

Machine Learning

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- ① What is Machine Learning?
- ② Different Types of Machine Learning

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What is Machine Learning

- Tom M. Mitchell defines machine learning in his book "Machine Learning" (1997) with a widely accepted and clear definition:
- A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P , if its performance at tasks T , as measured by P , improves with experience E .

- Breaking Down the Definition:
- Task (T): The specific activity the program is designed to perform (e.g., recognizing handwritten digits, recommending movies, or cancer detection).
- Experience (E): The data or interactions that the program is exposed to during training.
- Performance Measure (P): A quantitative metric to evaluate how well the program performs the task.

① What is Machine Learning?

② Different Types of Machine Learning

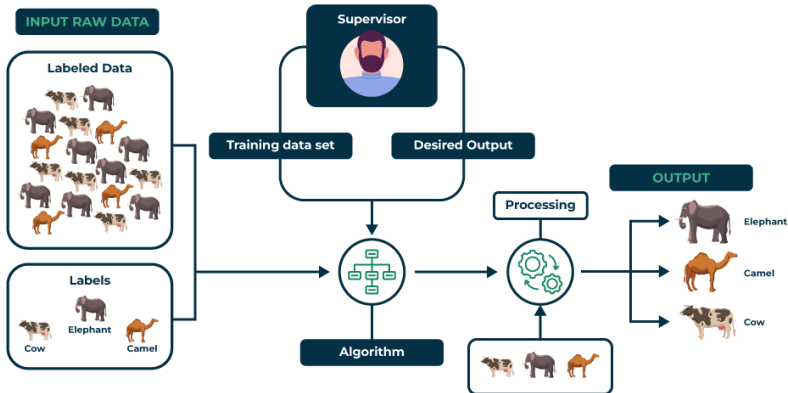
Supervised Learning

- In supervised learning, the model learns from labeled data, where each input (feature) is paired with a corresponding output (label or target). The goal is to learn a mapping from inputs to outputs.
- In other words, we provide the computer with the problem and its solution, enabling it to discover answers for unsolved problems.

Supervised Learning Example

- **Regression:** Predict continuous values (e.g., house prices, temperature).
- **Classification:** Predict discrete categories (Heart Disease Detection, Classifying the risk level of cardiovascular diseases using patient vitals and medical history)

Supervised Learning



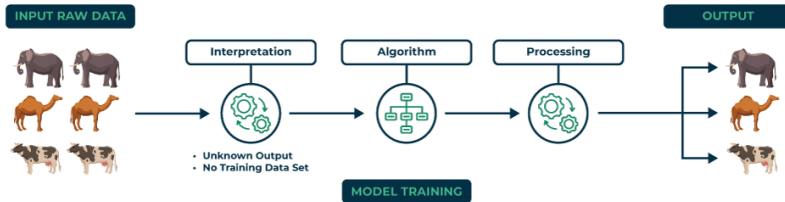
Unsupervised Learning

- In unsupervised learning, the model learns patterns or structures from data without labeled outputs. It is used to uncover hidden patterns or groupings.

Unsupervised Learning Example

- **Clustering:** Group similar data points (e.g., customer segmentation).
- Algorithms: K-Means, DBSCAN, Hierarchical Clustering.

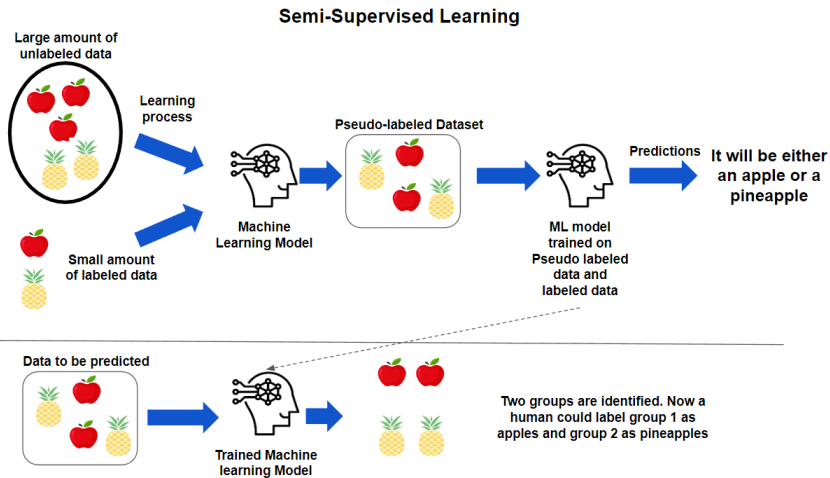
Unsupervised Learning



Semi-Supervised Learning

- Semi-supervised learning combines elements of supervised and unsupervised learning. It uses a small amount of labeled data and a large amount of unlabeled data to improve learning.
- Example : Image recognition tasks with few labeled images and many unlabeled images.

Semi-Supervised Learning



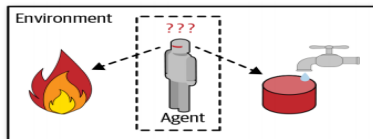
Reinforcement Learning

- Reinforcement learning (RL) involves learning by interacting with an environment to achieve a goal. The model (agent) learns to take actions that maximize cumulative rewards.
- Example : Robotics, game playing (e.g., AlphaGo), autonomous vehicles.

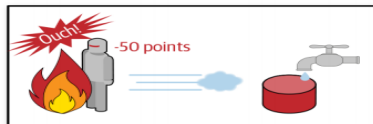
Reinforcement Learning Components

- Agent: The learner or decision-maker.
- Environment: The system the agent interacts with.
- Policy: A strategy that maps states to actions.
- Reward Signal: Feedback to guide learning.

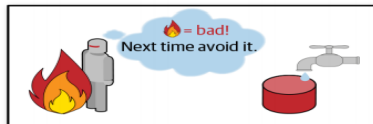
Reinforcement Learning



- 1 Observe
- 2 Select action using policy



- 3 Action!
- 4 Get reward or penalty



- 5 Update policy (learning step)
- 6 Iterate until an optimal policy is found

End of Preface