

# COMS4047A Alternate Assignment

## DQN Variations

Due: 18 November 2019

In this assignment, you will be required to implement three deep RL algorithms and evaluate them on three Atari games. The algorithms you are required to implement are:

- Deep Q-Networks: V. Mnih, et al. “Human-level control through deep reinforcement learning.” *Nature* 518.7540 (2015): 529.
- Double DQN: H. Van Hasselt, A. Guez, and D. Silver. “Deep reinforcement learning with double Q-learning.” *Thirtieth AAAI conference on artificial intelligence*. 2016.
- Dueling Double DQN: Z. Wang, et al. “Dueling Network Architectures for Deep Reinforcement Learning.” *International Conference on Machine Learning*. 2016.

This is a group assignment—**groups of 3 or 4 are allowed**. You may choose any three Atari environments to train and test these algorithms on. You will need to submit your code, as well as a write-up that analyses these three algorithms on the games you picked. Since these domains are easier than Obstacle Tower, you will need to provide a detailed write-up of your results, which will serve as the basis for your assignment mark.

The document should include a detailed description of the algorithms, and how they differ from one another. Training results for each of the algorithms should be graphed and shown—one for each game. Given that deep RL suffers from high variance, multiple runs should be performed in an attempt to make the results statistically significant. You should also provide a discussion based on these results, identifying strengths and weaknesses and general trends observed.

Finally, analyse the algorithms by performing a sensitivity analysis on a single hyperparameter of your choosing. The hyperparameter can be a standard one, such as learning rate, or it can refer to the network architecture, the activation functions used, etc. Whichever hyperparameter you choose, run the same experiments for different reasonable values, and determine whether the results change significantly. Comment on your findings.

Once complete, zip your code and write-up, and upload it onto Moodle.