1 Summary

Unfortunately 1) I didn't follow up very closely with the professor towards the end of the semester so I didn't get the update sooner, and 2) another group published a very similar paper to what we were trying to do, I would be changing my research topic slightly.

The new project would be to explore if evolutionary algorithm could perform some tasks better than reinforcement learning, or if we could find ways in which evolutionary algorithm to improve the performance of reinforcement learning. There has been previous examples where evolutionary algorithm and reinforcement learning are both used to improve the performance for a given task.[1]

2 Introduction of new topic

Reinforcement learning has shown huge potential in many areas of research, and some reinforcement learning models have outperformed human in classical games like chess and Go. Recently, multiagent reinforcement learning has gained more attention due to its applications in autonomous driving, robot coordinations, and many others. Currently there are reinforcement learning algorithms that perform pretty well in multiagent tasks [2], which could serve as excellent benchmark for our project.

On the other hand, evolution has always been a fascinating topic and human never fails to learn from nature. Behaviors such as evolving together as a population can be commonly seen in bacteria and most if not all microorganisms. We hope this could give us insights into another approach to solve the same multiagent learning problem.

3 Goals

- build a multi-agent reinforcement learning model
- compare it against benchmark to make sure it is working
- program an evolutionary algorithm that simulates the evolution, or "learning", of a population
- compare and improve both models

4 Current progress

I decided to start with something simple since I do not have a lot of background in machine learning especially reinforcement learning. Currently, I have made single agent model for both reinforcement learning and evolutionary algorithm regarding the task of bipedal walker.

The next step would be to expand the model to simple multiagents, ie. few agents (< 5), and limited cooperation. This should be a realistic next step to move the research forward. From there, I could then slowly increase the model complexity and move towards the goals listed above.

References

[1] Gupta, A., Savarese, S., Ganguli, S., and Fei-Fei, L. Embodied intelligence via learning and evolution. *arXiv preprint arXiv:2102.02202* (2021).

[2] Sukhbaatar, S., Fergus, R., et al. Learning multiagent communication with backpropagation. *Advances in neural information processing systems 29* (2016), 2244–2252.