

Unit 1- Emerging Technologies

Overview of Emerging Technologies

1. Artificial Intelligence, Machine Learning, Deep Learning
2. Database Management for Data Science, Big Data Analytics
3. Internet of Things (IoT) and Industrial Internet of Things (IIoT)
4. Cloud Computing and its Service Models
5. Cyber Security and Types of Cyber Attack

EMERGING TECHNOLOGY

Emerging Technology is a term generally used to describe a new technology. It also refers to the continuing development of an existing technology. The term commonly refers to technologies that are currently developing, or that are expected to be available within the next five to ten years, and is usually reserved for technologies that are creating, or are expected to create, significant social or economic effects.

Emerging Technologies are those technical innovations which represent progressive developments within a field for competitive advantage.

CHARACTERISTICS OF EMERGING TECHNOLOGIES

The five main characteristics of emerging technologies are as follows,

- Radical novelty – emerging technologies are radically novel. i.e., they fulfil a given function by using a different basic principle as compared to what was used before to achieve a similar purpose. Emerging technologies are always new and unique as it keeps changing its technologies and characteristics.
- Relatively fast growth – emerging technologies show relatively fast growth rates compared to non-emerging technologies. Technologies are developed on daily basis and the growth rate is at its peak.
- Coherence – emerging technologies are consistent in development and progress.
- Prominent impact- the impact of emerging technologies in today's world is immense and prominent. World without technologies are nowhere imaginable in the present world.
- Uncertainty – emerging technologies are characterised by uncertainty in their possible outcomes and uses which may be unintended and undesirable.

ARTIFICIAL INTELLIGENCE

- Artificial Intelligence is not a new word and not a new technology for researchers. The word Artificial Intelligence was first adopted by American Computer scientist John McCarthy at the Dartmouth Conference. AI was coined as an academic field for the first time. The father of AI is Alan Turing.
- Artificial Intelligence is a wide ranging branch of computer science or science and engineering concerned with building smart machines capable of performing tasks that typically require human intelligence such as visual perception, speech recognition, decision-making, and translation between languages. It is a branch of computer science that aims to develop intelligent com machines.
- AI refers to computer software that engages in human like activities, such as learning, planning, and problem-solving. AI underpins most of what is going to happen in our new world. A working understanding of AI is critical for just about every career because machines can learn and make decisions much quicker and more accurately than humans. There are many types of AI, where instead of being programmed what to think, machines can observe, analyses and learn from data and mistakes just like our human brains do.
- AI makes every process better, faster and more accurate. It has some very crucial applications as well, such as identifying and predicting fraudulent transactions, faster and accurate credit scoring, automating manually intense data management practices.

GOALS OF ARTIFICIAL INTELLIGENCE

Following are the main goals of AI,

- Replicate or reproduce human intelligence.
- Solve knowledge intensive tasks.
- Allow continuous learning.
- Encourage social intelligence.
- Promote creativity.
- An intelligent connection of perception and action.
- Building a machine which can perform tasks that requires human intelligence such as,
 1. Playing chess
 2. Plan surgical operation
 3. Driving a car in traffic.
 4. Proving a theorem.
- Creating systems which can exhibit intelligent behaviour, learn new things by itself, demonstrate, explain and can advise to its user.

SCOPE OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence has undergone a fast growth in the recent years. Artificial Intelligence has immense potential to change each sector of the economy for the benefit of society. The ultimate goal of AI is to make the computer programs that can solve the problems and achieve goals in the world, as well as humans.

1. AI in Data Analysis

The scope of AI in data analysis is rising rapidly. AI would be able to perceive patterns in data, where humans are not able to do so. Data processing has become an easy task with the help of AI. The required data can easily be fetched from the huge volume of data.

2. AI in Cyber Security.

Cyber security is another field which is benefiting from AI. The threat of hackers is becoming a serious issue and more significant in today's world. AI can help the organisations and business to get rid of all such cyber issues.

3. AI in Science and Research

AI is making a lot progress in the scientific sector. The research has become more easy as AI can handle large quantities of data and processes it quicker than human minds. This makes it perfect for research where the sources contain high data volumes.

4. AI in Transport

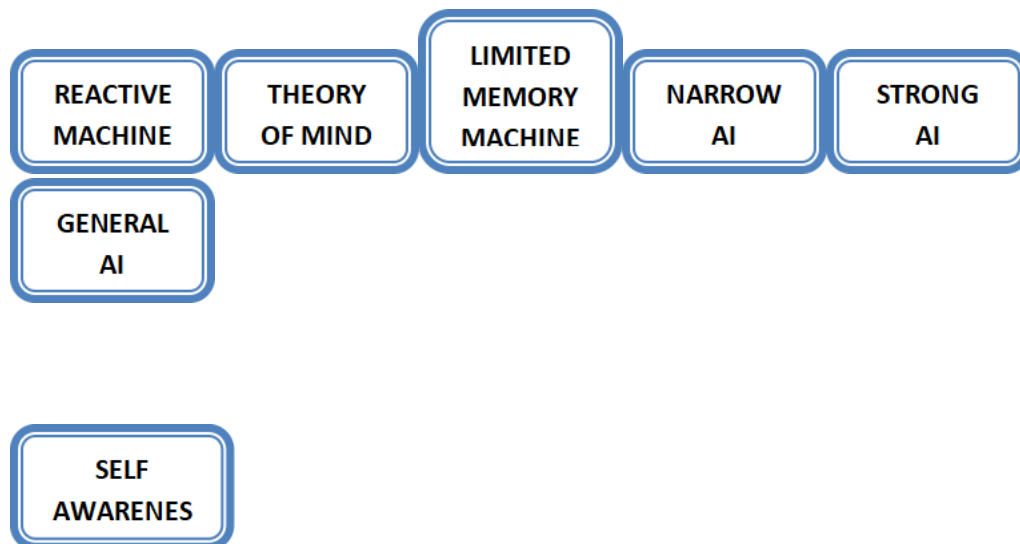
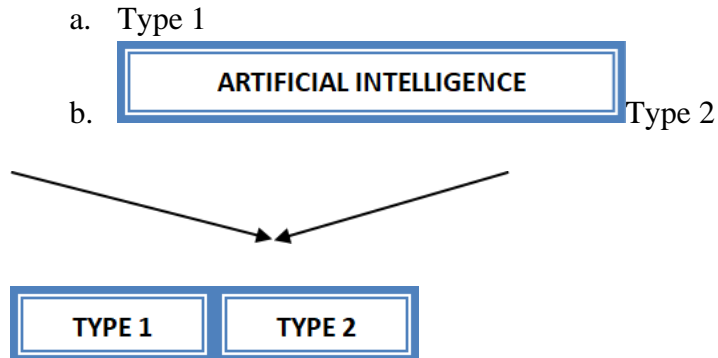
Self driving cars have gained much popularity in the recent markets. Likewise, the airplanes have been using autopilot to steer them in the air since 1912. The day is not so far when driverless vehicles become a reality.

5. AI in Healthcare

The medical sector is also using the technology for its advantages. The various advanced equipments which are been used in the hospitals are the best examples to show the scope of AI in healthcare. For example, the Knight Career Institute and Intel have made a collaborative cancer cloud. This cloud takes data from the medical history of cancer patients to help doctors in making a better diagnosis.

TYPES OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence can be divided into various types. There are mainly two types of AI. They are as follows,



TYPE 1 AI- BASED ON CAPABILITIES

- Narrow AI- narrow AI is also called as Weak AI. The machine intelligence that we witness all around us today is a form of narrow AI. It is called as weak AI as it can perform only a single task. It operates within a limited and pre-defined set of parameters, constraints and contexts. For example, Apple's Siri, Netflix, E-commerce sites.
- General AI- General AI is an AI version that performs any intellectual task with a human-like efficiency. The objective of general AI is to design a system capable of thinking for itself just like humans do. Currently, general AI is still under research, and efforts are being made to develop machines.

- Strong AI - Strong AI is also called as super AI. Strong AI is the AI version that surpasses human intelligence and can perform any task better than a human. Capabilities of a machine with super AI include thinking, reasoning, solving a puzzle, decision making, etc.,. Development of such systems in real is still world changing task.

TYPE 2 AI- BASED ON FUNCTIONALITY

- Reactive Machines - Reactive Machines are basic AI types that do not store past experiences or memories for future actions. Such systems react to the current scenarios based on the best possible action. For example, IBM's Deep Blue system. Deep Blue System was a chess playing expert system built by IBM supercomputer. It was the first computer to win a game, first to win a match. It defeated the world chess champion.
- Limited Memory Machines - Limited Memory Machines can store and use past experiences or data for a short period of time. The best example of limited memory machines is the self driving cars. The self driving cars can store the speeds of the vehicles in its vicinity, their respective distances, speed limits and other relevant information for it to navigate through the traffic.
- Theory of Mind - Theory of Mind refers to the type of AI that can understand the human emotions and beliefs and socially interact like humans. This AI type has not been developed but is in contention for the future.

Self Awareness – Self Awareness AI deals with super intelligent machines with their consciousness, sentiments, emotions and beliefs. Such systems are expected to be smarter than a human mind. Such AI is still a distant reality, but efforts are being made in this direction.

APPLICATIONS OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence has various applications in today's society. It is becoming essential for today's time because it can solve complex problems with an efficient way in multiple industries, such as Healthcare, entertainment, finance, education, etc. AI is making our daily life more comfortable and fast.

1.AI in ASTRONOMY

Artificial Intelligence can be very useful to solve complex universe problems. AI technology can be helpful for understanding the universe such as how it works, origin, etc.

2. AI in HEALTH CARE

- In the last, five to ten years, AI becoming more advantageous for the healthcare industry and going to have a significant impact on this industry.
- Healthcare Industries are applying AI to make a better and faster diagnosis than humans. AI can help doctors with diagnoses and can inform when patients are worsening so that medical help can reach to the patient before hospitalization

3. AI in GAMING

- AI can be used for gaming purpose. The AI machines can play strategic games like chess, where the machine needs to think of a large number of possible places.

4.AI in FINANCE

- AI and finance industries are the best matches for each other. The finance industry is implementing automation, chatbot, adaptive intelligence, algorithm trading, and machine learning into financial processes.

5.AI in DATA SECURITY

- The security of data is crucial for every company and cyber-attacks are growing very rapidly in the digital world. AI can be used to make your data more safe and secure. Some examples such as AEG bot, AI2 Platform ,are used to determine software bug and cyber-attacks in a better way.

6.AI in SOCIAL MEDIA

- Social Media sites such as Facebook, Twitter, and Snapchat contain billions of user profiles, which need to be stored and managed in a very efficient way. AI can organize and manage massive amounts of data. AI can analyse lots of data to identify the latest trends, hashtag, and requirement of different users.

7.AI in TRAVEL AND TRANSPORT

- AI is becoming highly demanding for travel industries. AI is capable of doing various travel related works such as from making travel arrangement to suggesting the hotels, flights, and best routes to the customers. Travel industries are using AI-powered chatbots which can make human-like interaction with customers for better and fast response.

8.AI in AUTOMOTIVE INDUSTRY

- Some Automotive industries are using AI to provide virtual assistant to their user for better performance. Such as Tesla has introduced Tesla Bot, an intelligent virtual assistant.
- Various Industries are currently working for developing self-driven cars which can make your journey more safe and secure.

9.AI in ROBOTICS

- Artificial Intelligence has a remarkable role in Robotics. Usually, general robots are programmed such that they can perform some repetitive task, but with the help of AI, we can create intelligent robots which can perform tasks with their own experiences without pre-programmed.
- Humanoid Robots are best examples for AI in robotics, recently the intelligent Humanoid robot named as Erica and Sophia has been developed which can talk and behave like humans.

10.AI in ENTERTAINMENT

- We are currently using some AI based applications in our daily life with some entertainment services such as Netflix or Amazon. With the help of ML/AI algorithms, these services show the recommendations for programs or shows.

11.AI in AGRICULTURE

- Agriculture is an area which requires various resources, labour, money, and time for best result. Now a day's agriculture is becoming digital, and AI is emerging in this field. Agriculture is applying AI as agriculture robotics, solid and crop monitoring, predictive analysis. AI in agriculture can be very helpful for farmers.

12.AI in E-COMMERCE

- AI is providing a competitive edge to the e-commerce industry, and it is becoming more demanding in the e-commerce business. AI is helping shoppers to discover associated products with recommended size, colour, or even brand.

13.AI in EDUCATION

- AI can automate grading so that the tutor can have more time to teach. AI chatbot can communicate with students as a teaching assistant.
- AI in the future can be work as a personal virtual tutor for students, which will be accessible easily at any time and any place.

ADVANTAGES OF ARTIFICIAL INTELLIGENCE

- Reduction in human error
- Reduce the risk (zero risk)
- 24/7 support
- Perform repetitive job
- Faster decision
- New Inventions
- Digital assistance

DISADVANTAGES OF ARTIFICIAL INTELLIGENCE

- High Costs
- No Creativity
- Unemployment
- Make humans lazy
- No ethics
- Emotionless

MACHINE LEARNING

Machine learning is a branch of the broader field of artificial intelligence that makes use of statistical models to develop predictions. Machine learning is a part of AI which provides intelligence to machines with the ability to automatically learn with experiences without being explicitly programmed. It is based on the idea that machines can learn from past data, identify patterns, and make decisions using algorithms. Machine Learning is a tool that allows the systems to learn and improve automatically based upon experience. It does not require specific programming to carry out an activity. It is the development of computer programs that can access data, and through a series of algorithms use the data to learn for itself what action should be taken based on the data. The primary objective of ML is to allow the system to learn automatically without human intervention.

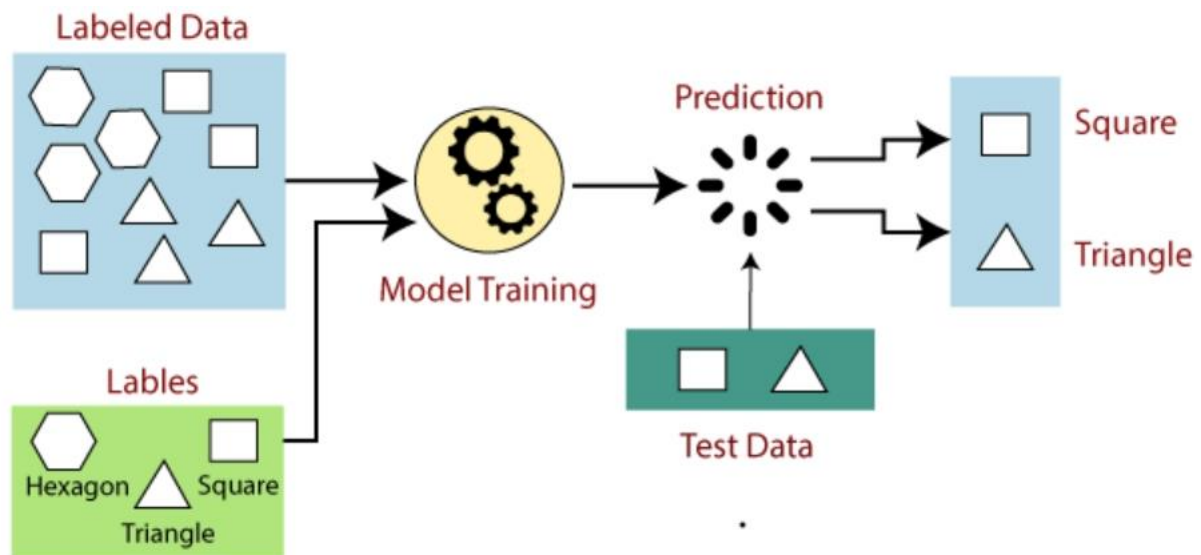
TYPES OF MACHINE LEARNING

There are three main approaches to ML. They are as follows,

1. Supervised Learning
2. Unsupervised Learning
3. Semi-Supervised Learning
4. Reinforcement Learning

Supervised Learning

As the name suggests, supervised machine learning is based on supervision. In the supervised learning technique, we train the machines using the labelled dataset, and based on the training, the machine predicts the output. The working of the supervised learning can be easily understood by the following diagram.



In the above example, we have a dataset of different types of shapes which include square, rectangle, triangle and hexagon. The first step is to train the model for each shape.

If the given shape has four sides, and all the sides are equal, then it will be labelled as a square.

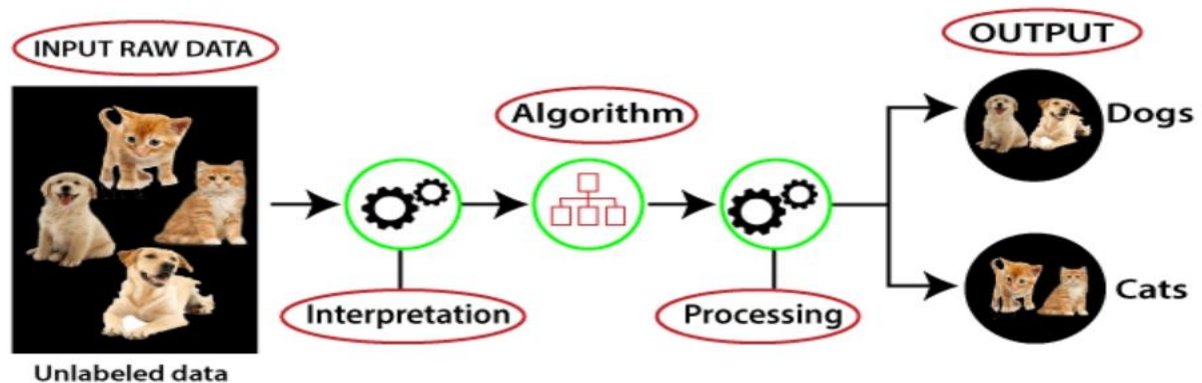
If the given shape has three sides, then it will be labelled as a triangle.

If the given shape has six equal sides, then it will be labelled as a hexagon.

After the training, the model test the dataset and predicts the output.

Unsupervised Learning

Unsupervised learning is different from the supervised learning. As the name suggests, there is no need for supervision. Here, the machine is trained using the unlabelled dataset and the machine predicts the output without any supervision. In the unsupervised learning, the machines are instructed to find out the hidden patterns in the data.



The given example is unlabelled, which means it is not categorised and corresponding outputs are also not given. This unlabelled input will undergo training process and then it will interpret the raw data to find out the hidden patterns and predict the output.

Semi-Supervised Learning

Algorithms fall somewhere in between supervised and unsupervised learning, since they use both labelled and unlabelled data for training typically a small amount of labelled data and large amount of unlabelled data. Usually semi-supervised learning chosen when the acquired labelled data requires skilled and relevant resources in order to train it or learn from it.

Reinforcement Learning

Reinforcement Learning (RL) is the science of decision making. It is about learning the optimal behaviour in an environment to obtain maximum reward. In RL, the data is accumulated from machine learning systems that use a trial-and-error method. Data is not part of the input that we would find in supervised or unsupervised machine learning.

Reinforcement learning is an autonomous, self-teaching system that essentially learns by trial and error. It performs actions with the aim of maximizing rewards, or in other words, it is learning by doing in order to achieve the best outcomes.

- Input: The input should be an initial state from which the model will start

- Output: There are many possible outputs as there are a variety of solutions to a particular problem
- Training: The training is based upon the input, The model will return a state and the user will decide to reward or punish the model based on its output.
- The model keeps continues to learn.
- The best solution is decided based on the maximum reward.

APPLICATIONS OF MACHINE LEARNING

1. Image Recognition

- It is one of the most common applications of machine learning.
- Used to identify digital images, objects, persons, places, etc.
- Popular use case of image recognition and face detection is, Automatic friend tagging suggestion.
- Facebook provides a feature of auto friend tagging suggestion.
- Whenever user upload a photo with his facebook friends, it automatically gets a tagging suggestion.
- This is possible because of the technology called as machine learning.

2. Speech Recognition

- It is the process of converting voice instructions into text.
- It is also known as “Speech to Text” or “Computer Speech Recognition”.
- For eg,. “search by voice” option in Google.
- Google Assistant, Siri, Alexa, etc, are using the speech recognition technologies to follow the voice instructions.

3. Traffic Prediction

- Google map shows the correct path with the shortest route and predicts the traffic conditions.
- It takes information from the user and sends back to its database to improve the performance.
- It predicts the traffic such as whether the traffic is cleared, slow-moving or heavily congested, etc,.
- It is possible with two means, they are,
- Real Time location of the vehicle from Google Map and sensors.
- Average time has taken on past days at the same time.

4. Product Recommendations

- Machine learning is widely used by various e-commerce and entertainment companies for product recommendations to the user.
- Such as Amazon, Flipkart, Netflix, etc,.
- Once searched product would always flash as advertisements.
- Similarly, in Netflix, it finds some recommendations for entertainment series, movies, etc.
- This is called machine learning.

5. Self driving cars

- The most exciting applications of machine learning is self driving cars.
- Tesla, the most popular car manufacturing company is working on self driving cars.
- It uses unsupervised machine learning method to train the car models to detect people and objects while driving.

6. Email Spam and Malware filtering

- Whenever receive a new mail, it is filtered automatically as important, normal and spam.
- Important mails with an important symbol.
- Spam emails in spam box.
- Some of the spam filters used by Gmail are,
- Content filters, header filters, permission filters, etc.,

7. Virtual Personal Assistant

- Virtual Personal Assistants such as Google assistant Alexa, Siri, etc.,
- They help in finding information using the users voice instructions.
- These assistants can help by various instructions such as, play music, open an email, schedule an appointment, etc.,

8. Online Fraud Detection

- ML is making our online transaction safe and secure by detecting fraud transaction.
- There are many ways in which the online fraudulent transactions can takes place.
- Fake accounts, fake ids, steal money in the middle of a transaction, etc.,
- Feed Forward Neutral network helps in checking whether it is a genuine transaction or a fraud transaction.

9. Stock Market Trading

- ML is widely used in stock market trading.
- There is always a risk of ups and downs in shares.

Long short-term neutral network is used for the prediction of stock market trends

10. Medical Diagnosis

- In ML is used for diseases diagnoses.

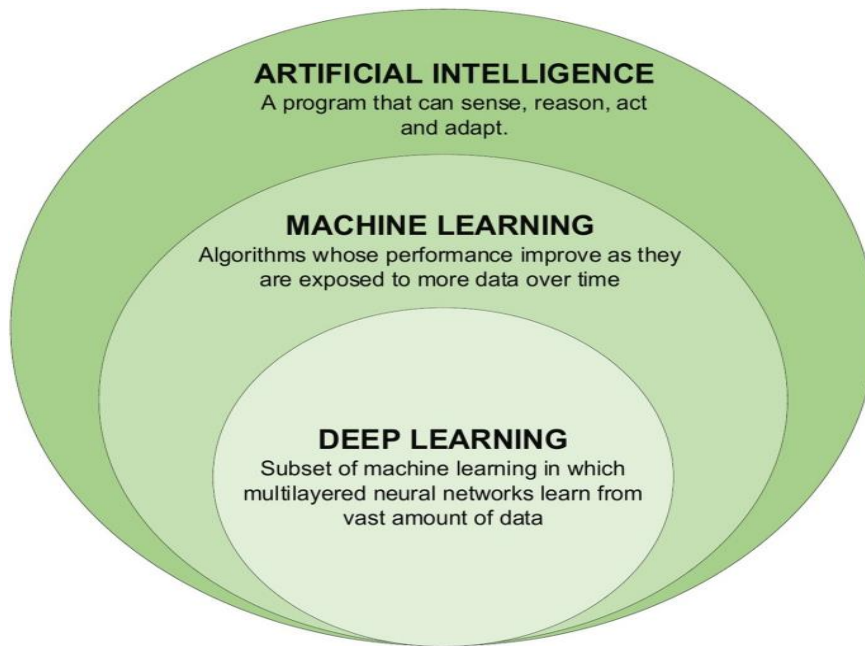
- Medical technology is growing very fast with the help of ML. For eg., 3D models are used to predict and detect the exact position of tumours in brain and other parts of the body

11. Automatic Language Translation

- ML helps in converting the text into our known language.
- Google's GNMT- Google Neural Machine Translation.

DEEP LEARNING

- Deep learning is based on the branch of machine learning, which is a subset of artificial intelligence.
- Deep learning models are capable enough to focus on the accurate features themselves by requiring a little guidance from the programmer and are very helpful in solving out the problem of dimensionality.
- Deep learning is implemented by the help of deep networks, which are nothing but neural networks with multiple hidden layers.
- It analyses data with learned representations similarly to the way a person would look at a problem.
- It is a subset of ML, is inspired by the information processing patterns in human brain.
- It does not require any human designed rules to operate.
- It uses a large amount of data.



CLASSIFICATIONS OF DEEP LEARNING

1. Deep Supervised Learning
2. Deep Semi-supervised Learning
3. Deep Unsupervised Learning
4. Deep Reinforcement Learning

1. Deep supervised learning

- The several supervised learning techniques are,
 - Recurrent Neural Networks (RNNs)
 - Convolutional Neural Networks (CNNs)
 - Deep Neural Networks (DNNs)
- In addition, RNN category includes Gated Recurrent Units (GRUs) and Long Short Term Memory (LSTM) approaches.
- Advantage is its ability to collect data or generate a data output from the prior knowledge.

2. Deep Semi-Supervised Learning

- Learning process is based on semi labelled datasets.
- Advantage is, minimize the amount of labelled data needed.

- Text document classifier is one of the most popular example.

3. Deep Unsupervised Learning

- It makes it possible to implement learning process in the absence of available labelled data.
- Means, no labels are required.
- Clustering is the example.

4. Deep Reinforcement Learning

- It operates on interacting with the environment, while supervised learning operates on provided sample data.
- It was developed by Google Deep Mind in 2013.

APPLICATIONS OF DEEP LEARNING

➤ Healthcare

From medical image analysis to curing diseases, deep learning played a huge role. It also helps physicians, clinicians and doctors to help the patients out of danger, and they can diagnose & treat the patients with apt medicines.

➤ Stock Analysis

Quantitative equity analysts are getting more benefits especially to find the trends for a particular stock whether it will be bullish or bearish and they can use many more factors like number of transactions made, number of buyers, number of sellers , previous day closing balance etc., when training the deep learning layers.

➤ Fraud Detection

These days hackers especially those based out of the dark-web have found ways to steal money digitally across the globe using different software. Deep learning will learn to find these types of fraudulent transactions in the web using a lot of factors like router information, IP address etc,

➤ Image Recognition

Suppose say the city police department has a people database of the city & they wanted to know the public gatherings like who is involved in the crimes, violence

Using public webcam available in streets this deep learning helps a lot in finding the person who was involved in the act.

➤ News Analysis

These days the government takes a lot of effort especially in controlling the spread of fake news & origin of it. Also during poll surveys like who would win elections in terms of popularity, which candidate been shared by most people in social media etc., And analysis of tweets made by country people using all these variables can predict the outcomes in deep learning.

DIFFERENCE BETWEEN AI, MI, DI

<u>AI</u>	<u>MI</u>	<u>DI</u>
Introduced by John McCarthy in 1956.	Introduced by Arthur Samuel in 1959	Introduced by Igor Aizenberg in 2000
Enables the machine to think like a human being without including any human intervention.	Machine learning is a subset of Artificial Intelligence	Deep learning the subset of machine Learning.
AI is based on fully machine activity.	MI is based on experience & trains the data from each phase of errors.	Deep learning algorithm inspired by structure & function of human brain.
Training & testing not used in the AI.	Training time required is comparably less than deep learning, and testing time required more than deep learning.	Training time required is comparably more than machine learning, & testing time required less than machine learning.
Eg. Alexa, Siri, Search engine	<u>Eg.</u> Speech recognition, Face recognition	Eg. Chatbots, Driverless Vehicles

DATA BASE MANAGEMENT SYSTEM(DBMS)

MEANING OF DATA

Data are individual facts, statistics or items of information, often numeric, that are collected through observation.

- The word “data” is the plural form of the word “datum” which means “fact”.
- Therefore, data is a collection of facts.

Characteristics of data

- Precise
- Relevant
- Consistent
- Good quality

Database

- Collection of data is database, which contains information relevant to the enterprise.
- The primary goal of database management is to provide a way to store and retrieve database information that is both convenient and efficient.
- Database systems are designed to manage large bodies of information.
- It ensures the safety of information stored.

Database Management

A DBMS is a collection of programs that allows data to be stored, reformed and extracted from a database.

- Database Management allows a person to organize, store and retrieve data from a computer.
- Database Management can also describe the data storage, operations, and security practices of a database administrator (DBA) throughout the life cycle of the data.
- Database management is the practice of collecting, keeping and using data securely, efficiently and cost-effectively.
- The goal of database management is to help people, organization and connected things optimize the use of data within the bounds of policy and regulation.
- It is used to make decisions and take actions that maximise the benefit to the organization.

Functions of DBMS

- Self -describing nature of a data base system.
Database system contains not only the database itself but also a complete definition of the database and constraints. The definition is stored in the system catalogue which

contain information as structure of each file that type of storage format of each data item.

- Insulating between programs & data,& data abstraction
In DBMS catalogue separate from the access programs this property is called as program data independence.
- Supporting of multiple views of the data
A database may have many users each of homemade required a different view of the database. A view maybe a subset of the database. A multiusers DBMS whose users have a variety of applications must provide facility for defining multiple views.
- Sharing of data and multiuser transaction processing
A multi user DBMS allows multiple users to access the database at the same time. The DBMS must provide concurrency control to ensure that several users trying to update the same data in a control the manners so that the result of the updates is correct.

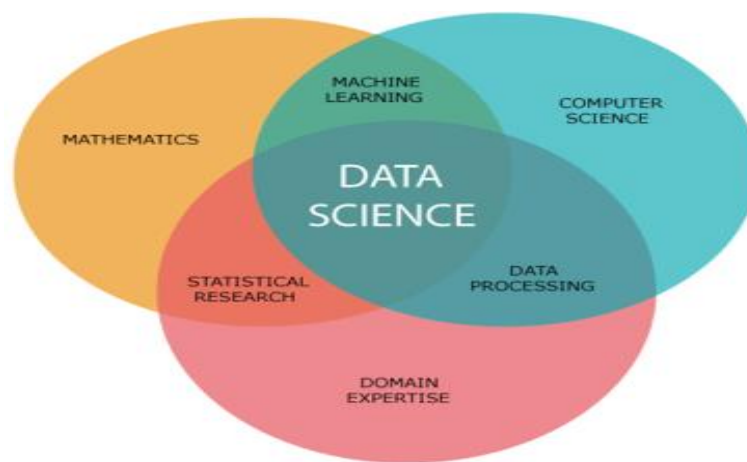
IMPLICATIONS OF DATABASE

- Potential for enforcing standards
- Flexibility
- Availability of up-to-date information
- Economics of scale

Data science

- It is area of study which involves extracting insights from vast amounts of data by the use of various scientific methods, algorithms and processes.
- It helps you to discover hidden patterns from the raw data.
- The term data science has emerged because of the evolution of mathematical statistics, data analysis and big data.
- It is an interdisciplinary field that allows you to extract knowledge from structured or unstructured data.
- It enables you to translate a business problem into a research project and then translate it back into a practical solution.
- R,SQL,Python,SaS, are essential data science tools.

COMPONENTS OF DATA SCIENCE



APPLICATIONS OF DATA SCIENCE

- Image recognition and speech recognition
- Gaming world
- Internet search
- Transport
- Healthcare
- Recommendation systems
- Risk detection

Big data- Analytics

Big data refers to the large, diverse sets of information that grow at ever increasing rates. It encompasses the volume of information, the velocity or speed at which it is created and collected, and the variety of scope of the data points being covered. This describes the large volume of data both structured and unstructured that inundates a business on a day-to-day basis.

DEFINITIONS

- According to John Mashey, “Big Data refers to the data sets with sizes beyond the ability of commonly used software tools to capture, manage and process data within a tolerate elapsed time.”
- According to McKinsey, “Big Data is the datasets whose size is beyond the ability of typical database software tools to capture, store, manage and analyze.”

Big data analytics

- Big data analytics allows the analysts, researchers and business users to make better and faster decisions using data that was previously inaccessible or unusable.
- It is the process of collecting, organizing and analyzing large sets of data called “big data” to discover patterns and other useful information.

- It can help organizations to better understand the information contained within the data.
- It also helps to identify the data that is most important to the business and future business decisions.
- Analysts working with Big Data typically want the knowledge that comes from analysing the data.

COMPANIES THAT ARE USING BIG DATA

- Amazon
- American Express
- BDO
- Capital One
- General Electric
- Miniclip
- Netflix
- Starbucks
- T-Mobile

CHARACTERISTICS OF BIG DATA

- Volume
- Variety
- Velocity
- Variability

Types of Big Data Analytics

Descriptive Analytics

Prescriptive Analytics

Diagnostic Analytics

Predictive Analytics

Outcome Analytics

❑ Descriptive Analytics

- It is a field of statistics that focuses on gathering and summarizing raw data to be easily interpreted.
- It concentrates on historical data, providing the context that is vital for understanding information and numbers.
- The field usually serves as a preliminary step in the business intelligence process.
- Thus, it creates a foundation for further analysis and understanding.
- In business intelligence, descriptive analysis is usually the first step and will result in visualizations like pie charts, line graphs, bar charts and other simpler graphical displays.
- It uses simpler mathematics and statistical tools instead of more complex calculations that predictive and prescriptive analytics perform.

❑ Prescriptive Analytics

- It is the area of data analytics that focuses on finding the best course of action in a scenario given the available data.
- It gathers data from a variety of both descriptive and predictive sources for its models and applies them to the process of decision making.
- It combines existing conditions and possible decisions to determine how each would impact the future.
- It uses mathematical and computer science techniques (statistical) to create and re-create possible patterns that could affect an organisation in different ways.

❑ Diagnostic Analytics

- It is a form of advanced analytics which examines data or content to answer the question “Why did this happen?”
- It is characterized by the techniques such as data discovery, data mining and correlations.
- It takes a deeper look at the data to attempt to understand the causes of events and behaviours.

- It lets you understand your data faster to answer critical workforce questions.

❑ *Predictive Analytics*

- It is a category of data analytics aimed at making predictions about future outcomes based on historical data and analytics techniques such as statistical modelling and machine learning.
- The science of predictive analytics can generate future insights with a significant degree of precision.
- It is the branch of the advanced analytics which is used to make predictions about unknown future events.
- It uses many techniques from data mining, statistics, modelling, machine learning and AI to analyze current data to make predictions about future.
- The patterns found in historical and transactional data can be used to identify risks and opportunities for future.

❑ *Outcome Analytics*

- It is also referred to as consumption analytics.
- It provides insight into customer behaviour that drives specific outcomes.
- This analysis is meant to help to learn how they are interacting with the products and services.

ADVANTAGES OF BIG DATA ANALYTICS

❖ Risk management

Big data analytics offers crucial insights on consumer behavior & market trends that help businesses to assess their position and progress.

❖ Product development and innovations

Big data analytics also helps businesses to decide on the manufacturing and nodding for a product to go ahead in the market.

❖ Quicker and better decision making

The world has become faster and so has become the process of decision making. Big Data analytics has fueled the process of decision making nowadays companies don't have to wait for days or months for a response.

❖ Improve customer experience

When business scan analyse customer behaviour so often, they can improve the customer experience and that to on a personal level.

❖ Complex supplier network

Through big data companies provide supplier networks also called B2B communities through a larger degree of precision. Big Data analytics allows suppliers to escape the constraints they encounter. It allows suppliers to adopt higher levels of contextual intelligence enhancing their success.

❖ Focused and targeted campaigns

Big data can be adopted by platforms for offering tailor items for the target market rather than wasting money on unsuccessful advertising campaigns. Big data aids businesses in executing a sophisticated analysis of customer trends.

APPLICATIONS OF BIG DATA ANALYTICS

- Government
- Social media analytics
- Technology
- Fraud detection
- Call centre analytics
- Banking
- Agriculture
- Marketing
- Smart phones
- Telecom
- Healthcare

Difference between Big Data & data analytics

	Big Data	Data analytics
Nature	Data analytics like a book where you can find a solution to your problems.	Big data can be considered as a big library where all the answers to all the questions are there but difficult to find answers to questions.
Structure of Data	Big data is mostly unstructured set of data that	When will find that the data will be already structured

	has to be sorted out to find an answer to any question and it is not very easy to process those enormous volume of data.	and it is easy to find an answer to a question.
Tools used in big data vs data analytics	One will need to use sophisticated technological tools such as automation tools or parallel computing tools to manage the big data.	One will use simple tools for statistical modelling and predictive modelling because the data to analyse is already structure and not complicated.
Type of industry using Big data & data analytics	Big data is used by retail industries and many more.	Data analytics is mainly used by industries like IT industries.

INTERNET OF THINGS

INTRODUCTION

- Today the internet has become universal, has touched almost every corner of the globe.
- It is affecting human life in unimaginable ways.
- The IoT refers to a new kind of world where almost all the devices and appliances are connected to a web.

MEANING

The internet of things describe the network of physical objects-“things” that are embedded with sensors, software and other technology for the purpose of connecting and exchange data with other devices and systems over the internet.

In other words, Internet of Thing (IoT) is a global technology that creates a global network of machines and devices that are capable of communicating and exchanging data with each other through the Internet.

Need:

IoT wants to connect all potential objects to interact each other on the internet to provide secure, comfort life for human.

EXAMPLES OF INTERNET OF THINGS

- ❖ Connected appliances
- ❖ Smartphone security systems
- ❖ Autonomous farming equipment
- ❖ Wearable health monitors
- ❖ Smart factory equipment
- ❖ Wireless inventory trackers
- ❖ Ultra high speed wireless internet
- ❖ Biometric cyber security scanners

IoT-Internet of Thing

IIoT -Industrial Internet of Thing

What are the benefits of IoT to organizations?

The internet of things offers several benefits to organizations. Some benefits are industry-specific, and some are applicable across multiple industries. Some of the common benefits of IoT enable businesses to:

- Monitor their overall business processes
- Improve the customer experience
- Save time and money
- Enhance employee productivity
- Integrate and adapt business models
- Make better business decisions
- Generate more revenue.

Uses/Applications of IoT are:

- **Smart phone:** smartphone has become the revolutionary ladder of success in the residential space and it is predicted smart homes will become as common as smartphones. The cost of owning a house is the biggest expense in a home owners life. Smartphone products at promise to save time energy and money.
- **Wearables:** variables have experienced a explosive demand in markets all over the world. Companies like Google Samsung have invested heavily in building such devices. Variable devices are installed with sensors, softwares which collect data and information about the users.
- **Connected cars:** the automotive digital technology has focused on optimising vehicles internal functions but now this attention is growing towards enhancing the in car experience. A connected car is a vehicle which is able to optimise its own operation maintenance as well as comfort of passengers using on board sensors and internet connectivity.
- **Industrial Internet:** industrial internet is the new bus in the industrial sector also termed as industrial internet of things. It is empowering industrial engineering with sensor software and Big Data analytics to create brilliant machines.
- **Smart cities:** smart cities another powerful application of iot engineering curiosity among world's population. Smart survallence, automatic transportation, smarter energy management systems, water distribution ,urban security and environmental monitoring all are examples of internet of things applications for smart cities.
- **IoT in agriculture:** with the continuous increase invoice population demand for food supply is extremely raised. Governments are helping farmers to use advance techniques and research to increase food production. Smart farming is one of the fastest growing field in IoT..
- **Smart Retail:** smartphones will be the way of retailers to remain connected with their consumers even out of Store. Interacting through smartphones and using technology can help retailers serve their consumers better
- **Retail Engagement:** The basic idea behind the smart grid is to collect data in an automated fashion and analyse the behaviour or electricity consumers and suppliers for improving efficiency as well as economics of electricity use. Smart grids will also be able to detect sources of power outages more quickly and at individual household levels like nearby solar panel making possible distributed energy system.
- **IoT in health care:** connected health care get remains the sleeping gaint of the internet of things applications. The concept of connected health care system and smart medical

devices bears enormous potential not just for companies but also for the well being of people in general.

- **IoT in poultry & farming** : livestock monitoring is about animal husbandry and cost saving. Using iot applications together data about the health and well being of the cattle ranchers knowing early about the Sick animal can pull out and help prevent large number of sick cattle.

Characteristics of IoT:

- ❖ Connectivity
- ❖ Things
- ❖ Data
- ❖ Communication
- ❖ Intelligence
- ❖ Action
- ❖ Ecosystem

Uses of IoT in BANKING

- Improved financial practices for customers.
- Enhanced banking experience
- Expanded range of service beyond banking
- Efficient branch banking
- Improve credit card experience

Industrial Internet of Things (IIoT)

- IIoT is part of bigger IoT system which focuses on devices and objects used in business environment.
- It is the IoT technology in industrial settings.
- It refers to the interconnected sensors, controllers and other devices networked together in an industrial setting.
- It allows for data collection, exchange and analysis of different data sources.

Purpose of Industrial IoT

- IIOT is the application of connected smart devices to monitor, automate & predict all kinds of industrial processes & outcomes.

- It focus is on industrial application such as manufacturing , power plants, oil and gas etc.
- It uses more sensitive and precise sensors.
- It deals with large scale networks.

It can be programmed remotely that is offers remote on-site program.

- It handles data ranging from medium to high.
- It requires robust security to protect the data.
- It needs stringent requirements.
- It is having very longlife cycles.
- It has high-reliability.

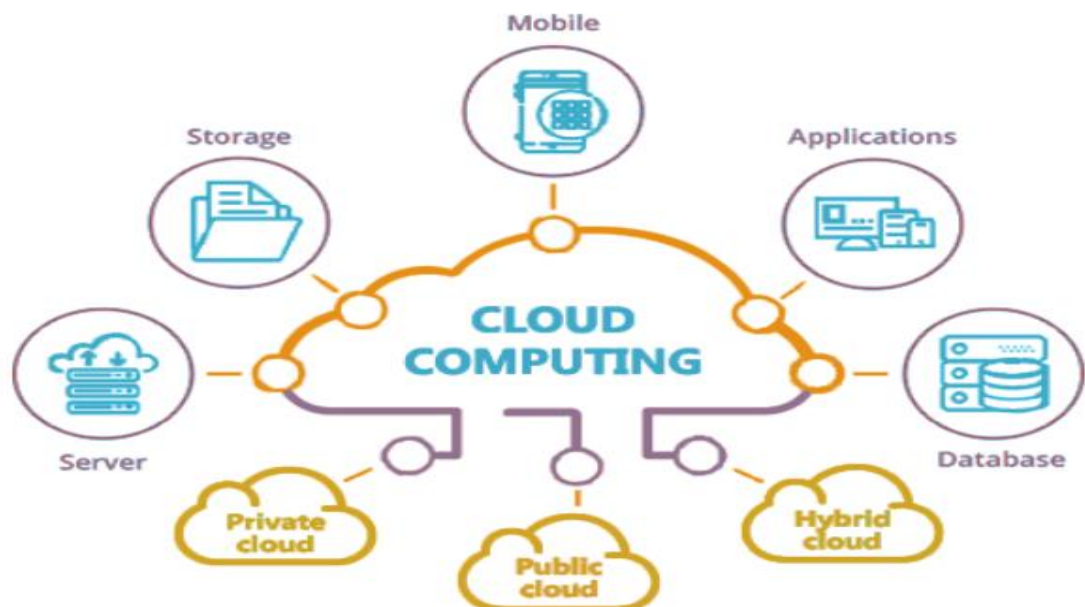
Difference between IIoT & IoT.

IIoT	IoT
It focuses on industrial applications such as manufacturing, power plants, oil and gas etc	It focus is on general applications ranging from wearables to robots and machines.
It uses critical equipment and devices connected over and network which will cause a life threatening or other emergency situations on failure there for uses more sensitive and precise sensors.	It's implementation starts with small scale level so there is no need to worry about life threatening situations.
It deals with large scale networks	It deals with small scale networks.
It can be programmed remotely that is offers remote on- site programming.	It offers easy off-site programming
It handles data ranging from medium to high	It handles very high volume of data.
It requires robust security to protect the data	It requires identity and privacy
It needs stringent requirements	It needs moderate requirements
It is having very long life cycle	It is having short product life cycle
It has high reliability	It is less reliable

CLOUD COMPUTING

Cloud computing is the delivery of different services through the internet. These resources include tools & applications like data storage, servers, databases, networking & software.

- Cloud storage uses data centers with massive computer servers that physically stores the data & it make it available online to users via web.
- Cloud computing helps optimise costs and increase offerings.
- Because organisations/establishes no longer require extra hardware and software.
- Cloud computing allows to create, configure and customize applications.
- The term cloud refers to network or internet.
- In other words, cloud is something, which is present at remote location.
- Cloud can provide services over network. i.e., on public networks or on private networks. Eg, WAN, LAN, etc.



DEFINITION

- Cloud computing is a paradigm that focuses on sharing data and computations over a scalable network of nodes. Examples of such nodes include end user computers, data centres and web services.
- Such a network of nodes is termed as cloud.
- An application based on such clouds is termed as a cloud application.
- Cloud Computing is the delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet (“the cloud”) to offer faster innovation, flexible resources, and economies of scale. You

typically pay only for cloud services you use, helping you lower your operating costs, run your infrastructure more efficiently, and scale as your business needs change.

Uses of cloud computing

- Test and build applications
- Store data
- Back up data
- Recover data
- Analyze data
- Stream audio and video

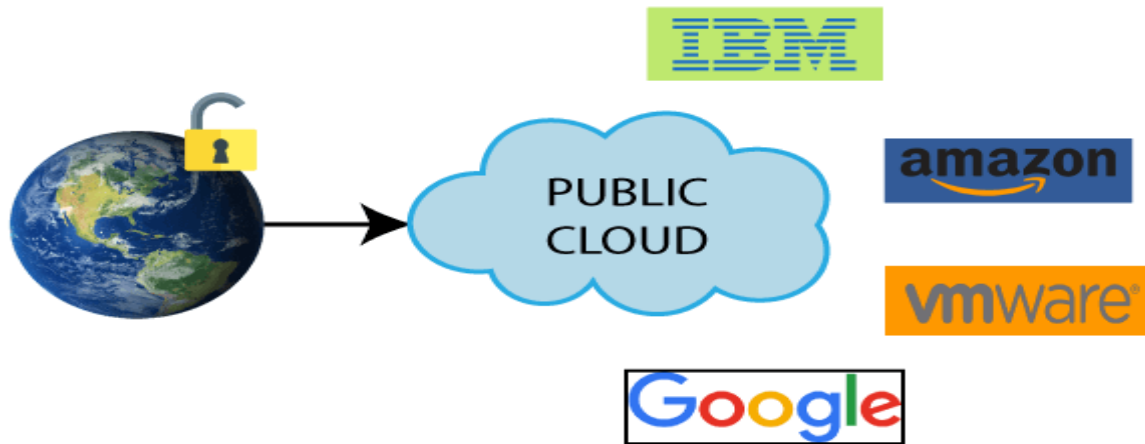
How cloud computing works?

- It works by providing permission to the user to upload and download the information which stores.
- A user will get the initial amount of storage at a very low price.
- Data can access from anywhere.
- Cloud computing can be divided into two systems: front end and back end.
- These two ends are connected together via internet.
- The central server ensures that everything runs smoothly and in a perfect manner.

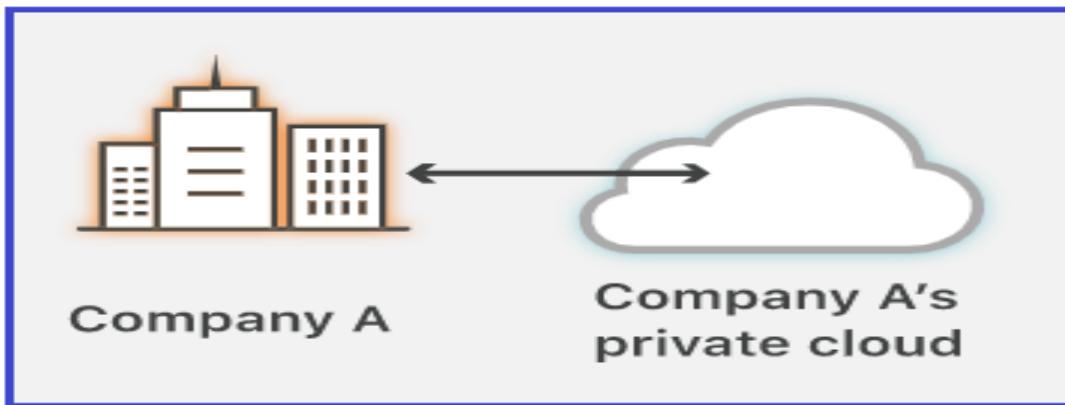
Models of cloud computing

1. PUBLIC CLOUD
2. PRIVATE CLOUD
3. HYBRID CLOUD
4. COMMUNITY CLOUD

Public cloud: it allows the systems and services to be easily accessible to the general public. It is less secure as it is publicly available. Eg: e-mail.



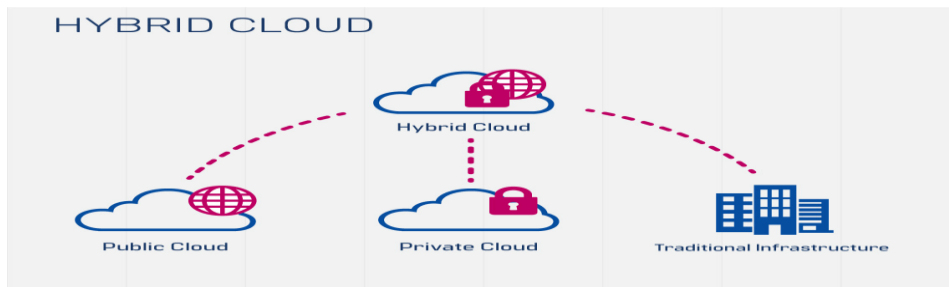
- ❑ Private cloud: it allows the systems and services to be accessible within an organization. It is more secure as it is private. Eg: IBM, Microsoft.



- ❑ Community cloud: it allows the systems and services to be accessible by a group of organizations.



- ❑ Hybrid cloud: it is mixture of public and private cloud.



ADVANTAGES OF CLOUD COMPUTING

1. Cost efficiency: Cloud computing is probably the most cost efficient method to use maintain and upgrade.
2. Almost unlimited storage: storing information in the cloud games almost unlimited storage capacity.
3. Backup and recovery: since all the data is stored in the cloud backing it up and storing the same is relatively much easier than storing the same on a physical device.
4. Automatic software integration: in the cloud software integration is usually something that occurs automatically, this means that cloud users don't need to make additional effort stock customise and integrated their applications as per own preferences.
5. Easy access to information: once the uses register in the cloud they can access the information from anywhere where there is an Internet connection this convenient feature let's user movie on time zone and geographical location issues.

DISADVANTAGES OF CLOUD COMPUTING

1. Security in the cloud: business needs to make sure that they choose the most reliable service provider who will keep the information totally secure.
2. Prone to attack: storing information in the cloud would make the companies vulnerable to external hack attacks and threats, therefore there is always the learning possibility of stealth of sensitive data.
3. Possible down time: cloud computing makes a small business dependent on the reliability of their internet connection.
4. In flexibility: choosing a cloud computing vendor often means locking the business into using that proprietary applications are formats.

Applications of Cloud Computing

- Storing file online

- Video making and editing software
- File converters
- Antivirus applications
- E-commerce applications
- Business process
- Backup and recovery

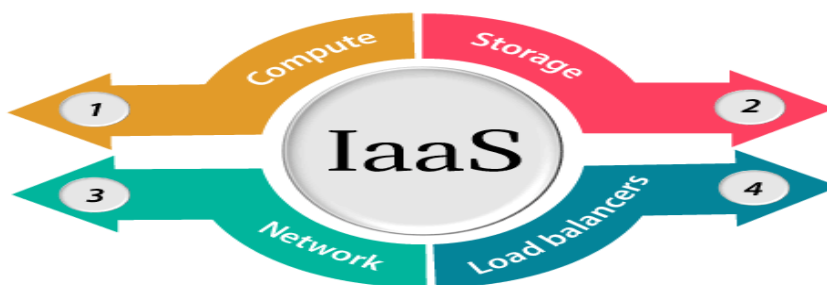
Cloud Service Models

There are three types of cloud service models. They are as follows,

- Infrastructure as a Service (IaaS)
- Platform as a Service (PaaS)
- Software as a Service (SaaS)

☐ Infrastructure as a Service (IaaS)

- It is a type of cloud computing service that offers essential compute, storage and networking resources on demand.
- It provides virtualized computing resources over the internet.
- It provides all the infrastructure necessities to the organization such storage, server and networking resources.
- IaaS makes the works more faster, easier, cost efficient and flexible.



CHARACTERISTICS :

- ❖ USES: IAAS is used by network architects.
- ❖ ACCESS: IAAS give access to the resources like virtual missions and virtual storage.

- ❖ **MODEL:** it is a service model that provide visualised computing resources over internet.
- ❖ **TECHNICAL UNDERSTANDING:** It required technical knowledge.
- ❖ **POPULARITY:** it is popular between developer and researchers.
- ❖ **CLOUD SERVICES:** Amazon Web services, sun, vcloud express.
- ❖ **ENTERPRISE SERVICES:** AWS virtual private cloud.
- ❖ **OUTSOURCED CLOUD SERVICES:** Salesforced.

Platform as a Service (PaaS)

- It allows programmers to easily create, test, run, and deploy web applications.
- It serves a platform and makes the work more easier.



CHARACTERISTICS

- ❖ **USES:** PAAS is used by developer.
- ❖ **ACCESS:** PAAS give access run time environment to deployment & develop tools for application.
- ❖ **MODEL:** it is a cloud computing model that delivers tools that is used for development application.
- ❖ **TECHNICAL UNDERSTANDING:** It required knowledge of subject to understand basic setup.
- ❖ **POPULARITY:** it is popular between developer who focus on the development of apps & scripts.
- ❖ **CLOUD SERVICES:** Facebook & google search engine.
- ❖ **ENTERPRISE SERVICES:** Microsoft azure.
- ❖ **OUTSOURCED CLOUD SERVICES:** Force.com, Gigaspaces.

❑ Software as a Service

- It is also called as cloud based software or cloud applications.

Here, the software would be hosted in the cloud and the user can access the software via web browser.



- ❖ USES: SAAS is used by end user.
- ❖ ACCESS: SAAS give access to the end user.
- ❖ MODEL: it is a service model in cloud computing that host software make available for client.
- ❖ TECHNICAL UNDERSTANDING: There is no requirement about technicalities company handle everything.
- ❖ POPULARITY: it is popular between consumer & company such as filesharing email & networking.
- ❖ CLOUD SERVICES: Ms.office web, facebook & google maps.
- ❖ ENTERPRISE SERVICES: IBM cloud analysis.
- ❖ OUTSOURCED CLOUD SERVICES: AWS, terremark.

CYBER SECURITY

Cyber Security is the protection of internet-connected systems such as hardware, software & data from cyberthreats. The practice is used by individuals & enterprises to protect against unauthorized access to data centres & other computerized systems.

- The technique of protecting internet connected systems such as computers, servers, mobile devices, electronic systems, networks and data from malicious attacks is known as cyber security.
- It can be divided into two parts, they are:
 - ✓ Cyber
 - ✓ Security

- Cyber refers to the technology that includes the systems, networks, programs and data.
- Security is concerned with the protection of systems, networks, applications and information.
- It is also known as electronic information security or information technology security.
- It is the process that is designed to protect networks and devices from external threats.

Types of Cyber Security

1. Application Security
2. Network Security
3. Cloud security
4. Mobile security

Cyber Attack

- A cyber attack is a deliberate attempt by external or internal threats or attackers to exploit and compromise the integrity and confidentiality of the information system of a target organization.
- Cyber attacks can be,
 - ✓ Targeted
 - ✓ Un-targeted
- Targeted – where it is singled out because of a specific interest in the business or the attacker is being paid to target you.
- Un-targeted – where attackers indiscriminately target as many devices, services or users as possible.

TYPES OF CYBER ATTACK

WEB BASED ATTACKS

1. INJECTION ATTACKS

It is the attack in which some data will be injected into a web application to manipulate application and search the required information.

Example: SQL injection, code injection, log injection, XML injection etc.,

2. DNS Spoofing

DNS spoofing is a type of computer security hacking where by a data is introduced into a DNS resolve catch causing the name server to return an incorrect IP address divert in traffic to the attacker computer or any other computer. The DNS spoofing attacks can go on for a long period of time without being detected and can cause serious security issues.

3. Session hijacking

It is a security attack on a user session over a protected network web applications create cookies to store the state and uses sessions. By stealing the cookies and attacker can have access to all the user data.

4. Phishing

Phishing is a type of attack which attempts to steal sensitive information like user login credentials and credit card number .It occurs when an attacker is masquerading as a trustworthy entity in electronic communication.

5. Brute force

It is a type of attack which uses at trial and error method. This attack generates a large number of gases and validates them top 10 actual data like user password and personal identification number. This attack may be used bike criminals to crack encrypted data or by security analyst to test an organisations network security.

SYSTEM BASED ATTACK

➤ Virus

It is a type of malicious software program that spread throughout the computer files without the knowledge of a user. It is a cell for replicating malicious computer program that replicates by inserting copies of itself into other computer programs when executed. It can also execute instructions that cause harm to the system.

➤ Worm

It is a type of malware whose primary function is to replicate itself to spread to uninfected computers. It work same as the computer virus worms often originate from email attachments that appear to be from trusted sender's.

➤ Trojan Horse

It is a malicious program that occurs unexpected changes to computer setting and unusual activity even when the computer should be idle. It misleads the user of it's true intent. It appears to be a normal application but when open executed some malicious code will run in the background.

➤ Backdoors

It is a method that bypasses the normal authentication process. A developer make create a back door so that an application or operating system can be accessed for trouble shooting or other purposes.

➤ Bots

A bot is an automated process that interacts with other network services. Some words program run automatically while others only execute commands when they receives specific output.

Effective Communication

Effective communication is a communication between two or more persons wherein the intended message is successfully delivered, received & understood.

In other words, effective communication is a process of exchanging ideas, thoughts, knowledge & information such that the purpose or intention is fulfilled in the best possible manner.

Characteristics of effective communication (7 C's)

- a) Clear
- b) Correct
- c) Complete
- d) Concrete
- e) Concise
- f) Considered
- g) Courteous

STRATEGIES OF EFFECTIVE COMMUNICATION

- ✓ Clarity
- ✓ Completeness
- ✓ Conciseness
- ✓ Empathizing with the receiver
- ✓ Encouraging open feedback
- ✓ Accurate use of body language
- ✓ Attentive listening

- ✓ Avoiding information overload
- ✓ Self confidence
- ✓ Respectfulness
- ✓ Non-verbal communication

Importance of effective communication

- ❖ Employee Management
- ❖ Team Building
- ❖ Growth of the organisation
- ❖ Build strong relationship
- ❖ Ascertain transparency
- ❖ Develops Trust
- ❖ Facilitates creativity & innovation
- ❖ Reduces misunderstanding
- ❖ Organisational growth

TEAM WORK

Team work is the concept of people working together as a team for specific purpose under the same value.

Importance of team work

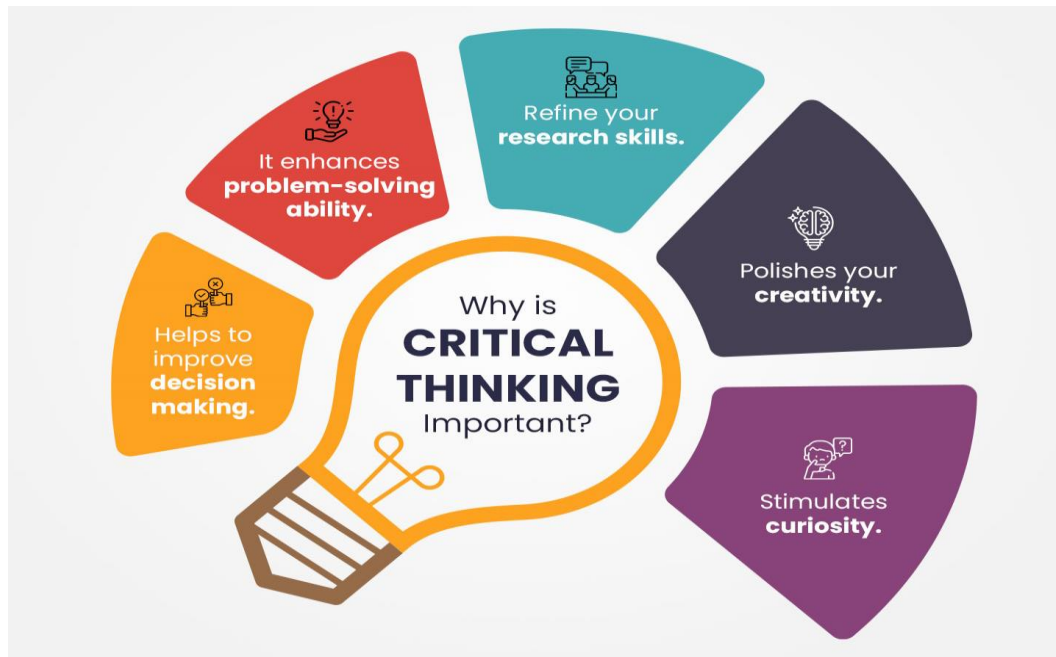
- ❖ Reduces stress
- ❖ Boosts productivity
- ❖ Aids problem solving
- ❖ Promotes innovation
- ❖ Learning opportunities
- ❖ Unity
- ❖ Common goal to achieve
- ❖ Builds strong relationship

CRITICAL THINKING

Critical thinking is **the ability to think clearly and rationally, understanding the logical connection between ideas.**

Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.

Importance of Critical thinking



COLLABORATIVE SKILLS

Collaboration skills are what you use to work with others efficiently. Collaboration skills **help you work well with others to complete a task or develop ideas together.**

Collaboration skills **enable you to successfully work toward a common goal with others.**

CORE VALUES/ESSENTIALS OF COLLABORATIVE SKILLS

CORE VALUES

RESPECT: We treat all people with dignity and kindness.

ACCEPTANCE: We embrace and celebrate differences.

INTEGRITY: We value honesty and ethical behavior.

RESPONSIBILITY: We are accountable for all our actions and their consequences.

SERVICE: We actively seek opportunities for contributing to our community in meaningful ways.

EXCELLENCE: We set high academic expectations and provide an educational environment in which they can be achieved.

INNOVATION

The introduction of new things, ideas, or ways of doing something. In other words, innovation is then simply new technology that is the systematic application of new knowledge to new resources to produce new goods or new services. Innovation is an important force in creating and sustaining organizational growth.

Application of Innovation:

- Products
- Services
- Procedures
- Production processes
- Internal or external organization

7 C's of Innovation

- Culture
- Continuous Improvement
- Collaboration
- Challenge
- Celebrate
- Consistency

- Constraint

DESIGN THINKING

Design thinking is a process for solving problems by prioritizing the consumer's needs above all else. Design thinking is a mindset and approach to problem-solving and innovation anchored around human-centered design.

- Solves concrete human needs
- Tackle difficult or ambiguous problems
- Better user experience
- Fresh and innovative solutions
- A more efficient work process.

Tools for enhancing skills

- ❖ Encourage teamwork
- ❖ Develop critical thinking skills
- ❖ Inculcate responsibility
- ❖ Set the stage for life-learning
- ❖ Help to engage with bosses.
- ❖ Develop independence and self-regulation
- ❖ Aid in skill development & self-assessment

