



CS6482 Deep Reinforcement Learning

Assignment 3: Sem1 AY 23/24 – DQN for Atari

15/April/24 (Teaching Week 11) – v1.

1. Objectives

To implement a Reinforcement Learning (RL) agent using a Deep Q Network (DQN) applied to the game of Atari in the OpenAI Gym environment.

Please email the lecturer with a request for permission to use an alternative to Atari if committed to a different simulator and/or environment. Provide a link to the alternative and a paragraph stating the rationale. The subject must be “CS6482: ALTERNATIVE”

2. Submission

Submit a **pdf** describing

1. Why Reinforcement Learning is the machine learning paradigm of choice for this task (1 marks, 0.5 pages)
2. The Environment (1 marks, 1 page):
 - a. the Atari game selected,
 - b. the inputs received from the OpenAI Gym environment, and
 - c. the control settings for the joystick.
3. Implementation (8 marks, approximately 4-6 pages approximately):
 - a. Capture and pre-processing of the data (2 marks),
 - b. The network structure (2 marks),
 - c. The Q learning update applied to the weights (3 marks),
 - d. Other concepts that you deem to be of significance, particularly independently researched techniques to speed up learning should you happen to use any (1 marks).

Coding fragments and/or diagrams should be included to illustrate the concepts under discussion.

4. Results (4 marks)
 - a. Plots with short accompanying explanations of the information conveyed.
 - b. How does one evaluate the performance of the RL agent?
 - c. Is the agent learning?
5. Exploration of recent developments in DQN i.e Dueling DQNs (6 marks)
6. References (1 marks)

The suggested page count for sections above are for guidance only and are not mandatory.

Submit a **Jupyter notebook** with the code where:

- The book is named CS6482-Prj2-ID1-ID2
 - Where ID1 and ID2 are the student id numbers of the team members
- The first line in the book is a comment with names and ID numbers of the team members
- The second line in the book should be a comment stating if the code executes to the end without an error.
- The third line in the book should be a comment with a link to the original source where you opted to reuse an existing implementation.

3. Notes and Guidelines

- This assignment **constitutes 20%** of the total marks awarded for this module.
- You may complete the assignment in a team of 2 or 3; or opt for an individual submission.
- **Submission deadline is 23:59:59 Sunday 5th May 2024 (Teaching Week 14).**
- Submission is via the Brightspace Assignment tool.
- Programming language is Python.

GRADING RUBRIC

Area	Beginning [0-8]	Developing [9-12]	Accomplished [12-16]	Exemplary [16-20]
Code	Copy and Paste No comments Does not run to completion	Commented satisfactorily, using a few sources Runs to completion	Comments are good Using many sources Runs to Completion	Excellent commentary Using many sources Some proprietary implementation Runs to completion
Report	Basic, Only 1 or 2 references that are not cited Communicates an absence of understanding of DQNs Deviates from spec Conveys impression of a late start i.e. rushed	Satisfactory A few references cited appropriately Communicated some understanding of DQNs Adheres to spec	Good Multiple references discussed and cited Communicates solid understanding of DQNs Adheres to spec	In depth Many relevant references cited Communicated deep understanding of DQNs Adheres to spec
Results	Trivial Not analysed	Basic plots and basic analysis	Basic plots that are analysed in depth.	Managed to get substantial results within the timeframe Deep analysis
Recent Advances in DQN	Absent	Using 1 reference only Implementation present that does not work, Results not presented	Using a few references Implementation present and runs to completion, Results are trivial.	Using many references Implementation present and runs to completion, Results presented and analysed