Machine Learning

- Branch of AI where **computers learn from data** without being explicitly programmed.
- Instead of rules → we give **examples**.
- Goal: make predictions, find patterns, or take decisions automatically.
- Rule-based: "If age < 18 → student discount."
- ML: Give system 1,000 records of people (age, purchase). It *learns* the pattern and predicts discount eligibility.

Types

- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning

Supervised Learning

- Input and output are given (i.e. Labelled Data Required)
- Learns Mapping from X → Y
- Example:
    - Predict House price from size and location (Regression)
    - Classify email as Spam / Not Spam (Classification)
- If we have images of dogs and cats will label on it and want to create a ML model from it then we will use Supervise Learning
- Algorithms: Linear Regression, Logistic Regression, SVM, Decision Tree

Unsupervised

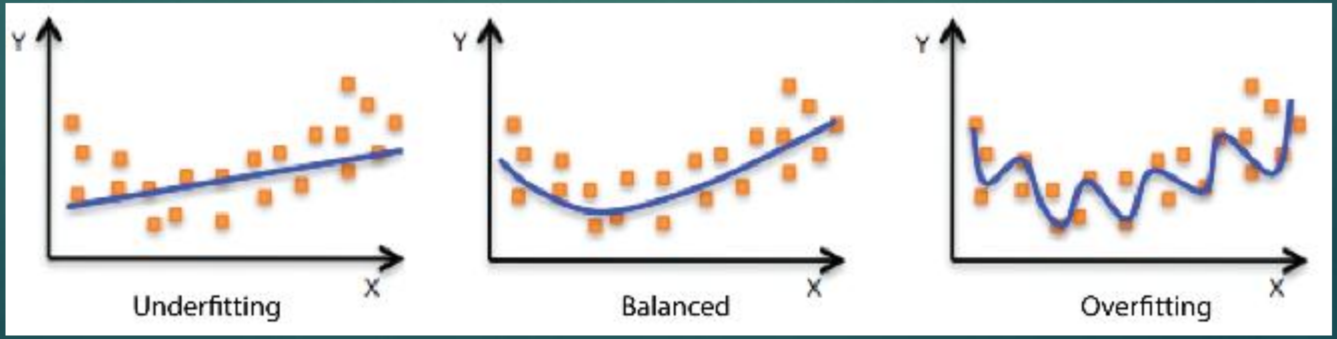
- Only input is given to the training model
- Goal is to find pattern in data
- Example:
  - Group customer by behavior (Clustering)
- If we have images of dogs and cats without label and want to create a ML model from it then we will use unsupervised Learning
- Example: K – Means Clustering, PCA

Reinforcement Learning

- Agents learns by trial and error with rewards/punishment
- Examples:
    - Self – Driving Car
    - Game Playing AI

Key Concepts

- Feature (X) ➔ Input Variables (Independent)
- Labels (Y) ➔ What we want to predict (Target Variable)
- Overfitting ➔ Model memorizes and fails on test data
- Underfitting ➔ Model too simple, Misses pattern
- Evaluation ➔ How model performs



Steps

1. Problem Definition. (What are we trying to predict)
2. Collect Data and Pre-Process it.
3. Split it into test and train data
4. Choose ML model
5. Train
6. Evaluate
7. Deploy

Scikit Learn

1. External Library for ML models (pip install scikit-learn)
2. ML algorithm are available as a Class
3. We use .fit(), .predict() for fitting and predicting data
4. Also have methods to split data and evaluate model

Scikit Learn

```
from sklearn import datasets
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

iris = datasets.load_iris()

print(iris.keys())  # print(iris.data)

iris_dframe = pd.DataFrame(iris.data, columns=iris.feature_names)
iris_dframe["species"] = iris.target

sns.pairplot(iris_dframe, hue="species")
plt.show()
```