What is Machine Learning?

Machine learning is a method of teaching computers to

- learn from data,
- find patterns,
- make decisions or predictions

without being explicitly programmed.

Type	Learns from	Output Type	Example
Supervised	Labeled Data (X + Y)	Predict known output	Predict heart disease (Y/N)
Unsupervised	Unlabeled Data (x only)	Discover hidden patterns	Customer Segmentation
Reinforcement	Environment + Rewards	Learn by trial/error	Game AI, Robot Navigation

Key terms:

Feature(X): An input variable (age, cholesterol)

Label/Target(Y): What we want to predict (heart disease= 1 or 0)

Model: A mathematical function that maps X □ Y

Training: The process of teaching the model by feeding it data

Prediction: Using the model on new, unseen data to guess Y

Loss Function: A measure of how wrong the model's predictions are.

Optimizer: A method to reduce the loss and improve the model.

Evaluation: Checking how well the model performs (accuracy, precision…)

Machine Learning Process (pipeline)

1. Understand the problem
2. Collect/Load Data
3. Explore/Clean
4. Feature Engineering
5. Split Data: Train/Test (normally 70/30)
6. Train Model (Logistic Regression)
7. Evaluate Model: Accuracy, Precision, Confusion Matrix

8. Deploy or Improve: Use it in real world OR improve accuracy

Performance Metrics:

Accuracy: % of correct predictions

Precision: How many predicted positives were actually correct

Recall: How many actual positives did we catch

F1-Score: Harmonic mean of Precision and Recall

Harmonic mean = (2 x P x R) / (P + R)

Example:

Point A □ B : 60 km/h

Point B □ A: 40 km/h

Confusion Matrix

Patient	Actual	Predicted	What Happened
A	1	1	TP
B	0	0	TN
C	1	0	FN
D	0	1	FP

Actual Predicted

1 1 TP

1 0 FN

0 0 TN

0 1 FP

1 1

Email filtering AI

AI: 10 emails spam

Actually: 6 of them were truly spam

4 emails were wrongly marked as spam

Precision = TP / (TP + FP) = 6/10 = 660%

Recall= TP / (TP + FN) = 6/10 = 60%