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Assignment 5 Problems

Neural Networks : Fall 1400 : Dr. Mozayani
Due Thursday, Dey 16, 1400

Contents

Problem 1

In this section, you need to provide an MDP (Markov Decision Process) model. It should be noted that you need to determine states, actions, state transition probabilities, and rewards for your model. (35 pts)

(a)

In a village, we want to make a decision at the beginning of each month whether the sale of shrimps is allowed or not. Every time we decide to sell shrimps, the number of shrimps will be reduced and we gain a profit from the sale of them. It should be noted that if the population of shrimps is reduced too much, it costs us a lot of money to compensate for their population, otherwise, the whole shrimp industry in this village will go broke.

(b)

In the Mario game, the goal is to reach the end flag without falling in the pit or dying by enemies. Assume that Mario (our agent) can either jump or move forward. The speed of Mario affects its jump distance, for instance, if he jumps at high speed, he may slip off the edge of the platform and fall (either in the pit or on the green pipe), or if the speed is too low, he can't reach the platform after jumping. A piranha plant will also come out of the pipe stochastically and kill Mario if it hits him. The game ends whether Mario gets killed or reaches the flag.
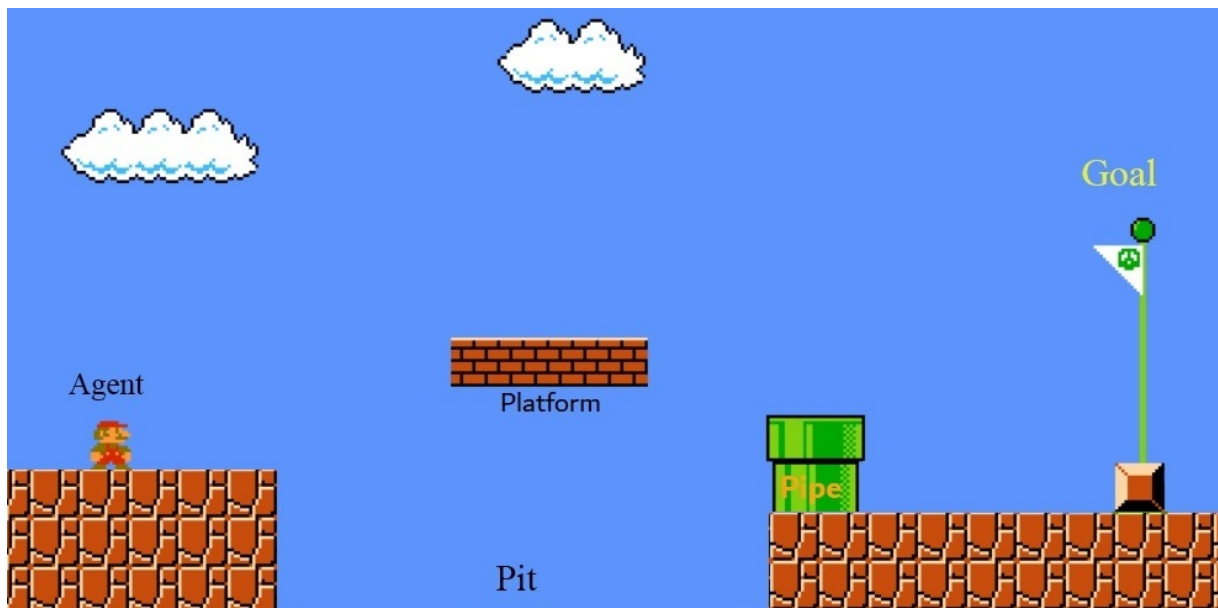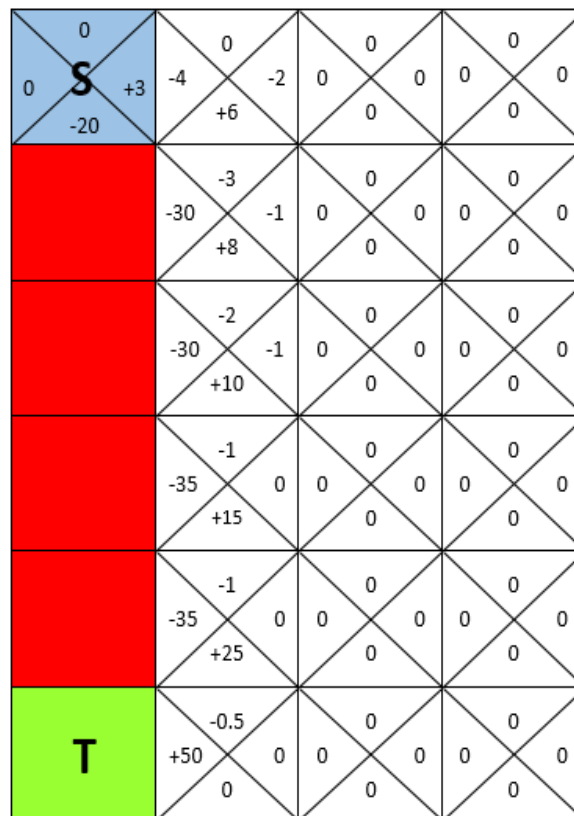
Problem 2

Imagine our agent wants to go from state **S** to **T**. State **T** has a reward of +120 and states with red color have a reward of -90. Taking each step has a -1 reward.

Run each episode with the following actions and update values by Q-Learning algorithm:
episode 1: Right, Down, Down, Down, Down, Down, Left.
episode 2: Right, Down, Down, Left.

Note that If the agent goes into a red-colored state or state **T**, the episode terminates. Set $\alpha = 0.9$ and $\lambda = 0.8$. (25 pts)

Problem 3

Design the most concise fuzzy system f(x) to uniformly approximate the continuous function g(x) = (1+x1)/(1+x2) defined on U = [-0.5, 0.5]x[-0.5, 0.5] with a required accuracy of epsilon = 0.1

Problem 4

We want to model a fuzzy controller in this part, the fuzzy controller will be for a steam turbine.

- Inputs: temperature and pressure (5 descriptors each)

- Output: throttle setting (7 descriptors)

After modeling the fuzzy controller answer this question.
"If for inputs temperature is 70% and pressure is 30% determine the throttle position."

Problem 5

(Bonus section)

In this section, you need to implement a Q-Learning agent in the FrozenLake environment. Please refer to the notebook provided in the assignment folder. Consider that you can't import any libraries and should use the environment class provided in the notebook to interact with the environment. (20 pts)

Notes

- Codes should be implemented in .ipynb format (notebooks)

- All Code cells should be executed before turning in the assignment (Make sure your outputs are there before you submit your assignment)

- Please explain the code and the results in the notebook

- Please upload your assignments as a zipped folder with all necessary components. Upload your file in HW5_NN_YourStudentID_YourName.zip format.