AIN - CTF Agent Team Design

A PROJECT REPORT

submitted by

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Abstract

The goal of this project is creating a team of cooperative agents that interact with each other and some enemy agents in a multi-agent system. The goal of this team is to defend a flag in a team-against-team *pygomas* environment. The following is a description of the strategy implemented using ASL and Python.

Our team consists of ten individual agents that follow four prototypes and three different logic patterns. The main role is the commander, a coordinator and central communicator, along with medics and guards, made up of soldiers and field operators. This report will go into detail on the specific behaviour of these agents.

1 Strategy

1.1 Environment

The environment is variable and contains a set of walls in various potential configurations. The team all spawns in random positions inside the axis base, whereas the enemies spawn in the allied team's base. A flag is spawned in an immediately known location as the combat starts.

1.2 Team Composition

The constructed team is made up of ten individual members.

- **1 Commander**, a medic following a unique logic pattern.

- **4 Soldiers** following the *guard* logic pattern.

- **3 Field Operators** following the *guard* logic pattern.

- **2 Medics** following their own logic pattern.

1.3 Behaviour

The **commander** is the mastermind of the team. Its role is to coordinate the team by assigning stations around the flag (in a circular formation) and ordering attacks periodically so all guards agree where they must go. The commander stays at the flag's position, looking around randomly. As a medic, the commander also creates medic packs once it has reached the flag.

The **guards** are the front line of the team. Their role is to detect and attack enemies in sight, ensuring that they don't hit their allies while keeping themselves alive. They also produce packs if their class allows it. If guards find nothing to do, they stay at their station, looking away from the flag.

The **medics** patrol around the flag within the circle created by guards, they create medic packs and also shoot enemies if their line of sight allows. They do not respond to attack commands.

All roles will drop their tasks if they run out of ammunition or health, seeking to fetch the closest available pack of the appropriate type. All roles also keep track of packs they have seen by using their memory system, informing the commander if they see a new one. The commander broadcasts this information to keep all agents synchronized.

1.4 Memory

Similarly to the single agent iteration, a memory system was developed for this team. Every individual agent in the team has a pack memory to manage fetching and registering packs. The commander additionally has a memory for ally and enemy positions that allows us to get a better global vision of the situation in the battlefield in the visualizer tool.
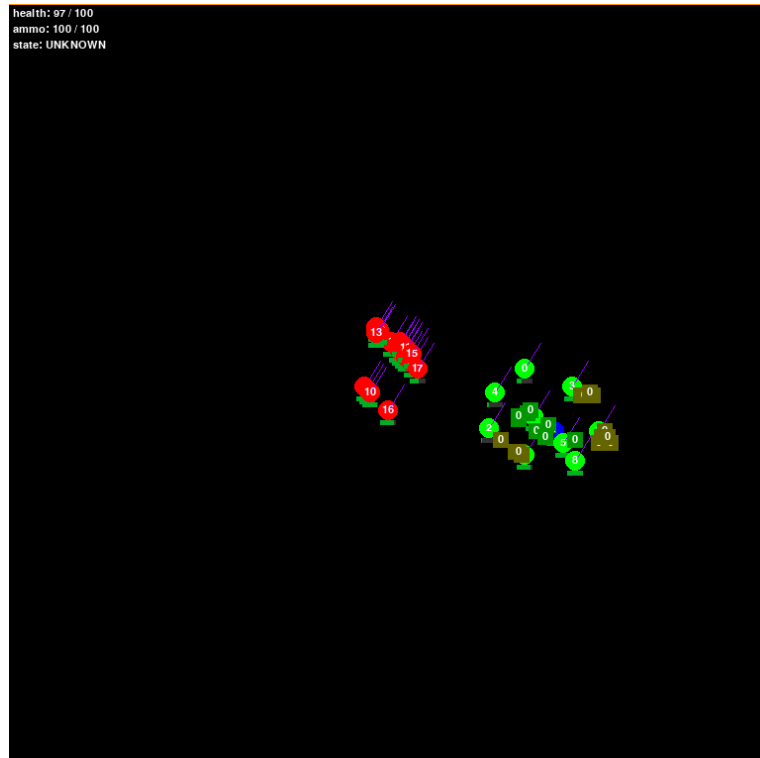

Figure 1: A representation of the *commander*'s memory state.

2   Conclusions

After repeated testing, the team unfortunately doesn't seem to work very well against full-out attacks from one direction. There are multiple reasons for this. The defense of the flag is structured in a large circle covering all angles, whereas the attack has all attackers coming from the same direction (and thus few agents can react in time to help).

However, we expect this strategy to work effectively against decentralized strategies of attack and in more complex situations. It's also highly scalable to many more agents by increasing the radius of the station circle while remaining effective.

Additionally, this strategy works well in *war of attrition* scenarios, since it protects the resources it creates and constantly keeps producing packs for future use. It follows that the longer this defense is prepared, the more effective it will be (due to the abundance of packs in the defended circle).