# Implementation of RL AIgorithms in OpenAI Gym

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# Problem Statement

We want to do a practical project that implements some reinforcement learning algorithms that we had learned in class and some variants of them.

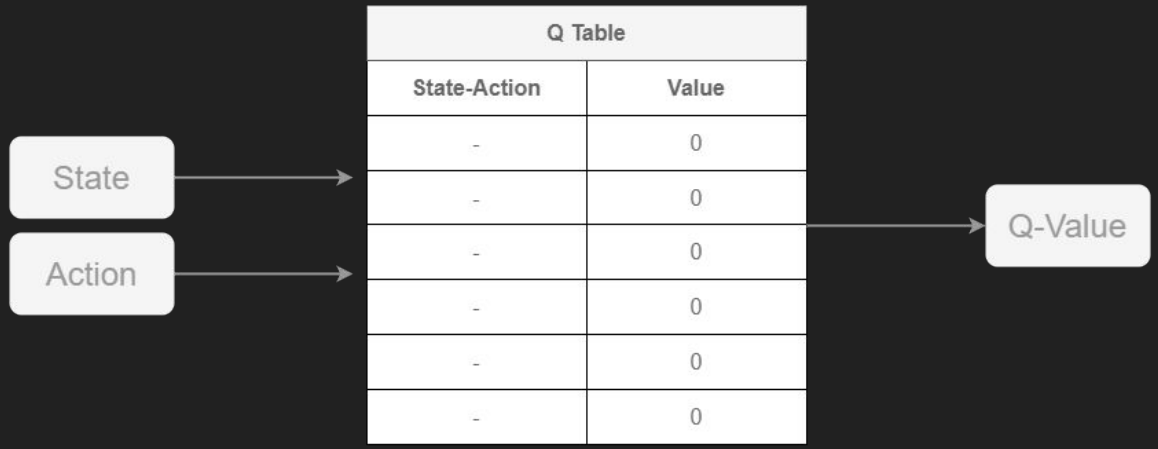
The following is a list of the algorithms we will implement:

- Q-Learning
- Deep Q-Network (DQN)
  - Experience Replay
  - Prioritized Experience Replay

# Q-Learning

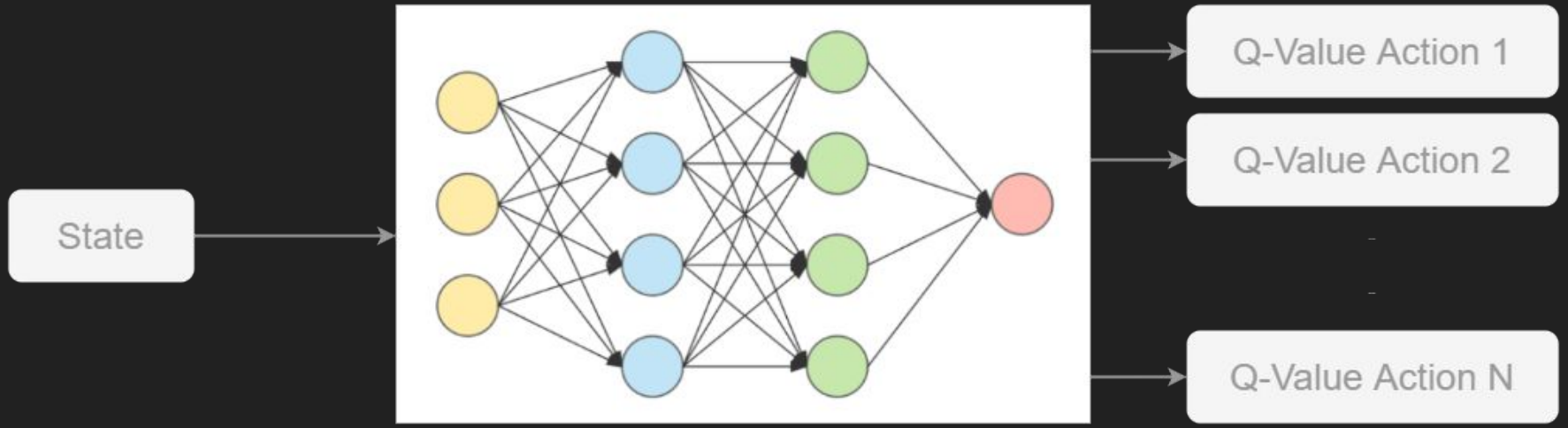
Q-Learning is a model-free learning technique that can be used to find the optimal action-selection policy using a Q function.

Q-learning is an off-policy TD control algorithm. The learned action-value function,Q, directly approximates $q_*$,the optimal action-value function, independent of the policy being followed.



# Deep Q-Network (DQN)

The **Deep Q-Network (DQN)** combines Q-Learning with deep neural networks to let RL work for complex, high-dimensional environments, like video games, or robotics.



# Deep Q-Network (DQN) - Buffers

A critical component of DQN-style algorithms is memory buffer.

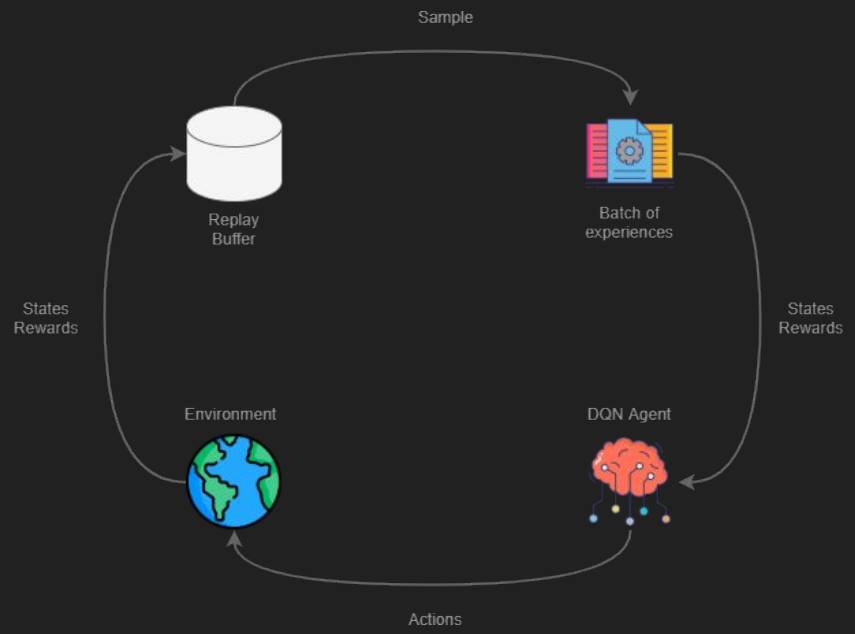
In this project we will develop two approaches:

**Experience Replay**

The most basic sampling strategy, it uses uniform sampling

**Prioritized Experience Replay**

Select experiences that significantly diverges from the expected reward.



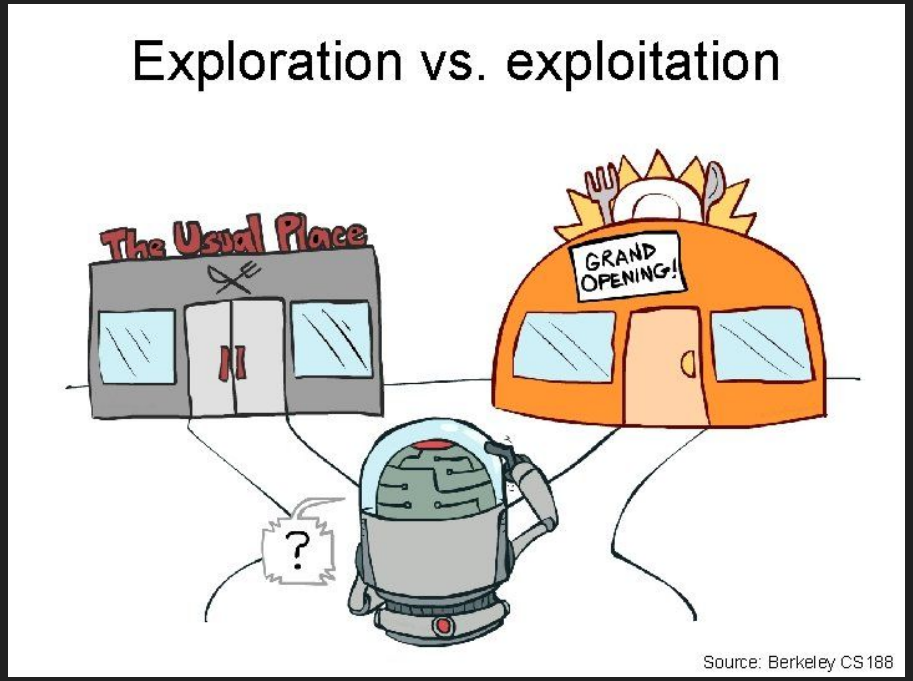
# Exploration vs Exploitation

The exploration-exploitation trade-off is a well-known problem in decision-making systems.

**Exploration**: Select random action.

**Exploitation**: Select best known action.

In this project we will implements the ϵ-greedy policy in our algorithms.

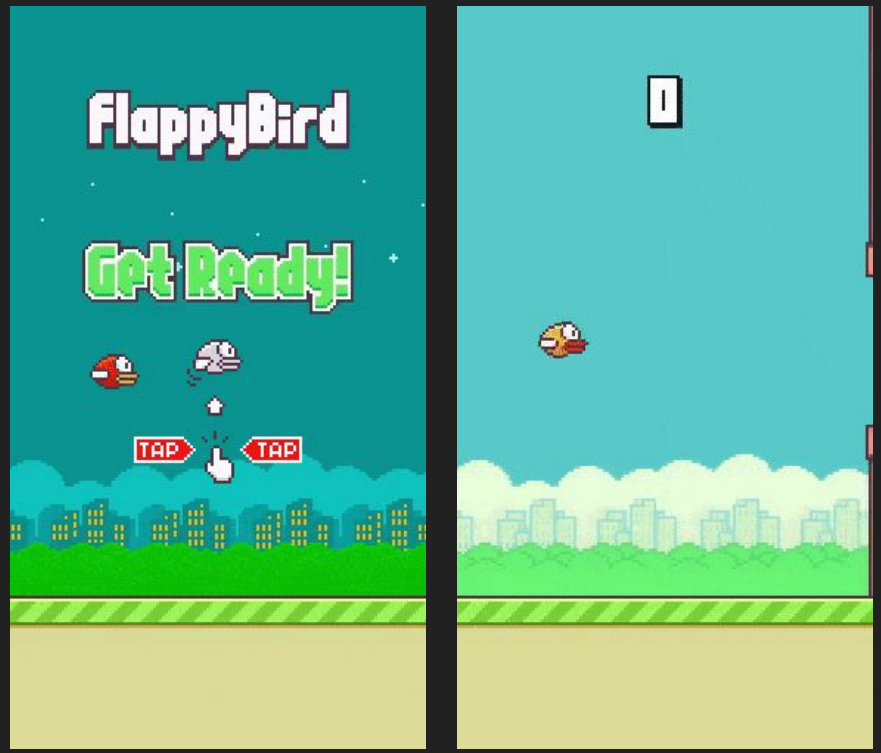


# Environment

State observation is composed by RGB-arrays (images) representing the game's screen.

Available actions:

- do nothing
- jump



# Experiments

We hope to test the reinforcement learning algorithms in the Lunar Lander OpenAI Gym Environment as explained earlier.

At the end of the experiment, we will provide a report with the results of the experiments and the performance of each algorithm.

**Experiment #1**

Q-Learning

**Experiment #2**

Deep Q-Network (Experience Replay)

**Experiment #3**

Deep Q-Network (Prioritized Experience Replay)

# Questions?