Proposal for Game theory project

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I. Option

Option 2 is selected, open to comment.

II. Introduction

The population game is a type of game which involves a large number of agents, who have continuously differentiable payoff functions proportional to the number of agents choosing a strategy [1]; Hofbauer and Sandholm have described a model which allows for the evolution of player strategies, showing long-term convergence under a game allowing stochastic evolution [1].

Robust game theory has been described by Aghassi and Bertsimas [2] to characterize incomplete information games, which were initially described by Harsanyi [3]. In their model, players optimize robustly while dealing with payoff uncertainty, and a robust-optimization equilibrium is described [2].

Vincent et al describe evolutionary games which involve players which are defined by a set of phenotypic traits, passing on strategy values by inheritance, with rationality not required by players [4]. Evolutionarily stable strategy (ESS) describes a strategy which prevents mutant strategy invasion of the population when adopted by all members [4], [5], [6].

III. Objective

This project proposes to study the evolutionary population games under incomplete information, and characterize how incomplete information may be utilized by players in a game which allows for cooperation.

IV. Motivation

In biological ecosystems, individuals possess limited information about their environments, and are presumed to act in a manner which optimizes based on their known information. Over the long term, this can influence evolutionary tendencies, e.g. specialist vs generalist species. Heritable "policy" (e.g. genetics and learned behaviors) influences descendant fitness over the long term. Furthermore, cooperation vs. conflict forms another dynamic in ecosystems, e.g. symbiosis, predation, and parisitism all manifesting as various forms of interaction between biological "players". Thus this forms an interesting area of further study.

V. Proposed methodologies

The project will involve analysis and simulation components. The analysis will focus on the synthesis of the various models, which the simulation component will attempt to model the population dynamics under a set of predefined rules.

The first 2-3 weeks will focus on literature review. The next three to four weeks will involve constructing the simulated model. Finally, the remaining time will involve analysis of results.

References

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