Assignment 3 Q-Learning

UMC 203: Artificial Intelligence and Machine Learning March 2025

Q – Learning

In this Assignment you will implement Q-Learning for path finding in a grid cell-based environment. Your agent has to find its way from the start cell to the goal cell in a grid maze. Along the way there are special cells called traps and boosts which give your agent negative and positive rewards respectively.

You are provided with three files, `BFS.ipynb`, `QL_Assignment.ipynb` and `themes.json`. `BFS.ipynb` performs a Breadth-first search on a grid maze to find if a path exists. `QL_Assignment.ipynb` has the environment and agent related code for training and testing. It generates a pickle file (`.pkl`) for each agent training scenario.

Questions: (20 marks)

- Complete the `QL_Assignment.ipynb` file. Regions where you have to fill in your code have been marked. Use your SR.No to generate a maze unique to you. Use the `BFS.ipynb` file to ensure that a path exists in your generated maze (we have made sure that a path exists for all your SR.No but it's better to check just to stay on the safer side). (10 marks)
- Train your agent on two scenarios, one where traps and boots are disabled and another where they are enabled, and comment on the paths learned by the agents in these scenarios. If the number of steps taken by your agent, when traps and boosts are disabled, are same as the number of steps in the path generated by `BFS.ipynb` then you are on the right track. (2 marks)
- Train your agent on different reward configurations, for both scenarios of trap and boost, and comment on the path it has learnt.(2 marks)
- With trap and boost disabled, after you have finished training and generated a Q-Table, perform manual calculations and Q-value updates for the first 5 steps of a new episode.(6 marks)

You must write a report with -

- Your answers to the above questions.
- Pictures of the learnt path and reward configurations for each training scenario.

Rename the report as `SRNO(5digit)_Assignment3_report`

Submission Guidelines -

You will have to submit your:

- Completed `QL_Assignment.ipynb` file (renamed as `SRNO(5digit)_Assignment3.ipynb`).
- Pickle files generated during training (for each scenario mentioned in the report).
- The report.