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V-Tech

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Contents

Preface

I am pleased to present the first issue of V-Tech, the technical magazine by the Department of Information Technology of VSIT, for academic year 2018-19. Teachers contribute articles in their field of interest as well as current/upcoming areas which help in expanding the knowledge base of faculty members.

Continuing with this tradition, this issue deals with different aspects of IT field. Starting from journey of established technologies like Data Mining, Artificial Intelligence, LIFi and the way forward, to current trending topics in the field such as Machine Learning, 3-D metal printing, iTwin, IOT. This issue also talks about some of the advances in embedded technologies like Driverless cars, Smart Inhalers, Space Explorer Rovers. Last but not the least; it also covers some areas of general interest like Why India Is One Of The Greatest Place For SEO Outsourcing Services, Artificial intelligence implications for china, etc.

I hope you will find this issue as interesting as I did. It will help all the readers in enriching their IT knowledge and hopefully strike a chord in at least one area where they can take a deep dive for their research activities.

Prof. Makarand Deshpande
Adjunct Professor

Artificial Intelligence - Robotics

Robotics is a domain in artificial intelligence that deals with the study of creating intelligent and efficient robots.

What are Robots?

Robots are the artificial agents acting in real world environment.

Objective :

Robots are aimed at manipulating the objects by perceiving, picking, moving, modifying the physical properties of object, destroying it, or to have an effect thereby freeing manpower from doing repetitive functions without getting bored, distracted, or exhausted.

What is Robotics?

Robotics is a branch of AI, which is composed of Electrical Engineering, Mechanical Engineering, and Computer Science for designing, construction, and application of robots.

Aspects of Robotics

- The robots have mechanical construction, form, or shape designed to accomplish a particular task.
- They have electrical components which power and control the machinery.
- They contain some level of computer program that determines what, when and how a robot does something.

Robot Locomotion

Locomotion is the mechanism that makes a robot capable of moving in its environment. There are various types of locomotions –

- Legged
- Wheeled
- Combination of Legged and Wheeled Locomotion
- Tracked slip/skid

Legged Locomotion

- This type of locomotion consumes more power while demonstrating walk, jump, trot, hop, climb up or down, etc.
- It requires more number of motors to accomplish a movement. It is suited for rough as well as smooth terrain where irregular or too smooth surface makes it consume more power for a wheeled locomotion. It is little difficult to implement because of stability issues.
- It comes with the variety of one, two, four, and six legs. If a robot has multiple legs then leg coordination is necessary for locomotion.

The total number of possible gaits (a periodic sequence of lift and release events for each of the total legs) a robot can travel depends upon the number of its legs.

If a robot has k legs, then the number of possible events N = (2k-1)!.

In case of a two-legged robot (k=2), the number of possible events is N = (2k-1)! = (2*2-1)! = 3! = 6.

Hence there are six possible different events :

- Lifting the Left leg
- Releasing the Left leg
- Lifting the Right leg
- Releasing the Right leg
- Lifting both the legs together
- Releasing both the legs together

In case of k=6 legs, there are 39916800 possible events. Hence the complexity of robots is directly proportional to the number of legs.

Wheeled Locomotion

It requires fewer number of motors to accomplish a movement. It is little easy to implement as there are less stability issues in case of more number of wheels. It is power efficient as compared to legged locomotion.

- **Standard wheel :** Rotates around the wheel axle and around the contact
- **Castor wheel :** Rotates around the wheel axle and the offset steering joint.
- **Swedish 45o and Swedish 90o wheels :** Omni-wheel, rotates around the contact point, around the wheel axle, and around the rollers.
- **Ball or spherical wheel :** Omnidirectional wheel, technically difficult to implement.

Slip/Skid Locomotion

- In this type, the vehicles use tracks as in a tank. The robot is steered by moving the tracks with different speeds in the same or opposite direction. It offers stability because of large contact area of track and ground.

Components of a Robot

Robots are constructed with the following :

- **Power Supply:** The robots are powered by batteries, solar power, hydraulic, or pneumatic power sources.
- **Actuators:** They convert energy into movement.
- **Electric motors (AC/DC):** They are required for rotational movement.
- **Pneumatic Air Muscles:** They contract almost 40% when air is sucked in them.
- **Muscle Wires:** They contract by 5% when electric current is passed through them.
- **Piezo Motors and Ultrasonic Motors:** Best for industrial robots.
- **Sensors:** They provide knowledge of real time information on the task environment.

Robots are equipped with vision sensors to be to compute the depth in the environment. A tactile sensor imitates the mechanical properties of touch receptors of human fingertips.

Computer Vision

This is a technology of AI with which the robots can see. The computer vision plays vital role in the domains of safety, security, health, access, and entertainment.

Computer vision automatically extracts, analyzes, and comprehends useful information from a single image or an array of images. This process involves development of algorithms to accomplish automatic visual comprehension.

Hardware of Computer Vision System

This involves:

- Power supply
- Image acquisition device such as camera
- A processor
- A software
- A display device for monitoring the system
- Accessories such as camera stands, cables, and connectors

Tasks of Computer Vision

- **OCR:** In the domain of computers, Optical Character Reader, a software to convert scanned documents into editable text, which accompanies a scanner.
- **Face Detection:** Many state-of-the-art cameras come with this feature, which enables to read the face and take the picture of that perfect expression. It is used to let a user access the software on correct match.
- **Object Recognition:** They are installed in supermarkets, cameras, high-end cars such as BMW, GM, and Volvo.
- **Estimating Position:** It is estimating position of an object with respect to camera as in position of tumor in human's body.

Applications of Robotics

The robotics has been instrumental in the various domains such as –

- **Industries:** Robots are used for handling material, cutting, welding, color coating, drilling, polishing, etc.
- **Military:** Autonomous robots can reach inaccessible and hazardous zones during war. A robot named Daksh, developed by Defense Research and Development Organization (DRDO), is in function to destroy life-threatening objects safely.
- **Medicine:** The robots are capable of carrying out hundreds of clinical tests simultaneously, rehabilitating permanently disabled people, and performing complex surgeries such as brain tumors.
- **Exploration:** The robot rock climbers used for space exploration, underwater drones used for ocean exploration are to name a few.
- **Entertainment:** Disney's engineers have created hundreds of robots for movie making.

Ashwini Koyande
Asst. Prof.

Corba

Distributed objects are the next wave in Internet innovation. CORBA, the Common Object Request Broker Architecture defined by the Object Management Group (OMG), specifies how software objects distributed over a network can work together without regard to client and server operating systems and programming languages.

CORBA is a complete distributed object platform. It extends applications across networks, languages, component boundaries, and operating systems. A CORBA Object Request Broker (ORB) connects a client application with the objects it wishes to use.

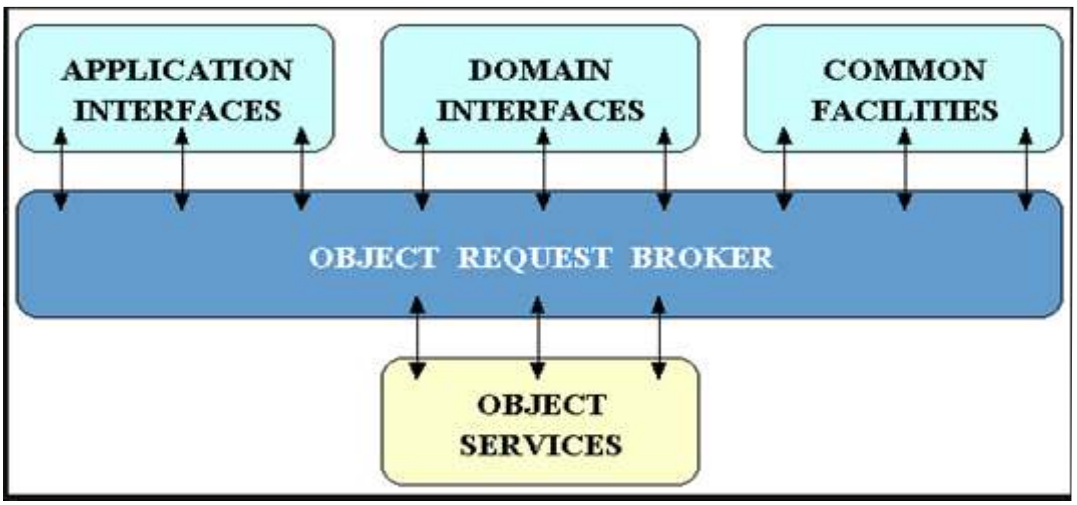
The client application does not need to know whether the object resides on the same computer or on a remote computer elsewhere on the network. The client application needs to know only two pieces of information: the object's name and how to use the object's interface. The ORB takes care of the details of locating the object, routing the request, and returning the result.

CORBA grew at the same time as three influential trends, which lent credence to the CORBA vision. First, the software development community realized the importance of object-oriented programming techniques, even though they'd been around for the better part of two decades. Second, industry leaders - including IBM, Microsoft, and Apple - were advocating new application models based on small, task-specific components instead of large, general-purpose monoliths. The components would be easy to write and update, since they were small.

Developers could more conveniently, and cheaply, upgrade only those parts of their software that were out of date, and users wouldn't have to purchase entirely new versions of the entire package. And the small components could be distributed over a network more easily than their gargantuan ancestors. The more enlightened of these component architectures promised a cross-platform future, where all components could work together entirely independent of the underlying operating system.

Introduction of CORBA Technology

The Common Object Request Broker Architecture (CORBA) is an emerging open distributed object computing infrastructure being standardized by the Object Management Group (OMG). CORBA automates many common network programming tasks such as object registration, location, and activation; request demultiplexing; framing and error-handling; parameter marshalling and demarshalling; and operation dispatching. The following figure illustrates the primary components in the OMG Reference Model architecture.



Object Services: These are domain-independent interfaces that are used by many distributed object programs. For example, a service providing for the discovery of other available services is almost always necessary regardless of the application domain. Two examples of Object Services that fulfill this role are:

- The Naming Service: which allows clients to find objects based on names;
- The Trading Service: which allows clients to find objects based on their properties.

Common Facilities: Like Object Service interfaces, these interfaces are also horizontally-oriented, but unlike Object Services they are oriented towards end-user applications. An example of such a facility is the Distributed Document Component Facility (DDCF), a compound document Common Facility based on OpenDoc. DDCF allows for the presentation and interchange of objects based on a document model, for example, facilitating the linking of a spread sheet object into a report document.

Domain Interfaces: These interfaces fill roles similar to Object Services and Common Facilities but are oriented towards specific application domains. For example, one of the first OMG RFPs issued for Domain Interfaces is for Product Data Management (PDM) Enablers for the manufacturing domain. Other OMG RFPs will soon be issued in the telecommunications, medical, and financial domains.

Application Interfaces: These are interfaces developed specifically for a given application. Because they are application-specific, and because the OMG does not develop applications (only specifications), these interfaces are not standardized. However, if over time it appears that certain broadly useful services emerge out of a particular application domain, they might become candidates for future OMG standardization.

Aasha Chavan
Assistant Professor

Digital Metal - 3D Metal Printing

3D Metal Printing Technology combines the design flexibility of 3D printing with the mechanical properties of metal. It is the process in which parts are manufactured by a laser fusing together high-performance metals, layer by layer. Metal 3D printing is a fast, accurate and cost-effective method to produce one-off prototype components and the economical manufacture of small series parts for testing purposes or as final production components for use in many different environments, without the investment in time and money of conventional tooling.

In traditional manufacturing, making metal objects can be a wasteful process. 3D printing metal parts uses less energy and reduces waste to a minimum.

3D Metal Printing Process

A 3D metal printer needs a CAD design to start the process, creating a detailed image from all angles of the desired design. Once the CAD software has been used to complete the design, it then needs to be converted into a .stl format to enable the 3D metal printer to interpret the instructions.

The metal printing process is a multi-layered approach, just like other forms of 3D printing and requires the design to be sliced very finely on the horizontal plane before it can start to be built. The 3D metal printer receives its instructions from the computer which instructs the Laser what shape to trace out across the powder. The Laser then pulses and heats up the powder which creates a solid form. This is how 3D printing in metal begins.

Once this initial base has been laid out the 3D metal printing process begins again, each layer typically no more than 0.1mm thick. This very gradual process is how metal 3D printers create the final product, with the heat from the Laser forming a solid shape. This process is known either as Direct Metal Laser Sintering or Selective Laser Melting, depending on the heat used and whether the powder is melted completely or just heated enough to fuse together.

Benefits of 3D printing metals

With 3D printers metal has far more flexibility and the ability to create cheaper and more complex moulds becomes possible. There are a number of benefits of using a 3D printer:

More cost effective: For low volumes of manufacturing, 3D printing provides an economical option which can be individually tailored to meet requirements.

No waste: All the powder left unused in the process of 3D printing can be saved and used again. Unlike traditional machining methods, there's zero waste which means it's an eco-friendly choice.

Fast: Although a mould may still take a couple of days to print – for more complex designs at least – this is an extremely rapid process by comparison to other methods.

Strong and robust finish: As the design is created as a continuous piece rather than having multiple welds and joins, there's no weak spots making it stronger overall.

Easy to tweak: If you need to change the design, the process is simple and only requires a few buttons to be pressed rather than an expensive and lengthy re-design.

Snehal Tandale
Assistant Professor

iTwin

What is an iTwin?

iTwin is a revolutionary new file sharing and remote access device brought to you by a company called iTwin. It's like two ends of a cable, without the cable. It's as simple to use as a flash drive. It's literally plug and play. iTwin can connect any two online computers anywhere in the world. iTwin enables you to have access to any or all of your home computer's files and folders while you're on-the-go. Similarly, you can also use iTwin to access to any or all of your office computer's files and folders while on-the-go. There's no in-built limit to the amount of storage you can access with iTwin while you're on-the-go. The only limit is the size of your hard drives. The only other "limit" is the speed of your Internet connection. The faster it is, the better your experience.

You can select files for accessing later on-the-go, or you can edit them remotely, without the files leaving your computer. You can also back-up files to your home or office computer while you're out on-the-go. It's so easy, it's unbelievable.

Who invented iTwin?

iTwin was invented by an Indian named Lux Anantharaman. After achieving a Bachelors degree in Electrical and Electronic Engineering from IIT in Chennai and a Masters degree from IISc in Bangalore, Lux worked first as an IT security researcher at the Institute of Systems Science, Singapore and then as senior researcher at Kent Ridge Digital Labs and the Institute for Infocomm Research. Lux specializes in PKI implementations, efficient digital certificate revocations and usable security.

How to use iTwin?

When you connect iTwin, you'll see a regular window pop-up, just as you would if you plugged in a regular USB flash drive. Drag and drop files and folders into this window to share them - as many as you want. Leave your computer with one half of iTwin connected to it. Detach the other half of iTwin and take it with you. Wherever you go, you can remotely access the shared files, simply by plugging the half you are carrying into any online Windows computer, anywhere. iTwin allows you to transfer files to - or from - your home computer. Or your office computer. Or your friend's, or your colleague's! iTwin also allows you to edit the shared files on a remote computer, while keeping them on that remote computer, (no need to transfer those files before you edit them).

Unique Features

1. **Smart key generation**

   Two iTwins together generate a random 256-bit AES key, everytime they are

physically paired and plugged into a computer. Smart Key generation is assisted by the computer to add randomness. Smart crypto key resides only on the two halves of the paired iTwin. Smart Crypto key is used for encrypting all data traffic between two iTwins.

2. **No "Temp Files"**

   Unplug iTwin and all temp files are purged automatically. This is especially useful when using a computer that does not belong to you.

3. **Password support**

   iTwin even provides password support. Passwords of any length can be set. Unlike other web services, iTwin's password is stored on itself, not on any server. If you forget your password, simply pair both halves of your iTwin, plug them into a computer and set a new password. No need for tech support!

4. **Bi-Directional File Access**

   When using iTwin, the connection between the 2 computers is completely symmetrical. Access, copy, backup & remotely edit files on computer A from computer B, and on B from A. You will have access to files on both A and B

5. **iTwin is like the two ends of a cable, without the cable.**

   iTwin is just like a wireless device connecting two systems and securely transferring data between them.

Rohini Desai
Assistant Professor

Indian startups Revolutionising the Healthcare sector with AI

India has encountered a number of brilliant minds in the sphere of artificial intelligence industry. In the recent times, a large number of artificial intelligence and machine learning relying startups have emerged and have flourished and India is already among the top countries in the field of AI.

A lot of healthcare industries in India also need automation for various tasks and they are using AI to help them in their industry.

Here is a list of Indian startups, in alphabetical order, leveraging the advantages of AI in the field of healthcare:

1. **Advancells:** Started in 2005, this startup is focused on therapeutic applications of Regenerative Medicine, which is a branch of translational research in tissue engineering and molecular biology that deals with the replacing and regenerating human cells, tissues or organs to restore or establish normal function. It delivers technologies for the safe and effective treatment options to patients all over the world at the highest medical standards. Founder: Vipul Jain
2. **Artelus:** Artelus stands for "artificial learning system" and was founded in the year 2017. This startup is focused on detecting diabetic retinopathy (DR) using deep learning algorithms. It captures the patient's retina image, analyses it and presents a report out of it. It can be used to detect DR in less than a total of three minutes, which is way faster than humans. It is also striving to create early detection tools for TB, breast cancer and lung cancer with the help of its AI screening tool. Founders: Rajarajeshwari K, Lalit Pant, Pradeep Walia
3. **ChironX:** ChironX founder, Mausumi Acharyya, is an expert imaging an AI expert. Founded in 2017, ChironX (earlier known as Advenio Technosys) detects diseases from large populations of medical images. It has an autodiagnostic software which uses complex image processing AI algorithms along with classical machine learning techniques. Their modules also use a lot of deep learning algorithms. Currently, it is working for retinal abnormality detections and acute respiratory infections. ChironX's research activities are funded by the Biotechnology Industry Research Assistance Council (BIRAC) and the Bill Melinda Gates Foundation and are being seed funded by KStart. Founder: Mausumi Acharyya, Sombodhi Ghosh
4. **LiveHealth:** It is a Pune-based startup that provides diagnostics to customers through automation. This 2014 startup delivers reports to patients or

organisations online as soon as they are available. It also offers online payment, monitors all patient activities in real time and enables doctors to access the patient data anytime. Doctors can also sign their patient reports with just one click. Their focus is maximum digitization and automation in providing medical diagnostics, due to which report entry errors are completely eliminated. Founders: Abhimanyu Bhosale, Mukund Malini

5. **Lybrate:** Founded in 2014, Lybrate is the country's first online doctor consultation platform. In a fast-moving, busy world today, we hardly have time to go to a doctor physically for every minor health problem that we face. Often we end up ignoring some symptoms that seem minor to us but turn out to be serious, because of our over-occupied work lives. Lybrate has an online application via which patients can connect to doctors and have a consultation online. The patients can also book lab tests and appointments online.

   Apart from this, Lybrate also provides weight diet and fitness, skin and hair care solutions. They have doctors from a variety of spectrum across the country. It also has a health consultant bot on Facebook Messenger. The aim of this startup is to create an online consultation for everyone easily accessible. Founder: Saurabh Arora.

6. **NeuroSynaptic Communications Private Limited:** Their aim is to make health care accessible to all the masses through their startup. It provides a high-quality ReMeDi Remote Healthcare Delivery Solutions. It collects information on various physiological aspects of patients remotely and provides them with its diagnosis. By doing this, they make the whole process of diagnosis affordable. They currently operate in four cities with the main focus on healthcare delivery. The majority of their work has been in schools so far and also have an app-based tool for parents to plan nutritious meals for their children. Apart from this, they also offer annual health check-ups and health education. It was founded in 2002. Founder: Sameer Sawarkar.

7. **Niramai:** The two founders of this startup, after seeing cancer in their family had felt a deep urge to solve this problem in society. Niramai is a Bangalore-based 2016 startup that provides breast cancer screening solutions. They build a machine learning software that helps to detect breast cancer at a much early stage, helping early diagnosis of the cancer. Founders: Geetha Manjunatha, Nidhi Mathur

8. **OncoStem Diagnostics:** Founded in 2011, this startup uses machine learning algorithms to help in personalised cancer treatment. OncoStem uses Proteomics and Genomics-based platforms and with the aid of a molecular fingerprint of a tumour, predicts cancer recurrence. Knowing the recurrence of cancer will also help to develop new drugs. It has a product called 'CanAssist-Breast', which they aim to help reduce breast cancer can predict the likelihood of cancer returning by analysing samples of the patient's tumour. Once this has been analysed through a machine learning based algorithm, the patient is classified as 'low' or 'high' risk. Patients classified as 'high-risk' would have a greater probability of cancer recurring than those classified as 'low-risk'. Those with a low-risk score can forgo Chemotherapy. Founder: Manjiri Bakre

Sanjeela Sagar
Assistant Professor

Li-Fi

What is Li-fi?

Li-Fi (short for light fidelity) is a technology for wireless communication between devices using light to transmit data and position. In its present state only LED lamps can be used for the transmission of visible light. The term was first introduced by Harald Haas during a 2011 TEDGlobal talk in Edinburgh. In technical terms, Li-Fi is a visible light communications system that is capable of transmitting data at high speeds over the visible light spectrum, ultraviolet and infrared radiation.

What is the difference between Wi-Fi and Li-Fi?

In terms of its end use, the technology is similar to Wi-Fi. The key technical difference is that Wi-Fi uses radio frequency to transmit data. Using light to transmit data allows Li-Fi to offer several advantages like working across higher bandwidth, working in areas susceptible to electromagnetic interference (e.g. aircraft cabins, hospitals) & offering higher transmission speeds. The technology is actively being developed by several organizations across the globe.

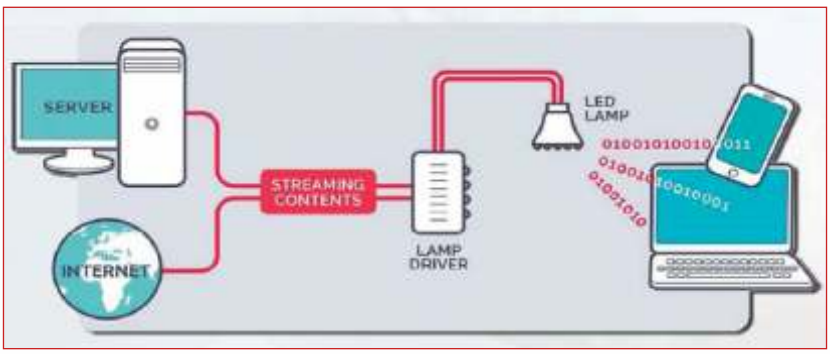
How Li-Fi works?

This optical wireless communications (OWC) technology uses light from light-emitting diodes (LEDs) as a medium to deliver networked, mobile, high-speed communication in a similar manner to Wi-Fi. The global Li-Fi market is estimated to reach the valuation of approximately USD 51 billion by 2023, reports Market Research Future (MRFR).

Visible light communications (VLC) works by switching the current to the LEDs off and on at a very high rate, too quick to be noticed by the human eye. Although Li-Fi LEDs would have to be kept on to transmit data, they could be dimmed to below human visibility while still emitting enough light to carry data. The light waves cannot penetrate walls which makes a much shorter range, though more secure from hacking, relative to Wi-Fi. Direct line of sight is not necessary for Li-Fi to transmit a signal; light reflected off the walls can achieve 70 Mbit/s.

What are the Advantages of using Li-Fi?

Li-Fi has the advantage of being useful in electromagnetic sensitive areas such as in aircraft cabins, hospitals and nuclear power plants without causing electromagnetic interference. Both Wi-Fi and Li-Fi transmit data over the electromagnetic spectrum, but whereas Wi-Fi utilizes radio waves, Li-Fi uses visible light, Ultraviolet and Infrared. While the US Federal Communications Commission has warned of a potential spectrum



crisis because Wi-Fi is close to full capacity, Li-Fi has almost no limitations on capacity. The visible light spectrum is 10,000 times larger than the entire radio frequency spectrum. Researchers have reached data rates of over 224 Gbit/s, which was much faster than typical fast broadband in 2013. Li-Fi is expected to be ten times cheaper than Wi-Fi. Short range, low reliability and high installation costs are the potential down sides.

Future of Li-Fi: It is predicted that future home and building automation will be highly dependent on the Li-Fi technology for being secure and fast. As the light cannot penetrate through walls, the signal cannot be hacked from a remote location.

Applications

Security: In contrast to radio frequency waves used by Wi-Fi, lights cannot penetrate through walls and doors. This makes it more secure and makes it easier to control access to a network. As long as transparent materials like windows are covered, access to a Li-Fi channel is limited to devices inside the room.

Hospital: Many treatments now involve multiple individuals, Li-Fi systems could be a better system to transmit communication about the information of patients. Besides providing a higher speed, light waves also have little effect on medical instruments and human bodies.

Vehicles: Vehicles could communicate with one another via front and back lights to increase road safety. Street lights and traffic signals could also provide information about current road situations.

Industrial automation: Anywhere in industrial areas data has to be transmitted, Li-Fi is capable of replacing slip rings, sliding contacts and short cables, such as Industrial Ethernet. Due to the real time capability of Li-Fi (which is often required for automation processes) it is also an alternative to common industrial Wireless LAN standards.

Beena Kapadia
Assistant Professor

Review on Discussion Paper

ARTIFICIAL INTELLIGENCE: IMPLICATIONS FOR CHINA

By Mckinsey Global Institute

The report talks about the effects of AI on the Chinas economy, its populations and its futuristic tactic.

The report starts defining what is artificial intelligence? where it has been used, how much percentage of population is affected by it and what would be the future to AI? And last but not the least the strategies to be adopted by China.

Artificial intelligence, or the idea that computer systems can perform functions typically associated with the human mind, has gone from futuristic speculation to present-day reality. AI's effect on productivity could be crucial to China's future economic growth as the population ages. According the report, AI-led automation can give the Chinese economy a productivity injection that would add 0.8 to 1.4 percentage points to GDP growth annually, depending on the speed of adoption.

Together with technologies such as the Internet of Things (IoT) and robotics, it can create an integrated cyber-physical world. Taking these into account, MGI's research on automation finds that it might take until 2055 for half of all current work activities to become automated—but there is a fair degree of uncertainty in this timing.

In health care, AI will greatly enhance the capability to analyze the human genome and develop personalized and more effective treatments for each patient. AI systems can analyze weather patterns and improve energy efficiency on a wide scale, enhancing our ability to monitor and combat climate change. And the possibilities are not even earthbound; AI systems could one day pioneer exploration of Mars and the outer reaches of space.

China and the United States are currently the world leaders in AI development. In 2015 China alone accounted for nearly 10,000 papers on AI published in academic journals, while the United Kingdom, India, Germany, and Japan combined to produce only about half as many scholarly research articles. China has reason to feel optimistic about its role in a future defined by AI due to its huge population as it can generate a tremendous volume of data, which is a prerequisite for “training” AI systems. Just as humans are fueled by food, AI cannot run without a steady diet of data. But several issues with data could stymie China's AI development. China's technology giants collect vast troves of data through their proprietary platforms, China is lagging the United States in creating a data-friendly ecosystem with unified standards and cross-platform sharing. Countries around the world have found that opening government data sets spurs private-sector

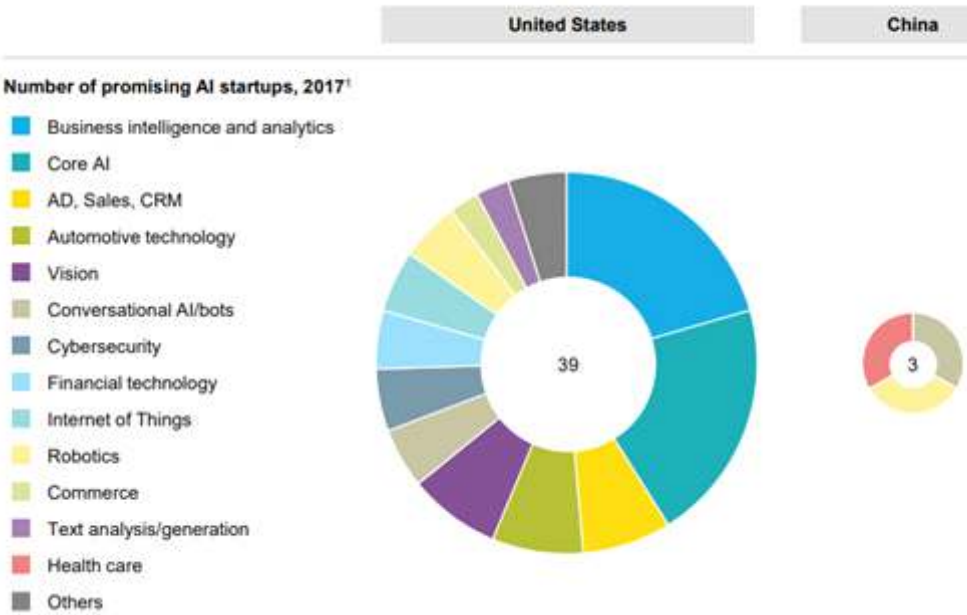
innovation, but China has relatively little public-sector data accessible for exploration And last but not least, limitations on cross-border data flows put China at a disadvantage for global collaboration.

The current degree of commercialization varies across AI technologies

Functionality	Maturity	Use cases	
Perception		IBM	Software can review medical images with the same accuracy as human radiologists
		Iflytek	Voice assistant app transcribes spoken Mandarin into text
Prediction		Netflix	Algorithm suggests films and TV shows to customers based on their previous viewing history and ratings
		Capital One	Algorithm predicts customers' purchasing behavior
Prescription		Wealthfront	AI-driven platform provides automated advice to customers on asset allocation and wealth management
		Google	AI can produce surrealistic "artwork" from white noise or images
Integrated solutions		Amazon	Smart speaker devices can control home appliances
		Baidu	Autonomous cars operate within known and limited environments

SOURCE: *MIT Technology Review*; TechNode; WealthManagement.com; Google Research blog; McKinsey Global Institute analysis

The United States has a more robust AI startup ecosystem than China



It lags the United States and the United Kingdom in terms of fundamental research that advances the field of AI. One of the major reasons is simply a talent shortage. Over half of the data scientists in the United States have more than 10 years of work experience, while up to 40 percent in China have less than five years of experience.

At the application level, China is on a par with other countries in terms of algorithm

development. In fact, Chinese players have achieved breakthroughs in developing AI algorithms used in voice recognition and targeted advertising. Thanks to global open source platforms, Chinese companies can quickly replicate the most advanced algorithms developed anywhere in the world.

Overall, China has more labor associated with activities that can be technically automated than any other country in the world. MGI estimates that 51 percent of work activities in China can be automated, affecting the equivalent of 394 million full-time employees. However, even in an early adoption scenario, in which ~90% of work activities will be automated by 2055, China may still face a shortfall of the labor needed to meet its GDP growth target of 4-5 percent. This would leave the nation looking for additional levers to enhance productivity.

AI systems can help scientists predict environmental changes; for example, Cornell University is using this capability to predict habitat changes and protect certain species of birds. AI also has wide applicability in health care. The Dutch government is using it to identify the most effective treatments for certain patient populations and cut down on medical mistakes through analysis of digitalized health records. In the United States, the Las Vegas Health Department is using this technology for public health surveillance, using social media tracking to pinpoint the origins of disease outbreaks. AI systems can enhance the safety and efficiency of public transportation and traffic systems. Evidence already shows that AI-enabled autonomous cars can reduce traffic injuries. Alibaba has collaborated with the government of Hangzhou to make city transportation smarter with AI-directed traffic lights, reducing congestion and speeding traffic by 11 percent in specific areas of the city. AI is also being used to predict energy demand and manage energy usage. Early use cases, such as Google lowering energy usage in its massive data centers and the British government managing surges in demand in its grid system, point to the possibility of billions in savings for companies and consumers alike.

But the ethical issues brought out by the advent of AI are ,First, in a world of ubiquitous sensors and AI systems, companies are constantly collecting data about individuals—not only as they use digital devices but as they move through public and personal spaces. In some settings, such as hospitals, this personal information is highly sensitive. This raises questions about who owns personal data, how it may be shared, and how it should be protected from the increasing risk of cybersecurity breaches. Second, AI may unintentionally discriminate in its decision making. Since the "real world"

can be racist, sexist, and biased in many ways, real-world data that is fed into algorithms can also have these features and when machine learning algorithms learn from biased training data, they internalize the biases. A top AI company experienced such an incident firsthand in 2016 when its experimental "chatbot" offended many Internet users with racist and sexist slurs after the program was trained in online forums. If biased AI is deployed for critical decision-making, its conclusions may even lead to unfair treatment of certain groups of people.

GEOPOLITICAL IMPLICATIONS

Furthermore, just as AI-driven automation may create a two-tiered labor market within individual economies, it may enlarge the global "digital divide," with poorer and less technologically advanced nations falling even further behind on the development curve. Some countries that expect rapid population growth and have been counting on a labor intensive economic development model may even face new waves of social unrest, as large segments of the population lose their jobs to machines. Lastly, computer simulation tools are already widely used in war games, and AI will further improve the accuracy and capability of such simulations. But the potential for weaponizing AI is a strong concern. A report commissioned by the US Navy argued that as military robots become more complex, greater attention should be paid to the implications of their ability to make autonomous decisions. Stephen Hawking, Elon Musk, and more than 1,000 AI and robotics researchers have signed a letter suggesting a ban on AI warfare, warning of the potential for rampant destruction at the hands of "autonomous weaponry." AI systems, like nuclear energy and nuclear weapons before them, may require strong international agreements to ensure their peaceful use and maintain global security.

CHINA'S PATH FORWARD ON AI

Strategic priority 1: Build a robust data ecosystem

Strategic priority 2: Broaden adoption of AI within traditional industries

Strategic priority 3: Strengthen the pipeline of specialized AI talent

Strategic priority 4: Ensure that education and training systems are prepared to develop technology skills and retrain large segments of the workforce

Strategic priority 5: Establishing an ethical and legal consensus among Chinese citizens and in the global community.

Ms.Mithila Chavan
Assistant Professor

Self-Driving /Autonomous Car

Definition:

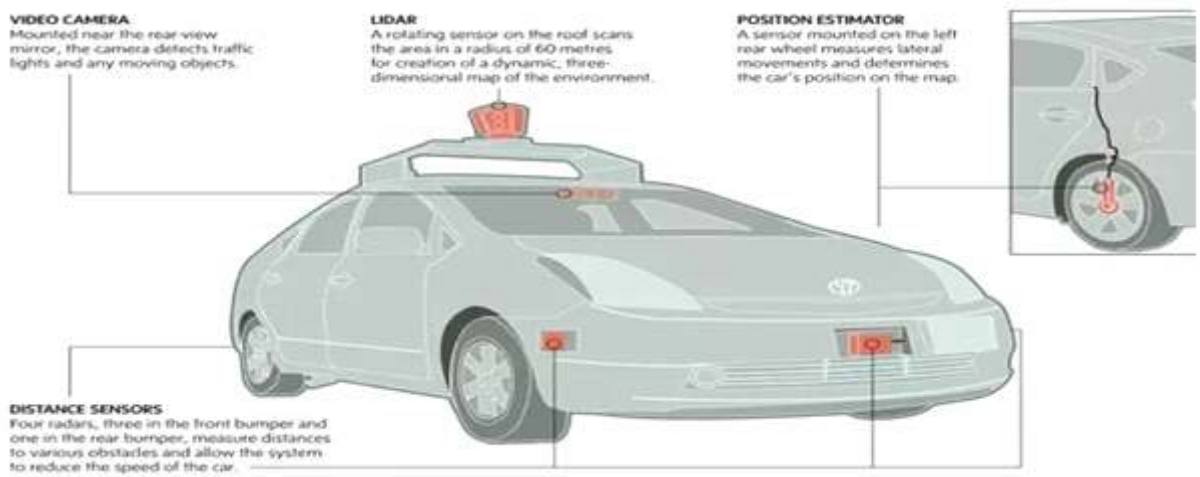
It is one of the most popular self-driving vehicles which is known as driverless cars or autonomous cars that travels without a human operation. The first automated car was developed by Japan in 1977, but Google began its invention in 2009, and then finally it came on public road in 2015 as a test drive. It uses various sensors, cameras, artificial intelligence concepts and software algorithms.

Basic Work Model:

A self-driving car is capable of sensing its environment and navigating without human control. Each vehicle has components of GPS unit, a navigation system, and a range of sensors including video cameras, laser rangefinders, radar, and video. The vehicle uses positional information from the GPS and navigation system to localize itself and sensor data to refine its position estimate as well as to build a three-dimensional image of its environment.

Data from each sensor is filtered to remove noise and often fused with other data sources to augment the original image. How the vehicle subsequently uses this data to make navigation decisions is determined by its control system.

The basic model of a self-driving car with all its components are labelled below:



The Components and its working are as follows:

Video Cameras

Pairs of digital video cameras are mounted on top of the car, slightly separated by short distance. These high performance stereo cameras typically have 50 degrees FOV and accuracy up to 30 meters. These high performance cameras will take images of its surrounding. A single image can only offer 2D information, but two images of the same

pattern is derived by a known distance which allows depth information (distance away). One more additional camera is mounted near the rear-view mirror specifically for traffic lights, signs, and pedestrians in front of the car.

Light Detection and Ranging(LIDAR) :

A special type of sensor called - HDL-64E is been installed on top of the car which uses pulsed laser beam will measure the distance and speed of its surroundings by bouncing its 64 lasers off of objects as it spins 360 degrees. This HDL-64E reads up to 1.3 million points per second, accurate to 2cm within a radius of 90-120 meters.

RADAR :

A set of four radar sensors attached to the front and back are used to determine the accurate distance. Radar is a technology that bounces high frequency radio waves to identify its object tracking, and this particular radar system is used to identify about 200 meters of radius.

Global Positioning System (GPS) tracking :

By pinging GPS satellites and triangulation of the received radio signals, we can find out where we are.

Navigation Through Google Maps

The laser mounted on top of a car will send the radiation which will be mapped, with its on-board GPS, and lateral movement sensors all feed into a buffer for processing that gets poured into the high resolution Google map.

Mapping and localization

The data from Laser and RADAR popularly known as LIDAR and other sensors go into algorithms to generate real-time probabilistic mappings of the car's surroundings.

Control System :

It feeds from the previously mentioned trajectory output to control the system of the car itself. The Google car blends multiple strategies from Model predictive control, well established physically based car physics models, and PID controller for operating low-level actions like applying torque on the wheels. The planner and the control algorithms cycle to understand the motions of the world.

Advantages:

- Less chance of road accidents.
- It provides smooth and speedy mobility for disabled individuals.

Disadvantages:

- If sensors do not work properly, then entire functioning will be hampered.
- There are chances of the software algorithm to be hacked.

Conclusion:

It would be great if such prototype with the model and its technology comes in the market. But we need to train the drivers how to tackle with the algorithms. We should be able to develop the regulations, insurance model, liabilities and more guidelines for this technology. Even if traffic sufferers are reduced by autonomous vehicles, the accidents at the hands of a machine will exist.

Ms.Geeta Sahu
Assistant Professor

Smart Inhalers

In today's stressful life as well as increasing pollution the problem of asthma can be triggered. Inhaled Corticosteroids & Bronchodilators are the cornerstone treatments for asthma. The first medication helps control inflammation while the second provides immediate relief when symptoms flair.

According to the report given to Health line by Tonya A. Winders, president and chief executive officer of the Allergy & Asthma Network, told Health line "Standard of care works for approximately 90% of all patients when taken correctly and as prescribed, "On the other hand, studies show about 50% of patients with asthma are not well controlled, which leads us to believe more can be done to increase adherence."

There enter the Bluetooth-enabled Smart Inhalers. Smart inhalers contain sensors that attach to existing inhalers and record when your medication is taken. They are Bluetooth-enabled, so can be paired wirelessly with a smart device like a phone or tablet or with a computer to allow data to be transferred from the smart inhaler automatically. In the future, an app on your smart phone could receive and interpret the data from your smart inhaler and send you health advice and reminders. The smart inhaler apps that have emerged so far appear to work with both iPhone and Android.

These devices are designed to detect inhaler use, remind patients to use their medication, encourage proper use of the device, and gather data about a patient's use of inhalers, that can help guide care. Each time the inhaler is used, it records the date, time, place, and whether the dose was correctly administered. This data could also be shared with patient's general practitioner, asthma nurse or hospital team to help tailor care to patient's needs. Knowing when and where your symptoms flare up may help identify personal triggers and allow a more individually tailored self-management plan. This can provide valuable insight to determine how adherent patients are to their medications, as well as help to understand the patterns of when a patient experiences a flare. This way the critical situations, where patients are more likely to get the asthma attack can be avoided.

Amraja K. Shivkar
Asst. Prof.

Important Research Areas in Molecular Data Mining

For the past few decades the online molecular databases have been growing at an exponential rate due to advanced computer technology and vast capacity of storage media. These databases had led to the evolution of biological data science. For exploring biological dataset, some data mining techniques have been widely used like clustering, classification and secondary structure prediction in proteins, feature selection in bioinformatics and pattern mining techniques. Data mining is the process of extracting or "mining" knowledge from vast amounts of data. It is the science of finding interesting patterns and relationship in huge amount of data.

Bioinformatics is the science of storing, organizing, extracting, analysing, interpreting and utilizing information from biological sequences and molecules. It can be defined as the application of computer technology to the management of biological information. Data Mining approaches seem ideally suited for data-rich bioinformatics but lacks a comprehensive theory of life's organization at the molecular level so there is always a need for suitable data mining strategies for the molecular data analysis, resulting molecular data mining.

Molecular data mining helps to extract useful knowledge from massive datasets gathered in biology, and in other related life sciences areas such as medicine and neuroscience. The extensive databases of biological information create both challenges and opportunities for development of novel data mining methods.

It is important to examine what are the important research issues in bioinformatics and develop new data mining methods for scalable and effective analysis.

Some of the grand research area in molecular mining includes:

1. **Sequence analysis**

   Sequence analysis is the most primal operation in the areas of computational biology. It is the process of subjecting a DNA, RNA or peptide sequence to any of a wide range of analytical methods to understand its features, function, structure, or evolution. Some important methodologies for sequence analysis are sequence alignment and searches against biological databases.

2. **Inherent uncertainty present in the molecular data:**

   Uncertainty is an epistemic property induced by the lack of information. There are many forms or levels of uncertainties in the real world problems. Large data sets commonly contain some uncertainty, particularly incompleteness and inconsistency. One of the major challenges for data analytics in biological data is to identify different

forms of uncertainty in the molecular data and the data relationships which leads to the vague estimation of the information present in the datasets. Another challenge is to identify appropriate mathematical tools and techniques to model these different forms of uncertainty to develop algorithms for effectively analysing the molecular dataset.

3. **Healthcare Sector:**

The healthcare environment is generally perceived as being 'information rich' yet knowledge poor'. There is a wealth of data available within the healthcare systems. However, there is a lack of effective analysis tools to discover hidden relationships & trends in data. Knowledge discovery & data mining have found numerous applications in business and scientific domain. Valuable knowledge can be discovered from application of data mining techniques in healthcare system. The healthcare industry collects huge amounts of healthcare data which, unfortunately, are not "mined" to discover hidden information. Discovery of hidden patterns & relationships often goes unexploited. Using medical profiles such as age, sex, blood pressure and blood sugar it can predict the likelihood of patients getting a heart disease or other diseases.

4. **Protein structure prediction:**

The amino acid sequence of a protein (so-called, primary structure) can be easily determined from the sequence on the gene that codes for it. In most of the cases, this primary structure uniquely determines a structure in its native environment. Knowledge of this structure is vital in understanding the function of the protein. For lack of better terms, structural information is usually classified as secondary, tertiary and quaternary structure. Protein structure prediction is one of the most important for drug design and the design of novel enzymes. A general solution to such predictions remains an open problem for the researchers.

5. **Identification of gene/SNP patterns:**

Genomic studies provide large volumes of data with the number of single nucleotide polymorphisms (SNPs) ranging into thousands. The analysis of SNPs permits determining relationships between genotypic and phenotypic information as well as the identification of SNPs related to a disease. The growing wealth of information and advances in biology call for the development of approaches for discovery of new knowledge. One such area is the identification of gene/SNP patterns impacting cure/drug development for various diseases. A global search mechanism, weighted decision tree, decision-tree based wrapper, a correlation based heuristic, and the identification of intersecting feature sets are employed for selecting significant

genes.

6. **Metabolomics:**

   Disease diagnosis using molecular profiles has been gaining more attention. For early detection of diseases, metabolomics has been a recently emerging field as promising tools among the molecular diagnosis study. Data mining techniques have been essential to handle, process, and analyse the metabolic profile data. However, due to complexity and largeness of such data conventional data mining techniques are not very suitable so there is the need for appropriate data mining strategies for the metabolomics data analysis.

7. **Analysis of mutations in cancer:**

   Genomes of cancer affected cells are rearranged in complex or even unpredictable ways. Cancer genome analysis may focus on the cancer type or on the patient, depending on the type of data and the aim of the analysis. The former approach involves examining a group of patients suffering from a particular type of cancer. It is used to identify biomarkers, characterize cancer subtypes with clinical or therapeutic implications, or to simply advance our understanding of the tumorigenic process. The latter approach consists of examining the genome of a particular cancer patient in the search for specific alterations that may be susceptible to tailored therapy. Although both the approaches draw on common experimental and bioinformatics techniques, they analyse different types of information and have different goals.

8. **Comparative genomics:**

   Comparative genomics is the study of the relationship of genome structure and function across different biological species. Gene finding is an important application of comparative genomics, as is discovery of new, non-coding functional elements of the genome. Comparative genomics exploits both similarities and differences in the proteins, RNA, and regulatory regions of different organisms. Computational approaches to genome comparison have recently become a common research topic in computer science.

   Bioinformatics and data mining are developing as interdisciplinary science and are fast growing research area today. It is important to examine what are the important research issues in bioinformatics and develop new data mining methods for scalable and effective analysis.

Dr. Amita Jain
Assistant Professor

Space explorer rover

A rover (or sometimes planetary rover) is a space exploration vehicle designed to move across the surface of a planet or other celestial body. Some rovers have been designed to transport members of a human spaceflight crew; others have been partially or fully autonomous robots. Rovers usually arrive at the planetary surface on a lander-style spacecraft. Rovers are created to land on another planet, besides Earth, to find out information and to take samples. They can collect dust, rocks, and even take pictures. They are very useful for exploring the universe.

Features :

Rovers arrive on spacecraft and are used in conditions very distinct from those on the Earth, which makes some demands on their design.

1. **Reliability**

   Rovers have to withstand high levels of acceleration, high and low temperatures, pressure, dust, corrosion, cosmic rays, remaining functional without repair for a needed period of time. Mars rover Sojourner in cruise configuration

2. **Compactness**

   Rovers are usually packed for placing in a spacecraft, because it has limited capacity, and has to be deployed. They are also attached to a spacecraft, so devices for removing these connections are installed.

3. **Autonomy**

   Rovers which land on celestial bodies far from the Earth, such as the Mars Exploration Rovers, cannot be remotely controlled in real-time since the speed at which radio signals travel is far too slow for real time or near-real time communication. For example, sending a signal from Mars to Earth takes between 3 and 21 minutes. These rovers are thus capable of operating autonomously with little assistance from ground control as far as navigation and data acquisition are concerned, although they still require human input for identifying promising targets in the distance to which to drive, and determining how to position itself to maximize solar energy. Giving a rover some rudimentary visual identification capabilities to make simple distinctions can allow engineers to speed up the reconnaissance. During the NASA Sample Return Robot Centennial Challenge, a rover, named Cataglyphis, successfully demonstrated autonomous navigation, decision-making, and sample detection, retrieval, and return capabilities.

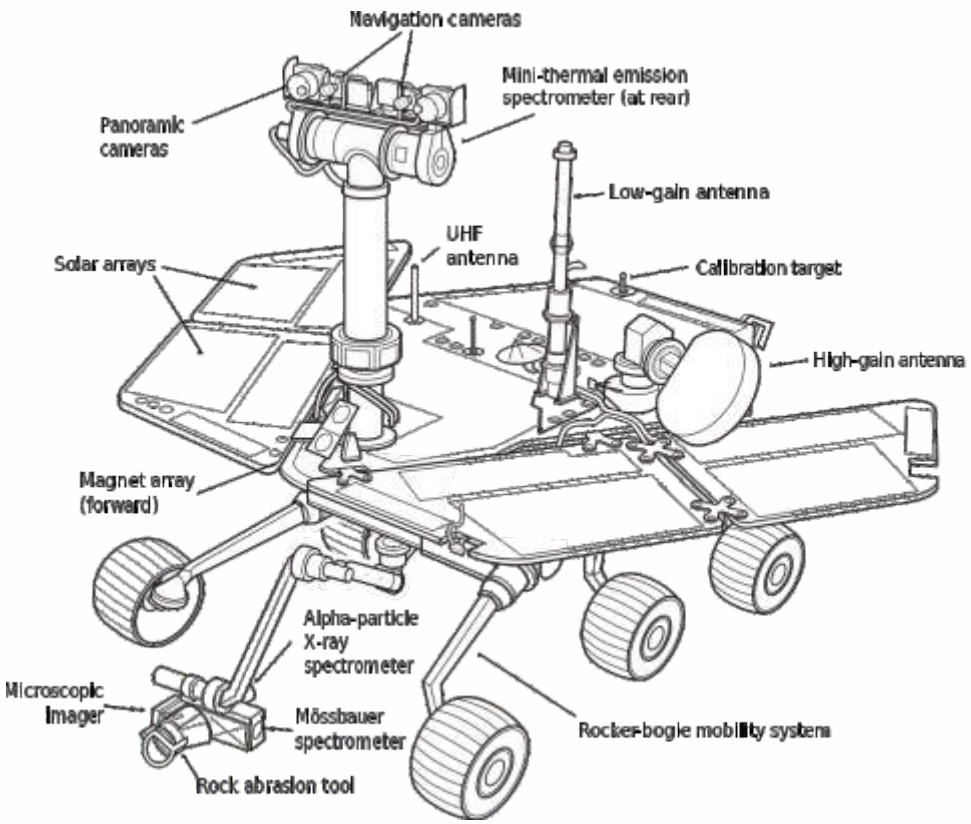
4. Non-wheeled approaches

Other rover designs that do not use wheeled approaches are possible. Mechanisms that utilize "walking" on robotic legs, hopping, rolling, etc. are possible. For example, Stanford University researchers have proposed "Hedgehog", a small cube-shaped rover that can controllably hop or even spin out of a sandy sinkhole by corkscrewing upward to escape for surface exploration of low gravity celestial bodies.

Active rover missions

1. Mars Exploration Rover Opportunity

Opportunity is a robotic rover on the planet Mars, active since 2004. It is the remaining rover in NASA's ongoing Mars Exploration Rover Mission. Launched from Earth on July 7, 2003, it landed on the Martian Meridiani Planum on January 25, 2004 at 05:05 Ground UTC (about 13:15 local time), three weeks after its twin Spirit (MER-A) touched down on the other side of the planet. On July 28, 2014, NASA announced that Opportunity, after having traveled over 40 km (25 mi) on the planet Mars, has set a new "off-world" record as the rover having driven the greatest distance, surpassing the previous record held by the Soviet Union's Lunokhod 2 rover that had traveled 39 km (24 mi).



1. **Mars Science Laboratory Rover Curiosity**

   On 26 November 2011, NASA's Mars Science Laboratory mission was successfully launched for Mars. The mission successfully landed the robotic Curiosity rover on the surface of Mars in August 2012. The rover is currently helping to determine whether Mars could ever have supported life, and search for evidence of past or present life on Mars.

Planned rover missions

1. **Chandrayaan 2**

   The Chandrayaan-2 is a mission by India, consisting of a lunar orbiter, a lander, and a rover. An opportunity was given to students to design this rover. 150 students submitted their designs but only six were selected. The Indian-designed rover weighs 20 kg, will have six wheels and will run on solar power. It will land near one of the lunar poles and will operate for two weeks. The proposed launch is in January 2019.

2. **TeamIndus Rover**

   TeamIndus, a private aerospace startup based out of Bangalore, is building a lunar mission comprising a lunar lander and rover. Originally started as a competitor for the $30M Google Lunar X Prize, the competition ended without a winner, but TeamIndus still plans on launching their spacecraft sometime in 2019. The solar-powered rover has four wheels and will be equipped with a number of cameras including CASPEX micro-camera from CNES. The rover will operate for a maximum of one lunar day or fourteen Earth days.

3. **ExoMars Rover**

   The European Space Agency (ESA) is currently designing and carrying out early prototyping and testing of the ExoMars rover. As of 2017, the rover is scheduled for launch in 2020.

4. **Mars 2020 rover mission**

   Mars 2020 rover design infographic detailing cameras

   The Mars 2020 rover mission is a Mars rover under development by NASA with a launch planned for 2020. It is intended to investigate an astrobiologically relevant ancient environment on Mars, investigate its surface geological processes and history, including the assessment of its past habitability and potential for preservation of biosignatures within accessible geological materials.

Niti D Salvi
Assistant Professor

Storing Data in DNA

Every five years, the amount of data we are producing increases 10 - fold, including photos and videos. Not all of it needs to be stored, but manufacturers of data storage aren't making hard drives and flash chips fast enough to hold what we do want to keep. Since we're not going to stop taking pictures and recording movies, we need to develop new ways to save them. nature has evolved an incredible information storage medium – DNA. It evolved to store genetic information, blueprints for building proteins, but DNA can be used for many more purposes than just that. DNA is also much denser than modern storage media: The data on hundreds of thousands of DVDs could fit inside a matchbox-size package of DNA. DNA is also much more durable – lasting thousands of years – than today's hard drives, which may last years or decades.

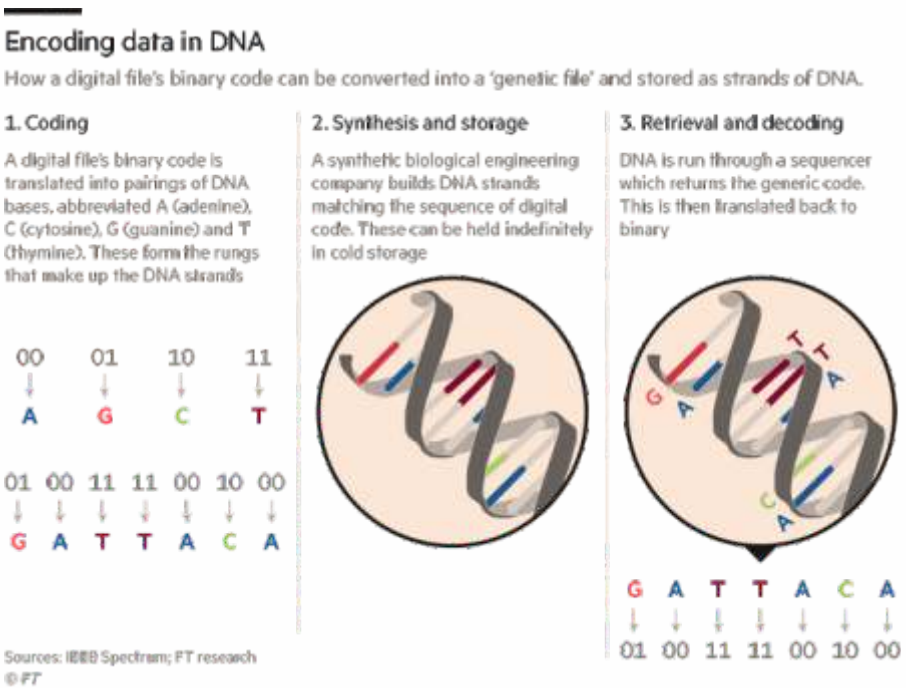
Traditional media like hard drives, thumb drives or DVDs store digital data by changing either the magnetic, electrical or optical properties of a material to store 0s and 1s.To store data in DNA, the concept is the same, but the process is different. DNA molecules are long sequences of smaller molecules, called nucleotides – adenine, cytosine, thymine and guanine, usually designated as A, C, T and G. Rather than creating sequences of 0s and 1s, as in electronic media, DNA storage uses sequences of the nucleotides.

There are several ways to do this, but the general idea is to assign digital data patterns to DNA nucleotides. For instance, 00 could be equivalent to A, 01 to C, 10 to T and 11 to G. To store a picture, for example, we start with its encoding as a digital file, like a JPEG. That file is, in essence, a long string of 0s and 1s. Let's say the first eight bits of the file are 01111000; we break them into pairs – 01 11 10 00 – which correspond to C-G-T-A. That's the order in which we join the nucleotides to form a DNA strand.

STORING THE DATA

After determining what order, the letters should go in, the DNA sequences are manufactured letter by letter with chemical reactions. These reactions are driven by equipment that takes in bottles of A's, C's, G's and T's and mixes them in a liquid solution with other chemicals to control the reactions that specify the order of the physical DNA strands.

This process brings us another benefit of DNA storage: backup copies. Rather than making one strand at a time, the chemical reactions make many identical strands at once, before going on to make many copies of the next strand in the series



READING THE DATA BACK

To read the data back out of storage, we use a sequencing machine exactly like those used for analysis of genomic DNA in cells. This identifies the molecules, generating a letter sequence per molecule, which we then decode into a binary sequence of 0s and 1s in order.

CHALLENGES

DNA storage is experimental. Before it becomes commonplace, it needs to be completely automated, and the processes of both building DNA and reading it must be improved.

Spruha More
Assistant Professor

UNDERSTANDING CNC

C. N. C. is abbreviation for Computer Numeric Control.

Before understanding CNC machines, we need to understand some basics like NC.

NC (Numerical Control):

Modern NC systems rely heavily on Computer technology. NC is abbreviation for numerical control. Numerical Control can be defined as a form of programmable automation in which the process is controlled by numbers, letters and symbols. Numerical control is the combination of mechanical, electrical and electronic devices, controlled by numerical data. In NC, the numbers form a programme of instructions designed for a particular work part or job. When the job changes, the programme of instructions is changed. This capability to change the programme for each new job is what gives NC its flexibility. It is much easier to write new programmes than to make major changes in the production equipment.

NC technology has been applied to a wide variety of operations including drafting, assembly, inspection, sheet metal press working, and spot welding. However, numerical control finds its principal applications in metal machining processes. The machined work parts are designed in various sizes and shapes, and most machined parts produced in industry today are made in small to medium-size batches. To produce each part, a sequence of drilling operations may be required, or a series of turning or milling operations may be required. The suitability of NC for these kind of jobs is the reason for the tremendous growth of numerical control in the metal working industry over the last 25 years.

CNC machine tools, the modern versions of NC machines have an embedded system involving several microprocessors and related electronics as the Machine Control Unit(MCU). Initially, these were developed in the seventies in the US and Japan. However, they became much more popular in Japan than in the US. In CNC systems, multiple microprocessors and programmable logic controllers work in parallel for simultaneous servo position and velocity control of several axes of a machine for contour cutting as well as monitoring of the cutting process and the machine tool. Thus, milling and boring machines can be fused into versatile machining centres. Similarly, turning centres can realize a fusion of various types of lathes.

Let us understand how the instructions in a programme are converted to operations needed for machining the parts. The control system software, which controls the axis

motion, is called the axis manager. The axis manager controls the movement of the axes on the machine tool. This control may be divided into two distinct activities, namely

- Axes interpolation
- Axes servo control

These two activities are executed by two specific routines, namely the interpolation and servo control routines, which communicate by means of a buffer for the exchange of data.

The axis manager is processed by one or more dedicated CPUs.

Interpolation:

Interpolation consists the calculation of co-ordinated movement of several axes using the programmed parameters, in order to obtain a resulting trajectory, which can be of various types such as

- Straight line
- Circular
- Helicoidal

The interpolation module computes instant by instant position commands for the servo module, which in turn, drives the motor. There are two types of interpolators, namely

- Process interpolator (for continuous axes)
- Point-to-point interpolator (for point-to-point axes)

Servo Control:

Servo control consists of all the activities which allow several axes to effectively maintain the trajectory calculated by the interpolator. Continuous axes are continuously controlled by the system both for 'speed' and 'position' so as to guarantee that the calculated trajectory is maintained. In contrast, for point-to-point axes there is no guarantee that the trajectory will be maintained. The only guarantee is that the final point will be reached.

For control of tool and work-piece motion, one of the two kinds of control systems are used.

Open loop:

The term open loop means that there is no positioning feedback, and in open loop systems the motion controller produces outputs depending only on its set points, without feedback information about the effect that the output produces on the motion axes. The movement pulses are sent out by the control unit and are received by a special

type of servomotor called a stepper motor. The stepper motor then proceeds with the next movement command. Since this control system only counts pulses and cannot identify discrepancies in positioning, the control has no way of knowing whether the tool has reached the proper location or not. The open loop control can be used in applications in which there is no change in load conditions, such as a CNC drilling machine. The advantage of the open loop control system is that it is less expensive, since it does not require the additional hardware and electronics needed for positioning feedback. The disadvantage is the difficulty of detecting positioning error.

Closed loop:

In the closed loop control system, the electronic movement pulses are sent from the control to the servomotor, enabling the motor to rotate with each pulse. The pulses are detected and counted by a feedback device called a transducer. With each step of movement, a transducer sends a signal back to the control, which compares the current position of the driven axis with the programmed position. When the number of pulses sent and received match, the control starts sending out pulses for the next movement. Closed loop systems are very accurate. Most have an automatic compensation for error, since the feedback device indicates the error and the control makes the necessary adjustments to bring the slide back to its position. They use ac, dc or hydraulic servomotors.

Kiran Datar
Assistant Professor

Why India Is One Of The Greatest Place For SEO Outsourcing Services!

SEO outsourcing in India has increased massive popularity for several aspects. The intrinsic perquisites of outsourcing SEO services in India have given rise to an incredible development of India's outsourcing industry. When done for correct reasons, outsourcing allows your company to expand as well as increase your revenues. Outsourcing is the practice of delegating the specific occupational process to external agencies. More and more companies are planning to outsource work to different countries or places.

At present, more than 30% "Digital Marketing Companies" are outsourcing their business to reputed specialists who have expertise in the required field. If you want to develop your online existence across different search engines, grow your sales and increase the web traffic or if you hope to switch over to the digital marketing domain, SEO outsourcing in India makes your job easy.

Any success of an online business website is put together on the accomplishment of its internet marketing campaign. Maintaining your website on the summit is not only awkward, but also timewasting. Outsourcing your SEO services in India can be an answer to all your difficulties.

We have pointed out some of the reasons to select SEO outsourcing services in India below:

Scope of growth: Outsourcing with the correct company compromises more "boots on the ground" and have a better upbeat presence. An effective SEO campaign will benefit you to explore the latest economics and find new markets.

Cost Efficiency: Outsourcing SEO also reduces an in-house SEO professional budget along with overhead loads of recruitment, management, etc.

Improved Proficiency: When you out source your business, they bring years of experience in business practices and proficiency in providing outsourcing projects. This develops the productivity and efficiency in the process thereby contributing to the growth of your company.

Skilled expertise: One of the primary reasons why a business wants to outsource a job is when it requires specialized proficiency. With highly proficient and an enthusiastic SEO team, you can be certain of getting the desired results.

Risk-Mitigating: Outsourcing the tasks of your business benefits to shift

responsibilities to the outsourced reseller. Since the outsourced provider is a professional, they plan your risk-mitigating aspects in a better way.

Save Infrastructure and technology: Outsourcing eradicates the necessity for investment in infrastructure because the reseller partner takes accountability of the business processes.

Focus on core activities: Outsourcing your business would permit you to concentrate on building your brand and move on to providing higher value added services while being free from outsourced activities.

Time zone advantage: Other than the cost benefit, the other advantage of outsourcing services in India is the time-zone difference between your country and the location you are outsourcing to. This unique advantage gives you an advantage of round the clock business operations.

Faster and superior services: Outsourcing makes your service better with greater quality deliverables. Outsourcing your business benefits to cut down the cash outflow and optimize resource utilization.

Payal Shah
Assistant Professor

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