Project 1 Report

This report provides a description of the implementation of a deep reinforcement learning agent which is trained to navigate a simulated environment provided by a unity ml-agent.

The code is written in PyTorch.

Learning algorithm

The learning algorithm used for the solution is based on a simple vanilla DQN agent. This includes a replay buffer implemented as a deque data structure.

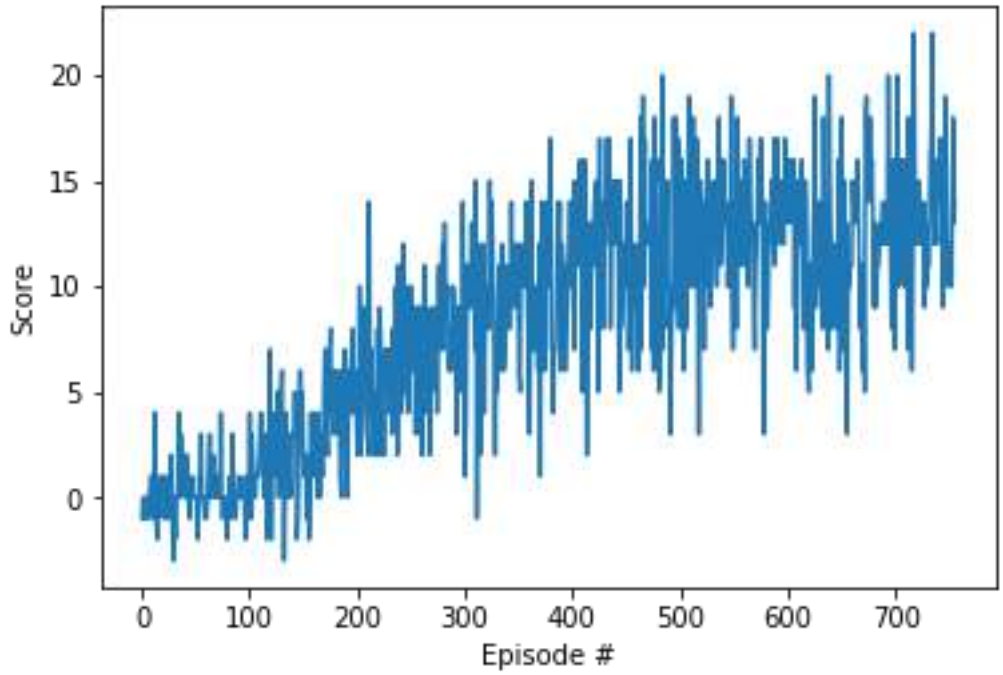
The action value function approximator is a neural network (NN) characterised by two fully connected layers and an output layer with four action values (one for each of the four actions per state characterising the environment in use).

The algorithm uses the following hyperparameters:

- **fc1_units** = 296: the number of units in the first fully connected layer of the NN.
- **fc2_units** = 296: the number of units in the second fully connected layer of the NN.
- **BUFFER_SIZE** = 1e5: Size of the Replay Buffer.
- **BATCH_SIZE** = 64: Number of inputs processed per batch when running Stochastic Gradient Descent.
- **GAMMA** = 0.99: Discount factor of the Q-Learning algorithm
- **TAU** = 1e-3: used to perform soft updates of the target network parameters
- **LR** = 5e-4: learning rate provided to the Adam optimiser.
- **UPDATE_EVERY** = 4: parameter used to decide how often to update the network.
- **eps_start =** 1.0**:** initial value for epsilon in relation to e-greedy policy improvement step.
- **eps_end =** 0**.**05**:** final value for epsilon in relation to e-greedy policy improvement step.
- **eps_decay** = 0.995: decay value for epsilon in relation to e-greedy policy improvement step.

Plot of Rewards

The environment was solved after 756 episodes, which is when the average score per hundred episodes reached +13.0. The figure below shows the score per number of episodes.



Ideas for Future Work

Improve training efficiency and speed with

1. Double DQN algorithm.
2. Prioritised Experience Replay.
3. Learning from multi-step bootstrap targets.
4. Implement distributional DQN.
5. Implement Noisy DQN