Machine Learning (ML) is a subfield of Artificial Intelligence that enables systems to learn patterns from data and improve over time without explicit programming. ML focuses on building models that can analyze data, make predictions, classify outcomes, and find hidden structures. It has revolutionized multiple industries through automation and intelligent decision-making.

ML is broadly divided into three major types:

1. Supervised Learning

Models learn using labeled data—each input has a correct output. Algorithms try to generalize these relationships to predict outcomes on new data.
Common algorithms include Linear Regression, Logistic Regression, Decision Trees, Random Forests, and Support Vector Machines.
Applications: Spam detection, credit scoring, medical diagnosis, stock price prediction.

2. Unsupervised Learning

Used when data has no labels. The model identifies hidden patterns, clusters, or structures.
Popular methods include K-means clustering, PCA, and Apriori for association mining.
Applications: Customer segmentation, anomaly detection, dimensionality reduction.

3. Reinforcement Learning

The model interacts with an environment and learns from **rewards and penalties**. It is used in robotics, gaming (e.g., AlphaGo), autonomous vehicles, and resource optimization.

Other important ML concepts include:

- **Feature Engineering:** Selecting important variables to improve model accuracy.

- **Model Evaluation:** Using metrics like accuracy, precision, recall, F1-score.

- **Overfitting & Underfitting:** Overfitting happens when the model memorizes training data; underfitting occurs when it fails to learn enough patterns.

- **Training vs Testing:** Models are trained on historical data and tested on unseen data to validate performance.

ML applications are everywhere—image recognition, natural language processing, fraud detection, recommendation systems, autonomous driving, and healthcare analytics. As data grows, machine learning continues to shape how modern systems make intelligent decisions.