Udacity Continuous Control project

Prepared for: Udacity Deep Reinforcement Learning Nano Degree
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SUMMARY

Algorithm

The algorithm used to solve the problem is Twin Delayed DDPG this is because it overcomes the limitations of vanilla DDPG.

Explanation:

Unlike DDPG TD3 simultaneously learns two Q-functions, Q_ϕ1 and Q_ϕ2, by mean square Bellman error minimisation. The Q- functions learnt by comparing MSE on the same target as shown Equation 1 and this target is decided by choosing minimum between the two as shown in Equation 2 but the policy is learnt by maximising Q_ϕ1 similar that of DDPG as shown in Equation 3.

$$y(r, s', d) = r + \gamma(1 - d) \min_{i=1,2} Q_{\phi_{i,\text{targ}}}(s', a'(s')),$$

Equation 1.

$$L(\phi_1, \mathcal{D}) = \underset{(s,a,r,s',d)\sim\mathcal{D}}{\mathrm{E}} \left[\left(Q_{\phi_1}(s, a) - y(r, s', d) \right)^2 \right]$$

$$L(\phi_2, \mathcal{D}) = \underset{(s,a,r,s',d)\sim\mathcal{D}}{\mathrm{E}} \left[\left(Q_{\phi_2}(s, a) - y(r, s', d) \right)^2 \right]$$

Equation 2.

$$\max_{\theta} \underset{s\sim\mathcal{D}}{\mathrm{E}} \left[Q_{\phi_1}(s, \mu_\theta(s)) \right]$$

Equation 3.

IMPLEMENTATION DETAILS

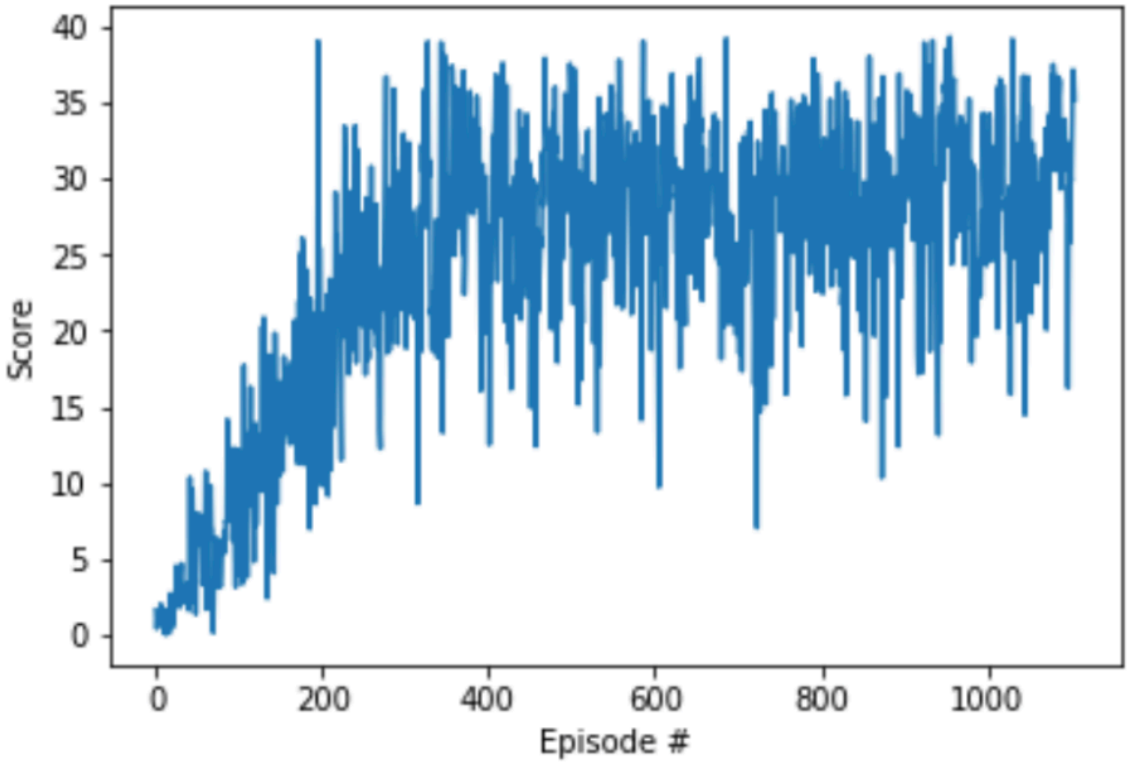
Model.py :

a. The actor model used for transforming the state information vector into the action vector is written in the class Actor.
b. The critic model used for transforming the state information vector and action vector is written in the class Critic.
c. The networks used in the code are one's which was used in the actual implementation of the Author.

CC.ipynb :

The TD3 function runs multiple episodes of the agent's interactions with the environment for a certain number of transitions. The network stores the average reward collected by the agent over the 100 episodes. Once the agent accumulates over the 40+ reward in 100 episodes the environment is considered to solved and model's weight are saved.

REWARD PLOT



As it can be seen in about 400 epochs the average reward was more than +20, hence the environment was solved.

FUTURE IDEAS

1) Implementing Soft Actor Critic
2) Implementing MultiAgent DDPG