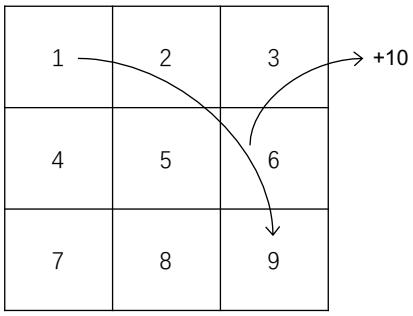
SI252 Reinforcement Learning 2022/05/28

Homework 6

Professor: Ziyu Shao *Due: 2022/06/12 11:59am*

1. **3x3 Grid World**:



The agent can be in one of the nine cells at any starting time. It can then move in one of four directions:{E,S,W,N}. If the agent hits a wall, it remains in its current cell and gets a reward -1. When the agent moves to cell 1, it then immediately moves to cell 9 and gets a reward of 10. The discount factor $\gamma = 0.9$.

   (a) Under the uniform policy (equal probabilities for each possible actions), compute the value of each state(cell).

   (b) For subproblem (a), show numerical results obtained by policy-evaluation algorithm and TD algorithm. Discuss the pros and cons of each algorithm.

   (c) Find the optimal value of each state and corresponding optimal policy.

   (d) For subproblem (c), show numerical results obtained by policy-iteration algorithm and Q-learning algorithm. Discuss the pros and cons of each algorithm.

2. **Python Implementation of REINFORCEjs**. Written by JavaScript language, REINFORCEjs is a Reinforcement Learning library that implements several common RL algorithms supported with fun web demos. The web address is: here. The source code is maintained in GitHub.

   (a) Reproduce the "GridWorld: Dynamic Programming Demo" by Python.

   (b) Reproduce the "GridWorld: Temporal Difference Learning Demo" by Python.

   (c) (**Bonus Problem**) Reproduce the "PuckWorld: DQN Demo" by Python.

   (d) (**Bonus Problem**) Reproduce the "WaterWorld: DQN Demo" by Python.

3. **Bonus Problem: OpenAI Spinning Up in Deep RL**. Welcome to Spinning Up in Deep RL! This is an educational resource produced by OpenAI that makes it easier to learn about deep reinforcement learning (deep RL). Please study the documents and install the environment. Either PyTorch or TensorFlow are allowed. In your report, please provide detailed figures and analysis to show many aspects of performances of various DRL algorithms.

   (a) Finish the problem set 1: "Basics of Implementation" . It includes three exercises: Gaussian Log-Likelihood, Policy for PPO, and Computation Graph for TD3.

   (b) Finish the problem set 2: "Algorithm Failure Modes" . It includes two exercises: Value Function Fitting in TRPO, and Silent Bug in DDPG.