Machine Learning (ML) is a type of artificial intelligence that helps computers learn from data and make decisions without being explicitly programmed. Instead of following fixed rules, ML models find patterns in data and make predictions or decisions based on what they have learned.

**USE**

We use ML when:  
There is too much data for humans to analyze manually.  
The problem is complex and has no fixed rules.

We need to make predictions based on patterns in data.

**Example:**

**Spam Email Detection:** Gmail uses ML to learn which emails are spam and automatically filter them.

**Netflix Recommendations:** Netflix suggests movies based on what you've watched before.

**Applications**

📌 **Healthcare:** Diagnosing diseases from X-rays.  
📌 **Finance:** Detecting fraud in credit card transactions.  
📌 **E-commerce:** Showing personalized product recommendations.  
📌 **Self-driving Cars:** Cars that drive themselves by recognizing traffic signs and obstacles.

**Supervised Machine Learning**

In **Supervised Learning**, we train the model using labeled data (where we already know the correct answers).

**Example:**

Teaching a computer to recognize cats and dogs using pictures labeled as “cat” or “dog.”

Predicting house prices based on previous house sales data.

**Regression:**

Used when predicting continuous values (e.g., house prices, temperature).

**Example:** Predicting the price of a house based on size and location.

**Classification:**

Used when predicting categories (e.g., Yes/No, Spam/Not Spam).

**Example:** Identifying whether an email is spam or not.

**Unsupervised Machine Learning**

In **Unsupervised Learning**, the model finds patterns in data without any labels.

**Example:**

Grouping customers based on their shopping behavior.

Identifying hidden patterns in social media posts.

**Clustering:**

Groups similar data points together.

**Example:** Google News groups similar news articles together.

**Association:**

Finds relationships between items in a dataset.

**Example:** Supermarkets use it to see which items are often bought together (e.g., "People who buy bread often buy butter").

**Machine Learning Workflow**

**Collect Data** – Gather information (e.g., customer details, emails).  
**Prepare Data** – Clean and organize data (remove duplicates, fill missing values).  
**Choose a Model** – Pick the right algorithm (e.g., Decision Tree, Neural Network).  
**Train the Model** – Teach the model using training data.  
**Evaluate the Model** – Test the model on new data.  
**Tune & Improve** – Adjust settings to make the model better.  
**Deploy** – Use the model in real-world applications.

**Example:**  
Building a model to predict whether a customer will buy a product:

Step 1: Collect past purchase data.

Step 2: Clean and process the data.

Step 3: Train the model.

Step 4: Test the model on new customer data.

Step 5: Improve accuracy and deploy in an e-commerce app.