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Towards the use of Trait Inheritance for Flocks of Navigating Agents

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Abstract. This preliminary work is focusing on investigating how flocks of entities can use trait inheritance to both endow them with a sense of individuality and to create better solutions for navigation problems over multiple generations using an evolutionary algorithm, with intended application to space environments. Traits are implemented so as to influence agents' actions and movements. They are designed so as to evolve over multiple generations of agents with the goal of further optimising their behaviour. The trait system is implemented so as to provide each agent with their own preferences for performing tasks, and the evolution algorithm is used to promote better set of traits in the agents.

1 OVERVIEW

The creation of intelligent agents with individualised behaviours is an important aspect of modern game design. Yet in many cases, agent credibility vanishes when a player discovers underlying patterns or rules that the agents are using. Furthermore, such agents usually have difficulty adapting to changing environments, circumstances and strategies. Here, navigation behaviours, such as steering [1] and A-Star preferences are parameterised; these values, set for individuals, are refined over multiple generations of agents in order to attempt increase their performance or adapt to changing conditions.

Traits are implemented so as to influence agents' actions and movements. They define, for example, differences in steering behaviours, whether an agent prefers a small but nearer reward, or to go further to obtain a larger reward, and so on. Traits are designed so as to evolve over multiple generations of agents, with the goal of further optimising their behaviour. Every agent is graded based on their actions performed and their success in performing the task, to determine the chance of passing their traits to new agents. The trait system is implemented so as to provide each agent with their own preferences for performing tasks. The evolutionary algorithm is used to promote better sets of traits in the agents over time. This is implemented in a space scenario, where agents visit asteroids to collect resources (see Figure 1).

2 DISCUSSION

One of the main questions explored in this research is whether the agents' traits will converge to a single optimal solution and the consequences for individualised behaviours. The process might consist of speciation of several groups of agents, with each 'family' pursuing a different local extrema. Since the model is based on reproduction by self-replication with error, rather than replication between more than a single agent, one solution will most likely perform better than the other in the end, and prevail as the more optimal one. In this case, even though there might exist a best set of traits, each agent will vary, due to reproduction with error, thus retaining unique quirks. A different scenario might be if the environment is dynamic, and the optimal solution changes over time [2].

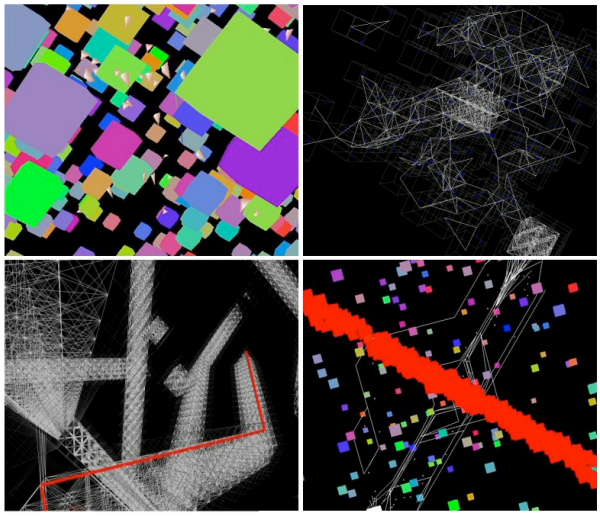

Figure 1. Example of the trait inheritance scenario involving multiple agents in a 3D space environment. Here, agents cooperate and compete by attempting to harvest resources from nearby asteroids.

A disadvantage of this approach is that it requires the system to be parametrised, so it needs to be designed taking that into consideration. It might be difficult to implement this approach for synthesising specific behaviour types, since the evolution process may provide optimal but unrealistic outputs if unconstrained [3]. This suggests a number of possible extensions to the current model and is an interesting domain of future research.

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