

FRA 503: Deep Reinforcement Learning

Homework 2

Part 1: Setting up Gymnasium.

For this homework, we will start using Gymnasium to implement reinforcement learning algorithms. The main page of Gymnasium is <https://gymnasium.farama.org/>. You can find all documentations there.

To set up Gymnasium, you can follow the instructions on <https://github.com/Farama-Foundation/Gymnasium>. Basically, you can just

```
pip install gymnasium
```

After that, in the github page, try running a CartPole-v1 environment. You may notice that this environment does not contain any learning algorithms. The point of running this environment is to make sure that you have the library up and running.

Part 2: Q-Learning on Blackjack.

After initializing your first environment, go to

https://gymnasium.farama.org/tutorials/training_agents/blackjack_tutorial/

This page will explain everything you need to know to set up a Q-Learning algorithm on Blackjack environment. Follow the tutorial and make sure you understand how to modify an agent to learn with different learning algorithms

Part 3: Exploring various learning algorithms

Your tasks are to change the learning algorithms by

1. Implementing MC Control
2. Implementing TD Control
3. Implementing Double Q-Learning Control

For each part, highlight the change you make to the code and give explanation on what you change. After you train the agent via all 4 algorithms (MC, TD, Q, Double Q), summarize and analyze the result, e.g. what algorithm performs best? Why?