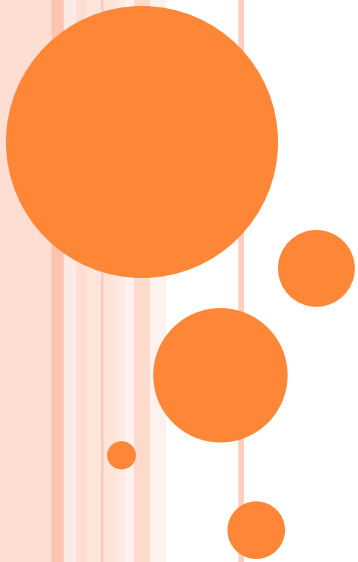


REINFORCEMENT LEARNING



WHAT IS REINFORCEMENT LEARNING?

- Reinforcement Learning is a **feedback-based** Machine learning technique in which an agent learns to behave in an environment by performing the actions and seeing the results of actions. For each good action, the agent gets positive feedback, and for each bad action, the agent gets negative feedback or penalty.
- In Reinforcement Learning, the **agent learns automatically** using feedbacks without any labeled data, unlike supervised learning.
- Since there is no labeled data, so the agent is bound to learn by its experience only.
- RL solves a specific type of problem where decision making is sequential, and the goal is long-term, such as **game-playing, robotics**, etc.

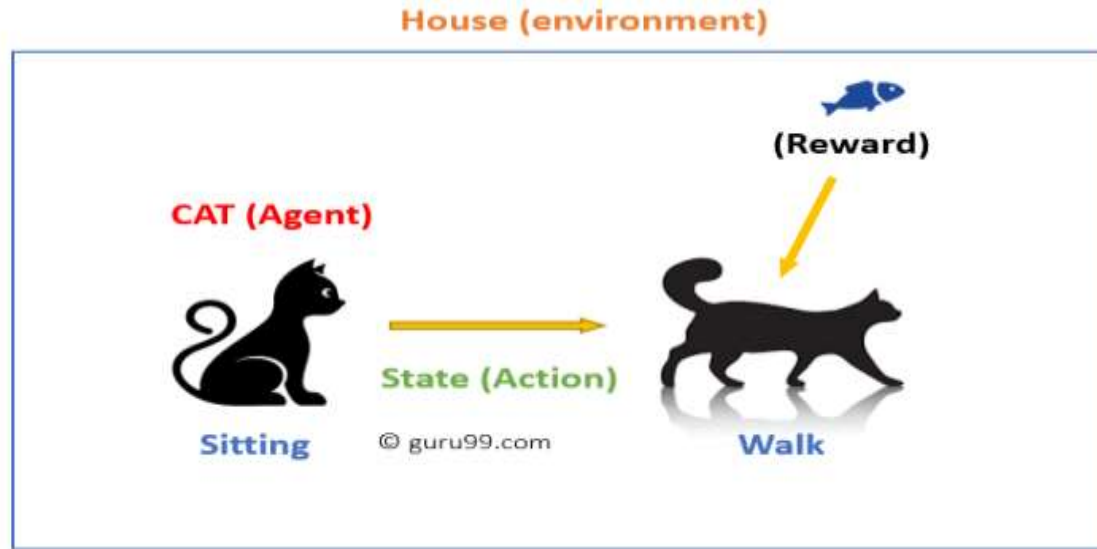
- The agent interacts with the environment and explores it by itself. The primary goal of an agent in reinforcement learning is to improve the performance by getting the maximum positive rewards.
- The agent learns with the process of hit and trial, and based on the experience, it learns to perform the task in a better way.
- Hence, we can say that *"Reinforcement learning is a type of machine learning method where an intelligent agent (computer program) interacts with the environment and learns to act within that."*



HOW REINFORCEMENT LEARNING WORKS?

Consider the scenario of teaching new tricks to your cat

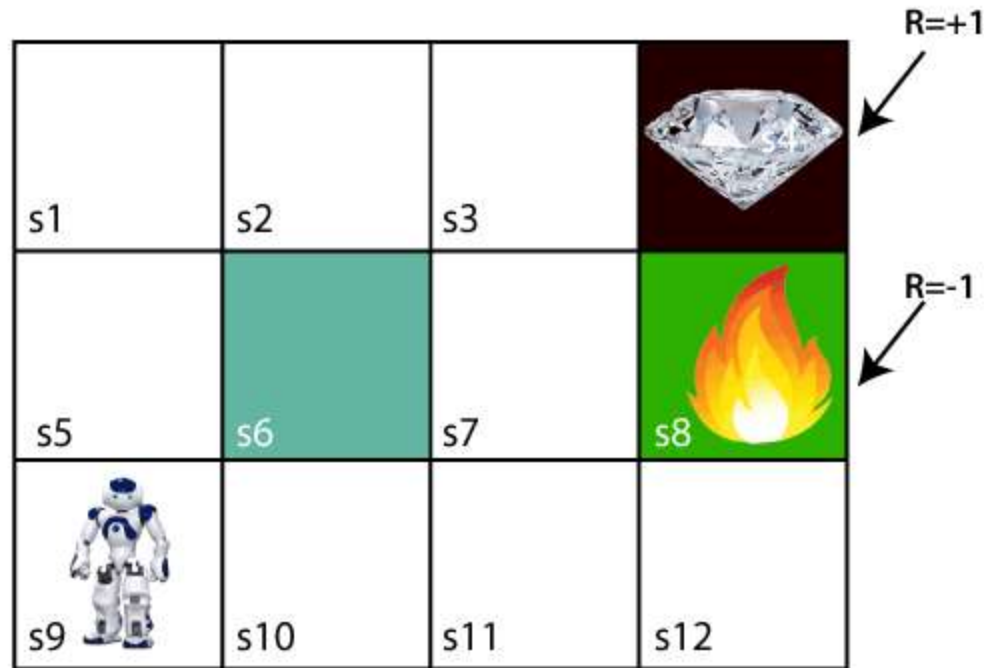
- As cat doesn't understand English or any other human language, we can't tell her directly what to do. Instead, we follow a different strategy.
- We emulate a situation, and the cat tries to respond in many different ways. If the cat's response is the desired way, we will give her fish.
- Now whenever the cat is exposed to the same situation, the cat executes a similar action with even more enthusiastically in expectation of getting more reward(food).
- That's like learning that cat gets from "what to do" from positive experiences.
- At the same time, the cat also learns what not do when faced with negative experiences.



In this case:

- Our cat is an agent that is exposed to the environment. Environment is our house. An example of a state could be your cat sitting, and you use a specific word in for cat to walk.
- Our agent reacts by performing an action transition from one "state" to another "state."
- For example, your cat goes from sitting to walking.
- The reaction of an agent is an action, and the policy is a method of selecting an action given a state in expectation of better outcomes.
- After the transition, they may get a reward or penalty in return.

Example: Let's take an example of a maze environment that the agent needs to explore. Consider the below image:



- In the image, the agent is at the very first block of the maze. The maze is consisting of an S_6 block, which is a **wall**, S_8 a **fire pit**, and S_4 a **diamond block**.
- The agent cannot cross the S_6 block, as it is a solid wall. If the agent reaches the S_4 block, then get the **+1 reward**; if it reaches the fire pit, then gets **-1 reward point**. It can take four actions: **move up, move down, move left, and move right**.
- The agent can take any path to reach to the final point, but he needs to make it in possible fewer steps. Suppose the agent considers the path **S9-S5-S1-S2-S3**, so he will get the +1-reward point.



TYPES OF REINFORCEMENT LEARNING

Two kinds of reinforcement learning methods are:

Positive:

It is defined as an event, that occurs because of specific behavior. It increases the strength and the frequency of the behavior and impacts positively on the action taken by the agent.

This type of Reinforcement helps you to maximize performance and sustain change for a more extended period.

Negative:

Negative Reinforcement is defined as strengthening of behavior that occurs because of a negative condition which should have stopped or avoided. It helps you to define the minimum stand of performance. However, the drawback of this method is that it provides enough to meet up the minimum behavior.

WHY USE REINFORCEMENT LEARNING?

Here are prime reasons for using Reinforcement Learning:

- It helps you to find which situation needs an action
- Helps you to discover which action yields the highest reward over the longer period.
- Reinforcement Learning also provides the learning agent with a reward function.
- It also allows it to figure out the best method for obtaining large rewards.



REINFORCEMENT LEARNING VS SUPERVISED LEARNING

Parameters	Reinforcement Learning	Supervised Learning
Decision style	reinforcement learning helps you to take your decisions sequentially.	In this method, a decision is made on the input given at the beginning.
Works on	Works on interacting with the environment.	Works on examples or given sample data.
Dependency on decision	In RL method learning decision is dependent. Therefore, you should give labels to all the dependent decisions.	Supervised learning the decisions which are independent of each other, so labels are given for every decision.
Best suited	Supports and work better in AI, where human interaction is prevalent.	It is mostly operated with an interactive software system or applications.
Example	Chess game	Object recognition

