

# **UNIT 1**

# **EMERGING TECHNOLOGIES**

## • Overview of emerging technologies:

- Artificial Intelligence, Machine Learning, Deep Learning
- Database Management for Data Science, Big Data Analytics
- Internet of Things(IoT), Industrial Internet of Things(IIoT)
- Cloud Computing and its service models
- Cyber Security and Types of Cyber Attack

# EMERGING TECHNOLOGY

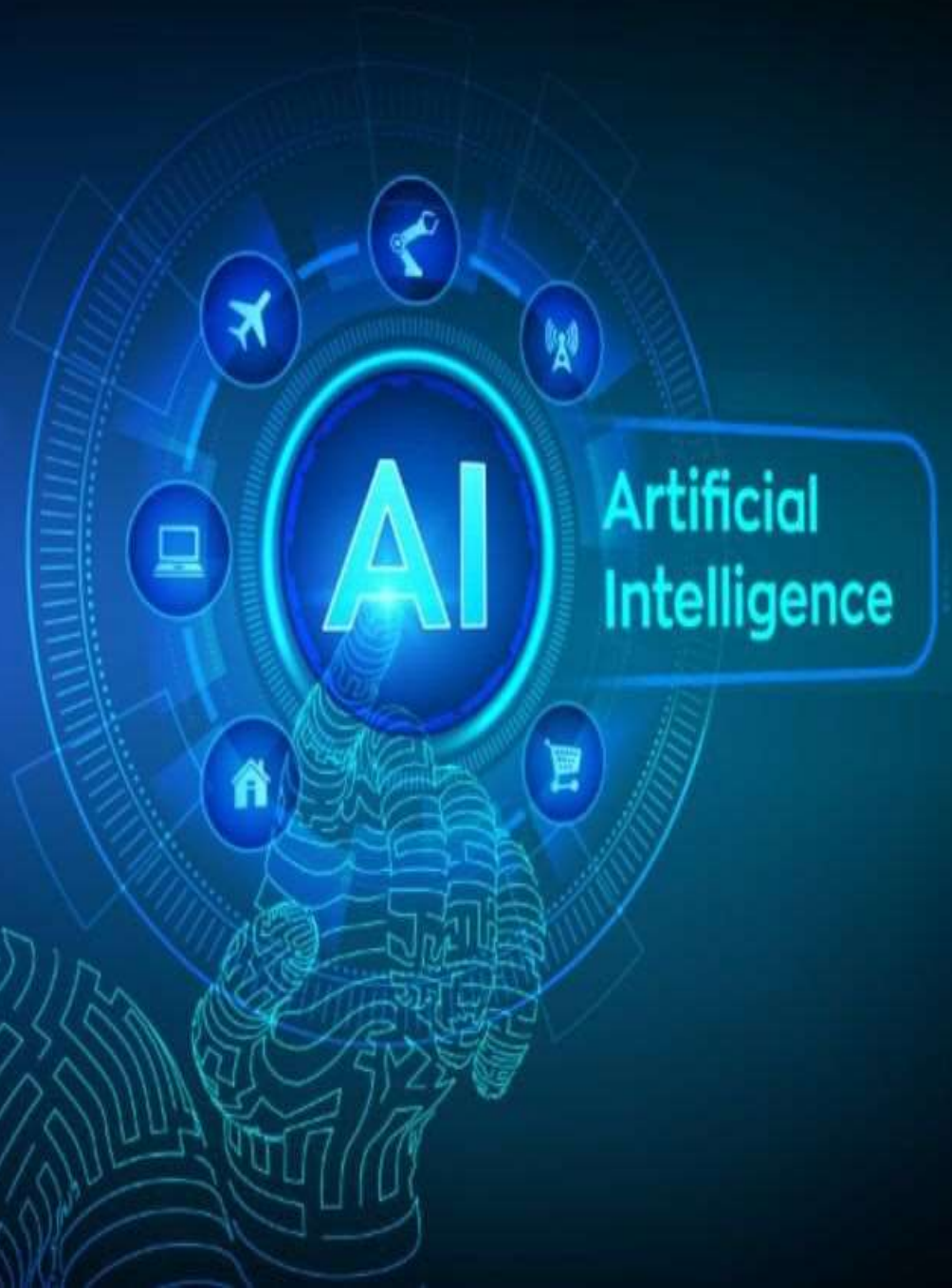
- Emerging Technology is a term generally used to describe a new technology.
- It also refers to the continuing development of an existing technology.
- The term commonly refers to technologies that are currently developing, or that are expected to be available within the next five to ten years, and 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 fulfill 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 characterized 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.

# ***APPLICATIONS 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 organizations and business to get rid of all such cyber issues.

### **3. AI in Science and Research**

AI is making a lot of 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.

# **ADVANTAGES AND DISADVANTAGES OF ARTIFICIAL INTELLIGENCE**

# Advantages

The advantages of Artificial intelligence applications are enormous and can revolutionize any professional sector. Let's see some of them

## *1) Reduction in Human Error:*

The phrase "human error" was born because humans make mistakes from time to time. Computers, however, do not make these mistakes if they are programmed properly. With Artificial intelligence, the decisions are taken from the previously gathered information applying a certain set of algorithms. So errors are reduced and the chance of reaching accuracy with a greater degree of precision is a possibility.

## **2) Takes risks instead of Humans:**

This is one of the biggest advantages of Artificial intelligence. We can overcome many risky limitations of humans by developing an AI Robot which in turn can do the risky things for us. Let it be going to mars, defuse a bomb, explore the deepest parts of oceans, mining for coal and oil, it can be used effectively in any kind of natural or man-made disasters.

## **3) Available 24x7:**

An Average human will work for 4-6 hours a day excluding the breaks. Humans are built in such a way to get some time out for refreshing themselves and get ready for a new day of work and they even have weekly offered to stay intact with their work-life and personal life. But using AI we can make machines work 24x7 without any breaks and they don't even get bored, unlike humans.

## *4) Helping in Repetitive Jobs:*

In our day-to-day work, we will be performing many repetitive works like sending a thanking mail, verifying certain documents for errors and many more things. Using artificial intelligence we can productively automate these mundane tasks and can even remove "boring" tasks for humans and free them up to be increasingly creative.

## *5) Digital Assistance:*

Some of the highly advanced organizations use digital assistants to interact with users which saves the need for human resources. The digital assistants also used in many websites to provide things that users want. We can chat with them about what we are looking for. Some chatbots are designed in such a way that it's become hard to determine that we're chatting with a chatbot or a human being.

## 6) *Daily Applications:*

Daily applications such as Apple's **Siri**, Window's **Cortana**, Google's **OK Google** are frequently used in our daily routine whether it is for searching a location, taking a selfie, making a phone call, replying to a mail and many more.

## 7) *New Inventions:*

AI is powering many inventions in almost every domain which will help humans solve the majority of complex problems.

# Disadvantages

As every bright side has a darker version in it. Artificial Intelligence also has some disadvantages. Let's see some of them

## *1) High Costs of Creation:*

As AI is updating every day the hardware and software need to get updated with time to meet the latest requirements. Machines need repairing and maintenance which need plenty of costs. It's creation requires huge costs as they are very complex machines.

## *2) Making Humans Lazy:*

AI is making humans lazy with its applications automating the majority of the work. Humans tend to get **addicted** to these inventions which can cause a problem to future generations.

### **3) Unemployment:**

As AI is replacing the majority of the repetitive tasks and other works with robots, human interference is becoming less which will cause a major problem in the employment standards. Every organization is looking to replace the minimum qualified individuals with AI robots which can do similar work with more efficiency.

### **4) No Emotions:**

There is no doubt that machines are much better when it comes to working efficiently but they cannot replace the human connection that makes the team. Machines cannot develop a bond with humans which is an essential attribute when comes to Team Management.

## ***5) Lacking Out of Box Thinking:***

Machines can perform only those tasks which they are designed or programmed to do, anything out of that they tend to crash or give irrelevant outputs which could be a major backdrop.

# | Types of AI



# Types of Artificial Intelligence

## Based on Capabilities

Narrow AI

General AI

Super AI

## Based on Functionalities

Reactive Machine

Limited Memory

Theory of Mind

Self-awareness

# Artificial Intelligence Based on Capabilities

## □ NARROW AI

Narrow AI, also called as **Weak AI**, focuses on **one narrow task** and cannot perform beyond its limitations. It targets a single subset of cognitive abilities and advances in that spectrum. Narrow AI applications are becoming increasingly common in our day-to-day lives as machine learning and deep learning methods continue to develop. **Apple Siri** is an example of a Narrow AI that operates with a limited pre-defined range of functions. Siri often has problems with tasks outside its breadth of abilities. Other examples of Narrow AI include google translate, image recognition software, recommendation systems, spam filtering, and Google's page-ranking algorithm.

## □ GENERAL AI

General AI, also known as strong AI, can understand and learn any intellectual task that a human being can. It allows a machine to apply knowledge and skills in different contexts. AI researchers have not been able to achieve strong AI so far. They would need to find a method to make machines conscious, programming a full cognitive ability set.

## □ SUPER AI

Super AI surpasses human intelligence and can perform any task better than a human. The concept of artificial super intelligence sees AI evolved to be so akin to human sentiments and experiences that it doesn't merely understand them; it also evokes emotions, needs, beliefs, and desires of its own. Its existence is still hypothetical. Some of the critical characteristics of super AI include thinking, solving puzzles, making judgments, and decisions on its own.

# *Artificial Intelligence Based on Functionalities*

## **□ REACTIVE MACHINE**

A reactive machine is the primary form of artificial intelligence that does not store memories or use past experiences to determine future actions. It works only with present data. They perceive the world and react to it. Reactive machines are provided with specific tasks, and they don't have capabilities beyond those tasks.

IBM's Deep Blue that defeated chess grandmaster Garry Kasparov is a reactive machine that sees the chessboard pieces and reacts to them. Deep Blue cannot refer to any of its prior experiences or improve with practice. It can identify the pieces on a chessboard and know how each moves. Deep Blue can make predictions about what moves might be next for it and its opponent. It ignores everything before the present moment and looks at the chessboard pieces as it stands right now and chooses from possible next moves.

## □ LIMITED MEMORY AI

Limited Memory AI trains from past data to make decisions. The memory of such systems is short-lived. They can use this past data for a specific period of time, but they cannot add it to a library of their experiences. This kind of technology is used in self-driving vehicles. Limited Memory AI observes how other vehicles are moving around them, at present, and as time passes.

This ongoing, collected data gets added to the AI machine's static data, such as lane markers and traffic lights.

They are included when the vehicle decides when to change lanes, avoid cutting off another driver, or hit a nearby vehicle.

## □ Theory of mind AI

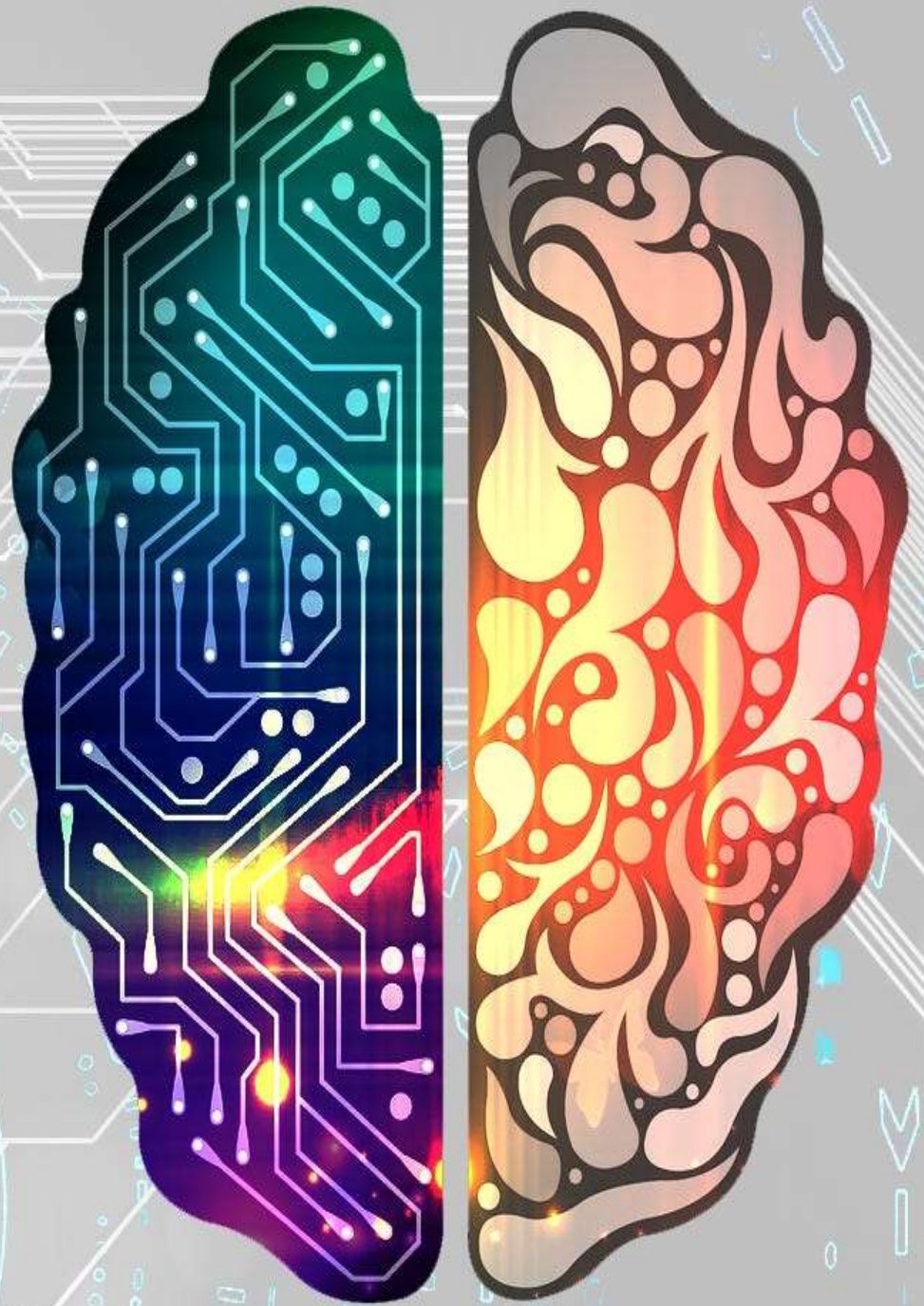
Theory of mind AI represents an advanced class of technology and exists only as a concept. Such a kind of AI requires a thorough understanding that the people and things within an environment can alter feelings and behaviors. It should understand people's emotions, sentiments, and thoughts. Even though many improvements are there in this field, this kind of AI is not fully complete yet.

Sophia from Hanson Robotics is another example where the theory of mind AI was implemented. Cameras present in Sophia's eyes, combined with computer algorithms, allow her to see. She can sustain eye contact, recognize individuals, and follow faces.

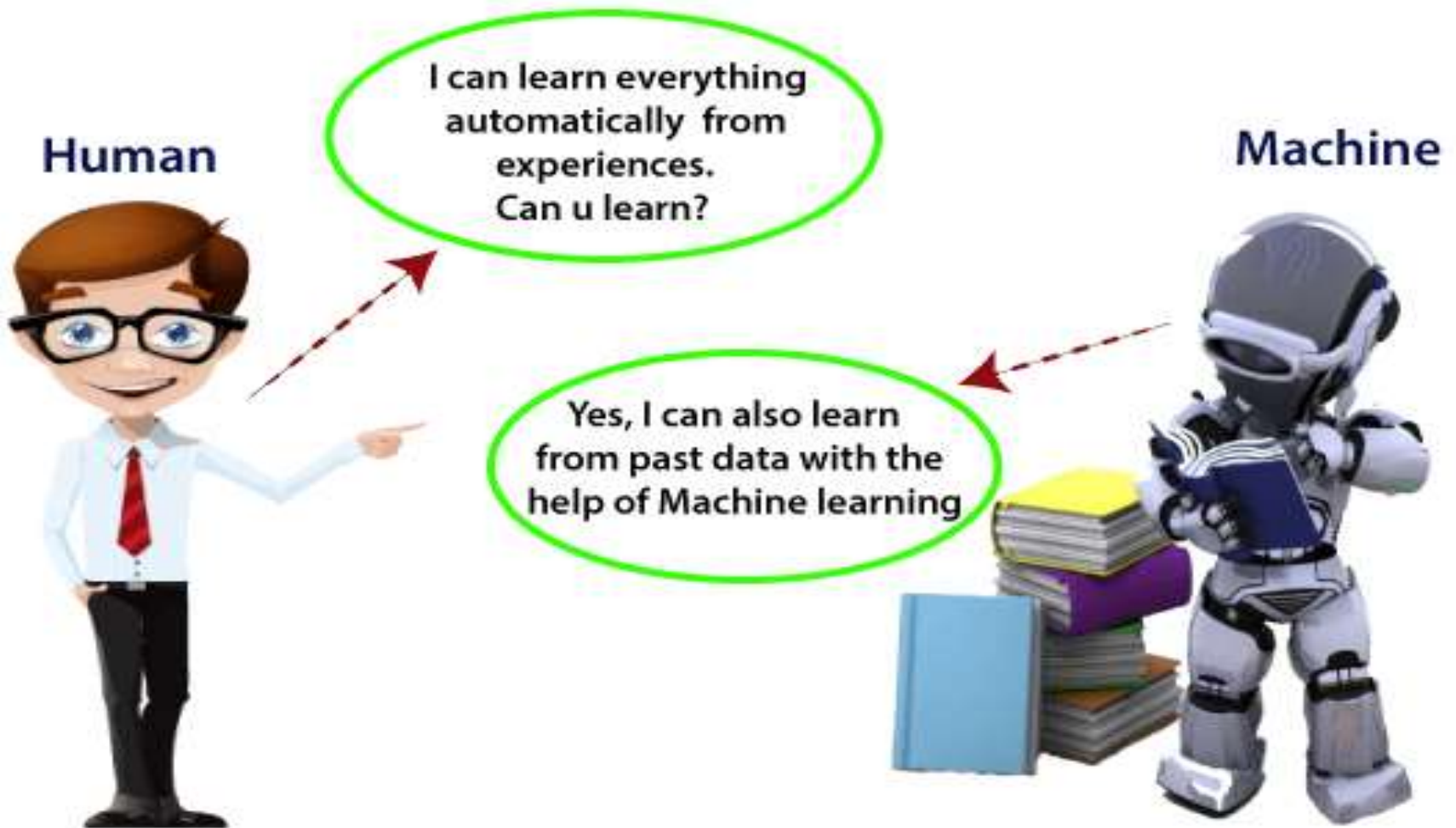
## □ Self-awareness AI

Self-awareness AI only exists hypothetically. Such systems understand their internal traits, states, and conditions and perceive human emotions. These machines will be smarter than the human mind. This type of AI will not only be able to understand and evoke emotions in those it interacts with, but also have emotions, needs, and beliefs of its own.

# MACHINE LEARNING



- In the real world, we are surrounded by humans who can learn everything from their experiences with their learning capability, and we have computers or machines which work on our instructions.
- But can a machine also learn from experiences or past data like a human does? So here comes the role of **Machine Learning**.

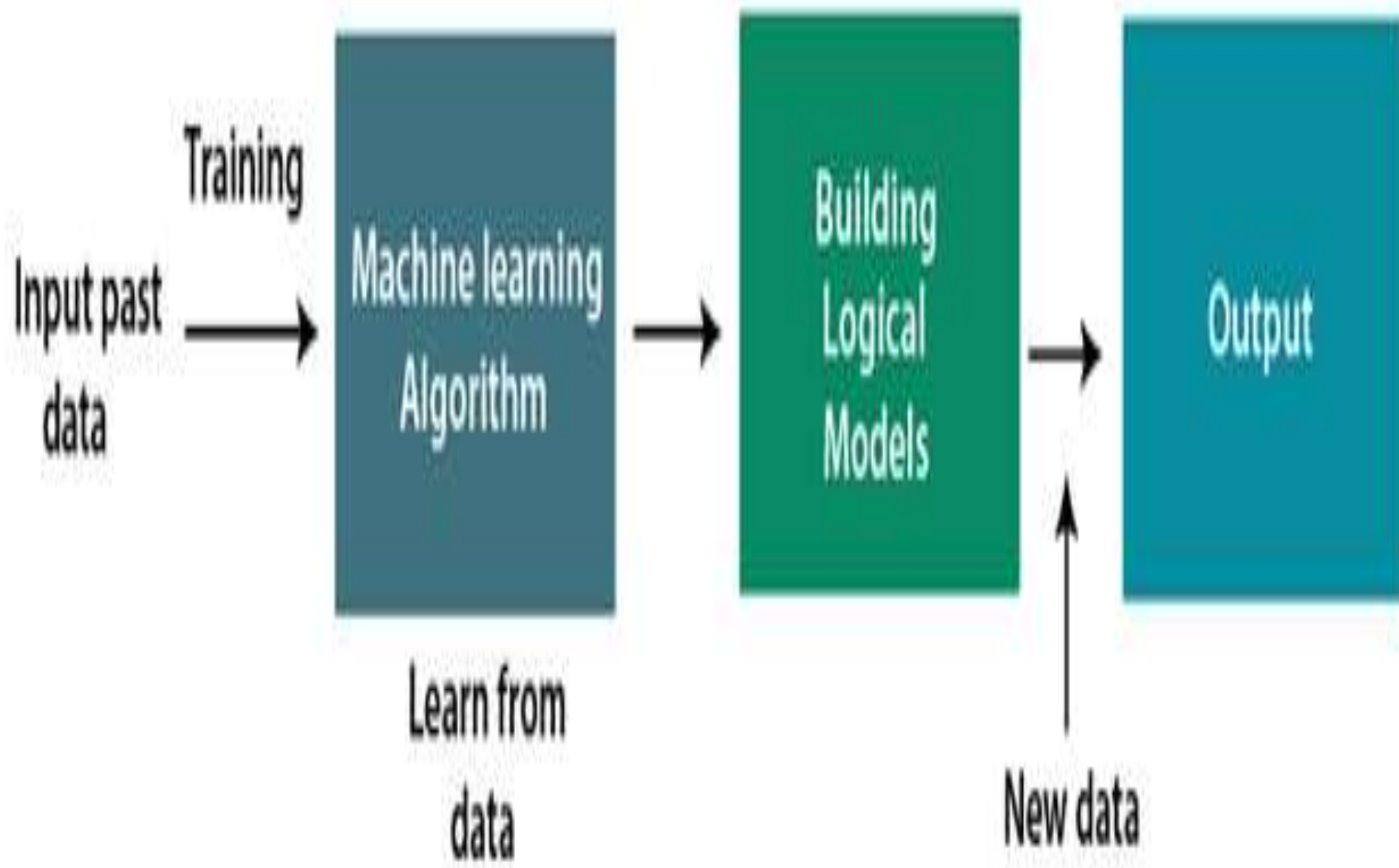


- A subset of artificial intelligence known as machine learning focuses primarily on the creation of algorithms that enable a computer to independently learn from data and previous experiences.
- Arthur Samuel first used the term "machine learning" in 1959. It could be summarized as follows:

*Without being explicitly programmed, machine learning enables a machine to automatically learn from data, improve performance from experiences, and predict things.*

# How does Machine Learning work

- A machine learning system builds prediction models, learns from previous data, and predicts the output of new data whenever it receives it.
- The amount of data helps to build a better model that accurately predicts the output, which in turn affects the accuracy of the predicted output.
- Let's say we have a complex problem in which we need to make predictions.
- Instead of writing code, we just need to feed the data to generic algorithms, which build the logic based on the data and predict the output.
- Our perspective on the issue has changed as a result of machine learning.
- The Machine Learning algorithm's operation is depicted in the following block diagram:



# **ADVANTAGES AND DISADVANTAGES OF MACHINE LEARNING**

# Advantages

## 1) Automation

Machine Learning is one of the **driving forces** behind automation, and it is cutting down time and human workload. Automation can now be seen everywhere, and the complex algorithm does the hard work for the user. Automation is more reliable, efficient, and quick. With the help of machine learning, now advanced computers are being designed. Now this advanced computer can handle several machine-learning models and complex algorithms. However, automation is spreading faster in the industry but, a lot of research and innovation are required in this field.

## 2) Scope of Improvement

Machine Learning is a field where things keep evolving. It gives many opportunities for improvement and can become the leading technology in the future. A lot of research and innovation is happening in this technology, which helps improve software and hardware.

## 3) Enhanced Experience in Online Shopping and Quality Education

Machine Learning is going to be used in the education sector extensively, and it will be going to enhance the quality of education and student experience. It has emerged in China; machine learning has improved student focus. In the e-commerce field, Machine Learning studies your search **feed and give suggestion** based on them. Depending upon search and browsing history, it pushes targeted advertisements and notifications to users.

#### 4) Wide Range of Applicability

This technology has a very wide range of applications. Machine learning plays a role in almost every field, like **hospitality, ed-tech, medicine, science, banking, and business**. It creates more opportunities.

# Disadvantages

## 1) Data Acquisition

The whole concept of machine learning is about identifying useful data. The outcome will be incorrect if a credible data source is not provided. The quality of the data is also significant. If the user or institution needs more quality data, wait for it. It will cause delays in providing the output. So, machine learning significantly depends on the data and its quality.

## 2) Time and Resources

The data that machines process remains huge in quantity and differs greatly. Machines require time so that their algorithm can adjust to the environment and learn it. Trials runs are held to check the accuracy and reliability of the machine. It requires massive and expensive resources and high-quality expertise to set up that quality of infrastructure. Trials runs are costly as they would cost in terms of time and expenses.

### 3) Results Interpretations

One of the biggest advantages of Machine learning is that interpreted data that we get from the cannot be hundred percent accurate. It will have some degree of inaccuracy. For a high degree of accuracy, algorithms should be developed so that they give reliable results.

### 4) High Error Chances

The error committed during the initial stages is huge, and if not corrected at that time, it creates havoc. Biasness and wrongness have to be dealt with separately; they are not interconnected. Machine learning depends on two factors, i.e., **data and algorithm**. All the errors are dependent on the two variables. Any incorrectness in any variables would have huge repercussions on the output.

## **6. Elimination of Human Interface**

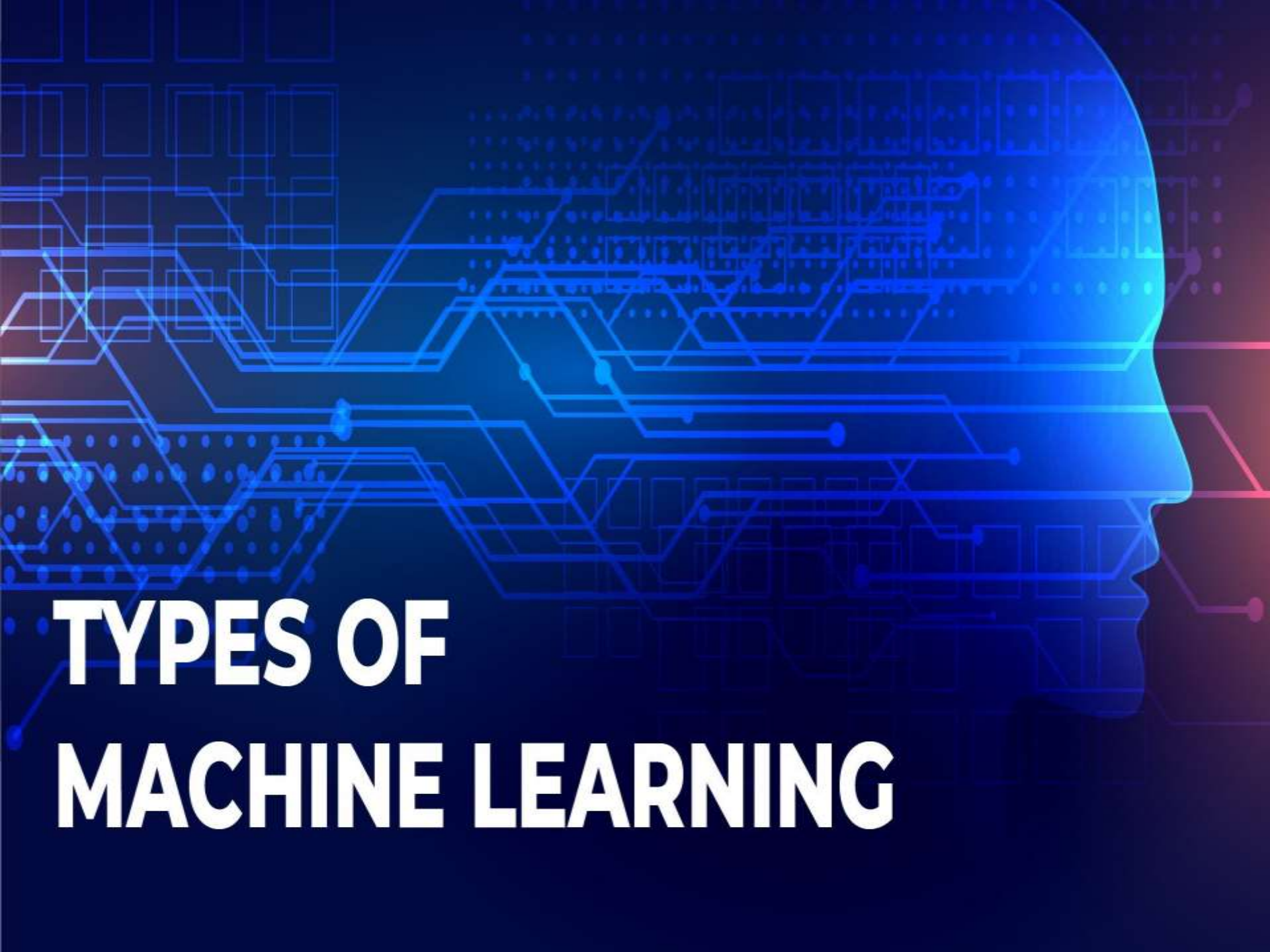
Automation, Artificial Intelligence, and Machine Learning have eliminated human interface from some work. It has eliminated employment opportunities. Now, all those works are conducted with the help of artificial intelligence and machine learning.

## **7. Changing Nature of Jobs**

With the advancement of machine learning, the nature of the job is changing. Now, all the work are done by machine, and it is eating up the jobs for human which were done earlier by them. It is difficult for those without technical education to adjust to these changes.

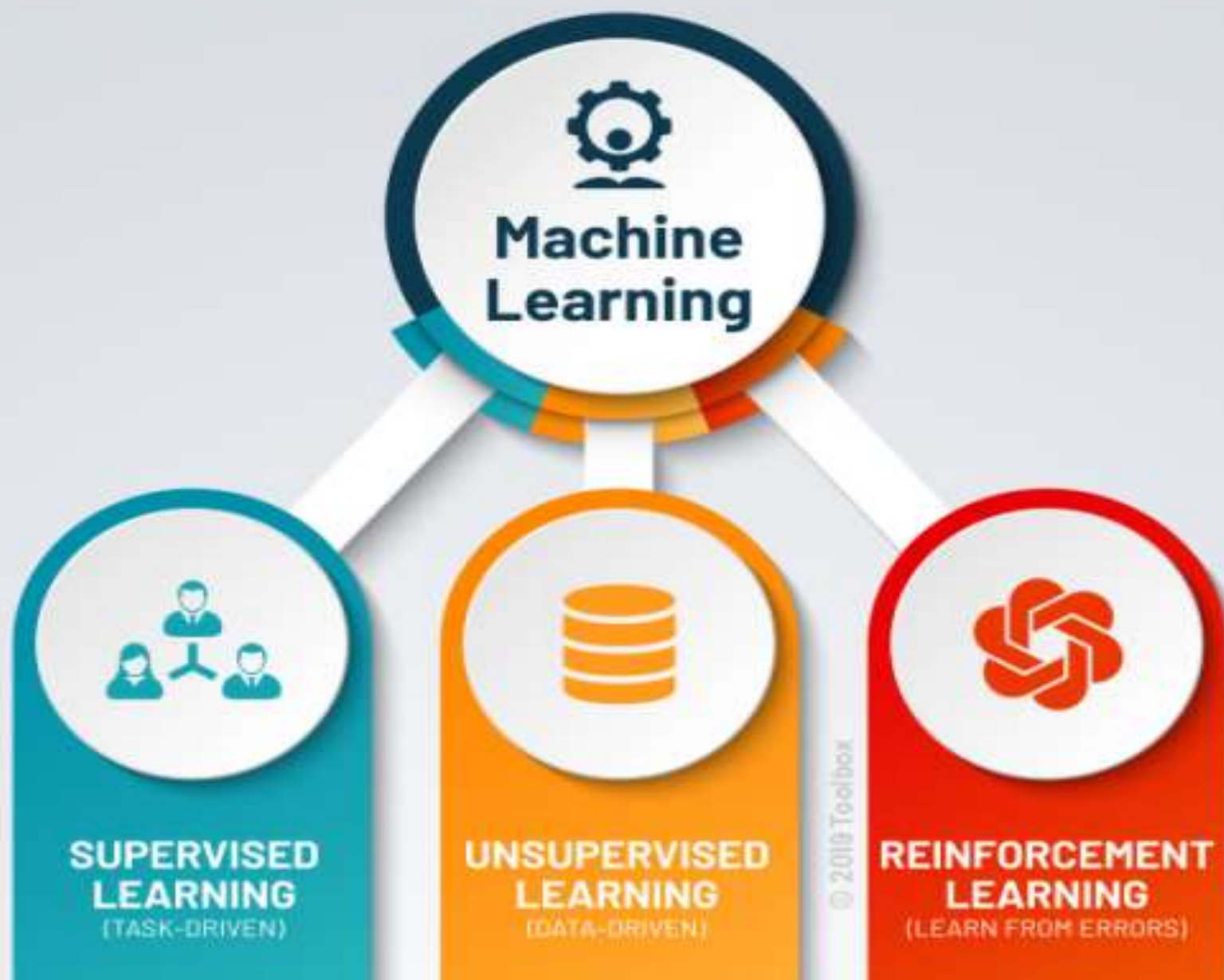
## **8. Highly Expensive**

This software is highly expensive, and not everybody can own it. Government agencies, big private firms, and enterprises mostly own it. It needs to be made accessible to everybody for wide use.



# **TYPES OF MACHINE LEARNING**

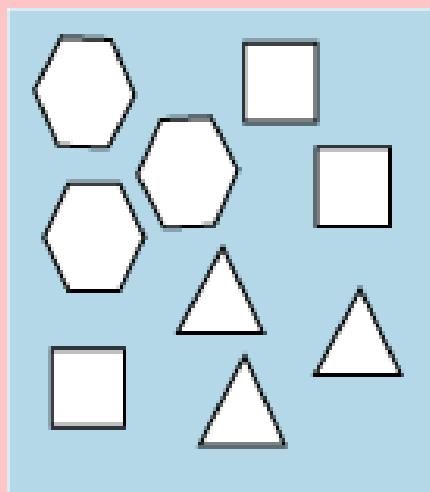
# TYPES OF MACHINE LEARNING



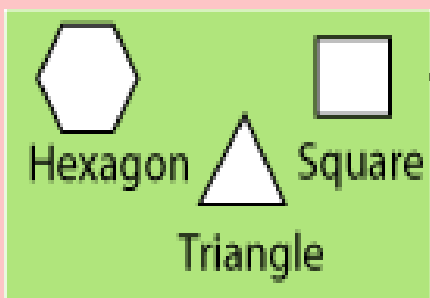
# • *Supervised Learning*

- As the name suggests, supervised machine learning is based on supervision.
- In the supervised learning technique, we train the machines using the labeled 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.
- It is a process of providing input data as well as correct output data to the machine learning model.

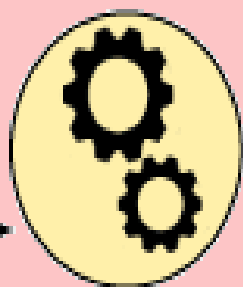
Labeled Data



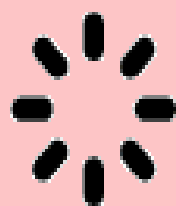
Lables



Model Training



Prediction



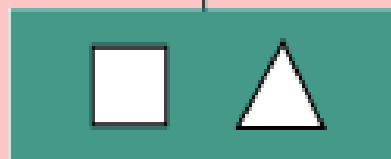
Square



Triangle

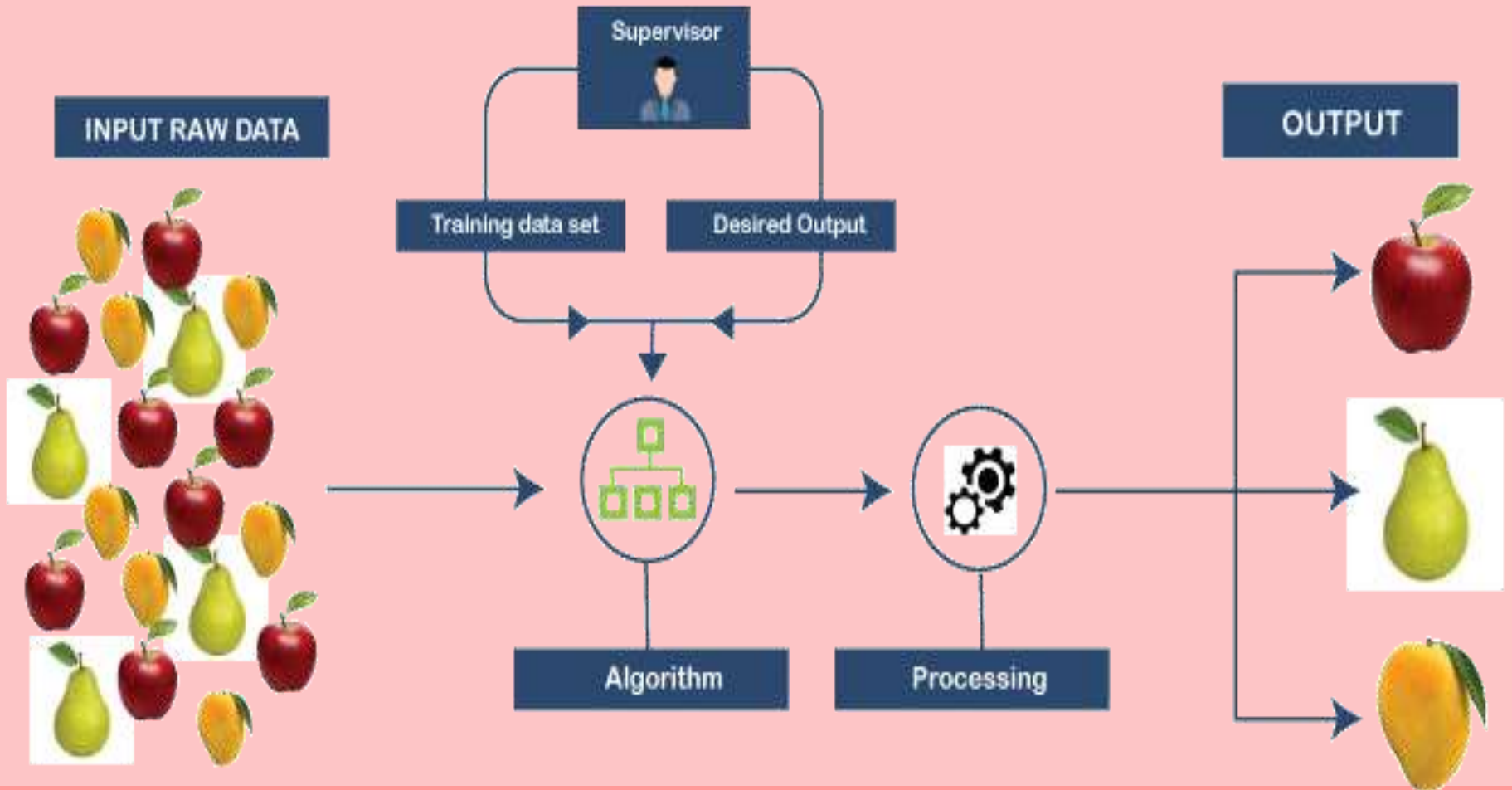


Test Data



- 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.

# SUPERVISED LEARNING



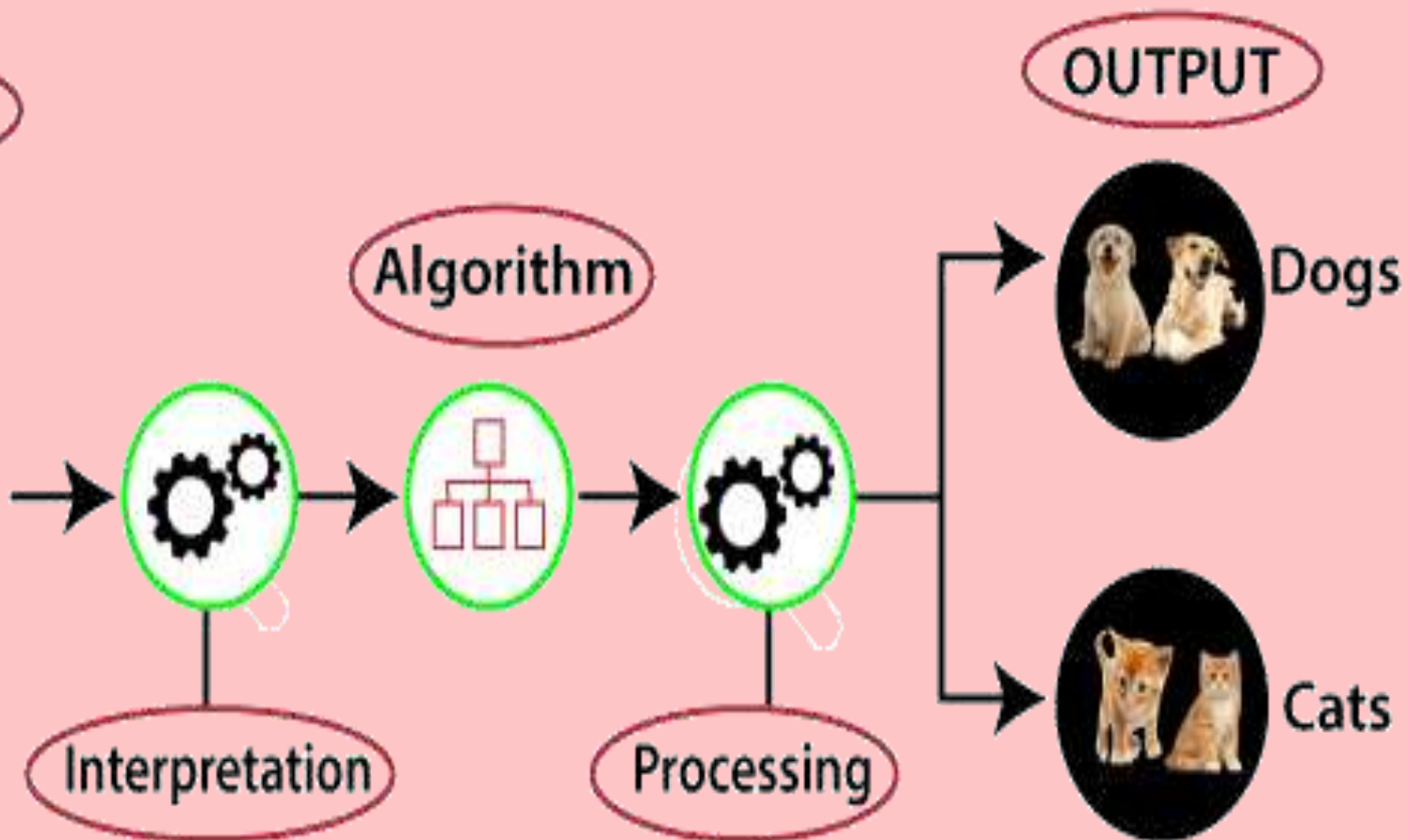
# • *Unsupervised Learning*

- 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.

INPUT RAW DATA



Unlabeled data



# *APPLICATIONS OF MACHINE LEARNING*

# 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.

# 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.

# 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.

# 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.

# 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.

# 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.,

# 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.,

# 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.

# 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.

# 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.

# 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.



## **ARTIFICIAL INTELLIGENCE**

A program that can sense, reason, act and adapt.

## **MACHINE LEARNING**

Algorithms whose performance improve as they are exposed to more data over time

## **DEEP LEARNING**

Subset of machine learning in which multilayered neural networks learn from vast amount of data

# *TYPES OF DEEP 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.



**DATABASE**  
**MANAGEMENT**  
**FOR DATA**  
**SCIENCE, BIG**  
**DATA ANALYTICS**

## Data

- Data can be defined as a representation of facts, concepts.
- 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.

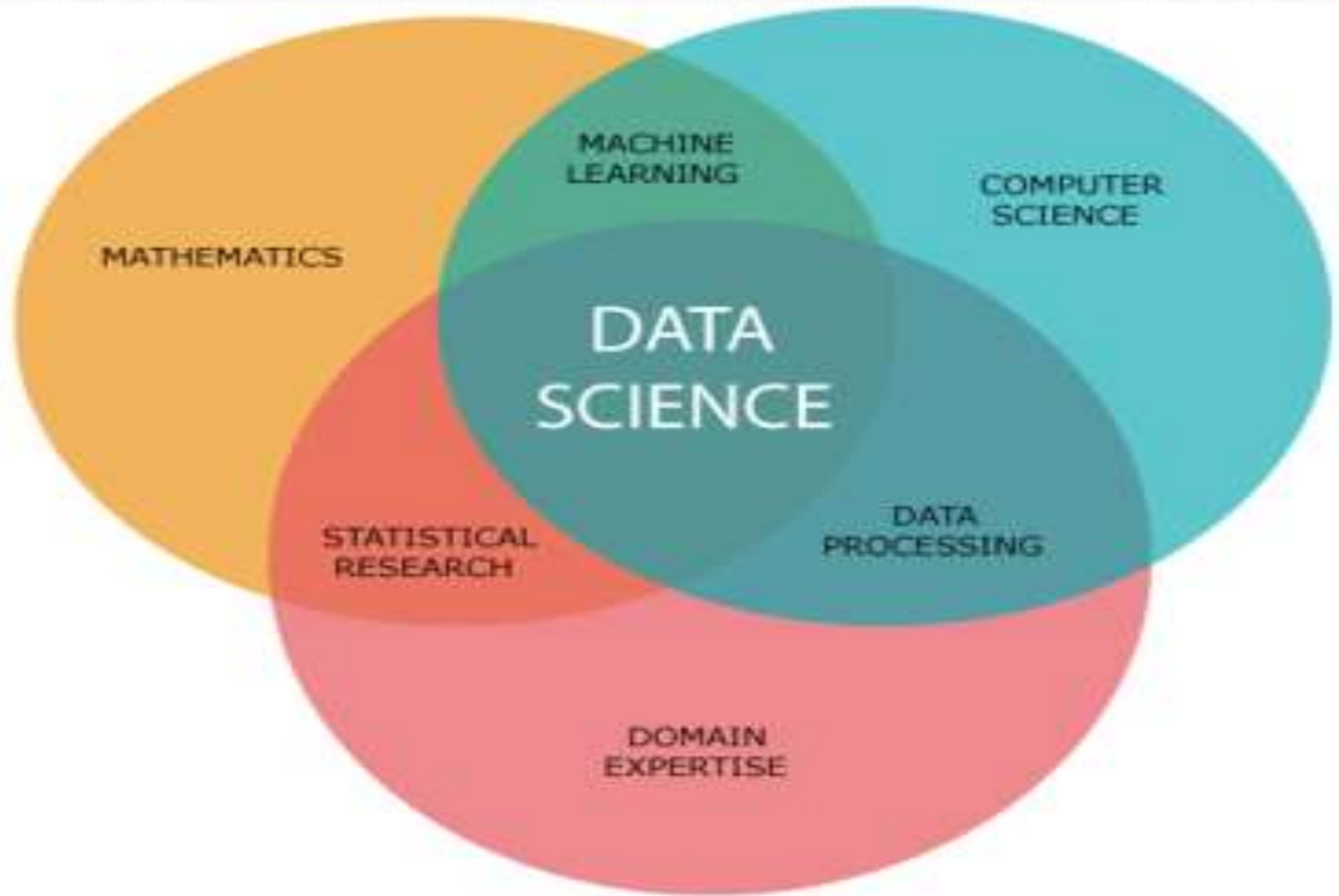
## Database Management

- 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.

## Data science


- It is an 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.

# COMPONENTS OF DATA SCIENCE





# **APPLICATIONS OF** **DATA SCIENCE**

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

## **DATABASE MANAGEMENT FOR DATA SCIENCE**

- Data processing and management tools like RDBMS and NoSQL for processing large volumes of data.
- Scripting languages like Python for quickly writing programs to clean and transform messy raw data.
- Basic machine learning and data mining algorithms for analysing the data.
- Statistical computing environments for writing analysis scripts.
- Visualization tools for presentation and communication of analysis scripts.



# **BIGDATA ANALYTICS**

# Big data - definition

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.

# *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.



**APPLICATIONS OF BIG DATA**  
**ANALYTICS**

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



# Internet of Things

- 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.
- 
- 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.
- 
- The difference between the Internet of Things and Internet is that Internet of Things can create information about the connected objects, analyze it and make decisions.
  - Security cameras, sensors, vehicles, buildings and software are examples of that can exchange data among each other.

# 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.


# 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.

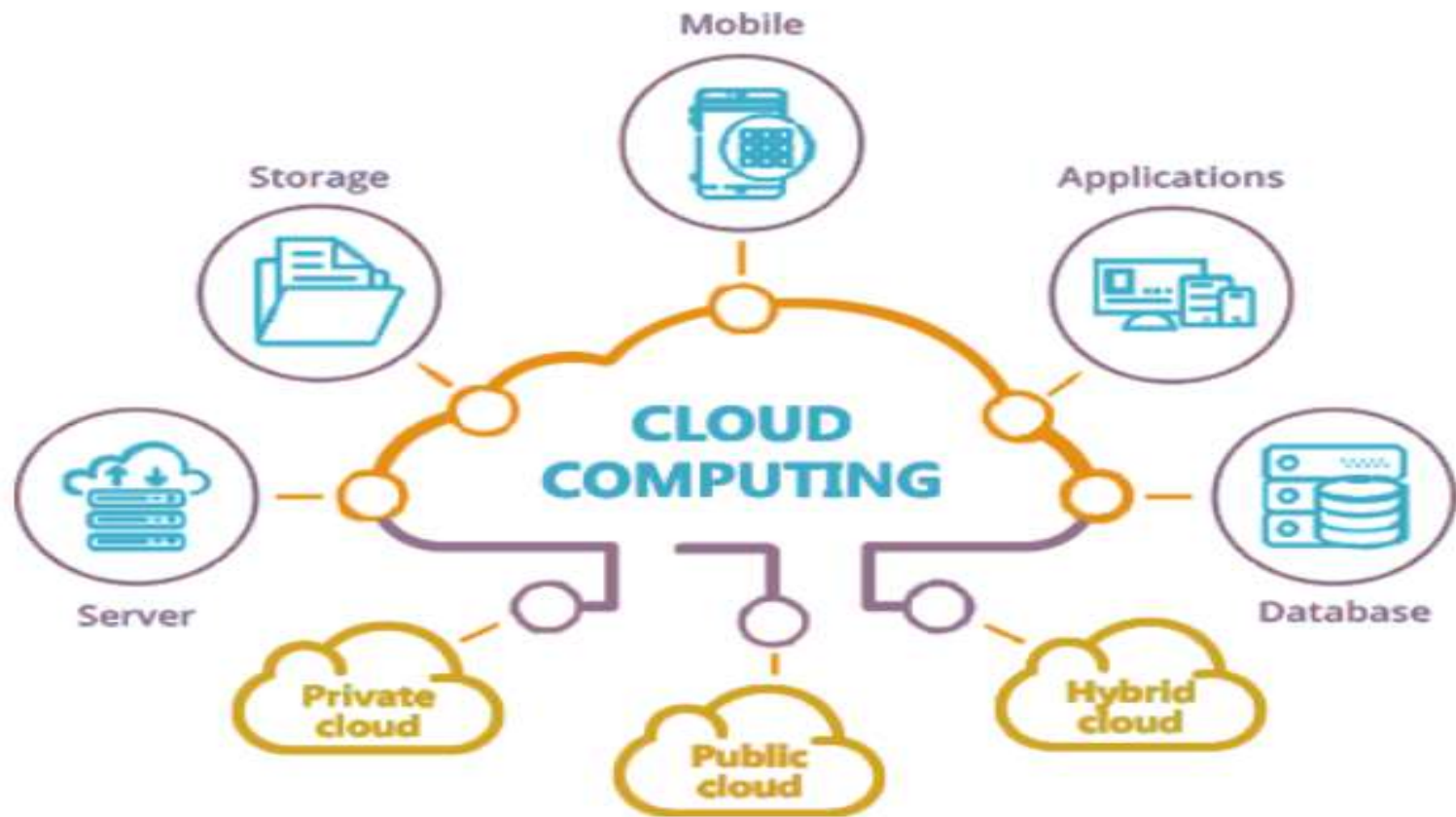
It refers to the interconnected sensors, controllers and other devices networked together in an industrial setting.

It allows for data collection, exchange and analysis of different data sources.



# Cloud Computing

- 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*

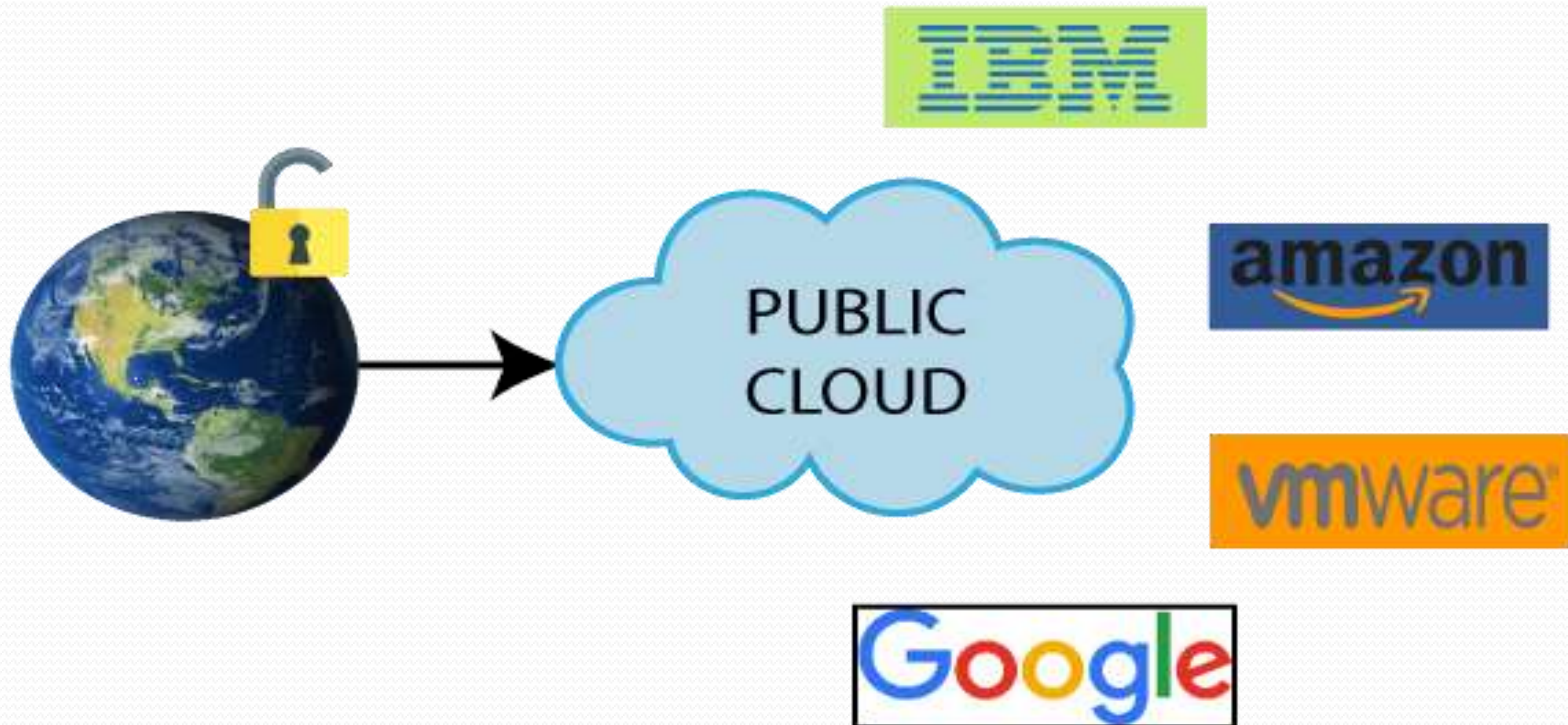
- Test and build applications
- Store data
- Back up data
- Recover data
- Analyze data
- Stream audio and video

# How cloud computing works?

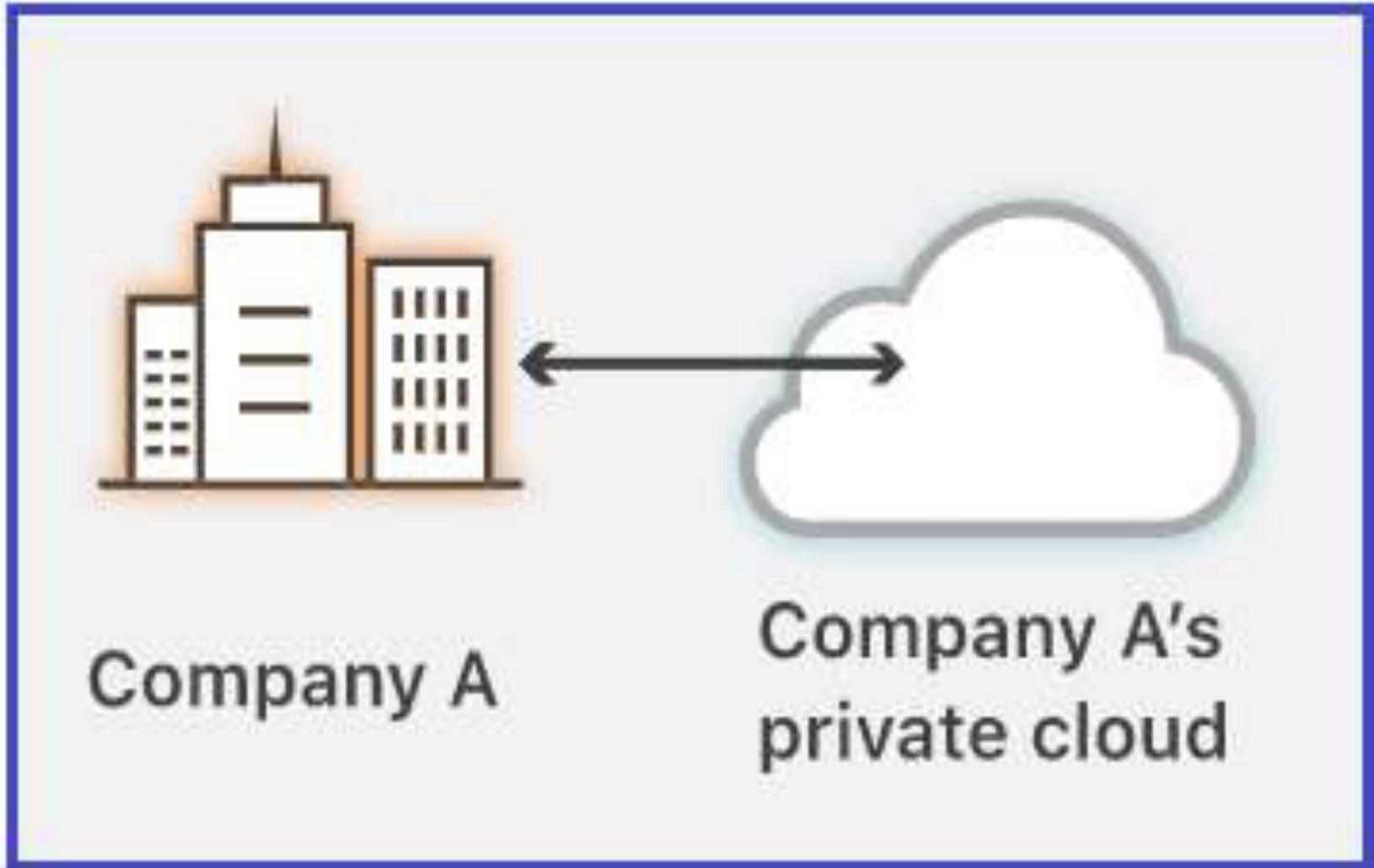
- It works by providing permission to the user to upload and download the information which stores.
- A user will get the initial amount of storage at a very low price.
- Data can access from anywhere.
- Cloud computing can be divided into two systems: front end and back end.
- These two ends are connected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

# Models of cloud computing

□ 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.



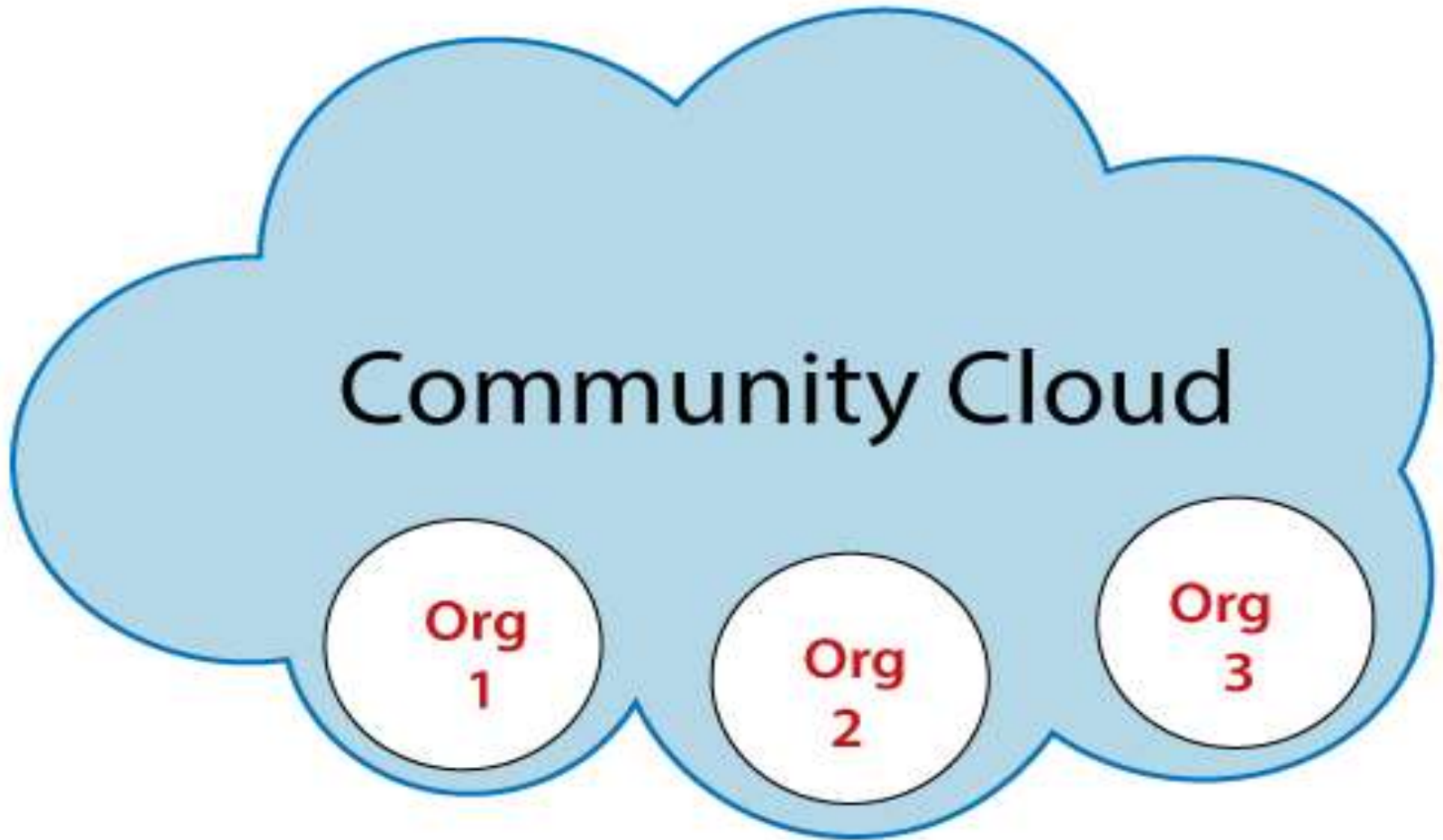
❑ **Community cloud**: it allows the systems and services to be accessible by a group of organizations.

# Community Cloud

Org  
1

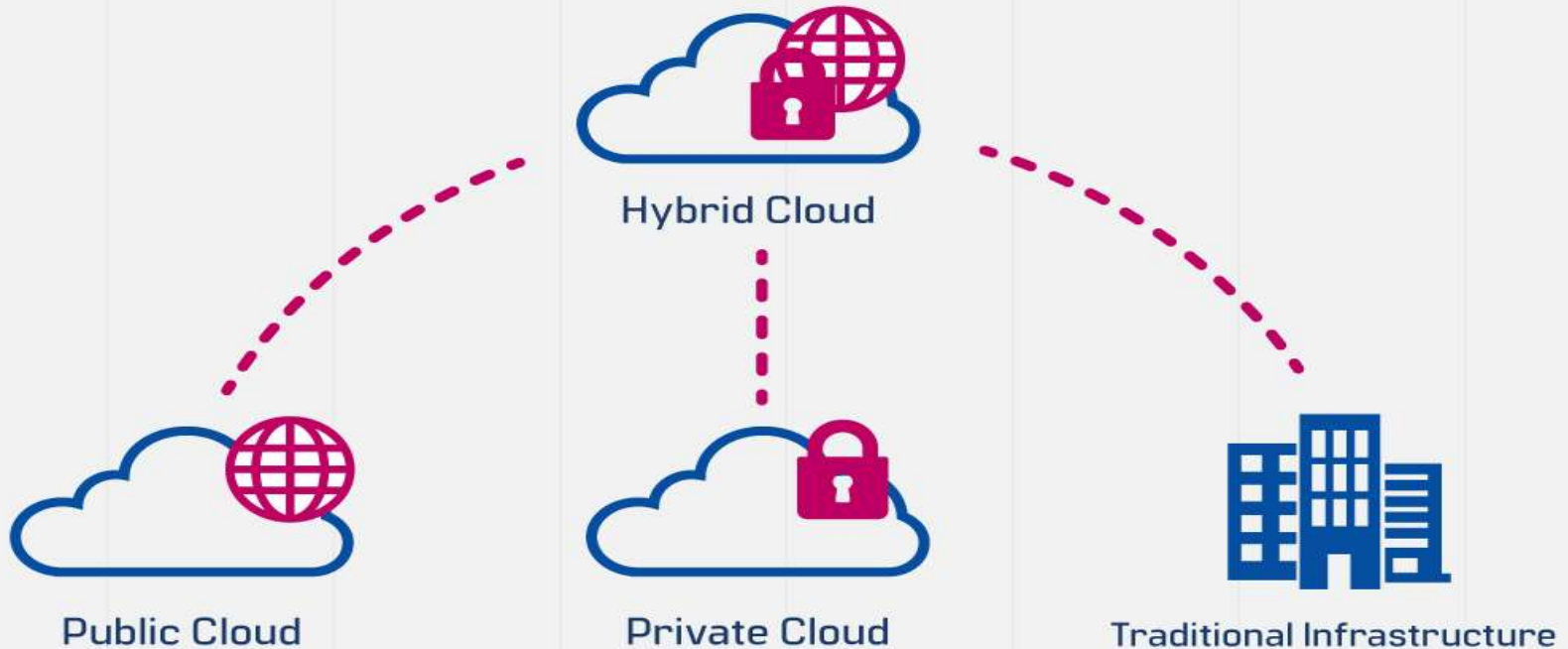
Org  
2

Org  
3



□ Hybrid cloud: it is mixture of public and private cloud.


## HYBRID CLOUD





# *Applications of Cloud Computing*

- Storing file online
- Video making and editing software
- File converters
- Anti virus 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)

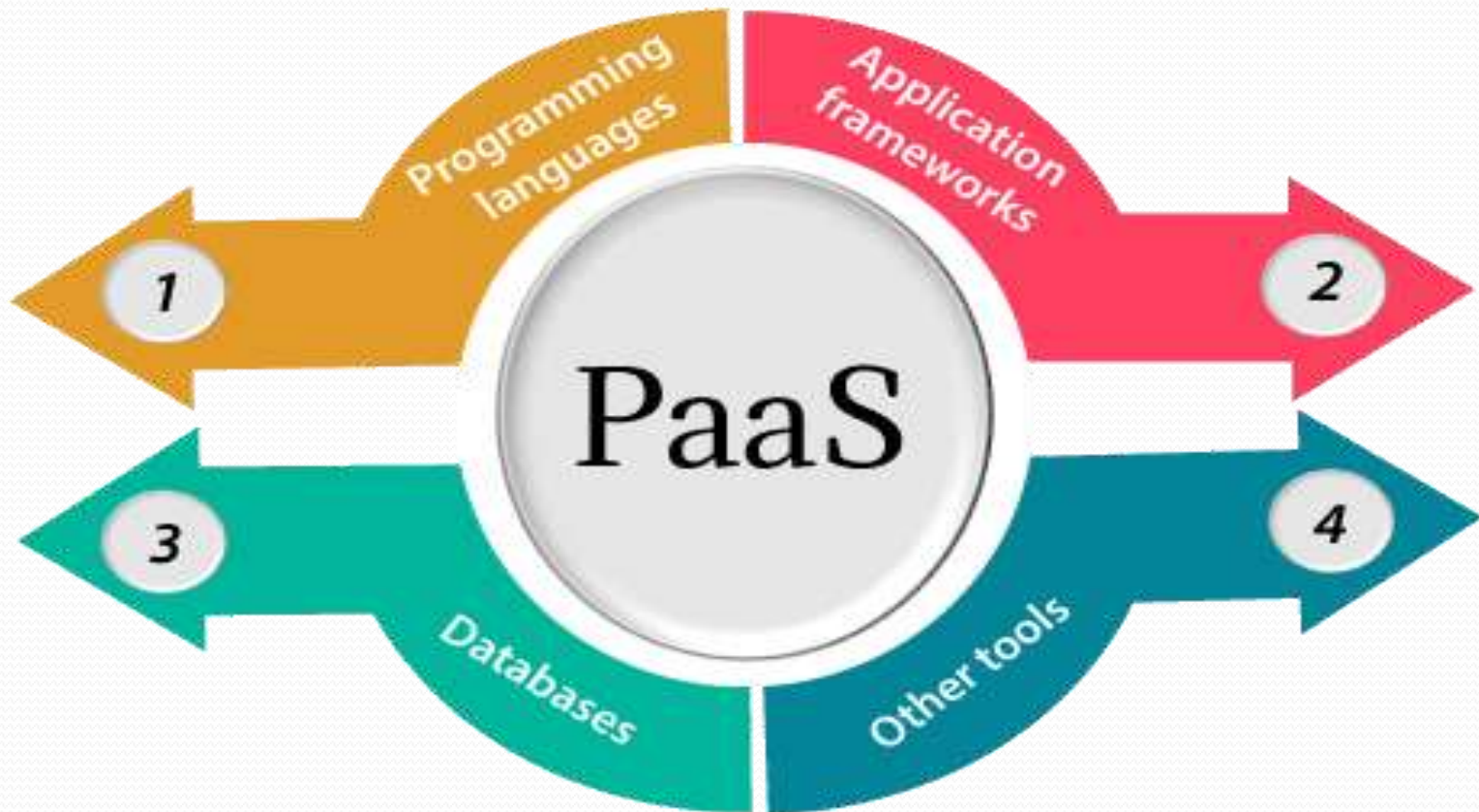
## □ Infrastructure as a Service (IaaS)

- 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.



## □ 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.




## 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.



IaaS	PaaS	SaaS
It provides a virtual data centre to store information and create platforms for app development, testing and deployment.	It provides virtual platforms and tools to create, test and deploy apps.	It provides web software and apps to complete business tasks.
It provides access to resources such as virtual machines, virtual storage, etc.	It provides runtime environments and deployment tools for applications.	It provides software as a service to the end users.
It is used by network architects.	It is used by developers.	It is used by end users.
Provides only infrastructure.	Provides infrastructure and platform.	Provides infrastructure, platform and software.



# *Cyber Security and Types of Cyber Attack*

# Cyber Security

- 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.

# 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 attacks

- Malware
- Phishing
- Man-in-the-middle (MITM) attack
- Distributed Denial of Service (DDoS)
- Brute Force
- SQL Injection (SQLI)

## ❑ Malware

- It means malicious software.
- It is the most common cyber attacking tool.
- It is used by cyber criminals or hackers to disrupt or damage a legitimate users system.
- The different types are as follows,
  - ✓ Virus
  - ✓ Trojans
  - ✓ Worms
  - ✓ Botnets
  - ✓ Spyware
  - ✓ Ransomware
  - ✓ adware

## □ Phishing

- It is a type of cyber crime in which a sender seems to come from a genuine organization like PayPal, eBay, friends, co-workers, etc.
- They contact the target/targets via e-mails, phone, text message, etc.
- Normally with a link to persuade them to click on that links.
- This link will redirect them to fraudulent websites to provide sensitive data such as personal information, banking and credit card information, etc.
- Clicking on such links will automatically install malware on the target devices that allows the hackers to control devices remotely.

## **□ Man-in-the-middle**

- It is a type of cyber attack in which a cyber criminal intercepts a conversation or data transfer between two individuals.
- The main objective is to gain access to business data.

## **□ Distributed denial of service**

- It is a type of attack where cyber criminals disrupt targeted servers, services or networks regular traffic by fulfilling requests to the target.
- The request will come from several IP addresses.
- It will slow down the system, overload the servers, prevent the organization from carrying out its vital functions.

## ❑ Brute force

- It is a cryptographic hack that uses a trial-and-error method to guess all the possible combinations until the correct information is discovered.
- Data such as login information, PINs, etc are hacked in this method.

## ❑ SQL Injection

- It is a common attack that occurs when cyber criminals use the malicious SQL scripts for backend database manipulation to access sensitive information.
- Once the attack is successful, it can view, change or delete the data in the SQL database.



**KOSHYS**

INSTITUTE OF MANAGEMENT STUDIES

# **DIGITAL FLUENCY**

## **Module 3:**

### **Building Essential Skills Beyond Technology**

By Prof. AKSHATHA S



# CONTENT

- Effective Communication Skills
- Creative Problem Solving & Critical Thinking
- Collaboration and Teamwork Skills
- Innovation & Design Thinking
- Use of tools in enhancing skills

# Effective Communication Skills

- Effective communication is a process of exchanging information, ideas, thoughts, and feelings in a way that is clear, concise, and easily understood by the intended audience. It involves both verbal and non-verbal cues and is crucial in various aspects of life, including personal relationships, the workplace, education, and beyond.

- Communication takes various forms, and individuals often engage in different modes of communication depending on the context and the nature of the message. Here's an overview of the four primary types of communication:
- Verbal communication
- Non-verbal communication
- Written communication
- Visual communication

- **Verbal Communication:**
- **Definition:** Verbal communication involves the use of spoken or written words to convey a message. It includes face-to-face conversations, phone calls, video calls, and any communication that utilizes language.
- **Characteristics:**
  - Direct exchange of information through spoken or written words.
  - Tone of voice, pitch, and emphasis contribute to the message.
  - Allows for immediate feedback and clarification.

- **Non-Verbal Communication:**
- **Definition:** Non-verbal communication involves transmitting messages without the use of words. It includes body language, facial expressions, gestures, posture, and other non-verbal cues.
- **Characteristics:**
  - Conveys emotions, attitudes, and feelings.
  - Can complement or contradict verbal messages.
  - Often more subconscious and spontaneous than verbal communication.

- **Written Communication:**
- **Definition:** Written communication involves conveying information through written words. It includes emails, letters, reports, memos, and any form of written documentation.
- **Characteristics:**
  - Allows for careful crafting and editing of messages.
  - Provides a permanent record of information.
  - Can be used for complex or detailed explanations.

- **Visual Communication:**
- **Definition:** Visual communication uses visual elements, such as images, charts, graphs, diagrams, and videos, to convey information. It complements verbal or written messages to enhance understanding.
- **Characteristics:**
  - Appeals to the sense of sight.
  - Aids in simplifying complex information.
  - Enhances engagement and retention.

## **Key characteristics of effective communication include:**

- **Clarity:**

- The message should be clear and easy to understand. Ambiguity and confusion can lead to misunderstandings.

- **Conciseness:**

- Communicate the message in a concise manner, avoiding unnecessary details. Brevity helps maintain the listener's attention and prevents information overload.

- **Active Listening:**

- Effective communication is a two-way street. Listening attentively to others demonstrates respect and understanding. It also helps in responding appropriately.

- **Feedback:**

- Encouraging and providing feedback ensures that the message has been accurately received and understood. It allows for clarification and adjustments if needed.

- **Non-Verbal Communication:**

- Non-verbal cues, such as body language, facial expressions, and gestures, play a significant role in communication. Aligning non-verbal cues with verbal messages enhances the overall effectiveness.

- **Empathy:**

- Understanding and acknowledging the emotions and perspectives of others contributes to empathetic communication. It fosters a sense of connection and trust.

- **Openness:**

- Open communication involves being transparent and honest. Sharing relevant information and being receptive to others' ideas and feedback creates an atmosphere of trust.

- **Respect:**

- Respectful communication involves recognizing the dignity and worth of others. It includes avoiding offensive language, active listening, and valuing diverse perspectives.

- **Adaptability:**

- Effective communicators can adapt their communication style to different audiences and situations. Flexibility is key in ensuring the message resonates with diverse individuals.

- **Consistency:**

- Consistent messaging helps in building trust. When messages align with actions, it enhances credibility and reliability.

- **Tone:**

- The tone of communication influences how a message is received. A positive and respectful tone fosters a more constructive and collaborative atmosphere.

- **Timing:**

- Communicating at the right time is essential. Timing can impact the effectiveness of a message and its reception.

- **Constructiveness:**

- Constructive communication focuses on finding solutions and working collaboratively. It avoids blame and promotes a positive and solution-oriented approach.

# 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

# PROBLEM SOLVING



problem



thinking



solution

# Creative Problem Solving

- Creative Problem Solving (CPS) involves breaking down a problem to understand it, generating ideas to solve the problem and evaluating those ideas to find the most effective solutions.
- **Key Elements:**
- **Divergent Thinking:** Generating a wide variety of possible solutions or ideas.
- **Convergent Thinking:** Analyzing and evaluating potential solutions to find the most effective one.
- **Flexibility:** Being open to different perspectives and adapting to changing circumstances.
- **Originality:** Developing novel and unique solutions.

- **Process of Creative Problem Solving:**
- **Identify the Problem:** Clearly define the issue or challenge.
- **Generate Ideas:** Brainstorm and come up with as many ideas as possible.
- **Evaluate Ideas:** Assess the strengths and weaknesses of each idea.
- **Implement Solutions:** Put the chosen solution into action.
- **Reflect:** Assess the outcomes and learn from the experience.

## **Some key techniques for fostering creative problem-solving include:**

- **Brainstorming:** Encourage free-flowing idea generation without judgment or limitations.
- **Mind Mapping:** Visually represent ideas and connections to encourage creative associations and organization of thoughts.
- **SCAMPER Technique:** Modify existing ideas or solutions by applying actions such as Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, or Reverse.
- **Lateral Thinking:** Generate unconventional ideas by exploring alternative approaches and questioning traditional assumptions.

# Critical Thinking

- Critical thinking involves analyzing, synthesizing, and evaluating information or situations. It's about actively and objectively assessing information rather than accepting it at face value.
- **Key Elements:**
- **Analysis:** Breaking down information into its components.
- **Evaluation:** Assessing the credibility and relevance of information.
- **Inference:** Drawing logical conclusions based on available information.
- **Problem Solving:** Applying critical thinking to address complex issues.

- **Process of Critical Thinking:**
- **Identify the Problem:** Clearly define the issue or question.
- **Gather Information:** Collect relevant data and sources.
- **Evaluate Information:** Assess the quality and reliability of the information.
- **Draw Conclusions:** Make logical inferences based on the analysis.
- **Communicate and Reflect:** Express findings clearly and reflect on the thinking process.



# Innovation:

- **Definition:** Innovation refers to the process of creating and implementing new ideas, products, services, or processes that bring about positive change. It involves transforming creative concepts into practical solutions that add value to individuals, organizations, or society as a whole.

## **Key Elements of Innovation:**

- **Creativity:** The generation of novel and valuable ideas.
- **Implementation:** Turning ideas into tangible products, services, or processes.
- **Adaptability:** The ability to respond to change and evolving needs.
- **Value Creation:** Delivering solutions that address specific needs or problems.

## **Types of Innovation:**

- **Product Innovation:** Creating new or improved products.
- **Process Innovation:** Improving operational processes.
- **Service Innovation:** Developing new or enhanced services.
- **Business Model Innovation:** Changing the way a business operates.

# Innovation Process:

- **Idea Generation:** Encouraging the creation of diverse and creative ideas.
- **Idea Selection:** Evaluating and selecting the most promising ideas.
- **Development:** Turning selected ideas into prototypes or plans.
- **Testing and Feedback:** Assessing prototypes and gathering feedback.
- **Implementation:** Bringing the innovation to market.

# Design Thinking:

- Design thinking is a human-centered approach to problem-solving and innovation. It places a strong emphasis on understanding the needs and perspectives of end-users, fostering empathy, and iteratively developing solutions.

- **Key Elements of Design Thinking:**
- **Empathy:** Understanding and appreciating the user's perspective.
- **Definition:** Clearly defining the problem to be solved.
- **Ideation:** Generating a wide range of possible solutions.
- **Prototyping:** Creating tangible representations of ideas.
- **Testing:** Gathering feedback through testing and iteration.

- **Design Thinking Process:**
- **Empathize:** Understand the needs and challenges of the user.
- **Define:** Clearly articulate the problem to be solved.
- **Ideate:** Generate a multitude of possible solutions.
- **Prototype:** Build simple representations of ideas.
- **Test:** Gather feedback and refine the solutions.

# Use of tools in enhancing skills

- The use of tools can significantly enhance skills in various domains by providing additional support, automation, and resources. Here are some ways in which tools can contribute to skill enhancement:
- **Learning Management Systems (LMS) and Online Courses:**
  - Platforms like Coursera, edX, and Khan Academy provide access to a wide range of online courses. These tools allow individuals to acquire new knowledge and skills at their own pace.
- **Collaboration Tools:**
  - Collaboration platforms such as Slack, Microsoft Teams, or Asana facilitate effective communication and coordination among team members. These tools improve teamwork, project management, and organizational skills.

- **Digital Note-Taking Apps:**

- Apps like Evernote, OneNote, or Notion help individuals organize and consolidate their notes. These tools can enhance information retention, critical thinking, and the ability to synthesize ideas.

- **Language Learning Apps:**

- Apps like Duolingo, Babbel, or Rosetta Stone assist individuals in learning new languages. These tools provide interactive exercises, pronunciation practice, and vocabulary building.

- **Virtual Reality (VR) and Augmented Reality (AR):**

- VR and AR tools are increasingly used for immersive training experiences. They can enhance skills in fields such as healthcare, aviation, and manufacturing by providing realistic simulations and hands-on practice.

- **Data Analytics Tools:**

- Tools like Tableau, Excel, or Google Analytics assist in data analysis and visualization. Proficiency in these tools can enhance skills in data interpretation, decision-making, and strategic planning.

- **Time Management Apps:**

- Apps like RescueTime or Toggl assist in tracking time spent on tasks. These tools can improve time management skills and help individuals identify areas for productivity improvement.

- **Coding Platforms:**

- Platforms like GitHub, Codecademy, and HackerRank provide coding challenges, collaborative coding environments, and opportunities to contribute to open-source projects. These tools can enhance programming and problem-solving skills.

# Collaboration Skills

- Collaboration skills are the capacity to work effectively with other staff members to achieve a common goal. This involves soft skills such as communication skills, problem-solving, and team-building. The best collaboration skills are essential in any collaborative environment, as they allow for more efficient and effective work.
- Collaborative skills are not individual skills but rather groups of different soft skills which enable collaboration and teamwork

# Skills for Collaboration

- **Communication:**

- Effective collaboration starts with clear and open communication. This involves expressing ideas clearly, actively listening to others, and providing constructive feedback.

- **Active Listening:**

- Actively listening to others demonstrates respect and ensures a full understanding of ideas, concerns, and perspectives. It helps in building trust and fostering open communication.

- **Emotional Intelligence (EQ)**

- Emotional intelligence, or EQ, is vital for success in the modern workplace. Individuals with high EQ can navigate difficult conversations, manage conflict effectively, and build strong relationships with their coworkers.

- **Task Delegation:**

- Collaboration often requires dividing tasks based on individual strengths and expertise. Knowing how to delegate responsibilities ensures that everyone can contribute meaningfully to the collaboration.

- **Shared Goals and Vision:**

- Successful collaboration hinges on aligning on common goals and a shared vision. This creates a sense of purpose and unity, motivating individuals to work together towards a common objective.

- **Trust Building:**

- Building trust is fundamental for effective collaboration. Trust allows collaborators to feel comfortable sharing ideas, taking risks, and relying on each other to fulfill their respective roles.

# Teamwork skills

- Teamwork skills are essential for individuals working collaboratively in a group or team setting. These skills contribute to a positive and productive working environment, fostering effective communication, cooperation, and collective achievement.

# Skills for teamwork

- **Communication:**

- Clear and open communication is fundamental for successful teamwork. This involves expressing ideas clearly, actively listening to team members, and providing feedback.

- **Active Listening:**

- Actively listening to others demonstrates respect and ensures a thorough understanding of ideas, concerns, and perspectives within the team.

- **Collaboration:**

- The ability to work collaboratively involves actively contributing to team discussions, sharing ideas, and supporting team goals. Collaborators understand that collective success is the priority.

- **Conflict Resolution:**

- Teams may encounter conflicts, and effective teamwork skills include the ability to address conflicts constructively, find common ground, and work towards mutually beneficial solutions.

- **Flexibility:**

- Being adaptable and open to change is important in a team setting. Team members should be willing to adjust their approaches, consider alternative ideas, and embrace change for the benefit of the team.

- **Respect for Diversity:**

- Appreciating and valuing diversity in skills, backgrounds, and perspectives enhances teamwork. Teams are stronger when they leverage the unique strengths and insights of each member.

- **Task Delegation:**

- Knowing how to delegate tasks based on individual strengths ensures that each team member can contribute effectively to the team's success.

- **Shared Goals and Vision:**

- Successful teams align on common goals and a shared vision. This creates a sense of purpose and unity, motivating team members to work together towards a common objective.

- **Trust Building:**

- Building trust within a team is crucial for effective collaboration. Trust allows team members to feel comfortable sharing ideas, taking risks, and relying on each other to fulfill their respective roles.



# Thank You.

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