

# Implementation of the DQN algorithms

## The base DQN algorithm

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For solving the banana problem I trained two agents. The first agent is based on a Deep Q-Network, and during training uses **experience replay** to sample from it randomly, and **fixed Q-targets** to avoid harmful correlation between the target and actual value of the Q-Network.

## The Double DQN algorithm

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As Deep Q-Learning tends to overestimate action values, I implemented **Double Q-Learning**, which has been shown to work well in practice to help with this. The Double DQN algorithm is a modification of the base DQN.

## The Neural Network

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Behind the DQN algorithms there is a simple neural network to estimate the Q values.

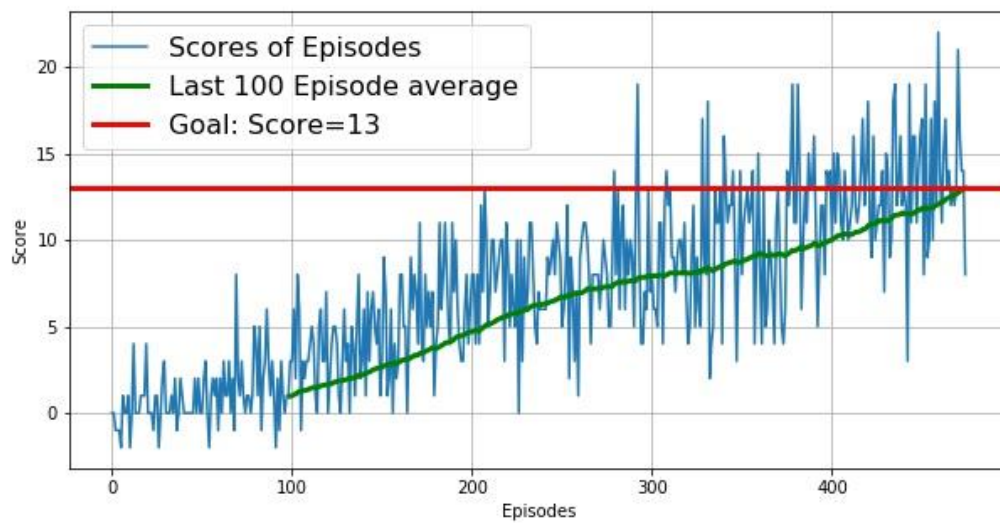
This network has an input dimension of 37 as this is the state space dimension. The hidden layers size is 64. The size of the output layer is 4 as this is the number of possible actions.

## Results

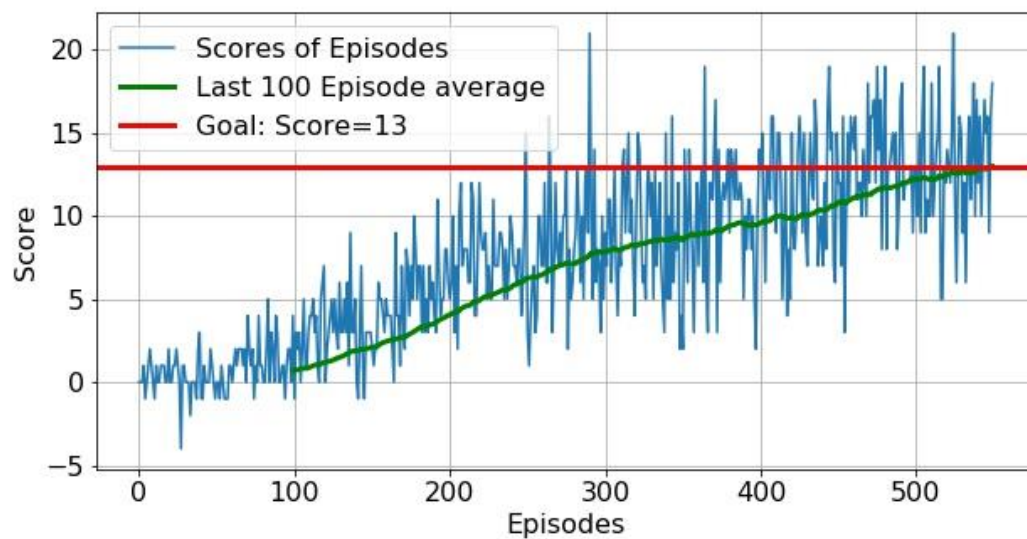
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The goal of the project was to train an agent to achieve an average score of +13 over 100 consecutive episodes. With my neural-network architecture and hyperparameters the non-double DQN achieved this goal during less than 500 episodes, while the Double DQN during more than 500 episodes, but the difference wasn't large.

The non-Double DQN:



The Double DQN



## Possible Improvements

- optimize **hyperparameters**
- implement **prioritized experience replay**
- implement **Dueling DQN**