Social simulation using a Multi-Agent Model based on Classifier Systems: MAXCS and the changing "El Farol" Problem

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1 EXTENDED ABSTRACT

Novel use of the "El Farol" problem (EFP) [1] – using a changing comfort threshold – testing a multi-agent system that learns using a learning classifier system (XCS) [4] is introduced (MAXCS) [3]. The EFP is inspired in a bar which has just a certain percent of seats (called hereafter *comfort threshold*) of the total agent population [1]. Each week, the agents decide whether to go or not to the bar, based on their previous experience. If the number of agents that go exceeds the number of seats, the place becomes uncomfortable, and those agents who decided to stay at home are rewarded, otherwise, those who attended are. There is no exact solution to the EFP, but for the purpose of this research a satisfactory result, or solution should be an attendance curve which oscillates around the threshold value.

The aim of this research is to investigate if the "attractor" values [1] appear around the threshold value as it changes during the experiment, therefore MAXCS adapts to the simplified version of "El Farol" Problem: the minority game [2]. Testing XCS in a multi-agent system is closer to real problems than it is to the multiplexer and the woods environments, where it has been extensively tested [4]. The solution in this multi-agent system is given by the co-evolution of the agents toward the behaviour that yields rewards. The environment presented to MAXCS by the EFP is non-Markovian and non-stationary which makes it an novel test bed for XCS.

The experiments are performed varying the comfort threshold from 0.6 to to 0.3, then 0.8, then 0.3 again and finally 0.5. The threshold is changed every 1000 steps, allowing 150 steps for exploration before and then the system only exploits its acquired knowledge. The system is tested with 10 and 100 agents that can perceive only the correct action for the previous 5 weeks.

The agents show two different behaviour types when exploiting their rules: a fixed behaviour (either attending to the bar or not) and a vacillating one (always taking the wrong action for the current state).

In conclusion, the use of XCS helped to find that there is no connection between the behaviour and the reward accumulated by the agents. It is the evolution and the learning algorithm used by XCS to update its parameters [4] which enforces the rules that produce the particular behaviour of the agents at the exploitation periods.

[1] An agent is considered an entity with goals and preferences, that uses strategies (based on XCS [4]) to fulfil its goals.

References

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