



# V-Tech

Technical Magazine of  
Information Technology  
Department

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Issue - I



## Preface

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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 2020-21. 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, and the way forward, to current trending topics in the field such as Machine Learning and artificial intelligence, Cryptocurrency, Augmented and virtual reality. This issue also talks about some of the advances in IOT and embedded technologies like Holter Monitor, robotics. Some current VLSI technologies like paper batteries and storage are also discussed in the issue. Last but not the least; it also covers the steps taken by Government for sustainable digital world.

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 Faculty**

## Index

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Sr No	Article	Author	Page No.
1	Bioplastics could solve a Major pollution problem	Spruha More	1
2	Claytronics – Programmable Matter	Snehal Tandale	4
3	COVID-19: The Epidemic and the Challenges	Amita Jain	6
4	Data Analytics in Health Care and Health Insurance Sector	Geeta Sahu	8
5	Governance Strategies for a Sustainable Digital World	Payal Shah	11
6	Machine Learning Classifiers	Sanjeela Sagar	13
7	Paper Battery	Maitreyi Joglekar	16
8	Power BI	Hrishikesh Tendulkar	19
9	Sentiment Analysis	Leena Jadhav	21
10	Types of Robots	Ashwini Koyande	23
11	What is Emotional Intelligence (EQ)?	Aasha Vanve	26

## Bioplastics could solve a Major pollution problem

Our civilization is built on plastics. In 2014 alone, industry generated 311 million metric tons, an amount expected to triple by 2050, according to the World Economic Forum. Yet less than 15 percent of it gets recycled. Much of the rest is incinerated, sits in landfills or is abandoned in the environment—where, being resistant to microbial digestion, it can persist for hundreds of years. Plastic debris accumulating in the ocean causes all kinds of problems, from killing wildlife when mistakenly ingested to releasing toxic compounds. It can even enter our bodies via contaminated fish.



### What is bioplastic?

Bioplastic simply refers to plastic made from plant or other biological material instead of petroleum. It is also often called bio-based plastic.

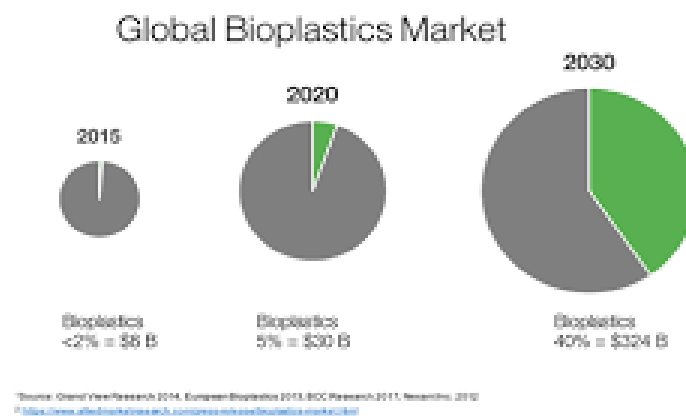
Biodegradable plastics can ease these problems, contributing to the goal of a “circular” plastic economy in which plastics derive from and are converted back to biomass. Like standard plastics derived from petrochemicals, biodegradable versions consist of polymers (long-chain molecules) that can be molded while in their fluid state into a variety of forms. The options currently available—mostly made from corn, sugarcane, or waste fats and oils—generally lack the mechanical strength and visual characteristics of the standard kinds, however. Recent breakthroughs in producing plastics from cellulose or lignin (the dry matter in plants) promise to overcome those drawbacks. In an added boon for the environment, cellulose and lignin can be obtained from nonfood plants, such as giant reed, grown on marginal land not suitable for food crops or from waste wood and agricultural by-products that would otherwise serve no function.

*Bio-based plastics are made from a wide range of renewable **BIO-BASED** feedstocks.*



© European Bioplastics

Cellulose, the most abundant organic polymer on earth, is a major component of plant cell walls; lignin fills the spaces in those walls, providing strength and rigidity. To make plastics from those substances, manufacturers must first break them into their building blocks, or monomers. Investigators have recently found ways to do so for both substances. The lignin work is particularly important because lignin's monomers are composed of aromatic rings—the chemical structures that give some standard plastics their mechanical strength and other desirable features. Lignin does not dissolve in most solvents, but investigators have shown that certain environmentally friendly ionic liquids (which are composed largely of ions) can selectively separate it from wood and woody plants. Genetically engineered enzymes similar to those in fungi and bacteria can then break the dissolved lignin into its components.



Companies are building on these findings. For example, Chrysalix Technologies, a spinoff from Imperial College London, has developed a process that uses low-cost ionic liquids to separate cellulose and lignin from starting materials. A Finnish biotechnology company, MetGen Oy, produces a number of genetically engineered enzymes that cleave lignins of different origins into components needed for a wide range of applications. And Mobius (formerly Grow Bioplastics) is developing lignin-based plastic pellets for use in biodegradable flower pots, agricultural mulches and other products.

### **What applications make use of bioplastics?**

Did you know that bioplastics have been around for at least 100 years? Corn oil and soybean oil were both used to manufacture auto parts for the Ford Model T. In more recent years, bioplastics have been used in a variety of consumer products, such as food containers, grocery bags, biodegradable utensils, and food packaging. These are called commodity plastics. Bioplastics can also be used for engineering grade applications, such as electrical and electronic housings and enclosures.

In short, bioplastics have made their way into nearly every industry: automotive, electronics, food and beverage packaging, agricultural, textiles, health care...you name it! To learn more about conventional and biobased plastics, visit our Plastics page.

## **Benefits of bioplastics?**

Bioplastics are also gaining popularity because they don't contain bisphenol A (BPA)...you may recall seeing plenty of marketing for BPA-free products, especially in the food storage and baby feeding/accessory industries. For instance, the European Union has banned the use of BPA in baby bottles, although it is not clear yet what the potential impacts are of BPA in consumer goods. For the time being, most of the concern seems to be centered on BPA's alleged ability to disrupt hormonal activity. Bioplastics provide a potential alternative to this issue (although there is no guarantee that BPA won't be added to bioplastics in the future).

## **Conclusion**

Right now, it's hard to claim that bioplastics are more environmentally friendly than traditional plastics when all aspects of their life cycle are considered: land use, pesticides and herbicides, energy consumption, water use, greenhouse gas and methane emissions, biodegradability, recyclability and more. But as researchers around the world work to develop greener varieties and more efficient production processes, bioplastics do hold promise to help lessen plastic pollution and reduce our carbon footprint.

**Spruha More**  
**Assistant Professor**

## Claytronics – Programmable Matter

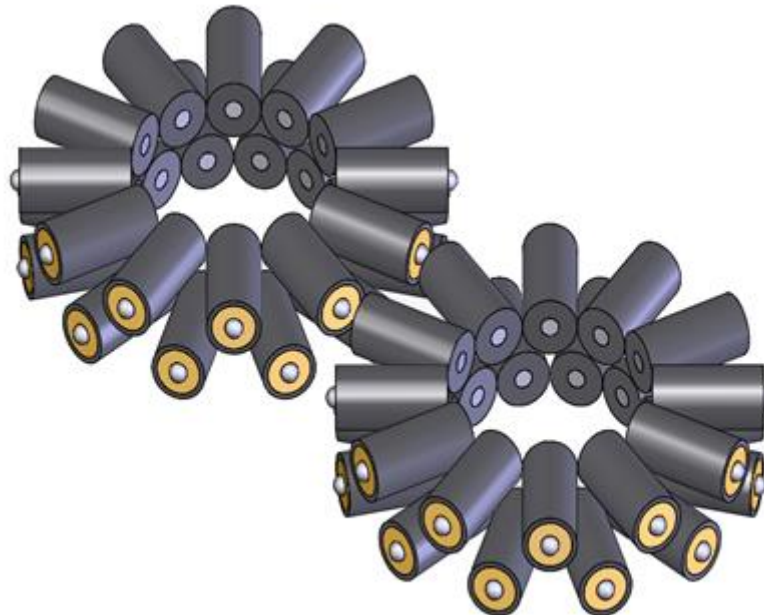
Catoms, or Claytronics Atoms, are also referred to as 'programmable matter'. Claytronics combines nanoscale robotics and computer science to create individual nanometer-scale computers which can interact with each other to form tangible 3D objects that a user can interact with.

Catoms consist of a CPU, a network device for communication, a single pixel displays, several sensors like infrared for communication and a means to adhere to one another.



The software used for Catoms are Meld and LDP. Meld is a programming language designed for robustly programming massive ensembles. LDP which stands for Locally Distributed Predicates, provides a means of matching distributed patterns.

Following diagram shows the structure of a Catom.



### Capabilities of Claytronics

**Computation:-** Catoms will take advantage of existing microprocessor technology and can perform calculations if required.

**Motion: -** This will enable them to form connections much more rapidly than traditional micro robots, and it will make them easier to manufacture in high volume. Catoms will bind to one another and move via electromagnetic or electrostatic forces, depending on the catom size.

**Power: -** Catoms are able to draw power without having to rely on a bulky battery or a wired connection.

Communication: - Millions or billions of atoms come together and communicate with each other.

Claytronics has the potential to greatly affect many areas of daily life, such as telecommunication, human-computer interfaces, and entertainment.

### **Applications of Claytronics**

Medicine: A replica of your physician could appear in your living room and perform an exam. The virtual doctor would precisely mimic the shape, appearance and movements of your "real" doctor, who is performing the actual work from a remote office.

Disaster relief: Objects made of programmable matter could be used to perform hazardous work and could morph into different shapes to serve multiple purposes.

Entertainment: A football game, ice skating competition or other sporting event could be replicated in miniature on your coffee table. A movie could be recreated in your living room, and you could insert yourself into the role of one of the actors.

3D physical modelling: Physical replicas could replace 3D computer models, which can only be viewed in two dimensions and must be accessed through a keyboard and mouse. Using claytronics, you could reshape or resize a model car or home with your hands, as if you were working with modelling clay.

Claytronics will become useful in many applications. The featured application of claytronics is a new mode of communication. Claytronics will offer a more realistic sense to communication over long distance called pario. Similar to how audio and video provide aural and visual stimulation, pario provides an aural, visual and physical sensation. A user will be able to hear, see and touch the one communicating with them in a realistic manner. Pario could be used effectively in many professional disciplines from engineering design, education and healthcare to entertainment and leisure activities such as video games.

**Snehal Tandale**

**Assistant Professor**



## COVID-19: The Epidemic and the Challenges

Coronaviruses (CoVs) are RNA infections that have become a significant public health concern since the Severe Acute Respiratory Syndrome-CoV (SARS-CoV) episode in 2002. The continuous evolution of coronaviruses was additionally featured with the rise of the Middle East Respiratory Syndrome-CoV (MERS-CoV) episode in 2012. At present, the world is worried about the 2019 novel CoV (SARS-CoV-2) that was at first distinguished in the city of Wuhan, China in December 2019. Patients reported extreme viral pneumonia and respiratory disease. The number of cases has been mounting from that point forward. Starting late February 2020, a huge number of cases and a several thousand deaths have been accounted for in China alone. Despite the fact that the casualty pace of SARS-CoV-2 is as of now lower than SARS-CoV, the virus seems to be highly contagious based on the number of infected cases to date.



The present information on SARS-CoV-2 can be summarized as follows:

Firstly, the emerging pneumonia, COVID-19, caused by SARS-CoV-2, exhibits strong infectivity but less virulence, compared to SARS and MERS, in terms of morbidity and mortality. the emerging pneumonia, COVID-19, caused by SARS-CoV-2, exhibits strong infectivity but less virulence, compared to SARS and MERS, in terms of morbidity and mortality. Secondly, the susceptible population includes the elderly and individuals with certain basic ailments, which requires more consideration and care. Thirdly, up until now, the supporting medications, joined with intense antiviral medications, for example, remdesivir, chloroquine, or lopinavir/ritonavir, have been conducted with definite effect on treat COVID-19 patients, while strong information from more clinical trials are required.

However, questions stay vague and more investigations are needed to explore the transmission and pathogenicity mechanism of the emerging coronavirus; to clarify the evolutionary path from the original host to cross-species transmission so as to potentially limit the transmission to naïve animals or humans, and; to reveal the mystery of the molecular mechanism of viral entry and replication, which provides the basis of future research on developing targeted antiviral drugs and vaccines.

The current symptomatic test for the infection is PCR-based. Since this test regularly takes 48 h, another speedier indicative test should be created. It will not be practical to isolate (quarantine) a large number of individuals until results of the PCR-based diagnostic test become available. Controlling the outbreak before it can spread is the best way to prevent pandemics. Border closures and screening at air terminals and checkpoints are old style gauges that were previously executed in the 2009 H1N1 influenza pandemic. This can diminish the spread of the infection yet won't be a secure system. The explanation is that the incubation period of the virus is accepted to be up to 14 days, similar to the case with MERS-CoV. This implies that carriers of the virus can appear at the border with no obvious symptoms and promptly go through security without raising any warnings. Compared to the SARS-CoV outbreak in 2003, the present increment in air traffic in China and worldwide has likely added to the more quick spread of SARS-CoV-2 in 2020. Without a quick analytic test, there are very

few acceptable choices that can totally stop the transmission of the virus Based on previous genetic experience with SARS-CoV, researchers should rapidly build up a vaccine for SARS-CoV-2.

The world is hoping to succeed in controlling this virus as quickly as soon as possible. Even after success, there needs to be follow-up with patients who are cured and announced virus-free. This is a lesson we learned from the Ebola outbreak, wherein a few patients who exited from the hospital “virus-free” were discovered later to harbor the Ebola virus that was carefully hiding itself in other parts of the body, such as the immune-privileged eye. Although this hidden Ebola virus was no longer transmissible to other humans, it rendered the label “virus-free” incorrect with these individuals.

The outbreak of COVID-19 has become a clinical threat to the general population and healthcare workers around the world. However, information about this novel virus stays restricted. The effective option of antiviral therapy and immunization are currently under evaluation and development. What we can do now is aggressively implement infection control measures to prevent the spread of SARS-CoV-2 via human-to-human transmission. . Neutralizing antibodies and vaccines could play significant roles in controlling the SARS-CoV-2 outbreak. General health care specialists should continue observing the circumstance, as the more we learn about this novel virus and its associated outbreaks, the better we can react.

**Dr. Amita Jain**

**Assistant Professor**

## Data Analytics in Health Care and Health Insurance Sector

### Introduction:

Big data denotes large volume datasets that grows exponentially over time and cannot be processed or stored using traditional data management tools. There is a huge amount of new data which is getting generated and stored daily. This data needs to be collected, stored and analysed effectively for decision making process in business. Data analytics are the techniques that provide a way to analyse this huge amount of data with the purpose of drawing conclusions about them by driving real outcomes and decisions. With a wide range of data available in the health care sector, including financial and clinical data, research can be done in order to generate meaningful insights to improve the overall efficiency in the industry. There is a large quantity of heterogeneous data collected from different sources in health care organization. Data analytics can help artificial intelligence to discover valuable hidden patterns and additional information such as patients need, market trends and requirements for efficient decision making process.



### 5V's for Data Analytics:

**Volume:** It is concerned with scale of data. i.e the volume of data which is growing every day.

**Velocity:** The speed at which data is increasing thus demanding analysis of streaming of data.

**Variety:** It depicts different forms of data to use for analysis such as under structured – relational databases and under unstructured like video, text.

**Veracity:** It is concerned with uncertainty or inaccuracy of the data.

**Value:** It is the valuable information extracted from the data to get good accuracy in predictions using data analytics tools and algorithms.

### Different Ways How Data Analytics is Improving Health Industry:

**Front office:** Health insurance sectors are trying to enhance client retention and satisfaction. Agents and various medical distributors may also be empowered with the probability for new business opportunities with existing clients with analysis.

**Policy administration and Underwriting:** They are the people who pay attention on group or network of people rather than taking a single person.

**Claims process:** In this customer feedback is taken and shared in the group. Positive and negative feedbacks help improving client's loyalty and skills to attract new customers.

### Various Sectors of Health Insurances in India:

**Public Sector:** The revenue generated via tax are being utilised by government of India to raise the funds in public sector that helps to combat the hospitalization expenses.

**Private Insurance Company:** Various private mediclaims are available with the scheme of investing some amount of money either monthly or yearly basis.

**Social Insurance:** This scheme is operational in India for the central and state government employees.

**Community based Insurance:** A wide variety of community based insurance is available such as Voluntary Health Services, Chennai SEWA and by many nongovernment organizations (NGO).

**Rashtriya Swasthya Bima Yojana:** In 2007, the Ministry of Labour and Employment, government of India released this scheme which will benefit many working population in India.

### **Analytical Tools to Improve Variety of Health Care Data:**

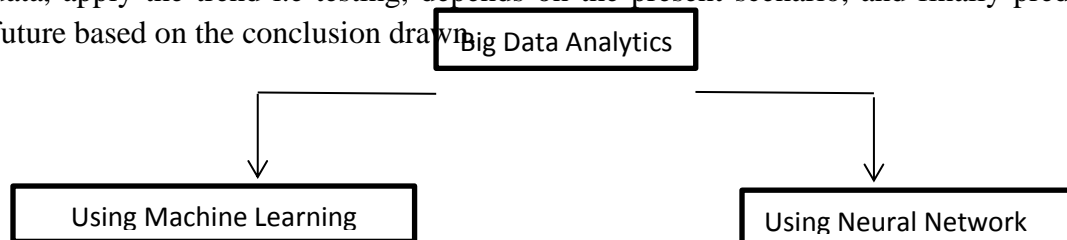
A large and unstructured data is generated and collected from variety of sources, different sensors including health care, medical, traffic and from social media. Algorithms are required to systematically arrange these raw data which further requires data processing. Arrangement needs to be done to dig out meaningful information. This may be described as knowledge acquisition, knowledge organization and processing.

One new technology called Hadoop is the answers to all these strategic questions for distributed data storage and processing on computer clusters. Some more related tools can be used such as Map Reduce, YARN, Hive, Pig, Spark and No SQL all these can be used for big data analytics.

Big data analytics or simply data analytics is the process of examining large data sets containing a variety of data types. This huge data should be processed to uncover the hidden pattern, unknown correlations, market trends, customer preferences and other useful health insurance related information. These analytical finding can lead to effective marketing, better customer service, operational efficiency, revenue generation and other benefits in health care industry.

A key concept underlying neural network methods in which large number of possible configurations of the abstract features of the input data is feasible, allowing for a compact representation of each sample and leading to a niche conclusion.

The health insurance sector generally needs data analysis to make out a trend from the past data, apply the trend i.e testing, depends on the present scenario, and finally predicting the future based on the conclusion drawn.



### **Conclusion:**

Big data could be huge manner forever insurance firms to change huge enhancement. Data analytics is beneficial to transform rural healthcare by gaining insight from their clinical and other data repositories and can make informed decisions.

**Reference :**

[1] D.Peter Augustine, Leveraging Big Data Analytics and Hadoop in Developing India's Healthcare Services, International Journal of Computer Applications, Volume 89, March 2014.

**Ms.Geeta Sahu**  
**Assistant Professor**

## Governance Strategies for a Sustainable Digital World

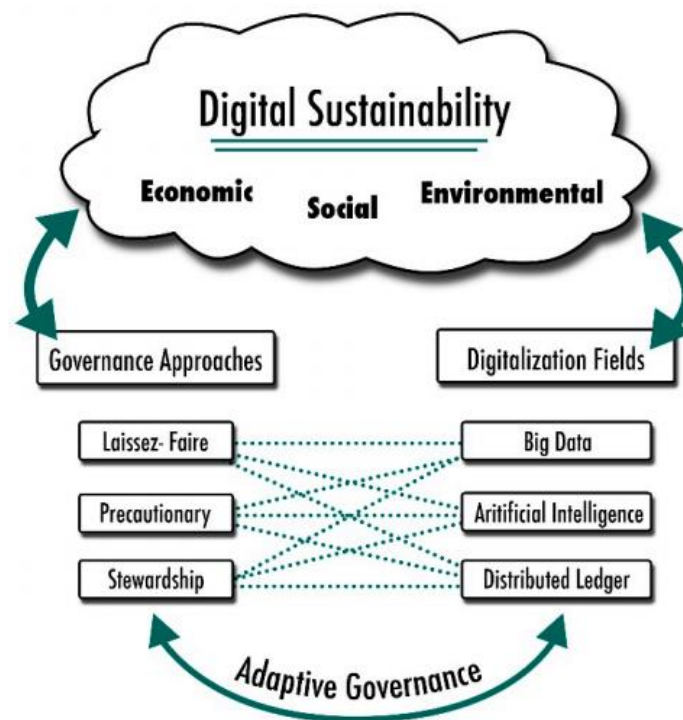
Digitalization is changing society by the increased connectivity and networking that digital technologies enable, such as enhancing communication, services, and trade. Increasingly, policymakers within various national governments and international organizations such as the United Nations (UN) and Organization for Economic Co-operation and Development (OECD) are examining the original sustainability policy concepts applied within the Brundtland Report of 1987 through the lens of digitalization. While the growth of a digital economy may increase productivity and benefit local and global economies, digitalization also raises potential sustainability challenges pertaining to social (i.e., the benefits or costs imposed by disruptive digital technologies upon social networks and ways of life, including threats to economic sustainability and the rise of economic disparity) and environmental wellbeing (i.e., natural resource stewardship and concern for future generations) driven by the automation of information processing and delivery of services. Various perspectives have been raised regarding how the process of digitalization might be governed, and national governments remain at odds regarding a single best strategy to promote sustainable digitalization using the Brundtland concept to meet the development needs of the present without compromising the needs of future generations (i.e., social and environmental well-being).



Digitalization, defined as the increased connectivity and networking of digital technologies to enhance communication, services, and trade between people, organizations, and things, it has been posited as both an emerging opportunity and as a challenge to the United Nations (UN) Global Sustainable Development Goals (SDGs), comprising 17 goals and 169 targets or objectives. The growth and maturation of the digital world, where an increasing scale of individual and communal activities are being recorded, digitized, and analyzed for future technological improvement, is creating unique opportunities to enhance social and environmental well-being, and further improve global standards of living while preserving and improving environmental health for future generations. Nevertheless, digitalization is increasingly shown to also enhance the likelihood of social and environmental sustainability challenges and threats, including the carbon footprint associated with increased electricity generation demand, cybersecurity vulnerabilities, and social discrepancies posed by the widening gap in access to information and communication technologies, commonly referred to as the “digital divide” between those who benefit from a digital economy, and those who may lose jobs, economic resources, or other social benefits. Even though a global understanding exists that governance approaches are needed to adequately balance the potential benefits and risks posed by digitalization and ensure a sustainable digital economy, different views and opinions are expressed over the best governance strategies needed to develop digitalized economies and manage digitalization processes and consequences. For example, representatives from the Organisation for Economic Co-operation and Development (OECD) Ministerial Council Meeting of June 2017 expressed differing viewpoints on optimal digitalization governance. These viewpoints included calls to resist pre-emptive regulation and

to promote favorable conditions on the one hand, for central governments to take an active role to shape the direction and soften negative consequences of digitalization on the other hand, and for a passive governing process in which government leaves industry to innovate while building capabilities to address resulting social and environmental harms. Given such a variety of viewpoints regarding how to best foster a sustainable digital economy, the question remains regarding how governance approaches should be constructed.

Generally, adaptive governance requires the cooperation of industry, academia, and non-governmental institutions to monitor digital services and characterize threats posed by digitalization and posit strategies and best practices to improve governing practices that are demonstrated to be ineffective or inefficient against such threats. Regardless of the governance approach chosen, stakeholders in government and industry may benefit from an adaptive governance approach not only to “keep up” with social and environmental sustainability challenges, but also to ensure that governance is relevant and helpful to stakeholders.



**Payal Shah**  
Assistant Professor

# Machine Learning Classifiers

## What is classification?

Classification is the process of predicting the class of given data points. Classes are sometimes called as targets/ labels or categories. Classification predictive modeling is the task of approximating a mapping function ( $f$ ) from input variables ( $X$ ) to discrete output variables ( $y$ ).

For example, spam detection in email service providers can be identified as a classification problem. This is a binary classification since there are only 2 classes as spam and not spam. A classifier utilizes some training data to understand how given input variables relate to the class. In this case, known spam and non-spam emails have to be used as the training data. When the classifier is trained accurately, it can be used to detect an unknown email.

Classification belongs to the category of supervised learning where the targets are also provided with the input data. There are many applications in classification in many domains such as in credit approval, medical diagnosis, target marketing etc.



There are two types of learners in classification as lazy learners and eager learners.

**1. Lazy learners:** Lazy learners simply store the training data and wait until a testing data appear. When it does, classification is conducted based on the most related data in the stored training data. Compared to eager learners, lazy learners have less training time but more time in predicting.

Ex. k-nearest neighbor, Case-based reasoning

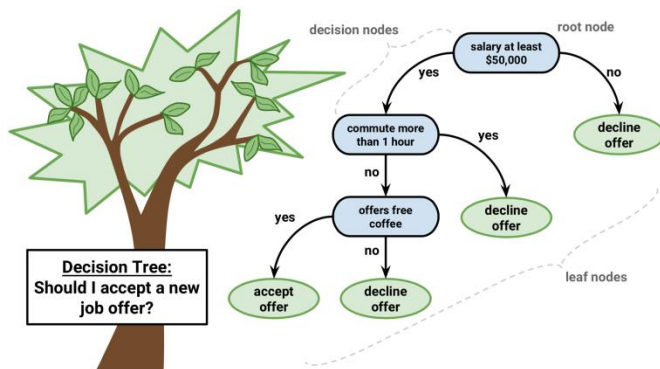
**2. Eager learners:** Eager learners construct a classification model based on the given training data before receiving data for classification. It must be able to commit to a single hypothesis that covers the entire instance space. Due to the model construction, eager learners take a long time for train and less time to predict. Ex. Decision Tree, Naive Bayes, Artificial Neural Networks

## Classification algorithms

There are a lot of classification algorithms available now but it is not possible to conclude which one is superior to other. It depends on the application and nature of available data set. For example, if the classes are linearly separable, the linear classifiers like Logistic regression, Fisher's linear discriminant can outperform sophisticated models and vice versa.



## Decision Tree



Decision tree builds classification or regression models in the form of a tree structure. It utilizes an if-then rule set which is mutually exclusive and exhaustive for classification. The rules are learned sequentially using the training data one at a time. Each time a rule is learned, the tuples covered by the rules are removed. This process is continued on the training set until meeting a termination condition.

The tree is constructed in a top-down recursive divide-and-conquer manner. All the attributes should be categorical. Otherwise, they should be discretized in advance. Attributes in the top of the tree have more impact towards in the classification and they are identified using the information gain concept.

A decision tree can be easily over-fitted generating too many branches and may reflect anomalies due to noise or outliers. An over-fitted model has a very poor performance on the unseen data even though it gives an impressive performance on training data. This can be avoided by pre-pruning which halts tree construction early or post-pruning which removes branches from the fully grown tree.

## Naive Bayes

Naive Bayes is a probabilistic classifier inspired by the Bayes theorem under a simple assumption that attributes are conditionally independent.

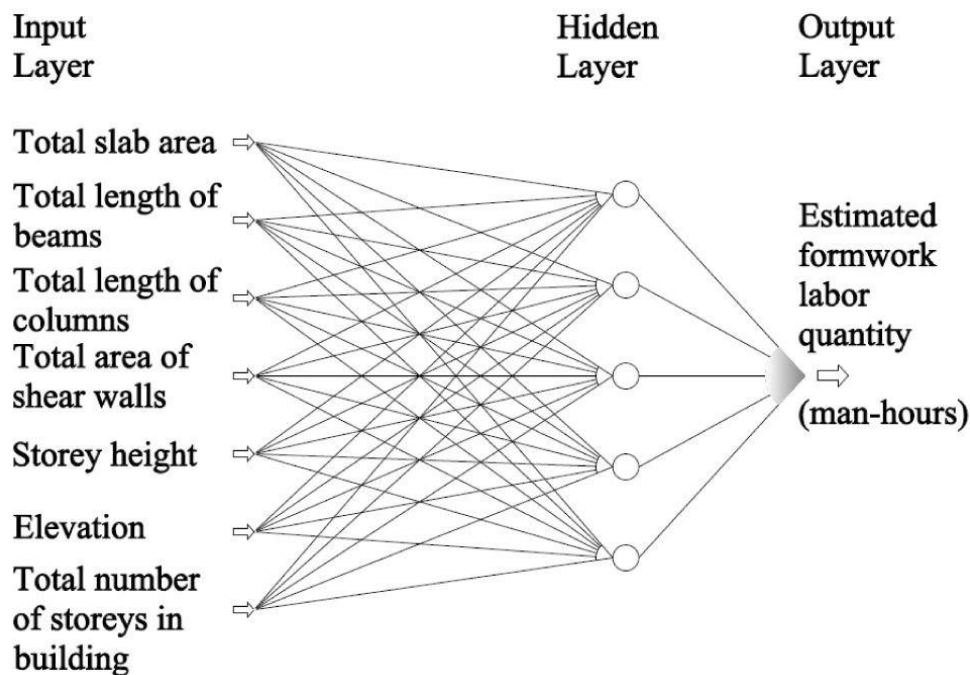
$$P(\mathbf{X} | C_i) = \prod_{k=1}^n P(x_k | C_i) = P(x_1 | C_i) \times P(x_2 | C_i) \times \dots \times P(x_n | C_i)$$

The classification is conducted by deriving the maximum posterior which is the maximal  $P(C_i | \mathbf{X})$  with the above assumption applying to Bayes theorem. This assumption greatly reduces the computational cost by only counting the class distribution. Even though the assumption is not valid in most cases since the attributes are dependent, surprisingly Naive Bayes has able to perform impressively.

Naive Bayes is a very simple algorithm to implement and good results have obtained in most cases. It can be easily scalable to larger datasets since it takes linear time, rather than by expensive iterative approximation as used for many other types of classifiers.

Naive Bayes can suffer from a problem called the zero probability problem. When the conditional probability is zero for a particular attribute, it fails to give a valid prediction. This needs to be fixed explicitly using a Laplacian estimator.

## Artificial Neural Networks



Artificial Neural Network is a set of connected input/output units where each connection has a weight associated with it started by psychologists and neurobiologists to develop and test computational analogs of neurons. During the learning phase, the network learns by adjusting the weights so as to be able to predict the correct class label of the input tuples.

There are many network architectures available now like Feed-forward, Convolutional, Recurrent etc. The appropriate architecture depends on the application of the model. For most cases feed-forward models give reasonably accurate results and especially for image processing applications, convolutional networks perform better.

There can be multiple hidden layers in the model depending on the complexity of the function which is going to be mapped by the model. Having more hidden layers will enable to model complex relationships such as deep neural networks.

However, when there are many hidden layers, it takes a lot of time to train and adjust weights. The other disadvantage of is the poor interpretability of model compared to other models like Decision Trees due to the unknown symbolic meaning behind the learned weights.

But Artificial Neural Networks have performed impressively in most of the real world applications. It is high tolerance to noisy data and able to classify untrained patterns. Usually, Artificial Neural Networks perform better with continuous-valued inputs and outputs.

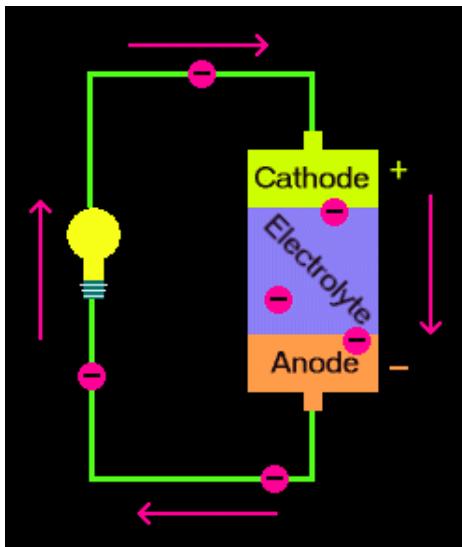
*All of the above algorithms are eager learners since they train a model in advance to generalize the training data and use it for prediction later.*

**Sanjeela Sagar**  
**Assistant Professor**

# Paper Battery

## Background

In simple words, **Battery** is a device which generates electrical energy and it is used for powering many wireless electronic/electrical devices. All the conventional batteries are electrochemical cells that convert chemical energy contained within its active materials directly into electric energy by means of an electrochemical oxidation-reduction (redox) reaction.



Each cell in battery has an anode, cathode and electrolyte. The electrolyte is the main material inside the battery. The chemical reactions in the electrolyte causes a build up of electrons at the anode. This causes an electrical difference between the anode and the cathode. The electrons wants to rearrange themselves to get rid of this electronic difference. So, electrons repel each other and try to go to a place with fewer electrons. In a battery, the only place to go is to the cathode. But, because of electrolyte in between anode and cathode, electrons can not travel straight to the cathode. When the circuit is closed the electrons will be able to get to the cathode. In the picture above, the electrons go through

the wire, lighting the light bulb along the way. In this way electrical potential difference causes electrons to flow through the circuit.

The electrolyte in the conventional batteries is toxic and also these batteries are non-biodegradable.

## Paper Battery

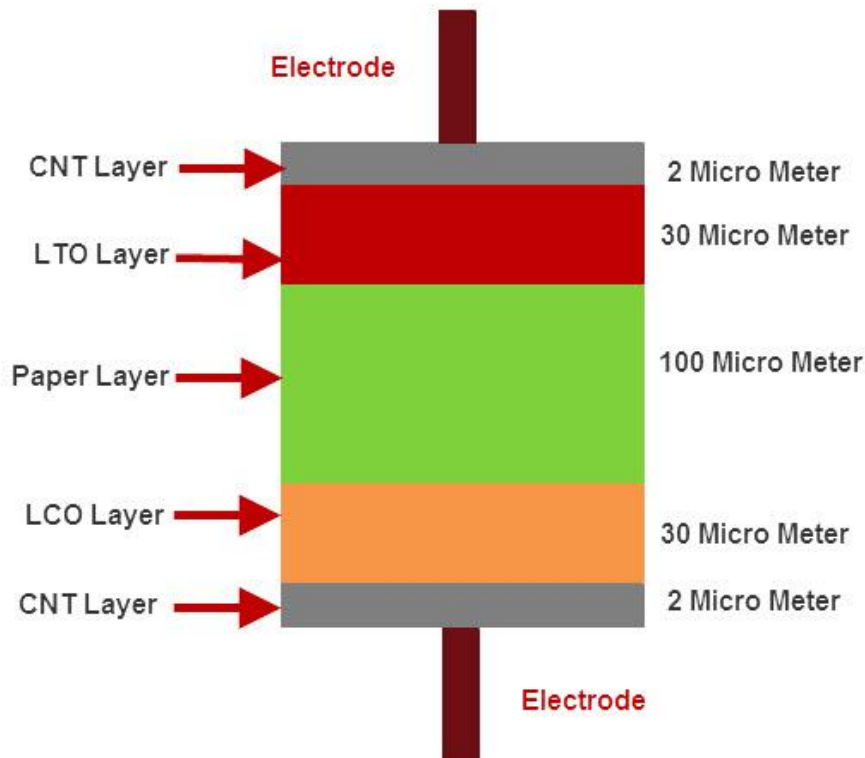
Paper battery is formed by combining carbon nanotubes with a conventional sheet of cellulose-based paper. The flexible and thin energy storage device which can be used as a battery is called as paper battery. Paper battery has energy storage capacity and property of super capacitor – high-energy density and thus, produces extreme power. It consists of infusion of carbon nanotubes with paper consisting of an ionic liquid as an electrolyte. The working of a paper battery is similar to an electrochemical battery except with the constructional differences.



## Paper Battery Construction

The major components used for the construction of paper battery include:

1. Carbon Nanotube (CNT) used for cathode terminal
2. Lithium metal (Li+) used for anode terminal
3. Different types of electrolytes that include blood, urine, and sweat (which are termed as bio-electrolytes)
4. Paper (Cellulose-Separator)



Once the paper of the battery is dipped in ion-based liquid, then the battery starts working i.e., electricity is generated by the movement of electrons from cathode terminal to anode terminal. This is due to the chemical reaction between the electrodes of paper battery and liquid. Due to the quick flow of the ions within a few seconds (10sec) energy will be stored in the paper-electrode during the recharging. By stacking various paper-batteries up on each other, the output of the paper battery can be increased.

### Advantages and Applications-

Paper battery works as a battery as well as a capacitor. Unlike conventional batteries, paper battery can be used by folding, twisting, moulding, crumpling, shaping, and cutting without affecting on its efficiency. As the paper batteries are the combination of cellulose paper and carbon nanotubes, which facilitates advantages of long-term usage, steady power, and bursts of energy. These types of paper batteries are estimated to use for powering the next generation vehicles and medical devices. Paper battery is a modern storage device with ultra-thin in size. It has special properties such as more economical, biodegradable, and bio compatible.

There are numerous applications for paper batteries in various fields. In electronics, paper battery is typically used in mobiles, laptops, calculators, cameras, mouse, keyboard, Bluetooth devices, and so on. Similarly, in medical sciences for artificial tissues, cosmetics, drug delivery systems, and so on. In automobiles and aircraft, paper batteries are used in hybrid vehicles because of their light weight.

**Maitreyi Joglekar**

**Assistant Professor**

## Power BI

Microsoft introduced a topic called as Business Intelligence in 2009 and then introduced Power Pivot in Microsoft Excel 2010. Power BI is an evolution of add-ins which was in built in Excel like Power Pivot, Power Query and Power View. While using Power BI one may or may not use Excel depending on the user's choice. Data analysts wanted simplicity, new visualizations and all of this existed in Power BI. Power BI is not just a tool it is an ecosystem that can integrate existing corporate features.



Power BI has two parts Power BI Desktop and Power BI. Power BI Desktop is a desktop application running on the PC whereas Power BI is a cloud service that one can use through the web browser. Power BI is a web service in which one can upload data and build various dashboards and charts by signing in it. In the main Power BI screen the following components are installed

**Dashboards** – It contains lists of dashboards created by any user. As soon as the workbook is loaded Power BI creates a dashboard with the same name itself.

**Reports** – Various reports can be created based on the data

**Datasets** – This list contains all the data sources that are connected to Power BI

With Power BI one can carry out the analysis by asking the questions in plain English language without using any special code or syntax. This procedure is called as Natural-Language Queries. For example if one types the query “Show Sales 2014 By Brand” in the question box and it displays bar graph for that data. And also displays any other related alternate queries. With “Quick Insights” feature Power BI searches a dataset for interesting patterns and provides with a list of charts that helps us to understand data better. The basic idea of using the insights is that some interesting and useful patterns can be searched on the data. Power BI proves extremely useful because it can easily find some points of interests in the data by using the brute force of algorithms.

Power BI also has the feature of creating the reports manually using the full potential of Power BI visualizations. To create a new report one has to just click on the data set and Power BI creates a new empty report interface for him. This user interface is a powerful tool because it combines various features in a single window. In this single window there is a navigation pane, central pane on which reports can be built by adding visualizations, visualization pane which offers various set of visualizations and field's pane which contains the list of all the fields in the dataset

All the charts produce the graphical visualization of the underlying numbers and any of those visualizations behave as a filter. When a particular point on chart is clicked it also reflects the changes in the other charts present in the canvas. This procedure is called as visual interaction.

Power BI offers different ways of filtering the data. The different ways are

Visual Level Filter – These work on individual visualization reducing the amount of data that the visualization can see. Moreover these filters can filter both data and calculations

Page Level Filter – These work at the report page level. Different pages can have different page level filters

Report Level Filter – It works on the entire report, filtering all pages and visualizations included in the report.

All the reports charts created in the Power BI can be seen on the native applications on mobile using the native apps like Power BI app for windows or iOS or Android. This feature also makes it possible to view reports offline without interactive capabilities.

Power BI also allows pinning a report by clicking on the button “Pin Live Page”. When visualization is pinned, Power BI saves it as it is but the visualization is disconnected from any others in the dashboard. Hence any visualization in the dashboard does not include the visual interactions of other visualizations. This is good because a dashboard is not intended for interaction. But sometimes if there is a need of visual interactions between some components of the dashboard then one can pin it as a live page. Visualizations belonging to the same live page will maintain the behaviour of visual interactions whereas the others will be limited to the visuals in the report.

Power BI can also help in refreshing the data. To Refresh the data in Power BI one can use the “Brush” icon which has many options to configure a visual. Power BI also allows to share the dashboard. For that the user has to click on the “Share” button which opens the Share Dashboard dialog box which has two tabs “Invite” and “Shared With”. The “Invite” tab is the one which provides the email of the people with whom the dashboard can be shared. This dashboard also allows the user to not only share the dashboard but also allows the user to send an email notification to the users. If the “Send email” checkbox is cleared then “Shared With” option is used to share dashboard across various users. In the Share dialog box one can also set up the access rights given to any other user by the owner of the dashboard. The “Publish To Web” feature guides anyone creating a public webpage, getting a URL that one can send in an email or the HTML code required to embed the report in a page of a particular website

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## Sentiment Analysis

**Basics:-** Sentiment Analysis is the process of determining whether a piece of writing is positive, negative or neutral. A sentiment analysis system for text analysis combines natural language processing (NLP) and machine learning techniques to assign weighted sentiment scores to the entities, topics, themes and categories within a sentence or phrase.



Understanding people's emotions is essential for businesses since customers are able to express their thoughts and feelings more openly than ever before. By automatically analysing customer feedback, from survey responses to social media conversations, brands are able to listen attentively to their customers, and tailor products and services to meet their needs.

Customer Feedback Text	Sentiment
<i>"This café is great, the staff are really friendly and the coffee is delicious"</i>	Positive
<i>"I would not recommend this café to anyone. Their coffee is terrible and is really expensive"</i>	Negative

### Types of Sentiment Analysis:-

#### 1. Fine-grained Sentiment Analysis:-

If polarity precision is important to your business, you might consider expanding your polarity categories to include:

- Very positive
- Positive
- Neutral
- Negative
- Very negative

This is usually referred to as fine-grained sentiment analysis, and could be used to interpret 5-star ratings in a review, for example:

Very Positive = 5 stars

Very Negative = 1 star

#### 2. Aspect-based Sentiment Analysis :-

When analysing sentiments of texts, let's say product reviews, you'll want to know which particular aspects or features people are mentioning in a positive, neutral, or negative way. That's where aspect-based sentiment analysis can help, for example in this text: "The battery life of this camera is too short", an aspect-based classifier would be able to determine that the sentence expresses a negative opinion about the feature battery life.



### 3. Multilingual sentiment analysis:-

It involves a lot of pre-processing and resources. Most of these resources are available online (e.g. sentiment lexicons), while others need to be created (e.g. translated corpora or noise detection algorithms), but you'll need to know how to code to use them.

#### **Benefits of Sentiment Analysis :-**

1. Processing Data at Scale - Sentiment analysis helps businesses process huge amounts of data in an efficient and cost-effective way.
2. Real-Time Analysis - Sentiment analysis can identify critical issues in real-time, for example-Is an angry customer about to churn? Sentiment analysis models can help you immediately identify these kinds of situations, so you can take action right away.
3. Consistent criteria - It's estimated that people only agree around 60-65% of the time when determining the sentiment of a particular text. Tagging text by sentiment is highly subjective, influenced by personal experiences, thoughts, and beliefs. By using a centralized sentiment analysis system, companies can apply the same criteria to all of their data, helping them improve accuracy and gain better insights.

**Conclusion:-** Sentiment analysis can be applied to countless aspects of business, from brand monitoring and product analytics, to customer service and market research. By incorporating it into their existing systems and analytics, leading brands are able to work faster, with more accuracy, toward more useful ends.

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# Types of Robots

The robots are all around us in many forms, many shapes. Sometimes robots are made for very simple tasks like cleaning the home or pulling heavy materials etc. In addition, there are some robots, which has been developed for medical purposes, and it can perform surgery as well with the guidance from the doctor. A very popular household robot is the vacuum cleaner robot. These robots are intelligent enough to go back to the charging station when the battery is low and then once charged it can resume at the exact spot from where they left. Like this, there can be many ways to classify robots. Here in this article, we are going to discuss a few major types of robots, which in various industries use to achieve some specific goals.



## Types of JIRA Robots

Before getting into various classification mechanisms for robots, let us first look into the internationally approved classification of robots known as JIRA (Japanese Industrial Robot Association). According to JIRA, robots are of following types:

- **Manual Handling Device:** An operator operates this kind of robot though this kind of robot has some degree of freedom.
- **Fixed Sequence Robot:** This type of robot can perform a fixed sequence of tasks in a cycle. However, the sequence is fixed and is not programmable.
- **Variable Sequence Robot:** This type of robot was almost the same as fixed sequence robots except for that these robots are reprogrammable.
- **Playback Robot:** This type of robot can playback a sequence automatically in a loop.
- **Numerical Control Robot:** This kind of robot also work through a sequence of instructions. However, the instruction set is numerical.
- **Intelligent Robot:** Intelligent Robots are the robots that can sense the environment around using the sensors and take a necessary set of actions automatically.

## Types of Robots Based on their Application

Now robots can be also of various types based on their nature of application and utility. Therefore, let us see in how many ways we can divide the types of the robot based on their application:

### 1. Industrial Robots

These are the robots that are generally used in the industrial environment for various purposes such as lifting very heavy components or moving parts from one place to another etc. Though these are robots they look mostly like a robotic arm only which is obviously huge in size.

These robotic arms not only help to move components from one place to another apart from these sometimes these are used to perform some repetitive actions like fitting screws or doing durability checks or even sometimes used to assemble components as well. Therefore, these are a highly efficient and useful piece of robotics.

## **2. Domestic Robots**

These kinds of robots are used at the home. These are basically used for cleaning, moping or as a vacuum cleaner. Apart from these, there are some surveillance robots as well which are used in households to increase security.

## **3. Surgical Robots**

These kinds of robots are used for performing surgeries that can be controlled by doctors remotely. These robots generally consist of multiple cameras using which doctors can get a 3d view of the region where the operation is taking place and then can operate accordingly.

## **4. Robonauts**

These are the robots that are used in various space programs. These robots are multipurpose and these can be both humanoid and non-humanoid robots. There are multiple robots that have been sent to space by NASA in recent times to perform multiple actions like collecting the sample, exploring rough surface and analyze, taking pictures and sending them back to earth.

Apart from these robots helps NASA to explore the places where it is tough for any astronaut to visit. The prime example of this kind of robotics is the curiosity rovers that were sent to Mars by NASA a few days back.

## **5. Commercial Entertainment Robots**

This type of robot is generally used for entertainment purposes and available commercially for sale. Such type of robots are meant to act as a companion and can perform basic tasks like greeting, dancing, walking and other customized action to replicate any pet like dog, cat, etc.

## **6. Army Robots**

Robots that are used in defense, falls in this category. This includes robots that are used for bomb disposal, border surveillance, Drones to capture images and drop tactical weapons, etc. A prime example of such robots is the robot named ATLAS which is made by Boston Dynamics.

## **7. Service Robots**

Service robots are those robots that are used in university or R&D teams to implement new features and show them off to the public. These robots are generally used for research purposes only and may be available commercially.

## **Top 5 Types of Robots as Per the Kinematics**

Robots can also be classified as per kinematics. Therefore, as per this parameter, robots are of following types:

**1. Stationary Robots:** Stationary robots are generally nothing but the robotic arm with a global axis of movement. We can further divide this into a few categories, which are as follows:

- **Cartesian Robots:** Robotic arm with the capability to move in XYZ coordinate. These robots are rigid structures and expensive with the high maintenance cost of the components.
- **Cylindrical Robots:** Robots with basic rotation capability. It can move in angular and linear directions.
- **Spherical Robots:** This type of robot works in a spherical system. It can move in a bi angular and single linear direction.
- **SCARA Robots:** SCARA stands for Selective Compliance Arm for Robotic Assembly. This type of robot has two parallel revolute joints.
- **Articulated Robots:** Robots with three revolute joints. This type of robot has been designed to achieve rotary motion.
- **Parallel Robots:** These are closed-loop systems to support a single platform. An example of this kind of robot would be Flight Simulators.

## 2. Wheeled Robots: Robots having wheels.

This kind of robots can further be categorized as:

- **Single Wheel Robots:** As you can probably guess, these are robots having a single wheel.
- **Two-Wheel Robots:** Robots having two wheels.
- **Three and more wheel Robots:** Robots having three or more wheels.

## 3. Legged Robots: Robots with articulated limbs.

These robots can further be divided into the following categories:

- **Bipedal Robots (Humanoid Robots):** Robots with two articulated limbs.
- **Tripedal Robots:** Robots with three articulated limbs.
- **Quadrupedal Robots:** Robots with four articulated limbs
- **Hexapod Robots:** Robots with six articulated limbs.

**4. Swimming Robots:** Robots that can swim. Generally, these robots look like fish. An example of such a robot would be a SOFI robot fish developed by MIT.

**5. Flying Robots:** Robots capable of flying. The drone comes under this category.

## Conclusion

Therefore, we can see that robotics has touched our lives in various segments from space to our own households. As robots become more intelligent with time, we can expect the operator intervention to become even less. Here we have tried to categorize robots based on some criteria however in the near future as we continue to explore more segments in robotics, we can expect even greater varies in the world of robotics.

**Ashwini Koyande**

**Assistant Professor**

## What is Emotional Intelligence (EQ)?

For most people, emotional intelligence (EQ) is more important than one's intelligence (IQ) in attaining success in their lives and careers. As individuals our success and the success of the profession today depend on our ability to read other people's signals and react appropriately to them.



Therefore, each one of us must develop the mature emotional intelligence skills required to better understand, empathize and negotiate with other people — particularly as the economy has become more global. Otherwise, success will elude us in our lives and careers.

“Your EQ is the level of your ability to understand other people, what motivates them and how to work cooperatively with them,” says Howard Gardner, the influential Harvard theorist.

Five major categories of emotional intelligence skills are recognized by researchers in this area.

### Understanding the Five Categories of Emotional Intelligence (EQ)

**1. Self-awareness.** The ability to recognize an emotion as it “happens” is the key to your EQ. Developing self-awareness requires tuning in to your true feelings. If you evaluate your emotions, you can manage them. The major elements of self-awareness are:

- Emotional awareness. Your ability to recognize your own emotions and their effects.
- Self-confidence. Sureness about your self-worth and capabilities.

**2. Self-regulation.** You often have little control over when you experience emotions. You can, however, have some say in how long an emotion will last by using a number of techniques to alleviate negative emotions such as anger, anxiety or depression. A few of these techniques include recasting a situation in a more positive light, taking a long walk and meditation or prayer. Self-regulation involves

- Self-control. Managing disruptive impulses.
- Trustworthiness. Maintaining standards of honesty and integrity.
- Conscientiousness. Taking responsibility for your own performance.
- Adaptability. Handling change with flexibility.
- Innovation. Being open to new ideas.

**3. Motivation.** To motivate yourself for any achievement requires clear goals and a positive attitude. Although you may have a predisposition to either a positive or a negative attitude, you can with effort and practice learn to think more positively. If you catch negative thoughts as they occur, you can reframe them in more positive terms — which will help you achieve your goals. Motivation is made up of:

- Achievement drive. You're constant striving to improve or to meet a standard of excellence.
- Commitment. Aligning with the goals of the group or organization.
- Initiative. Ready yourself to act on opportunities.
- Optimism. Pursuing goals persistently despite obstacles and setbacks.

**4. Empathy.** The ability to recognize how people feel is important to success in your life and career. The more skillful you are at discerning the feelings behind others' signal the better you can control the signals you send them. An empathetic person excels at:

- Service orientation. Anticipating, recognizing and meeting clients' needs.
- Developing others. Sensing what others need to progress and bolstering their abilities.
- Leveraging diversity. Cultivating opportunities through diverse people.
- Political awareness. Reading a group's emotional currents and power relationships.
- Understanding others. Discerning the feelings behind the needs and wants of others.

**5. Social skills.** The development of good interpersonal skills is tantamount to success in your life and career. In today's always-connected world, everyone has immediate access to technical knowledge. Thus, "people skills" are even more important now because you must possess a high EQ to better understand, empathize and negotiate with others in a global economy. Among the most useful skills are:

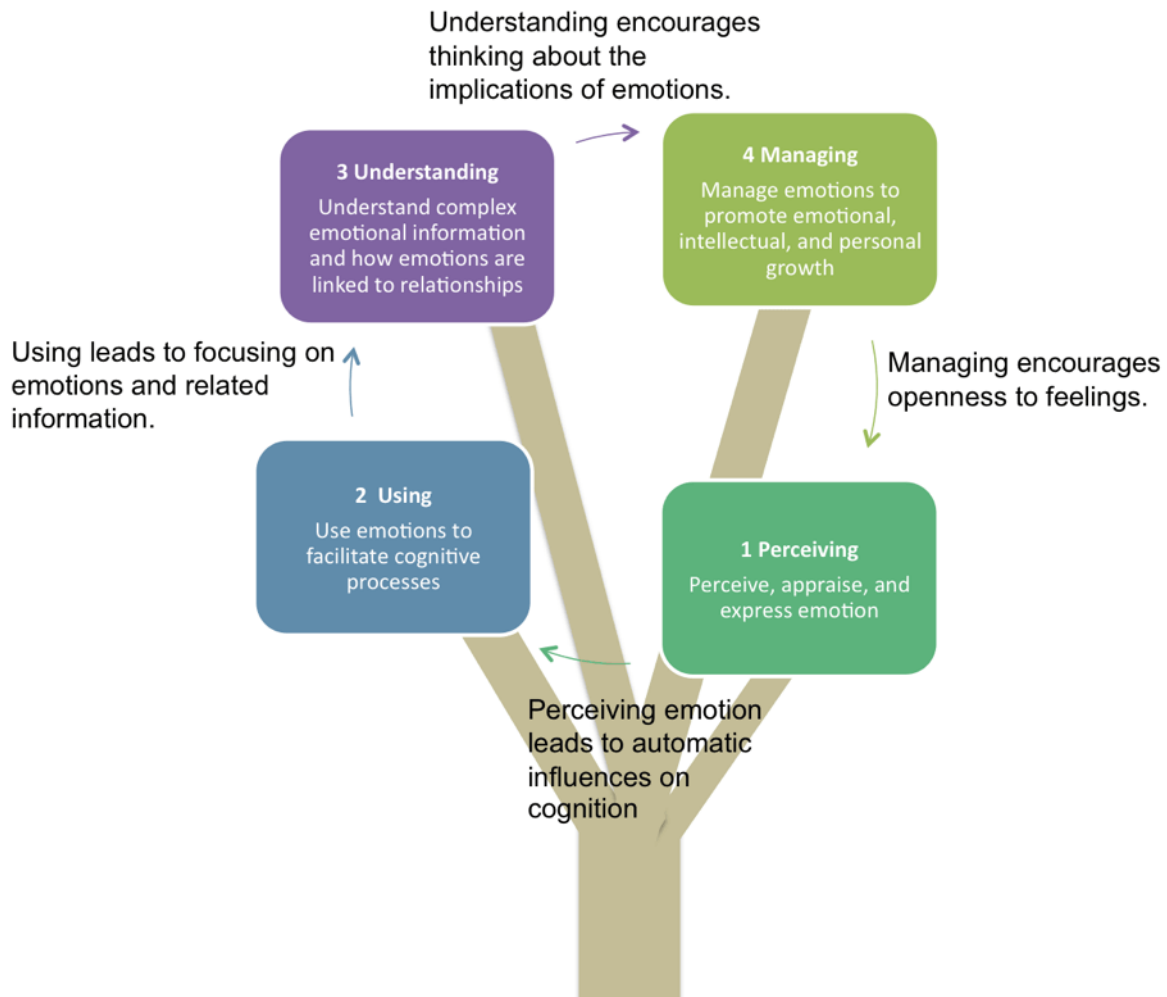
- Influence. Wielding effective persuasion tactics.
- Communication. Sending clear messages.
- Leadership. Inspiring and guiding groups and people.
- Change catalyst. Initiating or managing change.
- Conflict management. Understanding, negotiating and resolving disagreements.
- Building bonds. Nurturing instrumental relationships.
- Collaboration and cooperation. Working with others toward shared goals.
- Team capabilities. Creating group synergy in pursuing collective goals.

What factors are at play when people of high IQ fail and those of modest IQ succeed?

How well you do in your life and career is determined by both. IQ alone is not enough; EQ also matters. In fact, psychologists generally agree that among the ingredients for success, IQ counts for roughly 10% (at best 25%); the rest depends on everything else — including EQ.

A study of Harvard graduates in business, law, medicine and teaching showed a negative or zero correlation between an IQ indicator (entrance exam scores) and subsequent career success.

### The 4 Dimensions of Emotional Intelligence (and a Chart)



According to EQ “founding fathers” Salovey and Mayer, there are four distinct dimensions or branches of emotional intelligence that form a hierarchy of emotional skills and abilities:

1. Perceiving emotion;
2. Using emotions to facilitate thought;
3. Understanding emotions;
4. Managing emotions.

The first dimension, perceiving emotion, relates to being aware of and recognizing other people’s states (both physical and psychological states, like being in physical pain or feeling frazzled), identifying emotions in other people, expressing one’s own emotions and needs accurately and

appropriately, and distinguishing between accurate, honest feelings and inaccurate, dishonest feelings.

Using emotions to facilitate thought involves redirecting and prioritizing your thinking based on the feelings associated with those thoughts, generating emotions that will facilitate better judgment and memory, capitalizing on mood changes so you can appreciate multiple points of view, and using emotional states to improve your problem-solving skills and creativity.

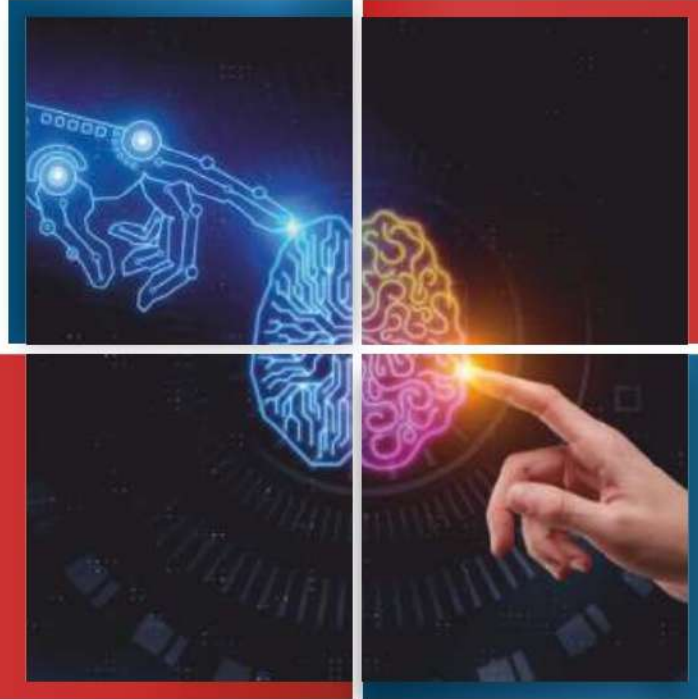
The dimension of understanding emotions includes understanding the relationships between various emotions, perceiving the causes and consequences of emotions, understanding complex feelings and contradictory states, and understanding the transitions among emotions.

The final dimension, managing emotions, refers to being open to both pleasant and unpleasant feelings; monitoring and reflecting on your emotions; engaging, prolonging, or detaching from an emotional state; and managing the emotions both within yourself and in others (Emmerling, Shanwal, & Mandal, 2008; Mayer & Salovey, 1997).

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