Enabling Inductive Program Synthesis in Decentralized Systems

Michelangelo: An AI Sculptor of Emergent Behavior

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Team Members

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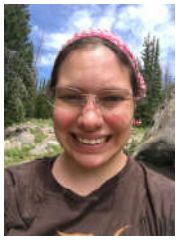


Problem Statement

Can we use genetic learning and inductive programming synthesis to develop an AI to "sculpt" the emergent behavior of decentralized and distributed systems.
What methods of selection, crossover, and mutation should be used on the bytecode genes to create a genetic algorithm which teaches the desired behaviors?

Results

- Collected academic literature on the current state of IPS and genetic learning
- Implemented major parts of the ESDES simulation framework
- Planned implementation and use cases for the genetic learning infrastructure

Background

Inductive program synthesis is a process that generates a program based on desired behavior defined by the programmer. Genetic algorithms consist of three main phases including selection, crossover, and mutation. There are a variety of methods for these phases which return similar results. The initial population of genes goes through these phases to generate offspring which are assessed based on a fitness function and the process continues until the desired fitness is reached.

Methods

The domain specific language (DSL) for this project is essentially a toolbox of simple yet useful functions for the drones, ranging from addition to locating and calculating the distance to the nearest neighboring drone.

Challenges & Future Work

Developing a working simulation framework has been the largest challenge of the project. Starting from scratch has given plenty of valuable chances to design the system specifically for our purposes but has meant that plenty of blockers have arisen in the design process.

Future work will continue to extend the simulation framework and implement the genetic algorithm work developed throughout this summer.

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