# Introduction to OpenAI Gym

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# Basic RL Framework

**Open AI Gym**

Environment

Action

Reward/
Penalty

Agent

Next-State
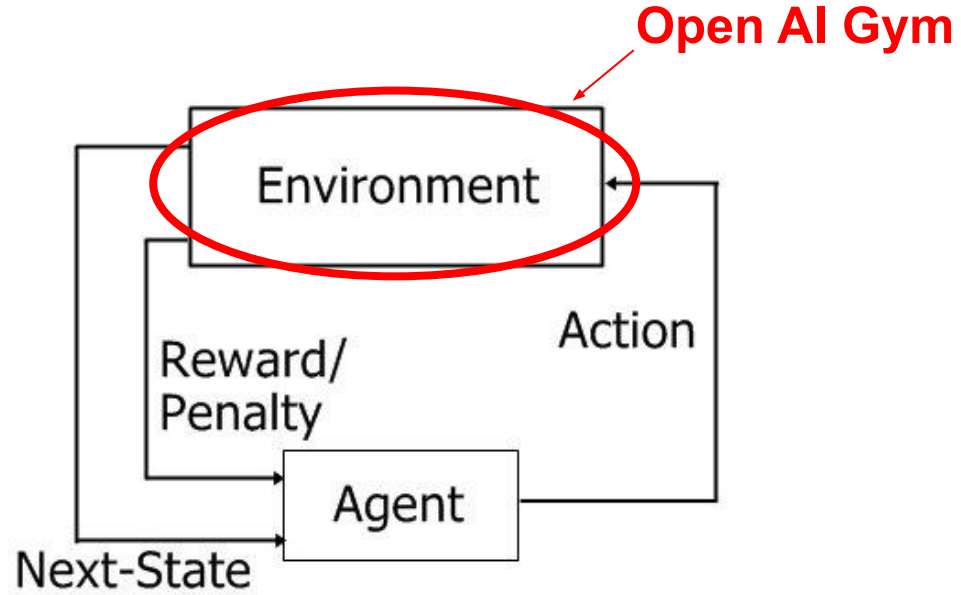
# What is OpenAI Gym?

- A toolkit for testing RL algorithms
- Provides you with different environments ([https://gym.openai.com/envs/](https://gym.openai.com/envs/))
- Up to you to create RL agents for these environments
- Has a standard API to access these different environments

# Why do we want to use the OpenAI gym?

- Safe and easy to get started
- Its open source
- Intuitive API
- Widely used in a lot of RL research
- Great place to practice development of RL agents

# Common Aspects of OpenAI Gym Environments

- Making the environment
- Action space, state space
- Reset function
- Step function

# Action and State/Observation Spaces

- Environments come with the variables *state_space* and *observation_space* (contain shape information)
- Important to understand the state and action space before getting started
  - What kind of information does the environment give the agent? (state information)
  - What are the actions that the agent needs to choose from?

| Num | Observation | Min | Max |
|-----|-------------|-----|-----|
| 0 | Cart Position | -2.4 | 2.4 |
| 1 | Cart Velocity | -Inf | Inf |
| 2 | Pole Angle | ~ -41.8° | ~ 41.8° |
| 3 | Pole Velocity At Tip | -Inf | Inf |

State Space

| Num | Action |
|-----|--------|
| 0 | Push cart to the left |
| 1 | Push cart to the right |

Action Space

# Stepping Through The Environment

# Make the Environment

*env = gym.make("CartPole-v0")*

- Instantiating the environment
- Use the 'env' variable to access the instance

# Reset Function

state = env.reset()

- Resets the environment to its starting state
- Call this before beginning each episode
- Returns the state information of the starting state

Before this point we had:

env

# Choosing The Action

action = YourAgent(state)

- Your agent will generally contain a tensorflow model that accepts the state information as an input
- *action* should be a vector that matches the dimensions of the action space

# Stepping Through The Environment

*new_state, reward, done, info = env.step(action)*

- **New State** : state information of the state after executing the *action* in the environment
- **Reward :** numerical reward received from executing the *action*
- **Done :** boolean value representing whether this episode has terminated or not
- **Info** : Additional information about the environment

# At This Point We Have Values For:

env | state | action | new_state | reward | done | info
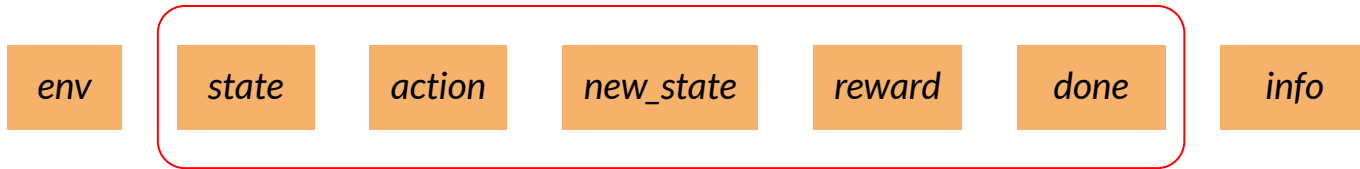
# Example

Link to Colab Notebook :

https://colab.research.google.com/drive/1PDdfwG1cZB6YXYsqkask6iDw3_XoYHTR

# Resources

https://gym.openai.com/envs/

https://gym.openai.com/docs/

https://github.com/openai/gym/wiki