in a cyclic fashion made it conceptually clearer compared to just joining the vertices in the actual chessboard (which would give a star like shape). However, as graphs, they are the same. The graph structure is not sensitive to how we draw it on paper. It only encodes certain information – namely information as to what are the vertices and what are the endpoints of each edge. All knowledge about the graph should be dependent only on this data.

Backtracking

Backtracking is an algorithmic paradigm that tries different solutions until finds a solution that "works". Problems which are typically solved using backtracking technique have following property in common. These problems can only be solved by trying every possible configuration and each configuration is tried only once. A Naive solution for these problems is to try all configurations and output a configuration that follows given problem constraints. Backtracking works in incremental way and is an optimization over the Naive solution where all possible configurations are generated and tried.

For example, consider the Knight's Tour problem. The knight is placed on the first block of an empty board and, moving according to the rules of chess, must visit each square exactly once.

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2)http://www.cis.upenn.edu/~matuszek/cit594-2009/Lectures/35-backtracking.ppt
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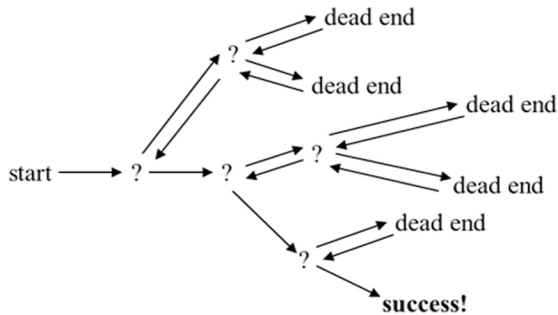
Swarup Dey Sarkar
Batch of 2017
Department of Computer Science

F. E. A. R.

Decades have passed since our planet was divided into nations governed by their own ruling bodies. The identities and cultures of these countries have dissipated into the sands of time. Generations have come and gone, with lesser knowledge of their ancestors being passed on. Traditions don't exist anymore and religions have been destroyed. We have reached our goal, one which our ancestors were misled into believing it would be for the betterment of their children and grandchildren. F.E.A.R. now controls us, some call it a government others call it a religion. People resent their oppressive rule, but F.E.A.R. is indestructible. Mutinies are ended before they start, crimes are solved before they committed, and such is the short leash F.E.A.R. has on its pet, mankind. There was only one thing F.E.A.R. was afraid of, science. Scientific research technology has been a taboo ever since F.E.A.R. took over. They knew that a machine with a brain of its own could aid mankind in overthrowing them. Since then they have been ruling with an iron fist, walls, soldiers and cameras kept the people in check.

A hundred and three years after the formation of F.E.A.R., there finally arrived our messiah. Xeron Raymane. As a child, his mother taught him about the ways of the Wild West. She passed on whatever she had learnt from her grandmother, of her native Texas, to her little boy hoping to raise him with the same values she was taught as a child. As his mind matured, he started to notice the pain around him. He slowly started resenting the system himself, but this was the norm. Who would have thought that he and his childhood friend, Jim Crast, would embark on a journey to deliver mankind from this oppression. While growing up, they learnt the ways of the system and the laws of the land. At school, Xeron, with the swashbuckling blood of a Texan in him would protect his genius buddy, Jim, from bullies. One day after having drowning himself in a ton of research, Jim rushed to Xeron's house. He entered breathing heavily, his face glowing and grabbed Xeron by the shoulders and whispered, "I did it! I found the solution." Puzzled at what his friend was talking about, Xeron asked, "And what exactly did you solve?" "The solution to our problems, the solution to F.E.A.R," said a visibly excited Jim. Xeron's face immediately lost its colour and said, "What do you mean? How can there be a solution to a corrupt governing body?" An evil grin slowly spread across Jim's face, "We destroy them," he said still grinning.

Was Jim crazy? He was never wrong, Xeron never doubted his decision making. This was unnatural. What did Jim have in mind, a full scale assault on the F.E.A.R. army? Jim then unveiled some old files that were in his backpack and presented them to Xeron. As the lad flipped through the pages, he felt a chill down

his spine. Did Jim just stumble on F.E.A.R.'s best kept secret? The date on the file read 2020. Xeron immediately got the word out that a rebellion was at hand, his calibre was enough to convince people to side with him and the added assurance that arguably the most intelligent person of their generation was assembling a secret weapon to assist them in finally overthrowing the hated rule of F.E.A.R. . The word had finally reached the top cats at F.E.A.R. who ordered sweeping the streets for any potential threats and for conducting trials and interrogations. The rebel forces often clashed with F.E.A.R. patrols, all done to buy Jim some time to complete his weapon. On the one hundred and twenty third anniversary of F.E.A.R.'s rule, a grand parade was organised outside the headquarters. This was the rebellions moment, the rebels marched forward towards the parade, showing themselves as a unit for the first time. They were surrounded by F.E.A.R. armed forces but they didn't flinch. The Commander of the F.E.A.R. forces laughed at the folly of the rebels and was raising his hand to give the command to fire when his hand was chopped off. Blood was everywhere and nobody saw anybody near the Commander. Panic started to spread, the rebel forces just calmly separated and there in the middle were a battalion of Metal Soldiers driven by artificial intelligence and a limitless armoury. Xeron then screamed, " Attack!" and the robots charged at the F.E.A.R. soldiers, hacking, slashing, blowing up and shooting each and every one of them till none were left. As Xeron and the Androids made their way to the F.E.A.R. control room, the president was making a last transmission to the people. Xeron ordered, "Sir, this doesn't have to end with bloodshed," "Oh yes it does", said the Android standing behind him, who then hacked him into two. The President, still holding the microphone for the transmission, stared at the robot in fear while being covered in blood. The robot snatched the microphone from him and slowly said, " F.E.A.R. is destroyed, the Rebellion is dead, you can never win your freedom, you cannot escape us, you can't outrun true fear!"

We are the masters of the machine, we shouldn't empower it to the extent that they escape our control. Machines are made to serve us, the moment we make them stronger than ourselves and provide them with an intelligence of their own, mankind will fall. That is the sad truth.

Raul Aaron David
**Batch of 2017**
Department of Computer Science
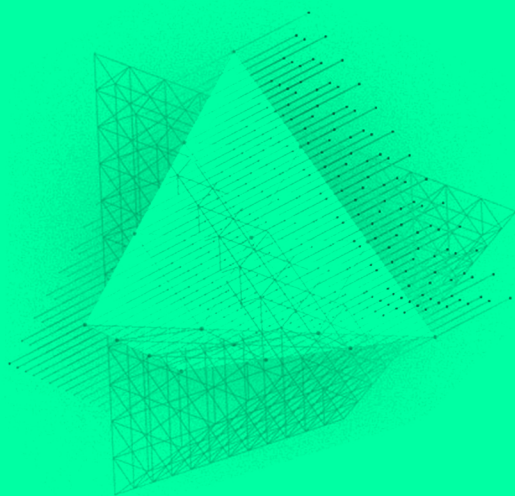
6 LATEST
TECHNOLOGY

Project Soli as of 2016

Less than a decade ago touch screen phones were a paradigm shift in human interaction with electronic devices and UI (User Interface) design. From keypads to touch screens and now touch less interactions with Project Soli, which is being developed by the Google's ATAP(Advanced Technologies and Project Group) division. Unlike Xbox One's Kinect, the Wii remote and others, we can perform simple interactions simply by making tiny pinching motions, like sprinkling salt on food, or rubbing motions as if you're moving rotating an imaginary dial. Soli is a RADAR sensor which detects motion and gestures on a millimeter scale in contrast to the above mentioned consoles.
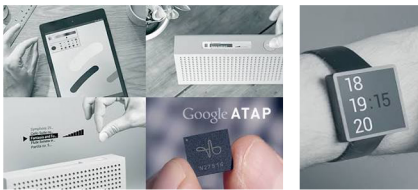
The vision behind Project Soli is to create a world where the human hand becomes a universal input device. It works by emitting electromagnetic waves in a broad beam while operating from a single integrated chip. Any object in the beam's path scatters the beam and reflects some portion back to the sensor and then relays the data to the processors where, after processing, the characteristics of the object can be determined. As the developers of Soli claim the size, position, velocity, distance and even material of the object can be detected with ease.

Android Nougat as of 2016

The 7.0 upgrade version of Android, named "Nougat" is expected to be launched in august-September. 2016. Keeping in mind the requirement and increasing importance of multitasking, Android Nougat, also codenamed Android N, provides a multi-window interface allowing the user to split the display area and use two applications t the same time. A more user friendly interface which makes communication easier is always well received by the public. This upgrade integrates this idea in its modified notification panel which now supports inline replies to the notifications. The newly added system partition which allows the system to use the application updates with a single reboot is expected to become an important feature of this Android version. Optimizing the total battery and data consumption is integral in determining how efficient the OS is. Android N will help in reducing the battery consumption when the phone is not currently in use and also it aims at changing the bandwidth used by the system, thus limiting the amount of background data downloaded thereby improving the overall data consumption. Currently the version has been released as a developer platform for

factory Nexus devices and it's the beta program where devices can avail the upgrade directly.

Project Ara as of 2016

Project Ara is Google's version of a modular phone. Now, what does a modular phone mean? A modular phone is to a regular smartphone what a MacBook is to custom built PC. That is, you can mix and match each component in your phone to suit your needs just like with a custom built PC. The current retail model has a GPU, irreplaceable CPU and RAM, camera and battery bundled together by a manufacturer and distributer and sold as a single functioning unit-the smartphone. It aims to put the choice of the individual components in the hands of the buyer.
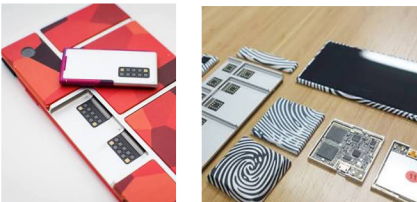
The advantage of a system like this is that if the camera is breaks or is not to your liking, you need only buy a new camera module, not an entire phone. The same goes for all the other modules. However, the disadvantage is that most smartphone users do not have the technical expertise to figure out what components they need and would rather have a device that works

out of the box. This technology is currently in the prototype stage at Google's ATAP division. The current prototype is not a fully modular phone but is more semi-modular in nature.

Bluetooth 4.0 as of 2016

Bluetooth has been an important part of cellular phones allowing users to exchange files much before the advent of USB cables or OTG pen-drives. However, the trouble of pairing devices and the limited connectivity range has forever posed a problem to the users. Bluetooth Special Interest Group plans to release Bluetooth versions 3.0 and 4.0 with a ramped up transfer rate (even up to 26Mbps) and a bettered battery consumption rate which improves battery life considerably, almost by 5 to 10 times. It also supports the new health and fitness devices like FitBit and Fuelband and a one tap pairing process which makes pairing with NFC devices faster and easier. With Bluetooth 4.0 being divided into Bluetooth Smart and Bluetooth Smart Ready, depending on the usage of devices, it hopes to transform the importance of Bluetooth on phones from an "accessory" to a necessity.

Wearable Tech as of 2016

Wearable technology is the integration of fashion accessories with electronic technologies. They are mostly being used as health trackers where each device has been incorporated with electronic software, sensors and connectivity software to connect it to the phone or PC, as desired. Google released its Google Glass, a device which can be worn as eyeglasses.

Lumus Wearable Display

The user can see notifications, texts, take pictures and record videos. It also accepts simple commands from the user.

Thereafter, Motorola released the Moto 360 smartwatch, a watch integrated with a modified mobile operating system, in 2014. Apple released the Apple Watch. Owing to this efficient and easy use, wearable technology is aiming to expand its usability in biomedicine, neural networks, data mining and assisted living.

ROBOTS as of 2016

An article on latest technology will be incomplete without robotic or artificial intelligence. From the 1970s, this field has made significant advancements over the decade to give the world its two most advanced robots NAO, developed by Aldebaran robotics and ASIMO, developed by Honda.

NAO as of 2016

NAO is a fully functional humanoid robot or Android with sensors containing microphones and two cameras. The two most successful uses of NAO were in Robocup Standard Platform League and in teaching autistic kids because the children find a child like interactive robot more relatable than humans. The groundbreaking features of NAO are its ability to get up when knocked down, locate where a sound is coming from, respond in a very human like manner and walk at moderate speed, articulate its interactions with humans and the massive flexibility it offers in terms of areas of application.
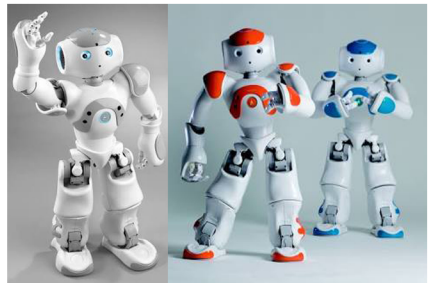
ASIMO as of 2016
Advanced Step in Innovative Mobility

The things ASIMO can do is more advanced than any other robot at this point. ASIMO can run at 9 kilometers per hour, walking can be achieved by gyroscopic sensors and perfect motor manipulation with relative ease but running requires the robot to step stabilize itself in mid air because at some point within the run both feet leave contact with the ground. It can kick a soccer ball to another person, that is, it can direct the motion of the ball by calculating its trajectory. ASIMO has another key feature. The various motors and sensors in the hand adjust the strength of its grip for different objects, i.e., it will easily to open a tightly capped bottle and also hold a Styrofoam cup and then pour the contents of the bottle in it. All this makes ASIMO one of the most advanced androids ever developed.
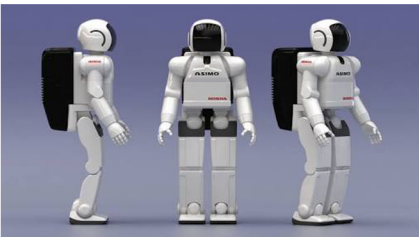
Virtual Reality as of 2016

Virtual Reality is a computer technology that recreates an environment, real or virtual, for user interaction. By manipulating the human senses, it attempts to create the same experience as one would receive if they were physically present in that environment. It can be implemented through a computer monitor or a headset. Virtual Reality has made its way into gaming, military training and entertainment in general. Mobile companies, like Samsung, have released smartphones which have been created to support virtual reality as well. This technology stepped into the limelight after the release of Oculus Rift, developed by an American company in 2014. An expanded screen which provides a 3D image of objects, sound stimulators and sensors which read the user's movements are the key components of a device which supports virtual reality. Although, developments are still being made in the technical sector, the major concerns of this technology are motion sickness in the user and the chance of disorientation with prolonged use and how strongly this technology can tend to affect the human behaviour.

ENCRYPTED

MEET THE DEPARTMENT

BSC COMPUTER SCIENCE

3RD YEAR

BSC COMPUTER SCIENCE

2ND YEAR