

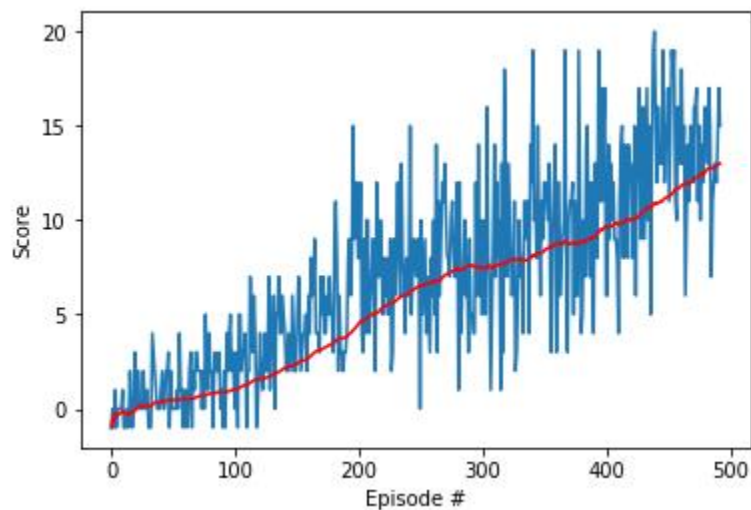
P1 Navigation Project Report

Learning Algorithm and Plot of Rewards:

- The learning algorithm is DQN, a value based RL learning algorithm.
- The DQN agent model is a neural network which includes following layers
 - 3 Linear (Dense) layers
 - 1st and 2nd linear layers are followed by relu activation layer
 - 3rd linear layer is output layer which outputs the value for each stage-action pair
- Here are the hyperparameters used in 1st training experiment and experiment results.
 - eps start=1.0, eps end=0.01, eps decay=0.995
 - BATCH_SIZE = 64, GAMMA = 0.99, TAU = 5e-4, LR = 0.0005, UPDATE_EVERY = 4

```
Episode 100      Average Score: 1.01
Episode 200      Average Score: 4.46
Episode 300      Average Score: 7.44
Episode 400      Average Score: 9.65
Episode 492      Average Score: 13.00
Environment solved in 392 episodes!      Average Score: 13.00
```

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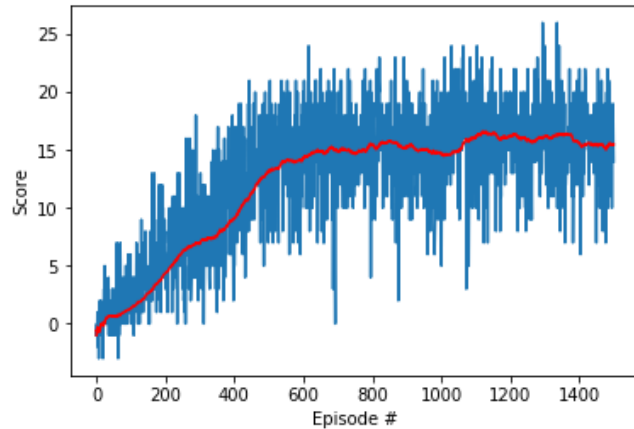


- Change the threshold from 13.0 to 20.0

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Episode 100    Average Score: 1.33
Episode 200    Average Score: 4.35
Episode 300    Average Score: 6.90
Episode 400    Average Score: 9.12
Episode 500    Average Score: 13.10
Episode 600    Average Score: 14.36
Episode 700    Average Score: 14.86
Episode 800    Average Score: 15.45
Episode 900    Average Score: 15.34
Episode 1000   Average Score: 14.74
Episode 1100   Average Score: 16.03
Episode 1200   Average Score: 16.28
Episode 1300   Average Score: 16.17
Episode 1400   Average Score: 15.57
Episode 1500   Average Score: 15.49

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- Here are the hyperparameters used in 2nd training experiment and experiment results.

- eps start=1.0, eps end=0.01, eps decay=0.5
- BATCH_SIZE = 64, GAMMA = 0.99, TAU = 5e-4, LR = 0.0005, UPDATE_EVERY = 4

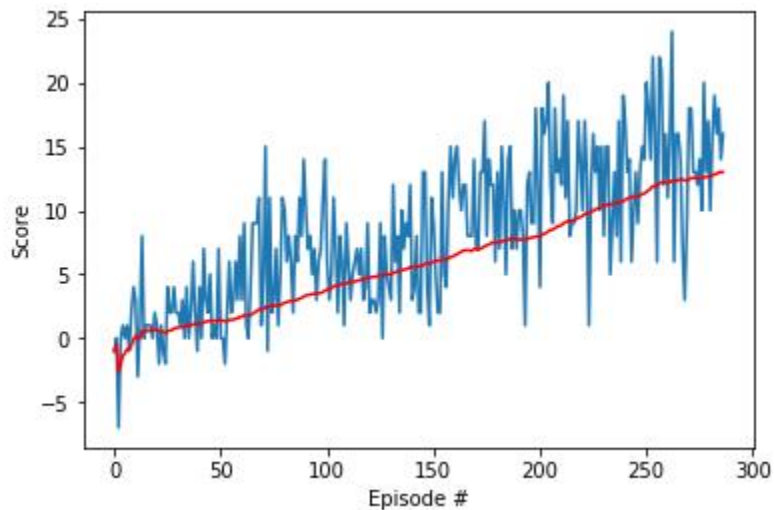
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Episode 100    Average Score: 3.72
Episode 200    Average Score: 7.95
Episode 287    Average Score: 13.00
Environment solved in 187 episodes!    Average Score: 13.00

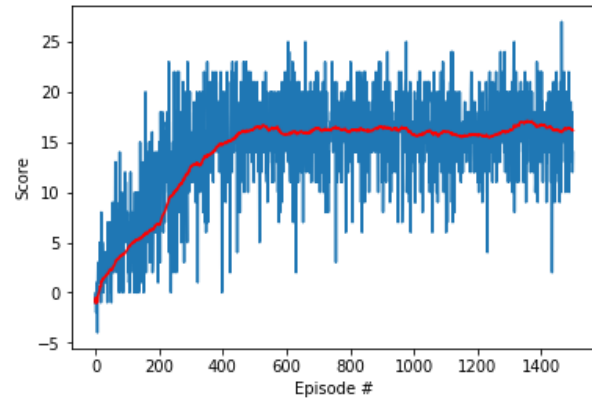
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- Increase the stop threshold from 13.0 to 20.0. The training saturates at average reward 15.0

Episode 100	Average Score: 4.21
Episode 200	Average Score: 6.75
Episode 300	Average Score: 12.54
Episode 400	Average Score: 14.76
Episode 500	Average Score: 16.41
Episode 600	Average Score: 15.79
Episode 700	Average Score: 16.36
Episode 800	Average Score: 16.01
Episode 900	Average Score: 16.49
Episode 1000	Average Score: 15.80
Episode 1100	Average Score: 16.01
Episode 1200	Average Score: 15.68
Episode 1300	Average Score: 16.08
Episode 1400	Average Score: 16.75
Episode 1500	Average Score: 16.15



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- Conclusion:
 - It seems that reducing eps decay, which accelerates decaying rate of exploration, will help the agent converge faster.
 - I also tested different learning rate and the result indicates that by increasing learning rate from 0.001 to 0.0005, the final convergence of the reward will increase from 15.0 to 16.0

Learning Algorithm and Plot of Rewards:

- Change DQN to DDQN
- Apply Prioritized Experience Replay
- Try Dueling DQN
- Apply Actor-Critic learning algorithm
- Increase layers of original DQN neural networks