Exploring Artificial Societies Through Sugarscape

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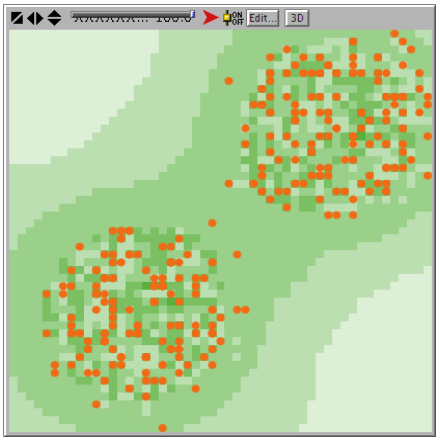
Abstract

Agent based modeling is a method used to understand complicated systems through the simple rules of behavior which its agents follow. It can be used to explain simpler systems, such as the pattern in which birds fly, or more complicated systems, such as self-segregating neighborhoods. The systems lend insight into the way in which they develop. One common application of agent based modeling, Sugarscape, developed by Epstein and Axtell, creates an environment where agents follow simple survival rules within their society. Sugarscape allows for analysis of a variety of trends resulting from the agents interactions, among which is wealth distribution.



Background and Introduction

Agent based modeling, a bottom-up method of modeling complex situations, has become a useful method for simulating problems in the field of social science. The agents, the main building blocks of the model, are designed to follow a set of rules or guidelines. Their interactions result in a more sophisticated global result. This approach programming lends itself naturally to social sciences because of simplistic way in which it creates societies through its components which are guided by rules directed at individual interactions rather than the group. One common simulation using agent based modeling is sugarscape, which is comprised of a set of agents who make calculated moves through a sugarscape a landscape that varies in the amount of sugar, a renewable source of energy for the agents, available at each square in the grid.

Methods and Procedures

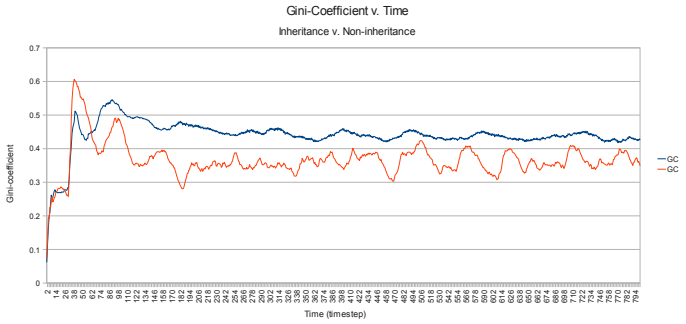
The Sugarscape agents behaviors are specified by a set of guidelines. One of these guidelines involves searching for food: in each timestep, each agent determines which patch or patches of the Sugarscape would be the best place to move. This is done within each agents scope of vision, a number specified by the user (usually between 1 and 10 patches). The agent then gathers all sugar on the square, which it stores as energy, and subtracts from its energy stores various unit of energy for metabolism.

At each timestep, the agent may also reproduce. The user may choose what attributes of the parent agent will be inherited by its offspring. There is a switch that allows for the inheritance of vision and metabolism.

At each timestep, the agents may also die.

Each timestep, the amount of sugar in the patches adjusts to reflect the consumption by the turtles.

The wealth of the agents is analyzed using the Gini coefficient at each timestep.



Results and Conclusions

If metabolism and vision are inherited, the Gini coefficient varies by an average of 0.8, with the average Gini coeffienct over 800 timesteps of the non-inheriance simulation at 0.37 and the average Gini coefficient over 800 timesteps of the inheritance simulation at 0.44. This reflects a much greater inequality when the agents are able to inherit the ”genes”–good or bad–of their parent agents. It is important to note, however, that the wealth distribution during inheritance simulations is much more stable than the wealth distribution of the non-inheritance simulations.