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School of Computer Science and Engineering
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RL for Swarm Systems

Selection as a tool for information summarization in swarms

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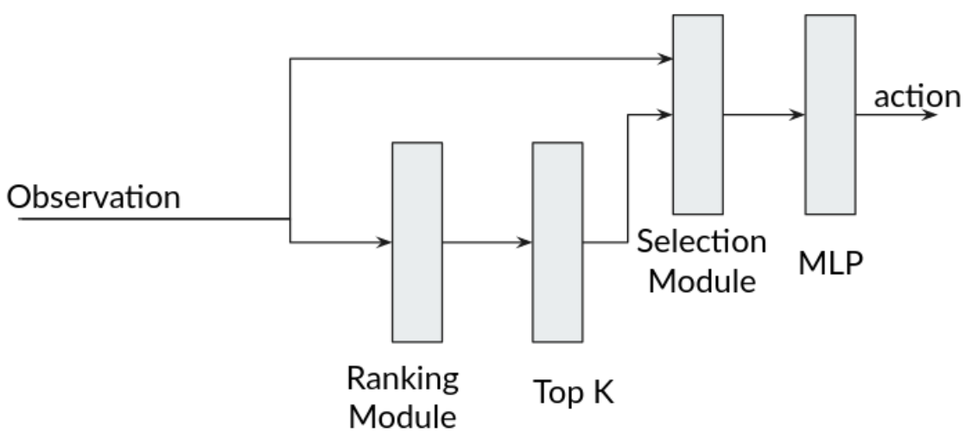
Project Objectives

Currently there are many techniques used to construct generalizable swarm RL policies, but there is no consensus on which technique is the best. Research is continuously being conducted to improve the state of the art for Swarm RL.

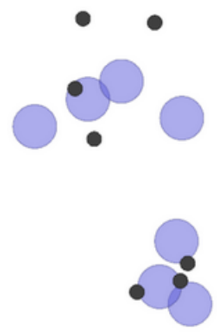
The objectives of this project are to establish a reliable baseline for swarm algorithms to be benchmarked against and to develop a swarm RL model capable of adapting to various swarm scenarios.

This project aims to contribute the following:
1. A Swarm RL model that is permutationally invariant and can handle variable observation sizes.
2. An environment that can be used to benchmark various Swarm RL models.

Selection Model



Simple Spread Environment



Conclusion

The best performing model was the Mean embedding model trained using CMA-ES. It was the only model able to solve the task it was trained on and able to generalize to a larger number of agents. Mean embeddings trained using gradient descent was not able to solve the task - possibly due to gradient descent based solutions being vulnerable to getting stuck in local minima.

Although the proposed selection model did not perform as well as the Mean embedding model, the selection model has further benefits like being able to focus on selective parts of the environment while ignoring others. This might be useful in more complex swarm RL tasks.

Further research can be carried out by evaluating the selection model on complex MARL tasks such as the StarCraft 2 environment, the Flatland environment, and the lux AI environment.