TJHSST Computer Systems Lab Senior Research Project Final Proposal Artificial Intelligence in Agent-Based Modeling 2008-2009

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Abstract

Agent-based modeling is an extremely diverse field of research, and much analysis and research into the effectiveness of agent-based modeling. Agent-based modeling is valued for its ability to model scenarios in a level of detail that would be prohibitively complicated in an equation based model. I will investigate the possible value of detailing agent behavior beyond simple rules, to the level of basic artificial intelligence for each agent. This project will yield a deeper understanding of multi-agent modeling. A modeling of a simple predator-prey interaction with implementation of advanced decision-making mechanisms for agents should yield different results depending on the level of intelligence each agent has.

Keywords: multi-agent modeling, artificial intelligence

1 Elaboration on the problem statement, purpose, and project scope

1.1 Scope of Study

Clearly, implementing a scenario that investigates all artificial intelligence in agent-based modeling is beyond the scope of the resources available. As a

result, this project will attempt to analyze the results of implementing varying levels of artificial intelligence for agents in a simple simulation between predator and prey. Multiple cases of the scenario will be set up, and the rules for each agent will be varied between cases. The cases will be compared to yield results concerning the effect of the artificial intelligence.

1.2 Expected results

Ideally I will gather information about the impact of modeling a scenario with artificial intelligence in contrast with simpler setups. The existing research into the effectiveness of artificial intelligence in agents is considerably sparser than the investigation into the rest of this area, and this project will hopefully provide a starting point for further research.

1.3 Type of research

This project is pure basic research into a method of analzying problems.

2 Background and review of current literature and research

Research has been done on the effectiveness of agent-based modeling versus equation-based modeling. A specific example compared traditional equation-based models of interactions to agent-based modeling, and attempted to determine whether agent-based modeling provided advantages over equation-based modeling. The subject under examination was the interrelation of wealth versus education over the generations, and the comparison yielded similar results in the increasing disparity of wealth over generations due to the education of the respective children. However, the agent-based modeling yielded more information than the equations, showing that the classes which a family runs in do change over the generations, a result that the equation-based model was unable to show. In addition, another experiment investigated the necessary level of detail for rules that govern agents in a model, and determined that clearly a basic level of modeling agents is not sufficient when the results do not match results found in the actual scenario being modeled.

3   Expected Results

I plan to construct charts and graphs that detail and explain the data generated by the simulation, and compare the results from different scenarios. I will have the program output its results to a file, based on the seed used for the program, and graph that data separately for presentation. Also, I will create in-program graphs that display population over time of each kind of agent, possible food sources, and population of each agent with a given AI. The results could be useful to someone considering modeling a population of agents in a more detailed way, incorporating more specific aspects of a given scenario's agents. Possible verification of the value of the results could be accomplished through comparison to an equation-based model of the scenario written in a program such as Stella, to confirm basic functionality of the model without artificial intelligence used for the agents.