CS-37 Machine Learning with Python

Unit– 01 Introduction to Machine Learning

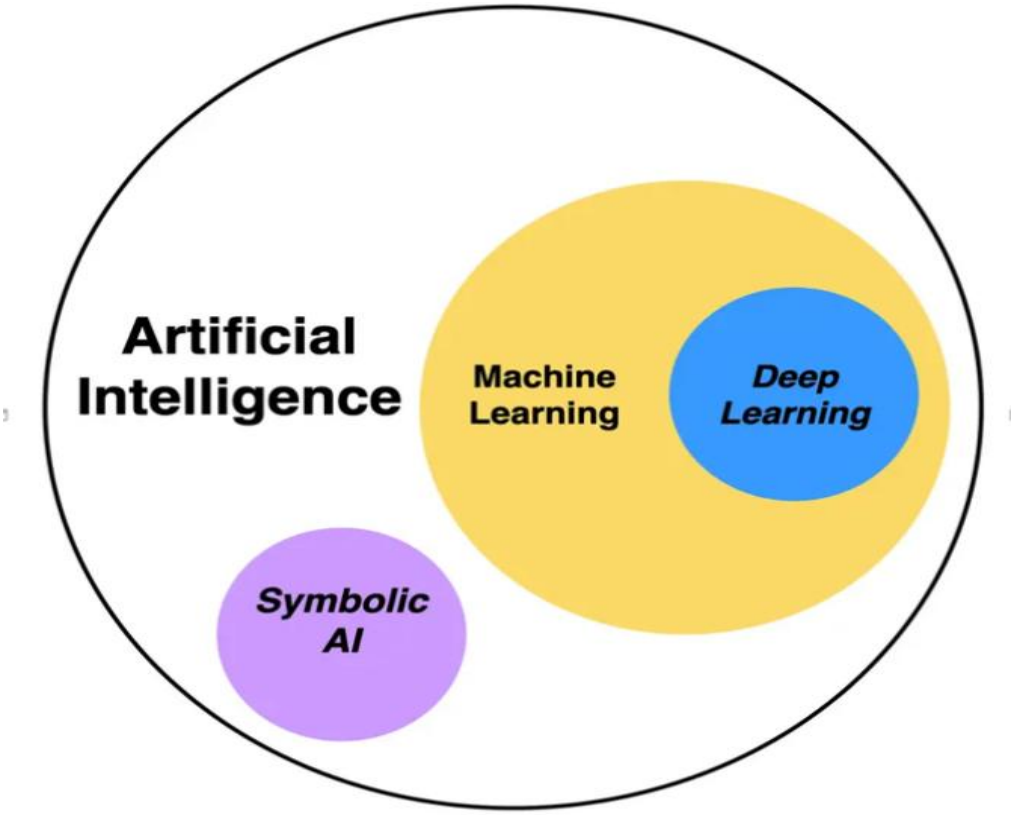
- Introduction to Machine Learning (ML)
- Relation of ML with AI and DL
- Defining Machine Learning
- How Machines learn?
- Types of machine learning:
  - 1. Supervised learning
  - 2. Unsupervised learning
  - 3. Reinforcement learning
- Applications of Machine Learning

1.1 Introduction to Machine Learning

- Machine Learning is making the computer learn from studying data and statistics.
- Machine Learning is a step into the direction of artificial intelligence (AI).
- Machine Learning is a program that analyses data and learns to predict the outcome.
- Eg. Chatbot

  Email automation & Spam filtering.

1.2 Relation of ML with AI and DL



1.2 Relation of ML with AI and DL

- **Artificial Intelligence:**

Artificial Intelligence, or AI, is the result of our efforts to automate tasks normally performed by humans, such as image pattern recognition, document classification, or a computerized chess rival.

Example:

Face Recognition

Smart Cars

Digital Assistants

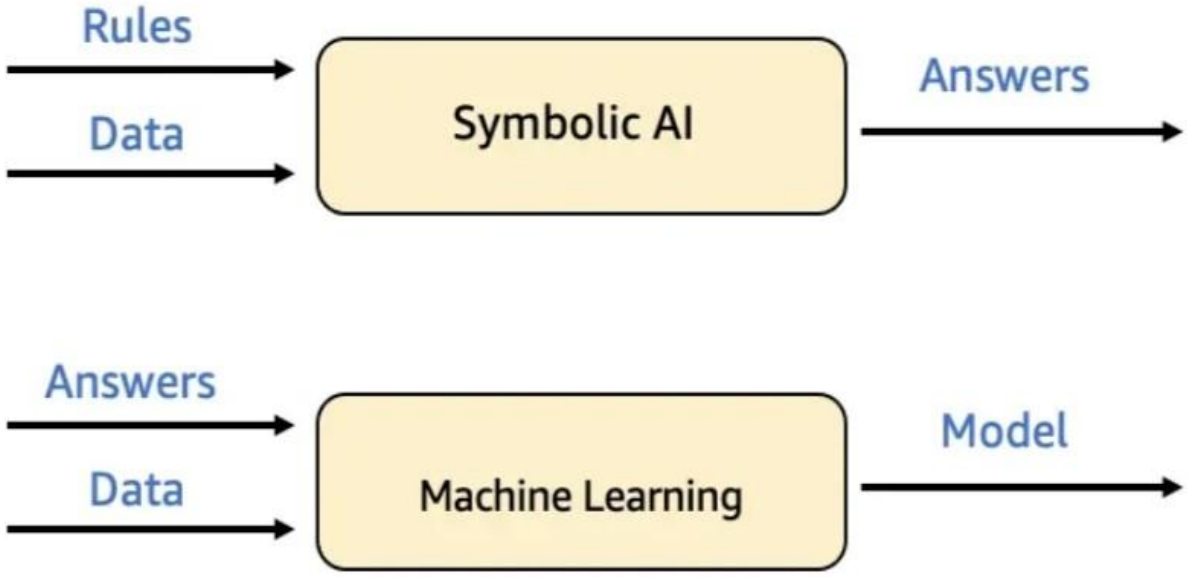
Entertainments & Social Apps

Google predictive search algorithm etc.

▪ Machine Learning:

✓ Machine Learning, or ML, focuses on the creation of systems or models that can learn from data and improve their performance in specific tasks, without the need to be explicitly programmed, making them learn from past experiences or examples to make decisions on new data.

✓ This differs from traditional programming, where human programmers write rules in code, transforming the input data into desired results.



▪ Deep Learning:

✓ Deep Learning is an ML technique that uses deep neural networks to learn from data.

✓ A neural network is a type of machine learning model made up of many layers of interconnected nodes that adjust as they are exposed to data.

Example:

Speed Detection

Automatic Text Generation

Game Playing (Chess)

Language Translation

Artificial Intelligence Vs Machine Learning

Artificial Intelligence	Machine Learning
1. AI stands for Artificial intelligence, where intelligence is defined as the ability to acquire and apply knowledge.	1. ML stands for Machine Learning which is defined as the acquisition of knowledge or skill
2. The aim is to increase the chance of success and not accuracy.	2. The aim is to increase accuracy, but it does not care about; the success.
3. It works as a computer program that does smart work.	3. Here, the tasks systems machine takes data and learns from data.
4. AI is decision-making.	4. ML allows systems to learn new things from data.
5. It is developing a system that mimics humans to solve problems.	5. It involves creating self-learning algorithms.
6. AI is a broader family consisting of ML and DL as its components.	6. ML is a subset of AI.
7. Three broad categories of AI are : a. Artificial Narrow Intelligence (ANI) b. Artificial General Intelligence (AGI) c. Artificial Super Intelligence (ASI)	7. Three broad categories of ML are : a. Supervised Learning b. Unsupervised Learning c. Reinforcement Learning

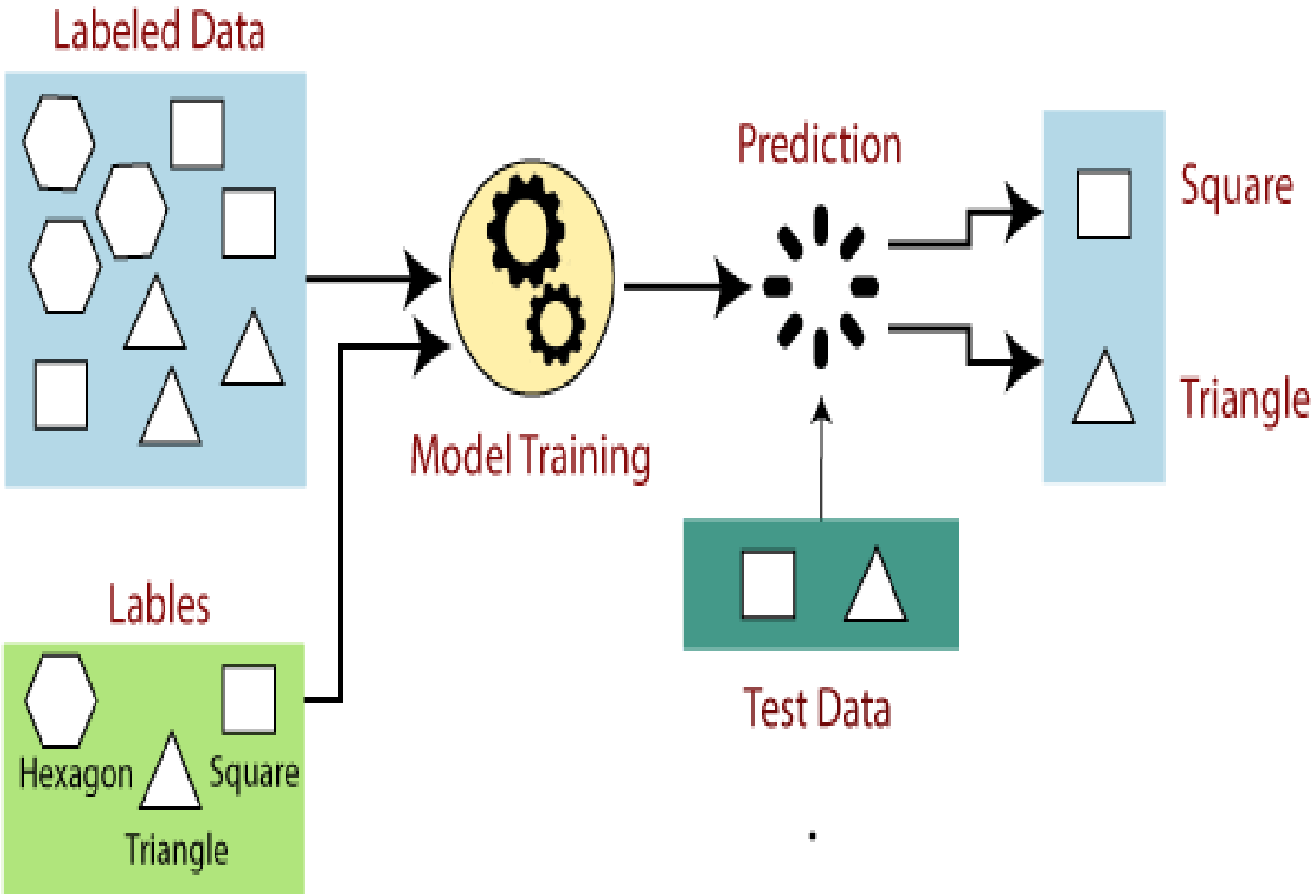
Machine Learning Vs. Deep Learning

Machine Learning	Deep Learning
1. Apply statistical algorithms to learn the hidden patterns and relationships in the dataset.	1. Uses artificial neural network architecture to learn the hidden patterns and relationships in the dataset.
2. Can work on the smaller amount of dataset.	2. Requires the larger volume of dataset compared to machine learning.
3. Takes less time to train the model.	3. Takes more time to train the model.
4. Less complex and easy to interpret the result.	4. More complex, it works like the black box interpretations of the result are not easy.
5. It can work on the CPU or requires less computing power as compared to deep learning.	5. It requires a high-performance computer with GPU.

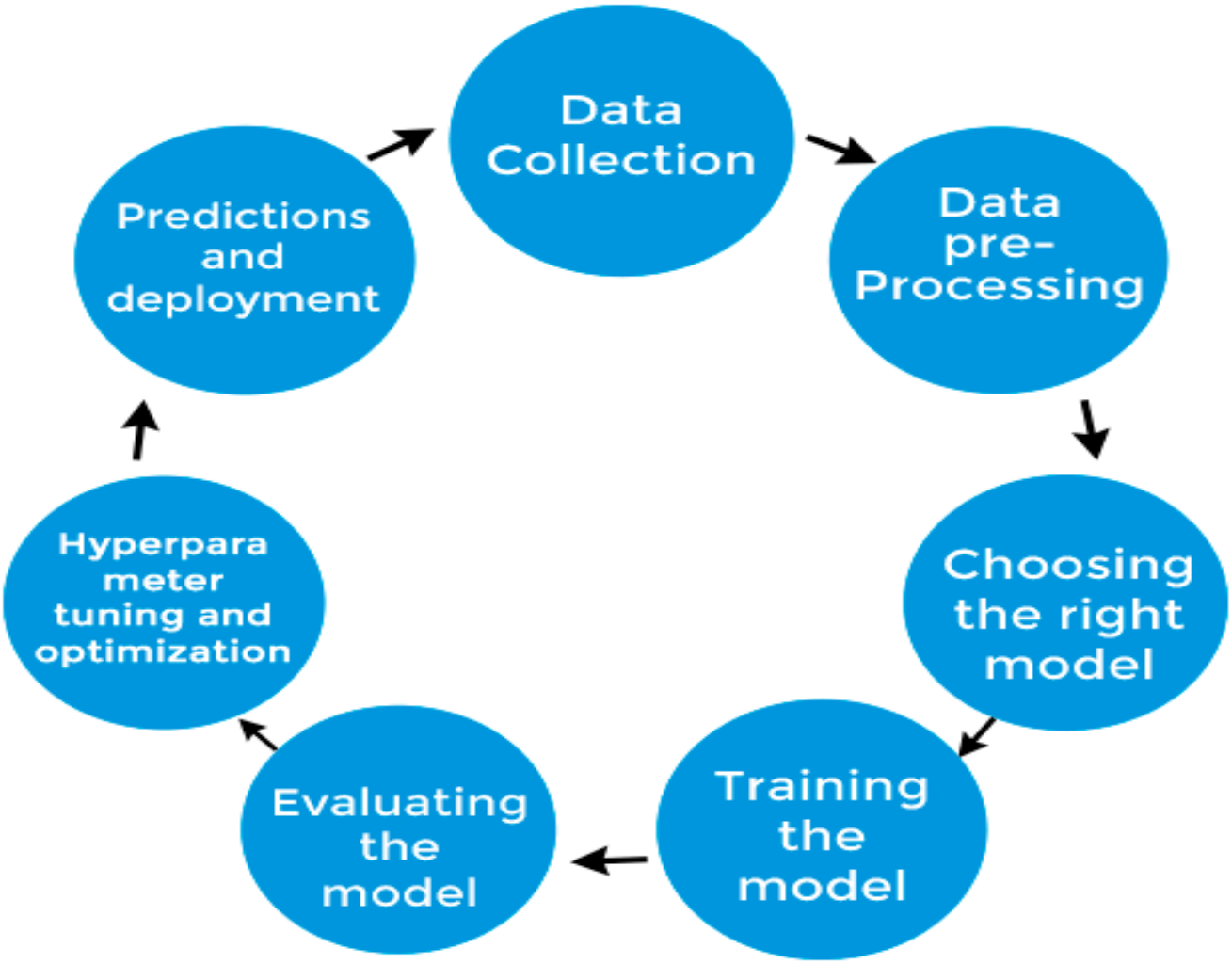
1.3 Defining Machine Learning

- **Machine Learning:**

ML is a branch of Artificial Intelligence (AI) that works on algorithm developments and statistical models that allow computers to learn from data and make predictions or decisions without being explicitly programmed.



- **Stage of Machine Learning:**



1. Data Collection:

- ✓ Data collection is an initial step in the process of machine learning.

- ✓ Data is a fundamental part of machine learning, the quality and quantity of your data can have direct consequences for model performance.

- ✓ Different sources such as databases, text files, pictures, sound files, or web scraping may be used for data collection.

- ✓ Data needs to be prepared for machine learning once it has been collected.

- ✓ This process is to organize the data in an appropriate format, such as a CSV file or database, and make sure that they are useful for solving your problem.

2. Data Pre-processing:

- ✓ Pre-processing of data is a key step in the process of machine learning.
- ✓ It involves deleting duplicate data, fixing errors, managing missing data either by eliminating or filling it in, and adjusting and formatting the data.
- ✓ Pre-processing improves the quality of your data and ensures that your machine-learning model can read it right.
- ✓ The accuracy of your model may be significantly improved by this step.

3.Choosing the right model:

- ✓ The next step is to select a machine learning model; once data is prepared then we apply it to ML Models like **Linear regression**, **decision trees**, and **Neural Networks** that may be selected to implement.

- ✓ The selection of the model generally depends on what kind of data you're dealing with and your problem.

- ✓ The size and type of data, complexity, and computational resources should be taken into account when choosing a model to apply.

4. Training the model:

- ✓ The next step is to train it with the data that has been prepared after you have chosen a model.

- ✓ Training is about connecting the data to the model and enabling it to adjust its parameters to predict output more accurately.

- ✓ Overfitting and under fitting must be avoided during the training.

5. Evaluating the model:

- ✓ It is important to assess the model's performance before deployment as soon as a model has been trained.

- ✓ This means that the model has to be tested on new data that they haven't been able to see during training.

- ✓ Accuracy in classifying problems, precision and recall for binary classification problems, as well as mean error squared with regression problems, are common metrics to evaluate the performance of a model.

6. Hyperparameter tuning and optimization:

- ✓ You may need to adjust its hyperparameters to make it more efficient after you've evaluated the model.

- ✓ Grid searches, where you try different combinations of parameters, and cross-validation, where you divide your data into subsets and train your model on each subset, to ensure that it performs well on different data sets, are techniques for hyperparameter tuning.

7. Predictions and deployment:

- ✓ As soon as the model has been programmed and optimized, it will be ready to estimate new data.

- ✓ This is done by adding new data to the model and using its output for decision-making or other analysis.

- ✓ The deployment of this model involves its integration into a production environment where it is capable of processing real-world data and providing timely information

Importance & Advantages of Machine Learning

1. Data Processing.
2. Data-driven insights. (Pattern, Trends etc.)
3. Automation.
4. Personalization.
5. Continuous Improvement.

Disadvantages of Machine Learning

1. Technical Expertise required.
2. Resource Intensive.
3. Data Acquisition.

▪ Deep Learning

- ✓ Deep learning is a subset of machine learning that uses artificial neural networks (ANNs) to model and solve complex problems.

- ✓ It is based on the idea of building artificial neural networks with multiple layers, called deep neural networks, that can learn hierarchical representations of the data.

- ✓ Deep learning algorithms use a layered architecture, where the input data is passed through an input layer and then propagated through multiple hidden layers, before reaching the output layer.

Advantages of Deep Learning

1. Automatic Feature learning.
2. Handling large and complex data.
3. Improved Performance.
4. Handling missing data.
5. Scalability.
6. Generalization

Disadvantages of Deep Learning

1. High computational cost.
2. Dependence on data quality.
3. Data privacy and security concern.
4. Limited data it was trained.

Applications of Deep Learning

1. Speech Recognition.
2. Natural Language processing.

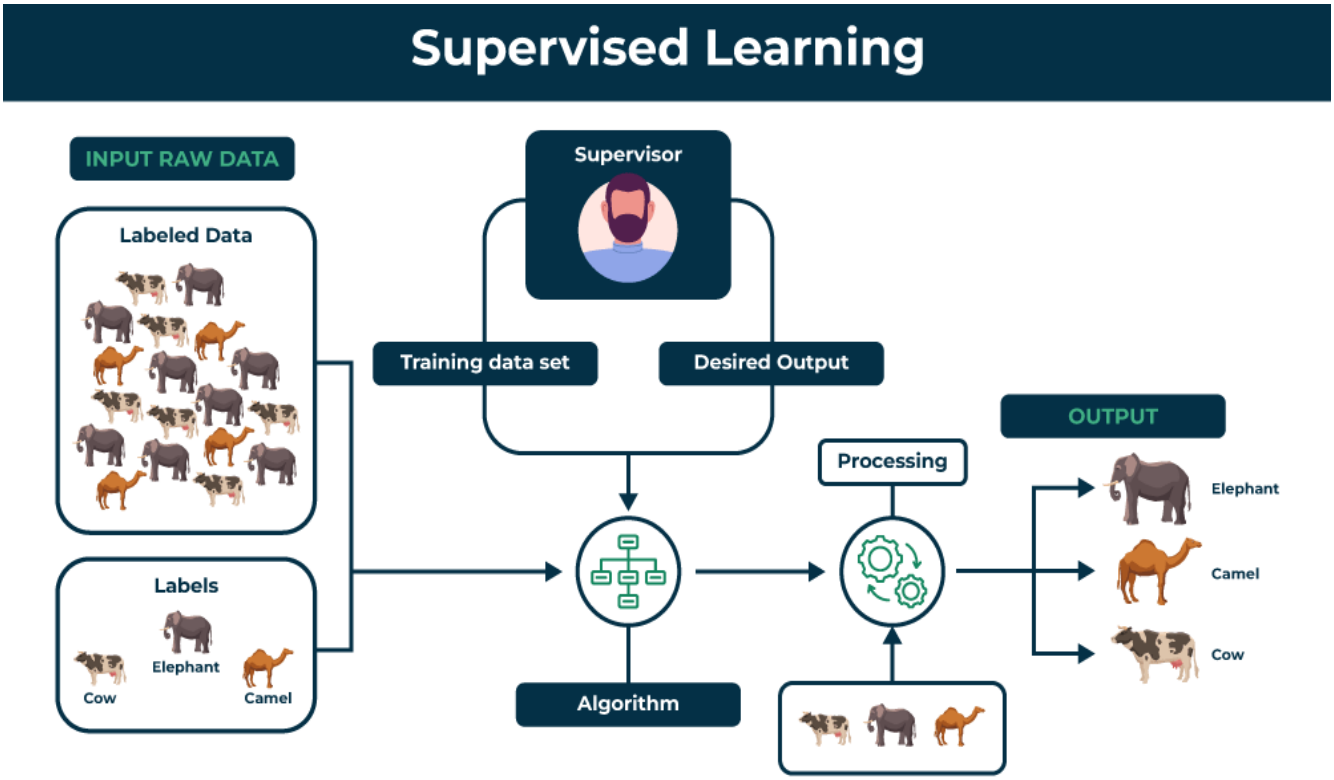
   (Chatbot,Virtual Assistants)
3. Fraud Detection.
4. Gaming.
5. Cyber Security.
6. Robotics.

Types of Machine Learning

1. Supervised Machine Learning
2. Unsupervised Machine Learning
3. Reinforcement Learning

1. Supervised Machine Learning

- ✓ Supervised Learning is defined as when a model gets trained on a **"Labelled Dataset"**.
- ✓ Labelled datasets have both input and output parameters.
- ✓ **Supervised Learning** algorithms learn to map points between inputs and correct outputs. It has both training and validation datasets labelled.
- ✓ **Example:** Consider a scenario where you have to build an image classifier to differentiate between cats and dogs. If you feed the datasets of dogs and cats labelled images to the algorithm, the machine will learn to classify between a dog or a cat from these labeled images. When we input new dog or cat images that it has never seen before, it will use the learned algorithms and predict whether it is a dog or a cat. This is how **supervised learning** works, and this is particularly an image classification.



- There are two main categories of supervised learning that are mentioned below:

1. Classification

2. Regression

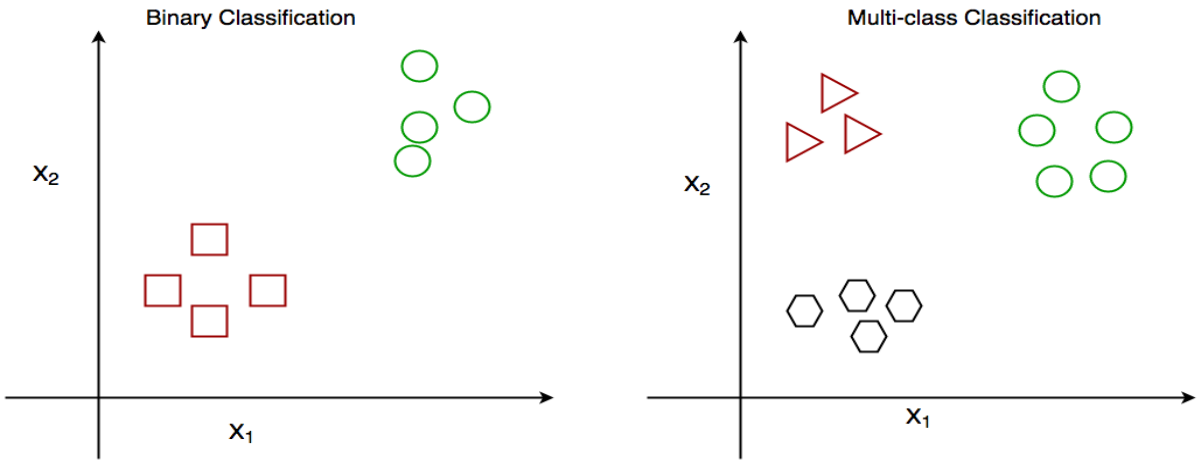
1. Classification

- ✓ **Classification** is the process of finding or discovering a model or function that helps in separating the data into multiple categorical classes i.e. discrete values.

- ✓ In classification, data is categorized under different labels according to some parameters given in the input and then the labels are predicted for the data.

- ✓ The derived mapping function could be demonstrated in the form of "IF-THEN" rules.

- ✓ The classification process deals with problems where the data can be divided into binary or multiple discrete labels.



- ✓ Classification deals with predicting **categorical** target variables, which represent discrete classes or labels.

- ✓ For instance, classifying emails as spam or not spam, or predicting whether a patient has a high risk of heart disease.

- ✓ Classification algorithms learn to map the input features to one of the predefined classes.

- ✓ Here, are some classification algorithms:

  - **Logistic Regression**
  - **Support Vector Machine**
  - **Random Forest**
  - **Decision Tree**
  - **K-Nearest Neighbors (KNN)**
  - **Naive Bayes**

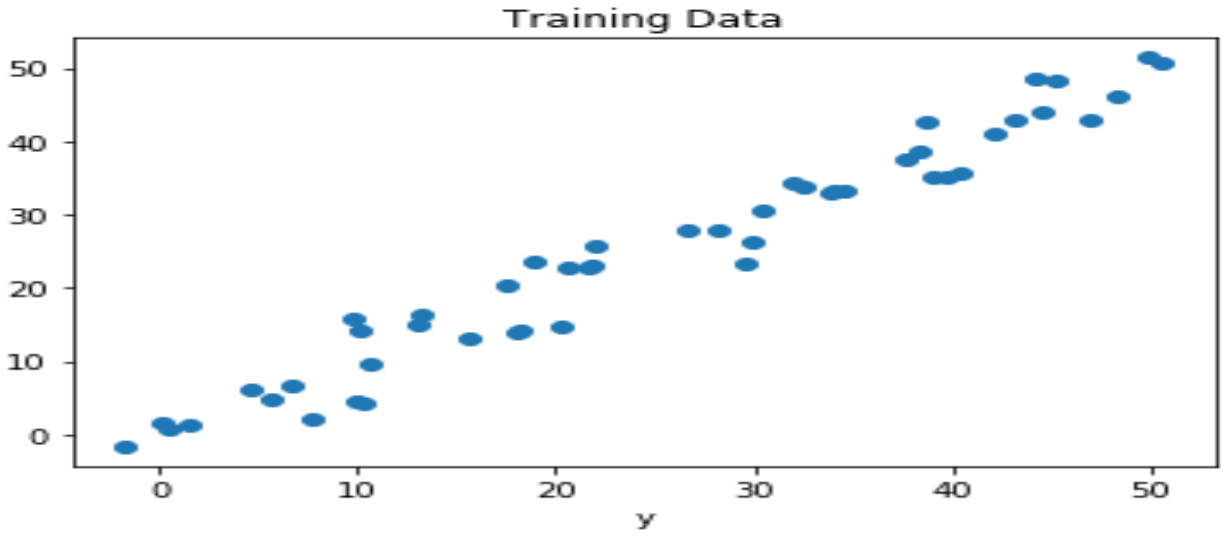
2. Regression

- ✓ Regression is the process of finding a model or function for distinguishing the data into continuous real values instead of using classes or discrete values.

- ✓ It can also identify the distribution movement depending on the historical data.

- ✓ Because a regression predictive model predicts a quantity, therefore, the skill of the model must be reported as an error in those predictions.

- ✓ we are finding the possibility of rain in some particular regions with the help of some parameters recorded earlier. Then there is a probability associated with the rain.



- ✓ **Regression**, on the other hand, deals with predicting **continuous** target variables, which represent numerical values.

- ✓ For example, predicting the price of a house based on its size, location, and amenities, or forecasting the sales of a product.

- ✓ Regression algorithms learn to map the input features to a continuous numerical value.

- ✓ Here are some regression algorithms:

  - **Linear Regression**
  - **Polynomial Regression**
  - **Ridge Regression**
  - **Lasso Regression**
  - **Decision tree**
  - **Random Forest**

Classification	Regression
1. In this problem statement, the target variables are discrete.	1. In this problem statement, the target variables are continuous.
2. Problems like Spam Email Classification, Disease prediction like problems are solved using Classification Algorithms.	2. Problems like House Price Prediction, Rainfall Prediction like problems are solved using regression Algorithms.
3. In this algorithm, we try to find the best possible decision boundary which can separate the two classes with the maximum possible separation.	3. In this algorithm, we try to find the best-fit line which can represent the overall trend in the data.
4. Output is Categorical labels.	4. Output is Continuous numerical values.
5. Objective is to predict categorical/class labels.	5. Objective is to Predicting continuous numerical values.
6. Example use cases are Spam detection, image recognition, sentiment analysis	6. Example use cases are Stock price prediction, house price prediction, demand forecasting.
Examples of classification algorithms are:	**Examples of regression algorithms are:**
7. Logistic Regression, Decision Trees, Random Forest, Support Vector Machines (SVM), K-Nearest Neighbors (K-NN), Naive Bayes, Neural Networks, K-Means Clustering, Multi-layer Perceptron (MLP), etc.	7. Linear Regression, Polynomial Regression, Ridge Regression, Lasso Regression, Support Vector Regression (SVR), Decision Trees for Regression, Random Forest Regression, K-Nearest Neighbors (K-NN) Regression, Neural Networks for Regression, etc.

Advantages of Supervised Machine Learning

- ✓ Supervised Learning models can have high accuracy as they are trained on labelled data.
- ✓ The process of decision-making in supervised learning models is often interpretable(something can be understood, explained, or accounted).
- ✓ It can often be used in pre-trained models which saves time and resources when developing new models from scratch.

Disadvantages of Supervised Machine Learning

- ✓ It has limitations in knowing patterns and may struggle with unseen or unexpected patterns that are not present in the training data.
- ✓ It can be time-consuming and costly as it relies on **labeled** data only.
- ✓ It may lead to poor generalizations based on new data.

Application of Supervised Machine Learning

- ✓ Image classification: Identify objects, faces, and other features in images.
- ✓ Natural language processing: Extract information from text, such as sentiment, entities, and relationships.
- ✓ Speech recognition: Convert spoken language into text.
- ✓ Recommendation systems: Make personalized recommendations to users.
- ✓ Predictive analytics: Predict outcomes, such as sales, customer churn, and stock prices.
- ✓ Medical diagnosis: Detect diseases and other medical conditions.
- ✓ Fraud detection: Identify fraudulent transactions.

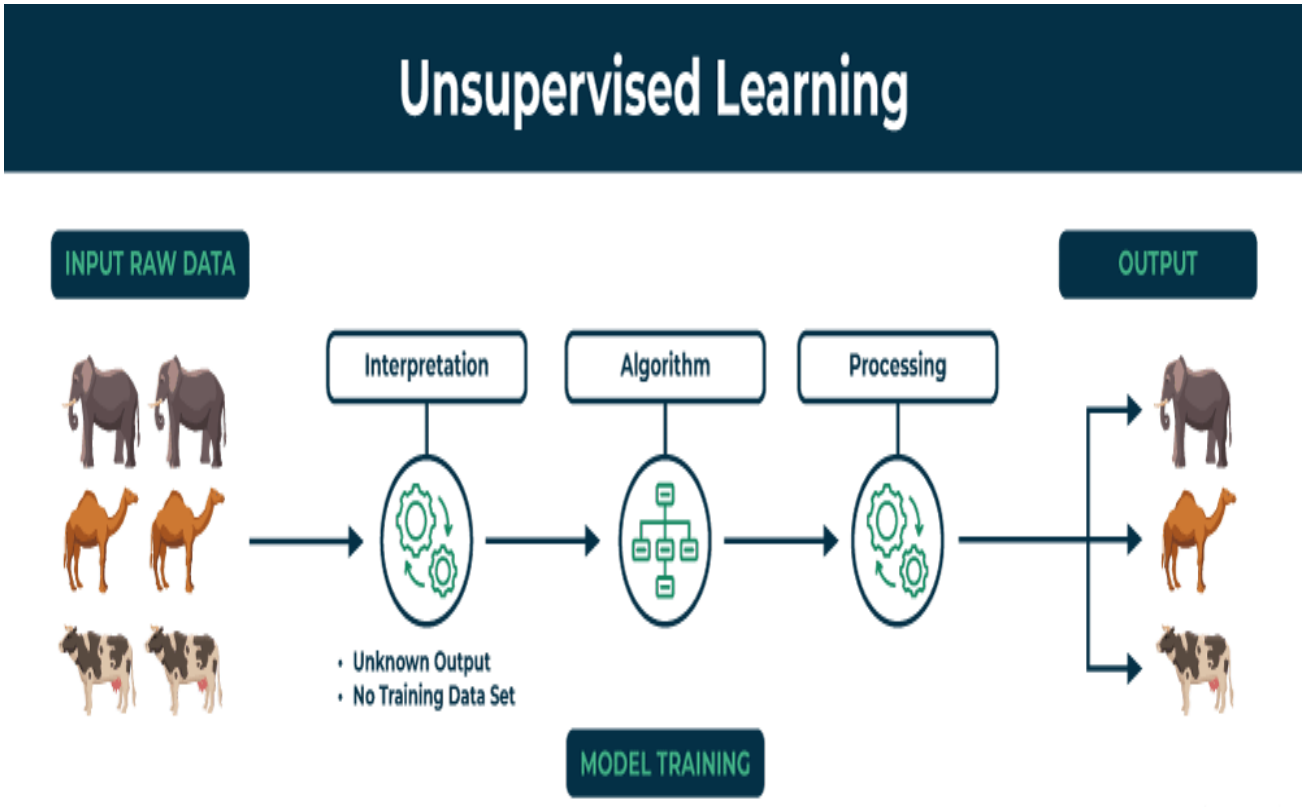
- ✓ Autonomous vehicles: Recognize and respond to objects in the environment.
- ✓ Email spam detection: Classify emails as spam or not spam.
- ✓ Quality control in manufacturing: Inspect products for defects.
- ✓ Credit scoring: Assess the risk of a borrower defaulting on a loan.
- ✓ Gaming: Recognize characters, analyze player behavior, and create NPCs.
- ✓ Customer support: Automate customer support tasks.
- ✓ Weather forecasting: Make predictions for temperature, precipitation, and other meteorological parameters.
- ✓ Sports analytics: Analyze player performance, make game predictions, and optimize strategies.

2. Unsupervised Machine Learning

✓ Unsupervised learning is a type of machine learning technique in which an algorithm discovers patterns and relationships using unlabeled data.

✓ The main aim of the unsupervised learning algorithm is to group or categories the unsorted dataset according to the similarities, patterns, and differences.

✓ Machines are instructed to find the hidden patterns from the input dataset.



- ✓ Let's take an example to understand it more preciously; suppose there is a basket of fruit images, and we input it into the machine learning model. The images are totally unknown to the model, and the task of the machine is to find the patterns and categories of the objects.

- ✓ So, now the machine will discover its patterns and differences, such as colour difference, shape difference, and predict the output when it is tested with the test dataset.

- There are two main categories of Unsupervised learning that are mentioned below:

1. Clustering
2. Association

2. Clustering

- ✓ The clustering technique is used when we want to find the inherent groups from the data.

- ✓ It is a way to group the objects into a cluster such that the objects with the most similarities remain in one group and have fewer or no similarities with the objects of other groups.

- ✓ An example of the clustering algorithm is grouping the customers by their purchasing behaviour.

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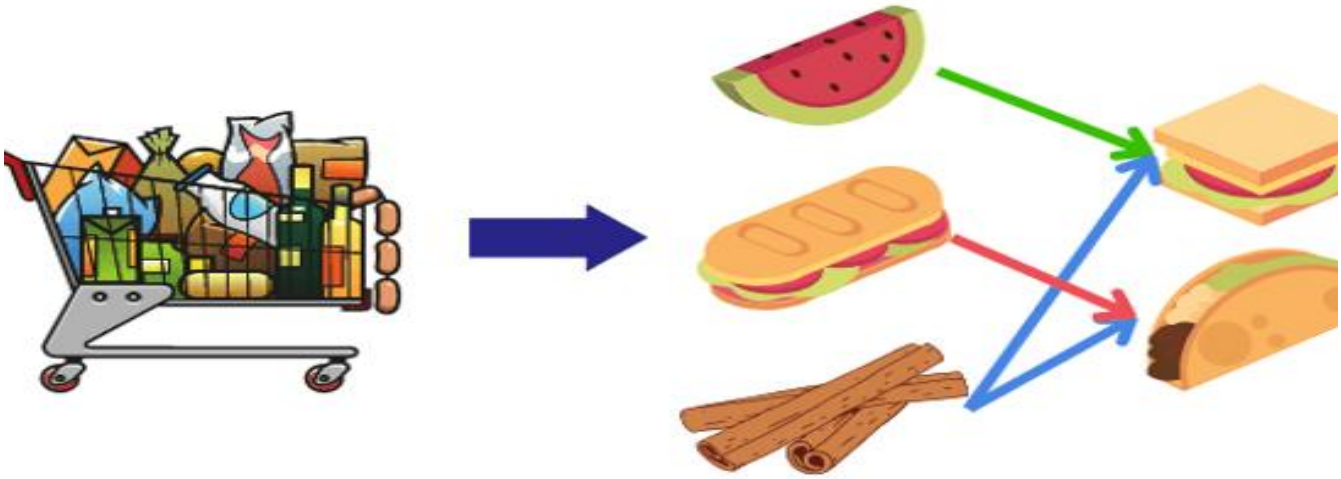
2.Association

- Association rule learning is an unsupervised learning technique, which finds interesting relations among variables within a large dataset.
- The main aim of this learning algorithm is to find the dependency of one data item on another data item and map those variables accordingly so that it can generate maximum profit.
- This algorithm is mainly applied in Market Basket analysis, Web usage mining, continuous production, etc.
- Some popular algorithms of Association rule learning are Apriori Algorithm, Eclat, FP-growth algorithm.

Association Rule Learning



"93% of people who purchased item A also purchased item B"

Advantages of Unsupervised Machine Learning

- ✓ It helps to discover hidden patterns and various relationships between the data.
- ✓ Used for tasks such as customer segmentation, anomaly detection, and data exploration.
- ✓ It does not require labeled data and reduces the effort of data labeling.
- ✓ These algorithms can be used for complicated tasks compared to the supervised ones because these algorithms work on the unlabeled dataset.

Disadvantages of Unsupervised Machine Learning

- ✓ The output of an unsupervised algorithm can be less accurate as the dataset is not labelled, and algorithms are not trained with the exact output in prior.
- ✓ Working with Unsupervised learning is more difficult as it works with the unlabelled dataset that does not map with the output.

Application of Unsupervised Machine Learning

- ✓ Content recommendation: Classify and tag content to make it easier to recommend similar items to users.
- ✓ Community detection in social networks: Identify communities or groups of individuals with similar interests or connections.
- ✓ Market basket analysis: Discover associations between products.
- ✓ Topic modeling: Discover latent topics within a collection of documents.
- ✓ Clustering: Group similar data points into clusters.
- ✓ Anomaly detection: Identify outliers or anomalies in data.
- ✓ Dimensionality reduction: Reduce the dimensionality of data while preserving its essential information

- ✓ Recommendation systems: Suggest products, movies, or content to users based on their historical behavior or preferences.

3. Reinforcement Learning

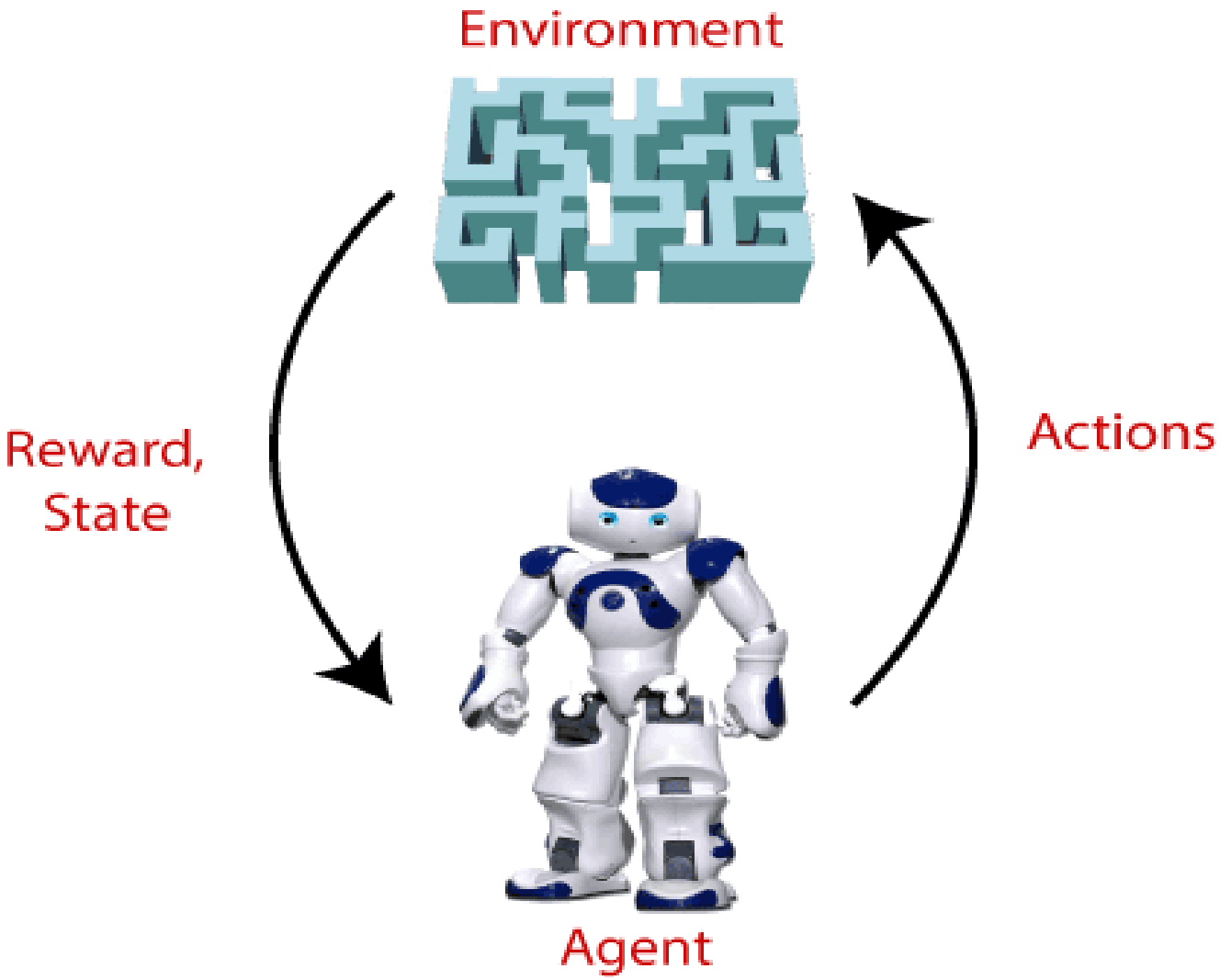
- ✓ Reinforcement learning is **a feedback-based learning method**, in which a **learning agent gets a reward for each right action** and **gets a penalty for each wrong action.**

- ✓ The agent **learns automatically with these feedbacks and improves its performance.**

- ✓ In reinforcement learning, **the agent interacts with the environment and explores it.**

- ✓ The **goal of an agent is to get the most reward points, and hence, it improves its performance.**

- ✓ Reinforcement Learning is a part of Machine learning **where an agent is put in an environment and he learns to behave in this environment by performing certain actions and observing the rewards which it gets from those actions.**



Advantages of Reinforcement Learning

- ✓ **Automated Learning** – RL allows agents to learn autonomously without the need for explicit programming.
- ✓ **Solves Complex Problems** – RL is capable of handling high-dimensional and complex problems, such as robotics, game-playing (e.g., AlphaGo), and autonomous driving.
- ✓ **Adaptability** – The agent continuously improves by interacting with the environment and adapting to changes.
- ✓ **Optimized Decision-Making** – RL helps in making better sequential decisions by maximizing long-term rewards.
- ✓ **Exploration and Exploitation Balance** – It effectively balances trying new strategies (exploration) and using known best actions (exploitation).
- ✓ **Self-Improvement Over Time** – The model improves as it gains more experience, leading to better efficiency and accuracy.
- ✓ **No Need for Large Labeled Data** – Unlike supervised learning, RL does not require labeled datasets, making it useful in real-world applications.

Disadvantages of Reinforcement Learning

- ✓ **High Computational Cost** – RL requires a lot of computing power and time to train effectively.
- ✓ **Difficult to Design Reward Functions** – Poorly designed reward functions can lead to undesired behaviors.
- ✓ **Slow Convergence** – RL algorithms can take a long time to converge, especially in complex environments.
- ✓ **Requires Large Amounts of Data** – In many cases, RL needs a vast amount of interactions to learn optimal policies.
- ✓ **Instability and Variability** – RL models can be unstable and sometimes fail to generalize well across different environments.
- ✓ **Ethical and Safety Concerns** – RL-based AI systems can behave unpredictably in real-world applications, raising ethical and safety issues.
- ✓ **Difficult to Implement** – Implementing RL from scratch can be complex, requiring expertise in mathematics, probability, and programming.

Application of Reinforcement Learning

- **Robotics**

✓ **Autonomous Robots:** Used in industrial automation, warehouse logistics (e.g., Amazon's robots), and service robots.

✓ **Humanoid Robots:** RL helps in controlling walking, balancing, and object manipulation.

✓ **Surgical Robots:** Used to enhance precision in robotic-assisted surgeries.

- **Game Playing**

✓ **Chess, Go, and Poker:** AlphaGo and AlphaZero by DeepMind use RL to master strategic board games.

✓ **Video Games:** RL agents can learn and play complex games like Dota 2 (OpenAI Five) and StarCraft II (AlphaStar).

✓ **Autonomous NPCs:** Used in game AI for adaptive and intelligent behavior.

- **Finance and Trading**

✓ **Stock Market Prediction:** RL models optimize stock trading strategies.

✓ **Portfolio Management:** RL is used for risk assessment and asset allocation.

✓ **Fraud Detection:** Helps detect anomalies in financial transactions.

- **Healthcare**

✓ **Personalized Treatment Plans:** RL tailors treatments based on patient responses.
✓ **Drug Discovery:** Optimizes molecular generation and selection.
✓ **Medical Imaging:** Used for detecting diseases in X-rays, MRIs, and CT scans.

- **Autonomous Vehicles**

✓ **Self-Driving Cars:** RL enables cars to learn from simulations and real-world driving data.
✓ **Traffic Signal Control:** Optimizes traffic lights for reducing congestion.
✓ **Drone Navigation:** Helps in obstacle avoidance and efficient route planning.

- **Natural Language Processing (NLP)**

✓ **Chatbots & Virtual Assistants:** RL improves dialogue generation and response optimization.
✓ **Machine Translation:** Enhances real-time language translation.
✓ **Speech Recognition:** Helps in adaptive speech-to-text learning.

- **Manufacturing & Supply Chain Optimization**

✓ **Process Control:** RL optimizes manufacturing processes to reduce waste.

- ✓ **Inventory Management:** Helps predict and manage stock levels efficiently.
- ✓ **Logistics & Routing:** Used for optimizing delivery routes in real-time.

- **Energy & Sustainability**

- ✓ **Smart Grid Management:** RL optimizes energy distribution and reduces power losses.
- ✓ **Renewable Energy Optimization:** Enhances efficiency in wind and solar power generation.
- ✓ **HVAC Systems:** Used for adaptive temperature control in buildings.

- **Recommendation Systems**

- ✓ **E-commerce (Amazon, Flipkart):** RL optimizes personalized product recommendations.
- ✓ **Streaming Services (Netflix, YouTube, Spotify):** RL helps in content recommendations.
- ✓ **Online Advertising:** Optimizes ad placements for maximum engagement.

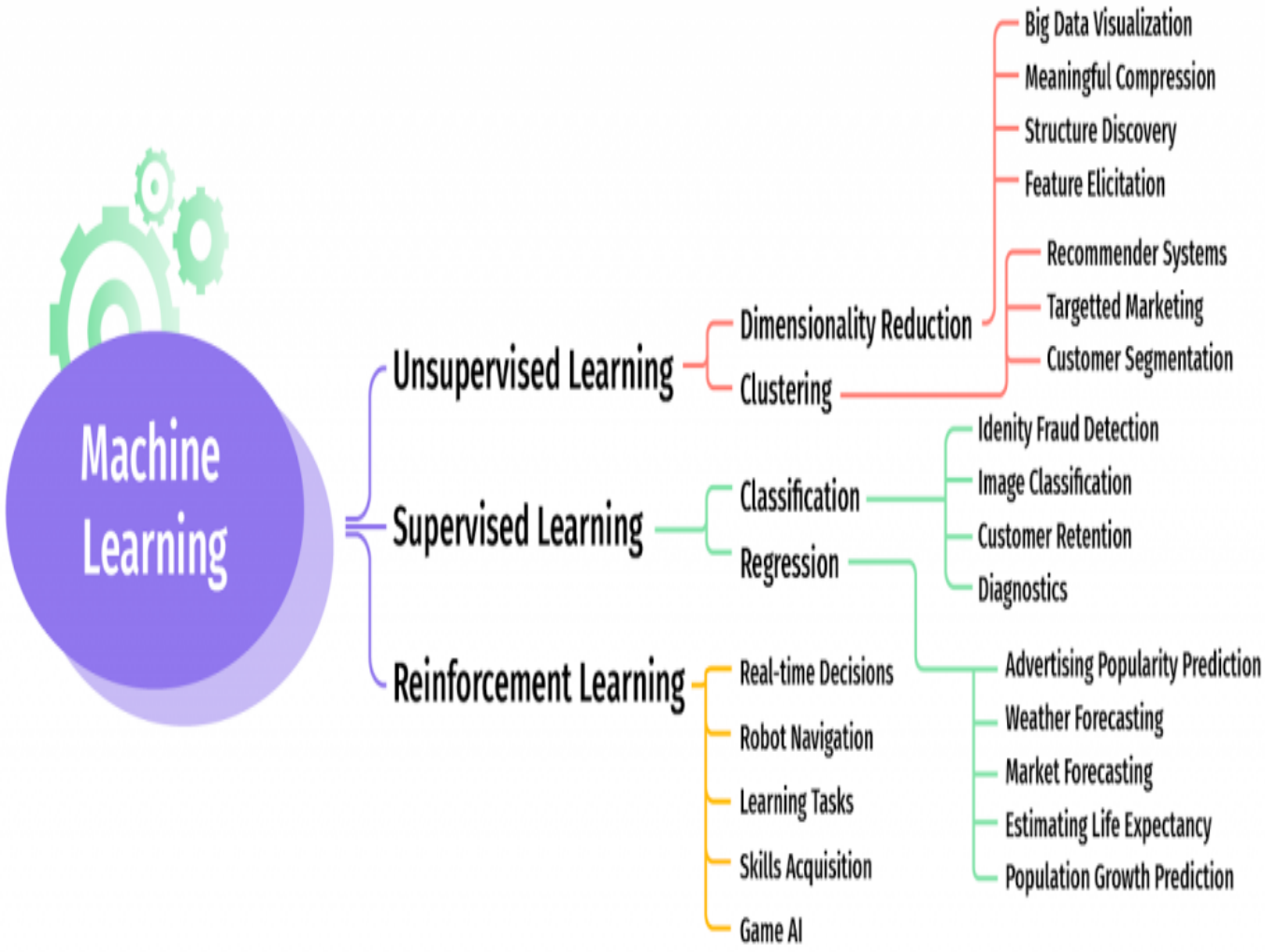
- **Cybersecurity**

- ✓ **Intrusion Detection Systems:** RL helps detect and prevent cyber threats.
- ✓ **Automated Penetration Testing:** Used for identifying system vulnerabilities.

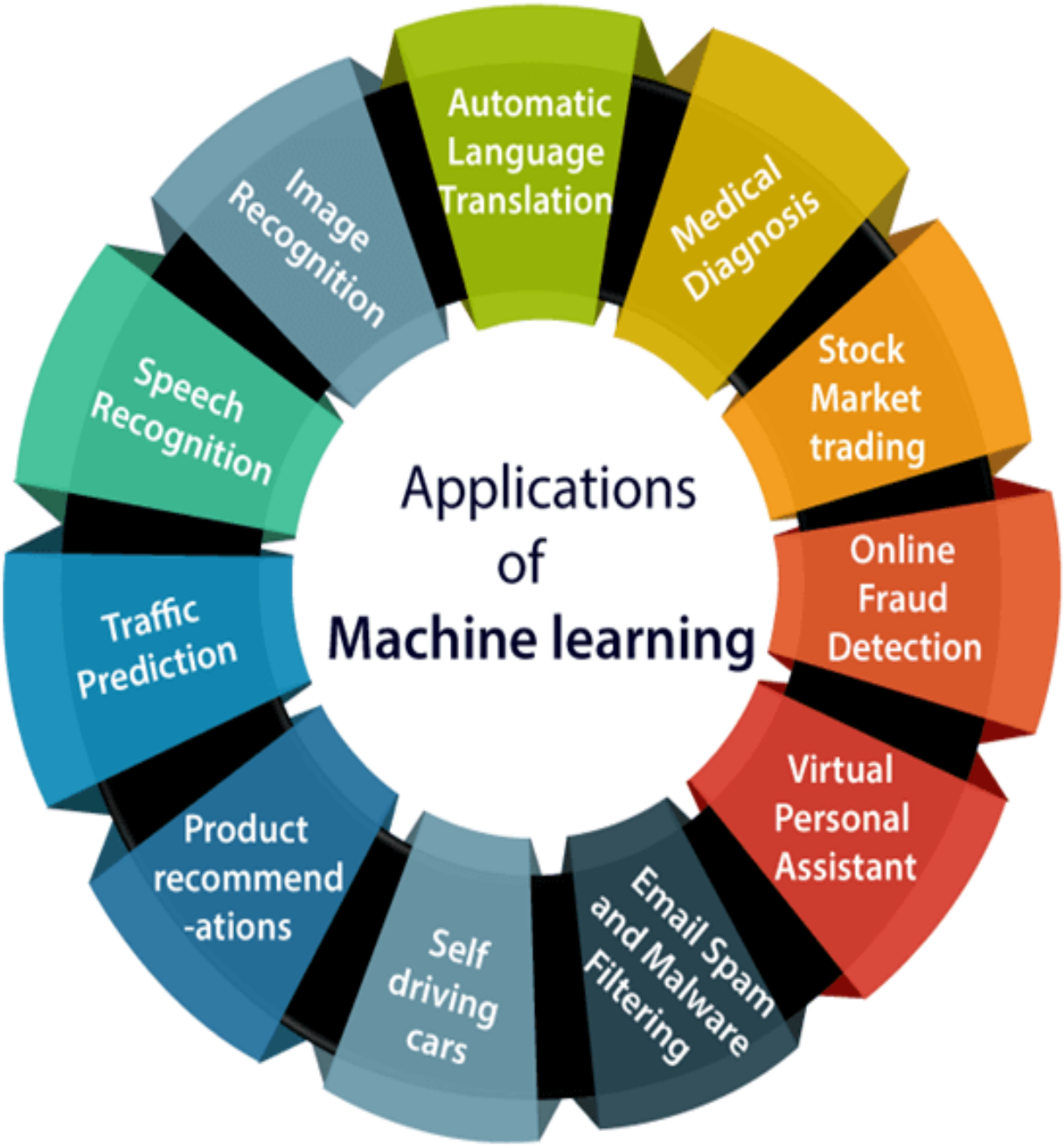
✓ **Malware Detection:** RL models adapt to evolving cyber threats.

- **Space Exploration**

✓ **Autonomous Rovers:** NASA uses RL for planetary exploration (e.g., Mars rovers).
✓ **Satellite Control:** RL optimizes satellite positioning and orbit adjustments.
✓ **Astronaut Assistance:** Used in robotic arms and AI-driven decision-making.



Application of Machine Learning



1. Image Recognition

- ✓ Image recognition is one of the most common applications of machine learning.
- ✓ It is used to identify objects, persons, places, digital images, etc. The popular use case of image recognition and face detection is, **Automatic friend tagging suggestion**:
- ✓ Facebook provides us a feature of auto friend tagging suggestion. Whenever we upload a photo with our Facebook friends, then we automatically get a tagging suggestion with name, and the technology behind this is machine learning's **face detection** and **recognition algorithm**.

2.Speech Recognition

- ✓ While using Google, we get an option of "Search by voice," it comes under speech recognition, and it's a popular application of machine learning.
- ✓ Speech recognition is a process of converting voice instructions into text, and it is also known as "Speech to text", or "Computer speech recognition."
- ✓ At present, machine learning algorithms are widely used by various applications of speech recognition.

- ✓ Google assistant, Siri, Cortana, and Alexa are using speech recognition technology to follow the voice instructions.

3.Traffic prediction

- ✓ If we want to visit a new place, we take help of Google Maps, which shows us the correct path with the shortest route and predicts the traffic conditions.
- ✓ It predicts the traffic conditions such as whether traffic is cleared, slow-moving, or heavily congested with the help of two ways:
    - **Real Time location** of the vehicle form Google Map app and sensors
    - **Average time has taken** on past days at the same time.
- ✓ Everyone who is using Google Map is helping this app to make it better.

4. Product recommendations:

- ✓ Machine learning is widely used by various e-commerce and entertainment companies such as **Amazon**, **Netflix**, etc., for product recommendation to the user.

- ✓ Whenever we search for some product on Amazon, then we started getting an advertisement for the same product while internet surfing on the same browser and this is because of machine learning.

5.Self-driving cars

- ✓ One of the most exciting applications of machine learning is self-driving cars. Machine learning plays a significant role in self-driving cars.
- ✓ Tesla, the most popular car manufacturing company is working on self-driving car.
- ✓ It is using unsupervised learning method to train the car models to detect people and objects while driving.

6. Email Spam and Malware Filtering

- ✓ Whenever we receive a new email, it is filtered automatically as important, normal, and spam.
- ✓ We always receive an important mail in our inbox with the important symbol and spam emails in our spam box, and the technology behind this is Machine learning.
- ✓ Below are some spam filters used by Gmail:
    - o Content Filter
    - o Header filter

- General blacklists filter
- Rules-based filters
- Permission filters

✓ Some machine learning algorithms such as **Multi-Layer Perceptron**, **Decision tree**, and **Naïve Bayes classifier** are used for email spam filtering and malware detection.

7. Virtual Personal Assistant

✓ We have various virtual personal assistants such as **Google assistant**, **Alexa**, **Cortana**, **Siri**.

✓ As the name suggests, they help us in finding the information using our voice instruction.

✓ These assistants can help us in various ways just by our voice instructions such as Play music, call someone, Open an email, Scheduling an appointment, etc.

8. Online Fraud Detection

✓ Machine learning is making our online transaction safe and secure by detecting fraud transaction.

- ✓ Whenever we perform some online transaction, there may be various ways that a fraudulent transaction can take place such as **fake accounts**, **fake ids**, and **steal money** in the middle of a transaction.
- ✓ So to detect this, **Feed Forward Neural network** helps us by checking whether it is a genuine transaction or a fraud transaction.

9. Stock Market trading

- ✓ Machine learning is widely used in stock market trading. In the stock market, there is always a risk of up and downs in shares, so for this machine learning's **long short term memory neural network** is used for the prediction of stock market trends.

10. Medical Diagnosis

- ✓ In medical science, machine learning is used for diseases diagnoses. With this, medical technology is growing very fast and able to build 3D models that can predict the exact position of lesions in the brain.
- ✓ It helps in finding brain tumors and other brain-related diseases easily.

11. Automatic Language Translation

- ✓ Nowadays, if we visit a new place and we are not aware of the language then it is not a problem at all, as for this also machine learning helps us by converting the text into our known languages.
- ✓ Google's GNMT **(Google Neural Machine Translation)** provide this feature, which is a Neural Machine Learning that translates the text into our familiar language, and it called as automatic translation.

EXAM IMP QUESTIONS (UNIT 1)

1. Compare Supervised, unsupervised and reinforcement learning.

2. Define the term Artificial Intelligence.

3. Discuss human learning vs machine learning.

4. Differentiate between supervised machine learning and unsupervised machine learning and reinforcement learning.

5. Explain the different strategies of addressing missing values in the dataset in detail with examples.

6. Discuss the process of Machine Learning with a neat diagram.

7. Explain Scatter Plot, Bar Plot and Pie plot with appropriate examples with data science. (Use dataframe or. csv file)

8. Explain Dataframe with all operations using PANDAS library.

9. Explain the application of machine learning.

ONE MARK QUESTIONS

1.Full Form:

Q1: What does AI stand for in the context of Machine Learning?

ANS: Artificial Intelligence

2. Fill in the Blanks:

Q2: In Machine Learning, the process of training a model using labeled data is known as _____ Learning.

ANS: Supervised

3. Definition:

Q3: Define Supervised Learning.

ANS: Supervised Learning is a type of machine learning where the model is trained on labeled data, which means that both the input and the corresponding correct output are provided.

4. Concept-based Question:

Q4: Which of the following is an example of unsupervised learning?

Linear Regression

K-Means Clustering

Logistic Regression

ANS: K-Means Clustering

5. True/False:

Q5: In Machine Learning, an algorithm that learns from data without supervision is called supervised learning.

ANS: False (This is called Unsupervised Learning.)

6. Fill in the Blanks:

Q6: _____ Learning is used to train a model by giving it feedback based on its actions, often used in robotics and gaming.

ANS: Reinforcement

7. Concept-based Question:

Q7: What is the main goal of Machine Learning?

ANS: The main goal of Machine Learning is to enable computers to learn from data and make decisions or predictions without being explicitly programmed.

8. Full Form :

Q8: What does SVM stand for in Machine Learning?

ANS: Support Vector Machine

9. Fill in the Blanks:

Q9: The process of cleaning and transforming raw data into a usable format for Machine Learning is called _____.

ANS: Data Preprocessing

10. True/False:

Q10: Overfitting occurs when a model performs well on training data but poorly on new, unseen data.

ANS: True

11. Definition:

Q11: Define Unsupervised Learning

Unsupervised Learning is a type of machine learning where the model is trained on data that is not labeled.

12. Full Form :

Q12: What does CNN stand for in Deep Learning?
ANS: Convolutional Neural Network

One-Mark Questions with Answers:

Full Form-Based Questions:

1. **Q:** What does **ML** stand for in Machine Learning?
   ANS: Machine Learning
2. **Q:** What does **DL** stand for in Artificial Intelligence?
   ANS: Deep Learning
3. **Q:** What does **ANN** stand for in Deep Learning?
   ANS: Artificial Neural Network
4. **Q:** What does **RNN** stand for in Machine Learning?
   ANS: Recurrent Neural Network
5. **Q:** What does **NLP** stand for in Artificial Intelligence?
   ANS: Natural Language Processing
6. **Q:** What does **GAN** stand for in Deep Learning?
   ANS: Generative Adversarial Network
7. **Q:** What does **KNN** stand for in Machine Learning?
   ANS: K-Nearest Neighbors

8. **Q:** What does **PCA** stand for in Machine Learning?
   ANS: Principal Component Analysis
9. **Q:** What does **ReLU** stand for in Deep Learning?
   ANS: Rectified Linear Unit
10. **Q:** What does **LSTM** stand for in Recurrent Neural Networks?
    ANS: Long Short-Term Memory

Concept-Based Questions:

11. **Q:** Which type of learning uses labeled data for training?
    ANS: Supervised Learning
12. **Q:** Which type of learning finds patterns in unlabeled data?
    ANS: Unsupervised Learning
13. **Q:** Which Machine Learning model is used for continuous numerical predictions?
    ANS: Regression Model
14. **Q:** Which Machine Learning model is used for classification tasks?
    ANS: Classification Model
15. **Q:** Which algorithm is commonly used for spam email detection?
    ANS: Naïve Bayes Classifier
16. **Q:** What is the primary goal of Reinforcement Learning?
    ANS: To maximize cumulative rewards over time.
17. **Q:** What is the process of reducing the complexity of a dataset while retaining important features?
    ANS: Dimensionality Reduction

18. **Q:** Which algorithm is best suited for detecting anomalies in data?
    ANS: Isolation Forest or One-Class SVM
19. **Q:** What type of learning is used in self-driving cars?
    ANS: Reinforcement Learning
20. **Q:** What does a Decision Tree algorithm do?
    ANS: It splits data into branches to make predictions based on conditions.