Project Proposal

Team Members

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Topic

Evaluating Deep Reinforcement Multi-Agent Algorithms for Google Research Football

Objective

Utilize the advances made in DQN algorithms and test them on a physics-modelled environment supporting multiple agents. Further, improve existing algorithms to create a novel algorithm with an aim of high performance.

Related Work

A lot of novel algorithms in reinforcement learning focus on solving reinforcement learning problems in classical environments like OpenAI gym environments. Exploring google research football's environment allows us to look at the algorithm performance in similar environments with varying complexity. Further, we plan to explore parallelized learning for multi-agent algorithms to allow for more scalable versions of existing algorithms.

Technical Outline

Google research football (GRF) is an extensive reinforcement learning environment allowing us to evaluate various multi-agent deep research learning algorithms in an environment of varying complexity. By running algorithms on the football academy first and then on the football benchmark.

To solve our environment, we are planning to apply different methods and improved versions of DQN and actor critic algorithm: double DQN and PPO. Finally improve on PPO with a parallelized learning implementation.

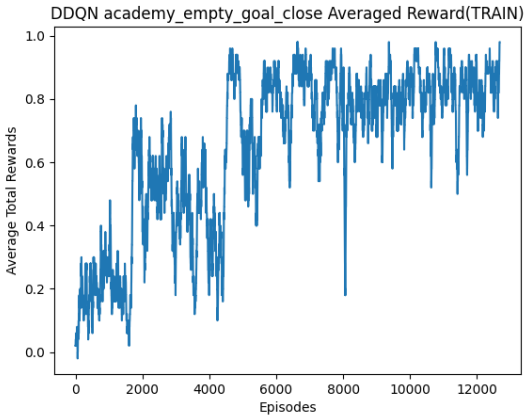
Current Work

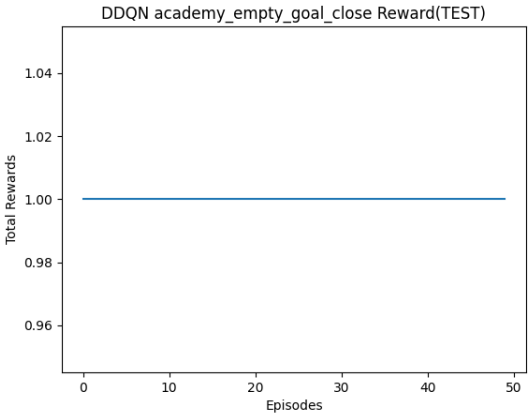
Currently we have tackled the academy problems of GRF, which are simplified versions of playing a full 11v11 match against AI with varying difficulty. Problems attempted include:

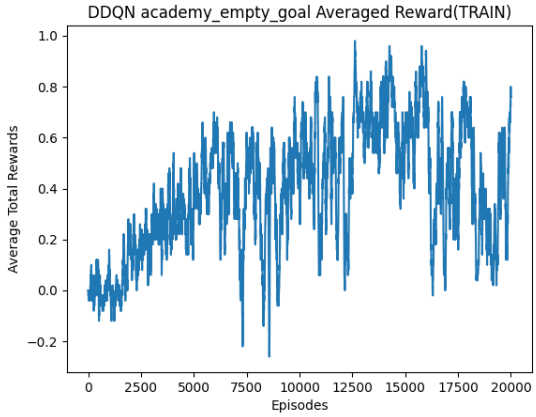
- academy_empty_goal_close
- academy_empty_goal
- academy_run_to_score

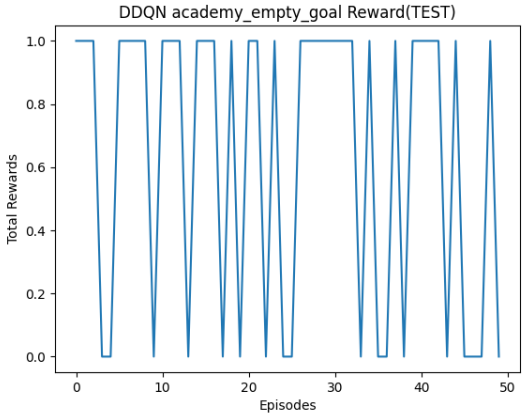
Based on the results below we observe that DDQN solved our first basic scenario but on slightly more complex scenarios the algorithm requires an exorbitant amount of training.

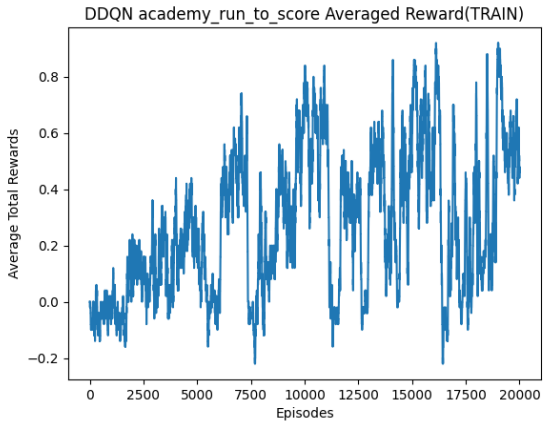
Results











Future Improvements

We plan to solve more complex academy challenges by implenting a PPO algorithm, and then improve on its performance by implementing a parallel learning algorithm.

References

1. Accelerate deep Q-network learning by n-step backup
2. Deep Q-Network Based Multi-agent Reinforcement
3. Massively Parallel Methods for Deep Reinforcement Learning
4. Google Research Football Scenarios