**Machine Learning**

**Artificial intelligent**

🡪 It is about artificially building software’s that are intelligent like humans.

🡪basically, any software that can be intelligent like human is AI, should be able to think like a human, understand like a human, reason like a human, act like a human, make decisions like a human.

🡪so, for example your voice assistants Alexa, Siri, your chat pods or when you're playing chess the online chess game they act like humans and play with you right this is all AI.

**Machine Learning**

**🡪** It is a subset of AI, it helps us in achieving AI.

🡪 Machine learning is about making machines learn from all the data that you already have to achieve AI. To make that act like humans.

🡪**Machine Learning** is a branch of **Artificial Intelligence (AI)** that allows computers to **learn patterns from data** and make decisions or predictions without being explicitly programmed for every task.

**💡 Simple Example:**

You show a model many pictures of cats and dogs.  
It **learns** from patterns in the data, so later it can say:  
👉 “This new picture looks like a cat!”

## ✅ **Why Do We Use ML?**

We use Machine Learning to:

* Automate decisions based on **data**
* Handle large-scale tasks that are **impossible to hardcode**
* Discover **hidden patterns** and make **predictions**

## 🧠 **Where is ML Used? (Real-World Examples)**

| **Domain** | **Application** |
| --- | --- |
| 🛍️ E-Commerce | Product recommendations (Amazon) |
| 📧 Email | Spam detection |
| 💳 Banking | Fraud detection |
| 🚗 Automotive | Self-driving cars |
| 🏥 Healthcare | Disease prediction (e.g., cancer detection) |
| 📱 Social Media | Face recognition, feed personalization |
| 🎮 Games | AI in strategy games, bots |

**Types of Machine learning**

**MACHINE LEARNING**

**|**

**-------------------------------------------------------------------------**

**| | |**

**Supervised Learning Unsupervised Learning Reinforcement Learning**

| | |

- Data is labelled - Data is not labelled - Agent learns via feedback

- Learn from input - Discover patterns - Trial & error learning

to output (X → y) in input data only to maximize reward

**| | |**

**-------------------- ---------------------- -------------------------**

**| | |**

**Classification Regression Clustering Game AI / Robots**

**(Yes/No, Spam) (Price, Salary) (Groupings) (Self-driving cars)**

🎯 1. **Supervised Learning**: -

🡪it is basically about predicting an output based on some input.

🡪 The **input data (features)** is labelled with the correct **output (target)**

🡪The model **learns** from this data to **predict outcomes** for new, unseen data

### 🧠 Think of it like a student learning with an answer key:

🡪 You show the model lots of questions **and their correct answers**.  
Then the model tries to **learn the relationship** so it can answer new questions on its own.

🧩 **Types of Supervised Learning**

## 📘**What is Regression?**

### 🔍 Definition:

**🡪Regression** is a supervised learning technique used to **predict continuous (numeric) values** based on input features.

🡪In simple words:  
🎯 Regression finds a relationship between **inputs (X)** and **a continuous output (y)**

### 🧠 Real-Life Analogy:

🡪You want to predict someone's salary based on their years of experience.

* Input (X): Years of experience
* Output (y): Expected Salary

🡪Regression helps you find the best-fit **line or curve** to make accurate predictions.

## ✅ **Why Do We Use Regression?**

| **Purpose** | **Explanation** |
| --- | --- |
| 📈 **Prediction** | Predict values like price, sales, marks |
| 🔄 **Trend analysis** | Observe how one variable affects another |
| 📊 **Forecasting** | Estimate future values (e.g., stock price) |
| 📉 **Optimization** | Find optimal outcomes (e.g., lowest cost) |

## 🌍**Where Is Regression Used?**

| **Domain** | **Use Case** |
| --- | --- |
| 🏠 Real Estate | Predicting house prices |
| 🏫 Education | Predicting exam scores from study hours |
| 🏥 Healthcare | Predicting disease progression or recovery rate |
| 💼 Business | Sales forecasting |
| 📈 Finance | Stock price prediction |
| 📦 E-commerce | Predicting product return probability |

## 🔢**Types of Regression in ML**

🡪Let’s now look at the **main types of Regression**:

| **Type** | **Description** |
| --- | --- |
| **1. Linear Regression** | Predicts a straight-line relationship between X and y |
| **2. Multiple Linear Regression** | Uses more than one input feature to predict the output |
| **3. Polynomial Regression** | Captures curved, non-linear relationships |
| **4. Ridge Regression** | Linear regression with L2 regularization to avoid overfitting |
| **5. Lasso Regression** | Uses L1 regularization to shrink some coefficients to zero |
| **6. Elastic Net Regression** | Combines Lasso and Ridge |
| **7. Logistic Regression** | Used for classification, not continuous regression (don’t confuse) |

### 📌 Visual Comparison (Simple):

| **Type** | **Output Example** | **Shape** |
| --- | --- | --- |
| Linear Regression | Predicting price from size | Straight Line |
| Polynomial Regression | Predicting marks from hours | Curved Line |
| Multiple Linear Regression | Predicting price from size, location, age | Plane (in 3D) |
| Ridge/Lasso | Same as linear, but avoids overfitting | Straight Line (with constraints) |