Epidemic Tag Game with Reinforcement Learning

Exploration of competitiveness and cooperation in games

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Abstract

Through multi-agent game of 'epidemic' tag with simple objective and standard reinforcement learning algorithms, we experiment with competitiveness and cooperation of trained agents. We explore players strategies and coordination under different environments.

Introduction

One of the greatest challenges in the field of artificial intelligence is creation of agents capable of solving wide variety of tasks, especially the complex ones. The agents interacting with physical enviroment are the most relevant ones. One approach to this challenge is training of agents with reinforcement learning to solve particular problem. In that case, once the agent has learned to solve the task, there is not much to improve. However, some tasks require multi-agent cooperation to be solved properly. This behaviour is more difficult to learn and more vulnerable to environment changes.

To better explore this field we created the simple environment in Unity game engine. We implemented **'epidemic' tag game** which rules are similiar to the simple one - the tagger have to touch another player, who becomes the new tagger. In our game, the original tagger does not change roles with the cought player but remains one of the taggers, so the number of taggers only increases. By this game, we can observe changing tactics of the tagger and the other players with increasing number of taggers. The environment enables us to experiment with many different parameters like adding physical objects, increasing speed of the players etc.

Main Objectives

1. Creation game environment in Unity.
2. Creation basic agents running on the game plane.
3. Implementing changes of target players into the taggers.
4. Training of basic agents.
5. Observing behaviour of agents.
6. Experimenting with different parameters.
7. Final observations.

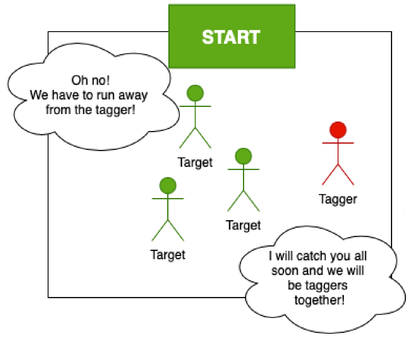

Figure 1: Start of the game

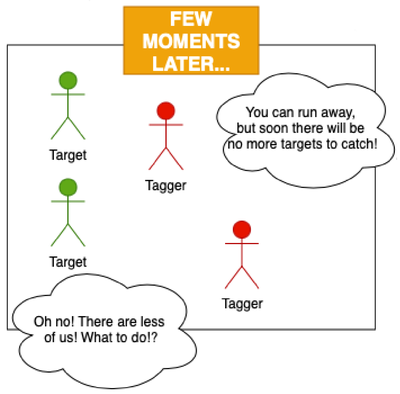

Figure 2: Middle of the game

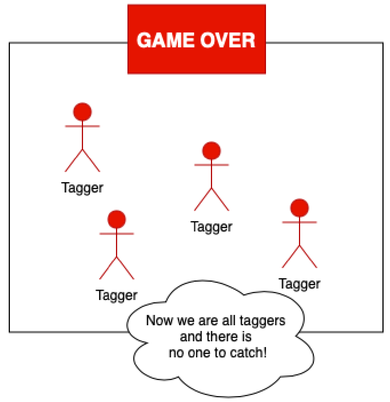

Figure 3: End of the game

Results

Figure 4: Cumulative reward

In the project we explored multi-agent system that enables us to experiment with different enviromental parameters and influence they have on strategies learned by players. We created the game environment and trained a simple agents.

As the training proceeded we observed that the cumulative reward reaches maximum after about 600k epochs. The reason might be the simplicity of trained agents and number of parameters included in agents sensors. Even though the model is relatively simple, we observed that the agents reaches some kind of equilibrium in which the taggers are not able to catch the players faster and the players are not able to run away from the taggers.

Conclusions

- the players in the 'epidemic' tag game have to cooperate and compete at the same time,
- the actions taken by the agents rely mostly on reward system in the training algorithm,

Forthcoming Research

We have demonstrated the simple environment for experiments with multi-agent cooperative and competitive systems. We observed some simple strategies taken by the agents under minimum of information from the environment. Our results show potential to learn more about the similiar behaviours.

In the future work we want to explore behaviour of such agents under different environment parameters. We want to observe how players choose their actions based on additional informations like raycasting and obstacles. Moreover we want to experiment with different reward systems and how they incluence tactics taken by the players. Finally, we want to improve the appearance of the game to make it more enjoyable.

References

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