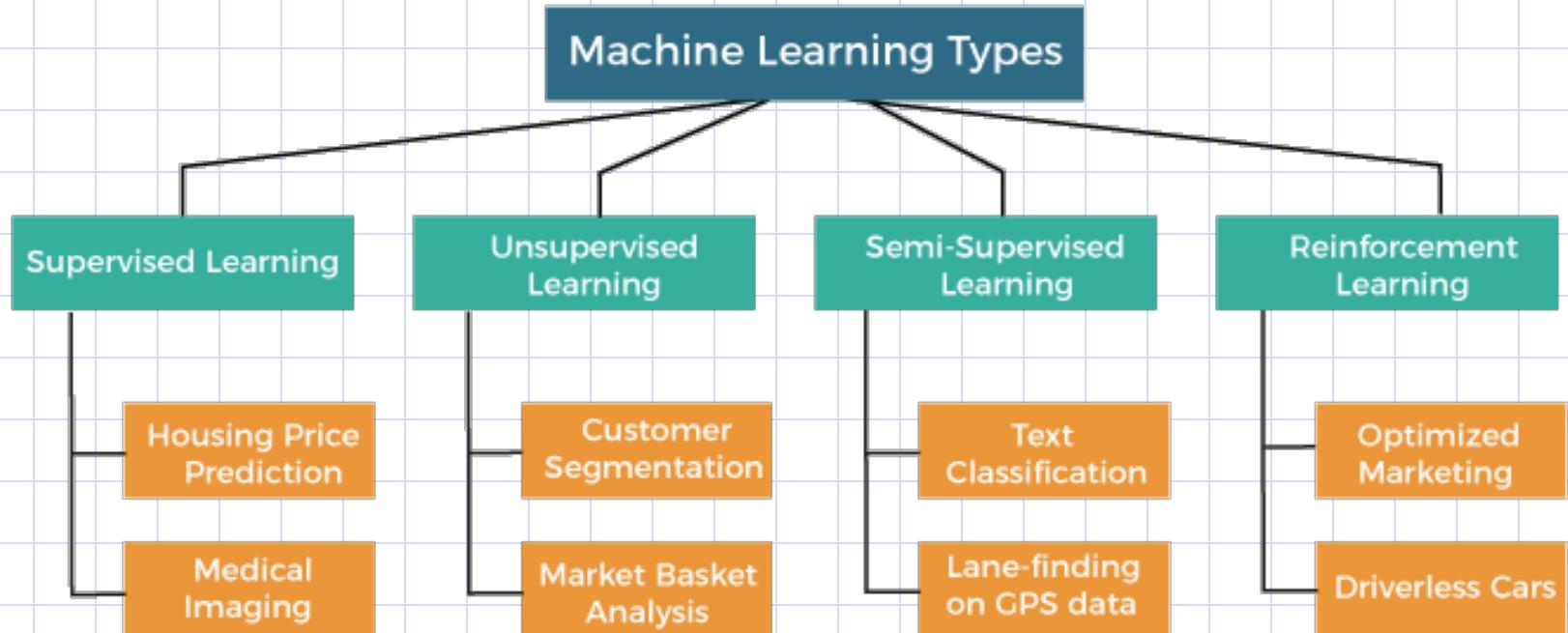


Goal of Reinforcement Learning

Objectives

- Understand reinforcement learning and compare with other types
- Describe how rewards relate to the goal of an agent
- Identify episodic tasks

Reinforcement Learning



Goal of Reinforcement
Learning

Reinforcement Learning

- Reinforcement learning works on a feedback-based process, taking action, learning from experiences, and improving its performance.
- Agent gets rewarded for each good action and get punished for each bad action;
- The goal of reinforcement learning agent is to maximize the rewards.

Reinforcement Learning

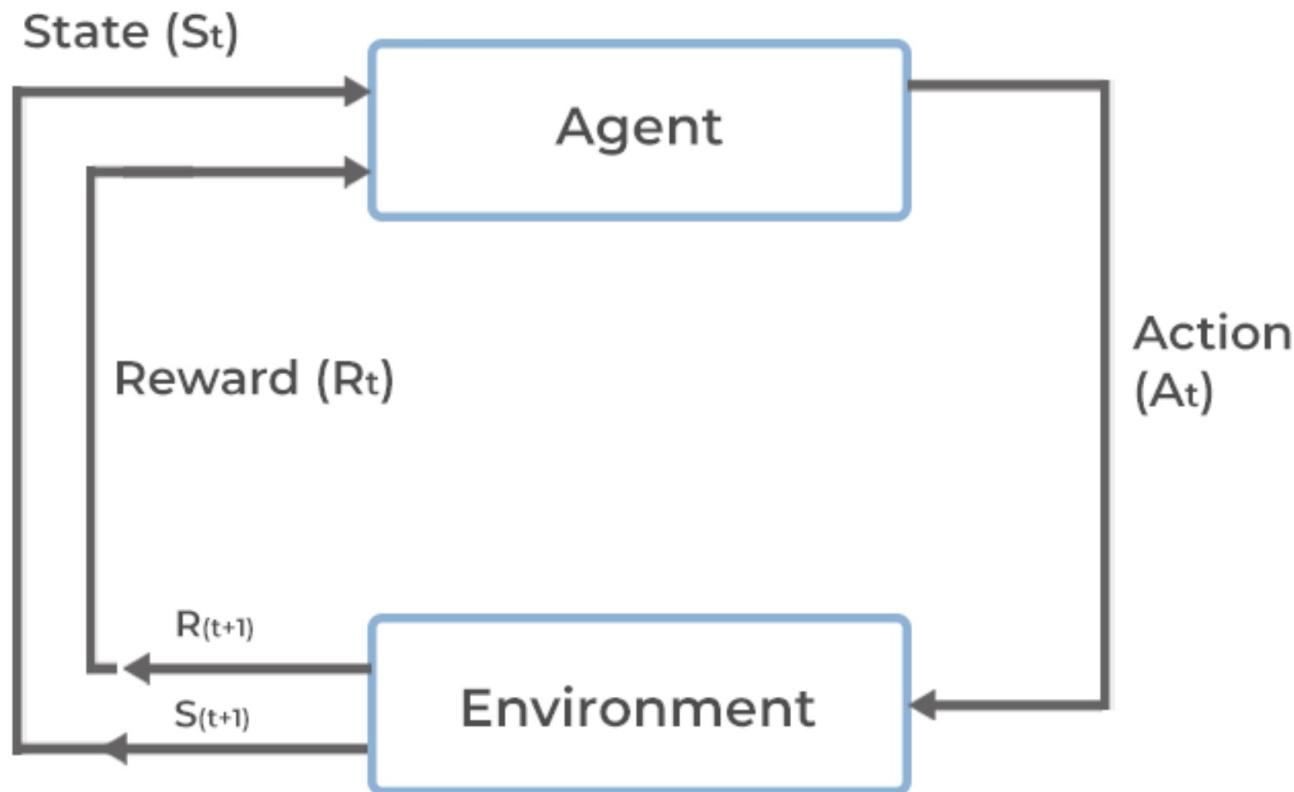
- There is no labelled data like supervised learning, and agents learn from their experiences only.
- The reinforcement learning process is similar to a human being; for example, a child learns various things by experiences in his day-to-day life.

Reinforcement Learning

- Reinforcement learning is categorized mainly into two types of methods:
 - **Positive Reinforcement Learning:** increasing the tendency that the required behavior would occur again by adding something.
 - **Negative Reinforcement Learning:** increases the tendency that the specific behavior would occur again by avoiding the negative condition.

Reinforcement Learning

- Key components of reinforcement learning



Reinforcement Learning

- Key components of reinforcement learning include:
 - Agent: The learner or decision-maker that interacts with the environment.
 - Environment: The external system with which the agent interacts.
 - State: A representation of the current situation or configuration of the environment, which provides all relevant information necessary for decision-making.

Reinforcement Learning

- Key components of reinforcement learning include:
 - Action: The set of possible moves or decisions that the agent can take at any given state.
 - Reward: A scalar feedback signal received by the agent after taking an action in a particular state.
 - Policy: A strategy or mapping from states to actions that the agent follows to select actions.

Reinforcement Learning

	Supervised Learning	Reinforcement Learning
Objective	Supervised learning aims to learn a mapping from input data to output labels based on labeled training examples.	Reinforcement learning focuses on learning a policy to maximize cumulative rewards by interacting with an environment.
Training Data	Supervised learning algorithms require a dataset consisting of input-output pairs, where the correct output (label) is provided for each input.	RL algorithms learn from feedback in the form of rewards received after taking actions in the environment. They do not require labeled datasets but learn from trial and error.
Feedback Signal	The training process relies on a feedback signal in the form of labeled data. The algorithm adjusts its parameters to minimize the discrepancy between predicted and actual outputs.	The feedback signal in RL comes in the form of rewards, which indicate the desirability of actions taken by the agent.

Goal of Reinforcement Learning

Reinforcement Learning

	Supervised Learning	Reinforcement Learning
Use Case	Supervised learning is suitable for tasks such as classification, regression, and object detection, where there is a clear distinction between input features and output labels.	RL is suitable for sequential decision-making tasks, where actions influence future states and outcomes. It is commonly used in robotics, game playing, autonomous driving, and resource management.
Examples	Image classification, spam detection, sentiment analysis.	Playing chess or Go, robotic control, autonomous driving.

Reinforcement Learning

- The goal of reinforcement learning: maximizing total future reward

$$\mathbb{E}[G_t] = \mathbb{E}[R_{t+1} + R_{t+2} + R_{t+3} + \dots]$$

maximize the expected return

Episodic Tasks

- Episodic tasks are a type of task in reinforcement learning (RL) where the agent interacts with the environment in discrete episodes.
- Each episode consists of a sequence of steps or time steps, starting from an initial state, progressing through a series of state-action transitions, and ending in a terminal state.

Episodic Tasks

Episodic Tasks

episode



Goal of Reinforcement
Learning

Episodic Tasks

- Key characteristics of episodic tasks include:
 - Episode Termination: Each episode terminates after a finite number of time steps or when a specific condition is met. Once an episode ends, the environment resets to its initial state, and a new episode begins.
 - Finite Horizon: Episodic tasks have a finite horizon, meaning there is a fixed number of time steps within each episode before termination. The length of an episode may vary depending on the task and environment.

Episodic Tasks

- Key characteristics of episodic tasks include:
 - Goal-Oriented: In many cases, episodic tasks involve achieving a specific goal or objective within the episode.
The agent's goal is to learn a policy that maximizes cumulative rewards or achieves the desired outcome over the course of the episode.

Episodic Tasks

- Examples of episodic tasks include playing a single game of chess, completing a maze, navigating a robot to a target location, or solving a puzzle within a fixed number of moves. In these scenarios, the agent's objective is typically to achieve a certain state or goal state within the episode.

Summary

- Understand reinforcement learning and compare with other types
- Describe how rewards relate to the goal of an agent
- Identify episodic tasks

Q & A

Goal of Reinforcement
Learning