1. Supervised Learning

Supervised learning involves training a model on a labeled dataset, where the correct output is known for each training example. The model learns to map inputs to outputs based on this training data.

Eg: Suppose we have a fruit basket you want to identify. The machine first analyzes the image to extract features like shape, color, and texture, then compares these to known fruits. For instance, if we train the machine with different fruits: a red, round shape with a depression at the top is labeled as an apple, and a long, green-yellow cylinder is labeled as a banana. After training, if given a new fruit to identify, the machine uses its learned features to classify it correctly, such as identifying a new banana and categorizing it accordingly. Thus, the machine applies knowledge from the training data to new examples.

2. Unsupervised Learning

Unsupervised learning involves training a model on data without labeled responses. The model tries to learn the underlying structure of the data by identifying patterns, clusters, or associations.

Suppose the unsupervised learning algorithm is given an input dataset containing images of different types of cats and dogs. The algorithm is never trained upon the given dataset, which means it does not have any idea about the features of the dataset. The task of the unsupervised learning algorithm is to identify the image features on their own. Unsupervised learning algorithm will perform this task by clustering the image dataset into the groups according to similarities between images.

3. Reinforcement Learning

Reinforcement learning is a type of machine learning where an agent learns to make decisions by performing actions in an environment to maximize some notion of cumulative reward.

Eg: Training a robot to navigate a maze.

The robot (agent) explores the maze (environment) and takes actions (moving forward, turning, etc.). For each action, it receives a reward or penalty (e.g., reaching a dead end might incur a penalty, while moving closer to the exit might provide a reward). Over time, the robot learns a policy that maximizes its total reward, enabling it to navigate the maze successfully.

4. Classification vs Regression vs Clustering

Classification

- A type of supervised learning where the goal is to predict a discrete label for an input.
- Outputs are categorical.
- Eg: Spam email detection, where emails are classified as 'spam' or 'not spam'.

Regression

- A type of supervised learning where the goal is to predict a continuous value for an input.
- Outputs are continuous.
- Eg: Predicting house prices based on features like size, location, and age.

Clustering

- A type of unsupervised learning where the goal is to group a set of objects in such a way that objects in the same group (cluster) are more similar to each other than to those in other groups.
- No labeled outputs; focuses on finding structure in the data.
- Eg: Customer segmentation, where customers are grouped into clusters based on their behavior.