Machine Learning

Types of machine learning

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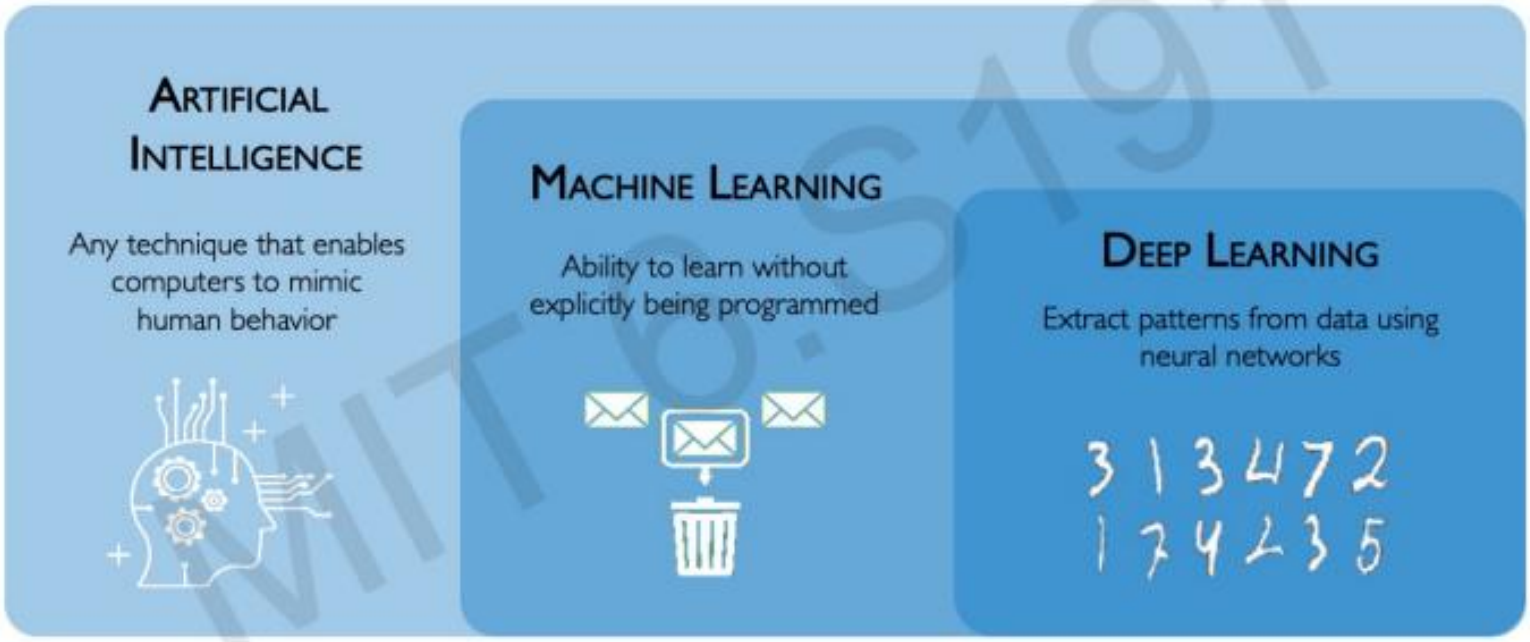
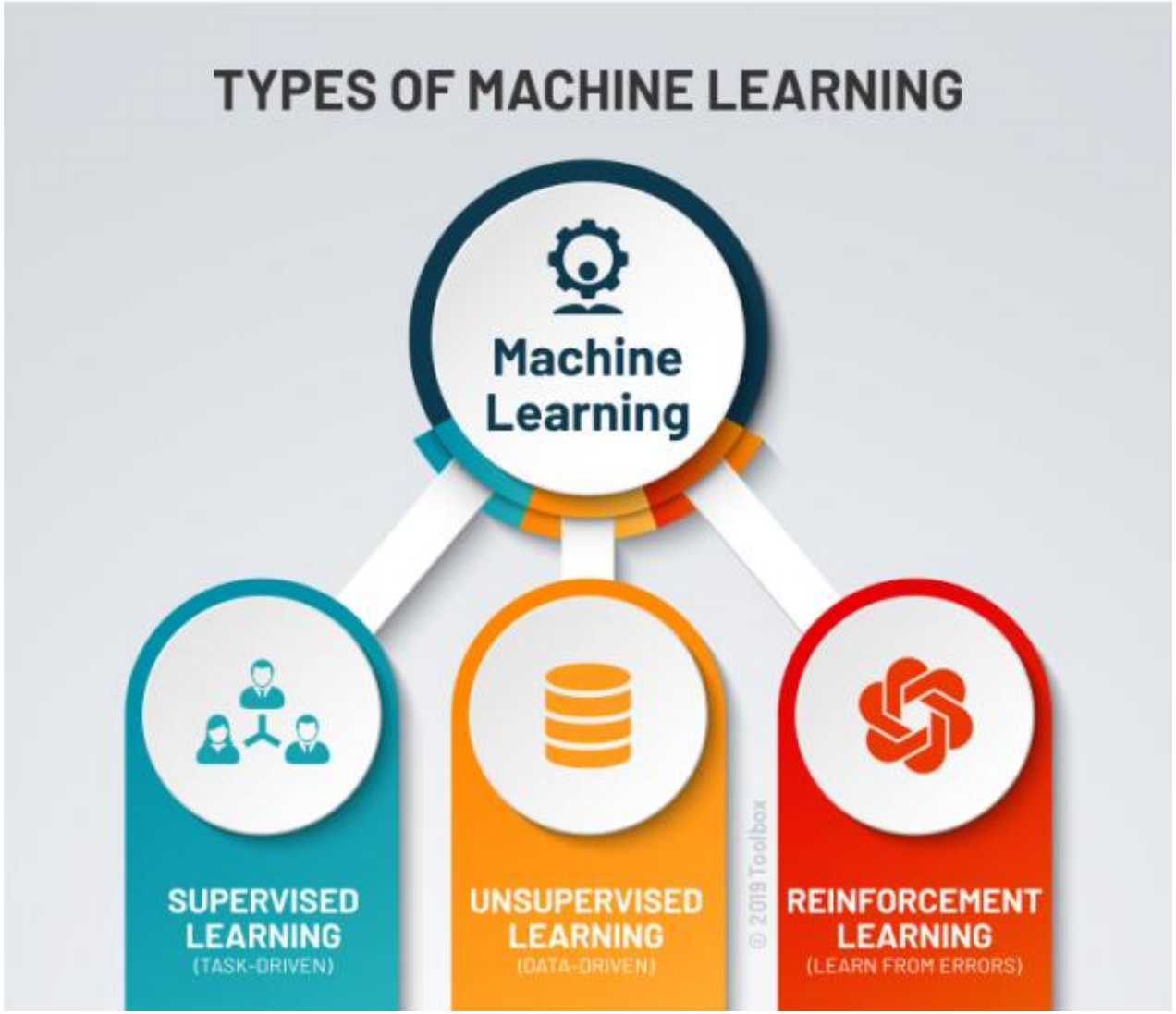
Recap

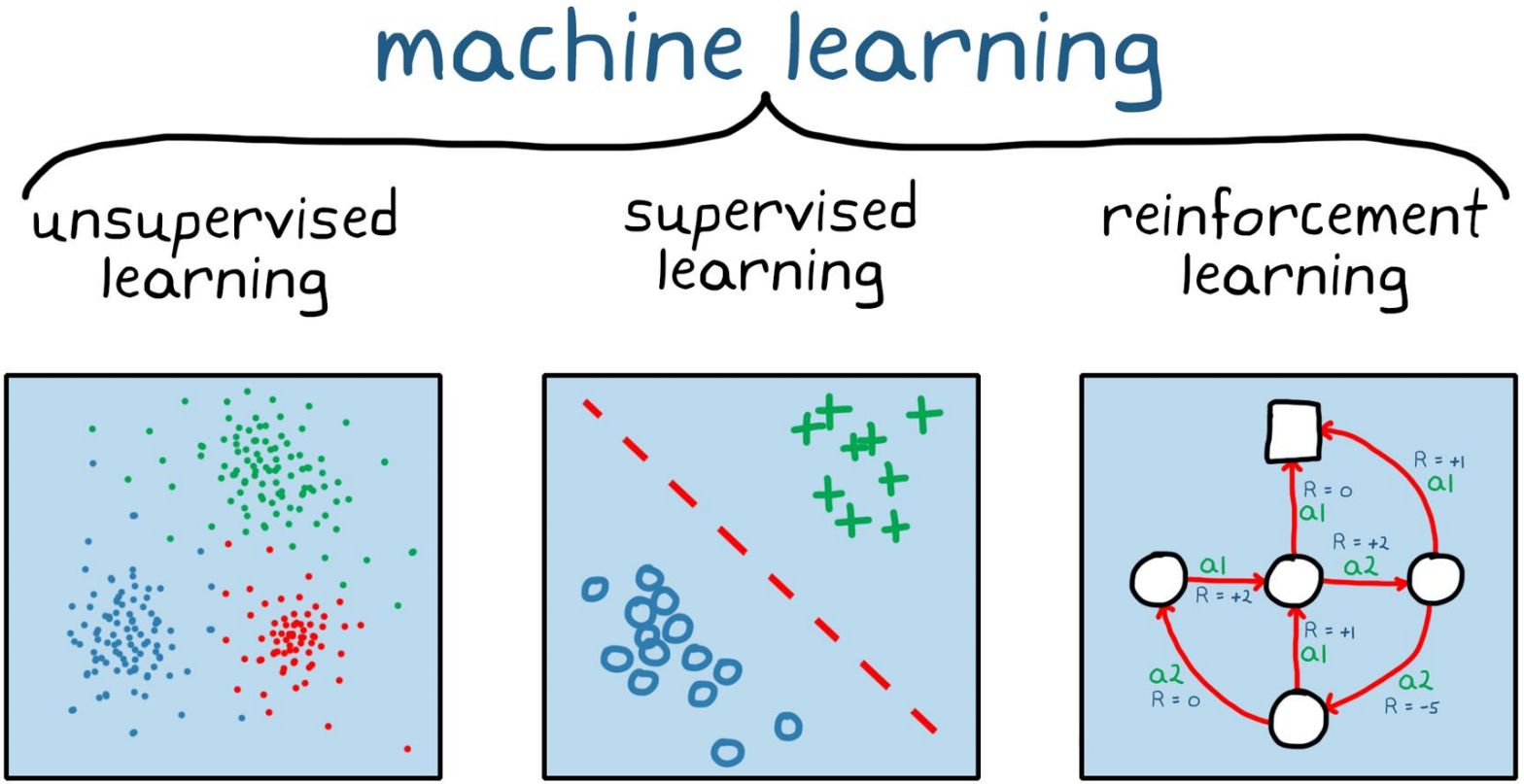
Machine Learning



Machine Learning



Machine Learning



Machine Learning

❑ Supervised Learning

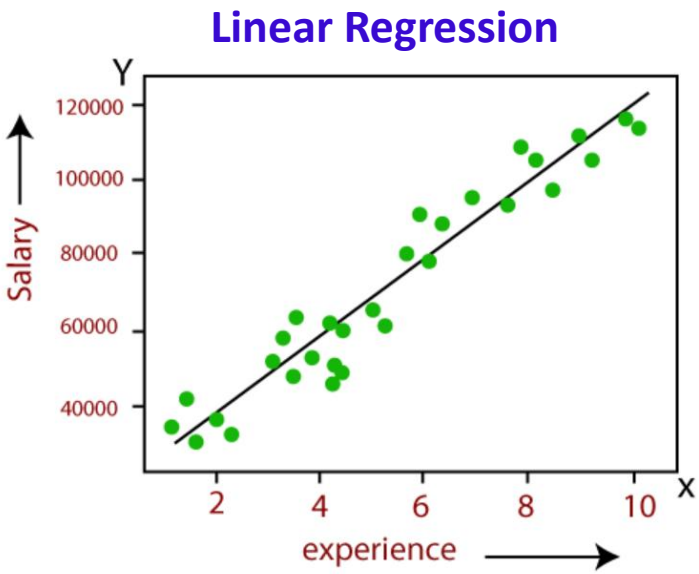
Supervised learning is the most common type of machine learning. It involves training a model using a labeled dataset, which means each input comes with the corresponding output (target). The model learns to map inputs to outputs by finding patterns in the data.

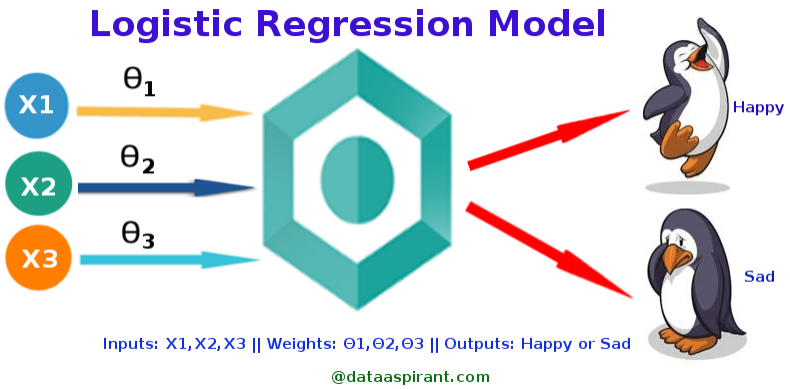
•**Key Characteristics:**

- **Labeled Data:** In supervised learning, the data is labeled, meaning that each training example includes both the input data and the desired output.
- **Learning Process:** The model makes predictions based on the training data and adjusts itself based on the errors it makes. The goal is to minimize the difference between the predicted and actual values.
- **Examples:**
  - **Classification:** Predicting categories, such as spam detection in emails (spam vs. not spam).
  - **Regression:** Predicting a continuous value, like house price prediction.

Machine Learning

- **Supervised Learning**





Machine Learning

- **Common Algorithms:**
  - Linear Regression
  - Logistic Regression
  - Support Vector Machines (SVM)
  - Neural Networks

- **Pros:**
  - High accuracy with enough labeled data.
  - Clear guidelines on expected outputs.

- **Cons:**
  - Requires a large amount of labeled data.
  - Less effective when there is a scarcity of labeled examples.

Machine Learning

❑ Unsupervised Learning

Unsupervised learning works with data that does not have labeled outcomes. The model tries to find hidden patterns or intrinsic structures in the input data without specific instructions on what to look for.

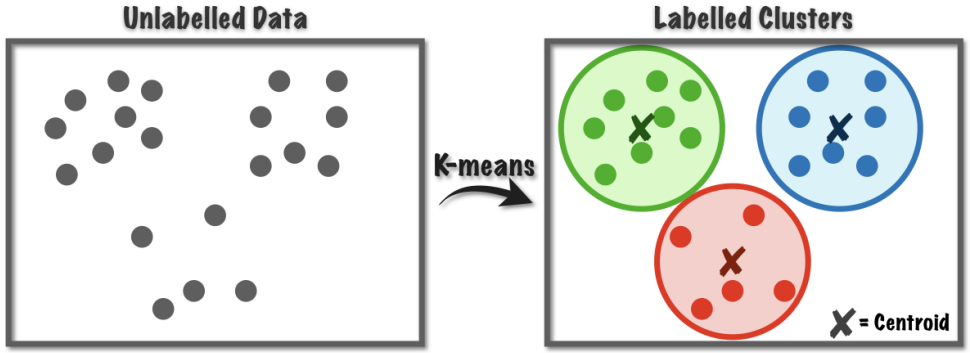
•**Key Characteristics:**

- **Unlabeled Data:** The input data does not have corresponding output labels.
- **Learning Process:** The model learns patterns directly from the input data by identifying similarities or differences.
- **Examples:**
  - **Clustering:** Grouping similar data points together, such as customer segmentation in marketing.
  - **Anomaly Detection:** Identifying unusual data points that do not fit the general pattern.

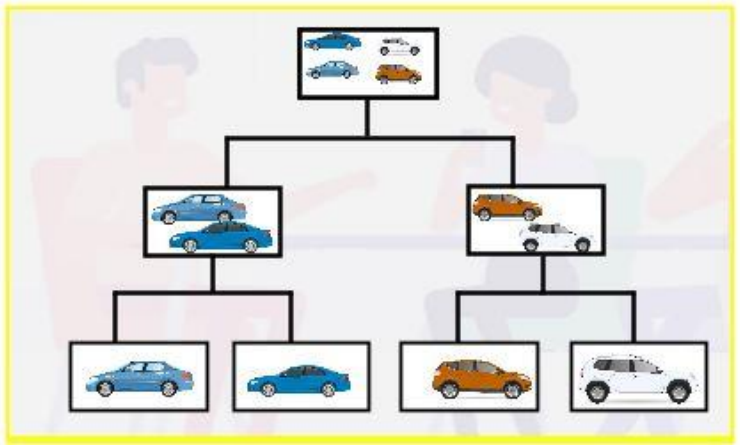
Machine Learning

- **Unsupervised Learning**

K-Means Clustering



Hierarchical Clustering



Machine Learning

- **Common Algorithms:**
  - K-Means Clustering
  - Hierarchical Clustering

- **Pros:**
  - Useful for exploring unknown patterns in the data.
  - Can handle large datasets without requiring labeled examples.

- **Cons:**
  - Results can be less interpretable.
  - Challenging to evaluate since there are no predefined outputs.

Machine Learning

❑ Reinforcement Learning (RL)

Reinforcement learning is a goal-oriented approach where an agent learns to interact with an environment to maximize cumulative rewards. It is often used in situations where actions must be taken sequentially to achieve a long-term objective.

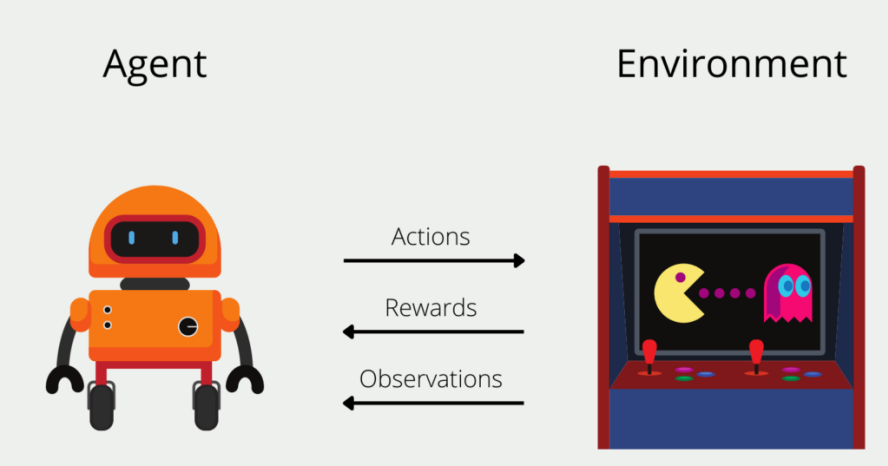
•Key Characteristics:

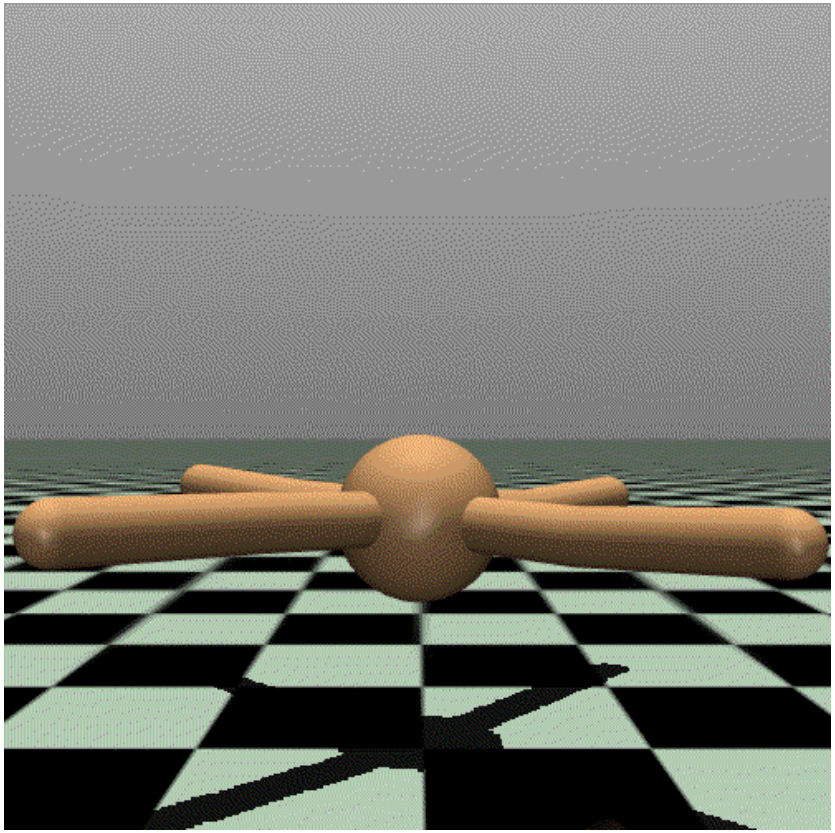
- **Agent & Environment:** The agent learns by interacting with the environment, taking actions, and receiving feedback in the form of rewards or penalties.
- **Learning Process:** The agent explores the environment and learns a policy that maximizes the expected reward over time.
- **Examples:**
  - **Game Playing:** Teaching an agent to play chess or video games.
  - **Robotics:** Training robots to perform specific tasks, such as navigating an obstacle course.
  - **Self-driving Cars:** Learning to drive through continuous interactions with road conditions and traffic rules.

Machine Learning

- **Reinforcement Learning (RL)**

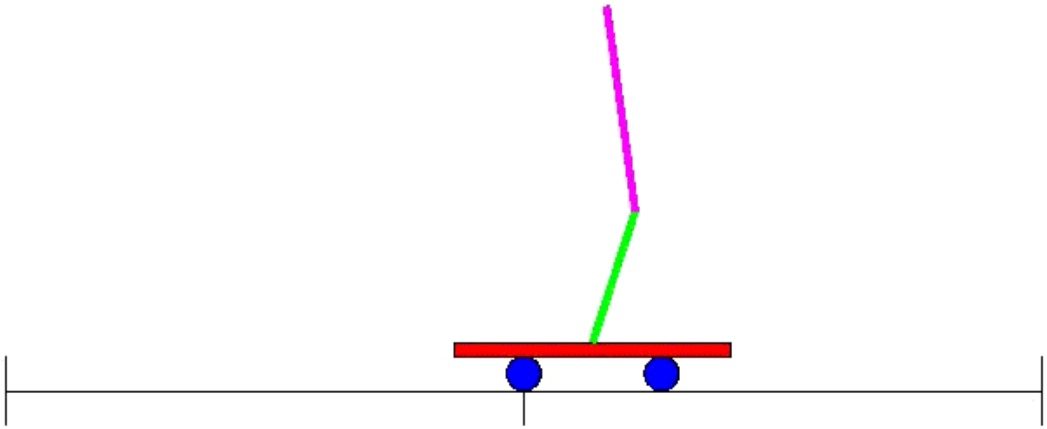
Q-Learning





Machine Learning

- **Reinforcement Learning (RL)**



Machine Learning

- **Common Algorithms:**
  - Q-Learning
  - Deep Q Networks (DQN)
  - Proximal Policy Optimization (PPO)

- **Pros:**
  - Suitable for complex problems involving long-term planning.
  - Does not require labeled datasets.

- **Cons:**
  - Requires extensive computation and time to learn.
  - High risk due to the trial-and-error nature of learning.

Machine Learning

Aspect	Supervised Learning	Unsupervised Learning	Reinforcement Learning
Input Data	Labeled	Unlabeled	States & Actions
Output	Known	Unknown	Reward Maximization
Main Goal	Map inputs to outputs	Find patterns or structure	Maximize rewards
Common Use Cases	Classification, Regression	Clustering, Anomaly Detection	Game AI, Robotics