Summary of Applying game theory to automated negotiation

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Abstract

In this report, the survey paper "Applying game theory to automated negotiation" [1] is summarised.

1 Introduction

This report summarizes the survey paper "Applying game theory to automated negotiation" published in October 1999 by the magazine Netnomics. The authors, Ken Binmore and Nir Vulkan from the ESRC Centre for Economic Learning and Social Evolution at the University College London, try to describe the ADEPT algorithm and what differences applying game theory makes.

In this report, Section 2 summarizes the text. Section 3 explains the algorithm used in the paper. Section 4 lines out the difference to other algorithms. Section 5 describes further improvements and section 6 finally concludes this summary.

2 Summary

In the introduction the authors start by describing, that an artificial agent is a program, that can make decisions independently from the user. In this section it is also stated, that there is a lot of research going on on this topic and that there will be way more of those agents in the future. These agents will try to fulfill their users interest as good as possible. Therefore they will tend to lie, or act tough, or exploit other strategic avenues. The authors try to solve those problems by applying game theory.

Afterwards they explain the ADEPT project and that those agents are the strongest ones. Bargaining situations can often be very complex when economic modelling is applied and the structure of ADEPT agents lends to implement game-theoretic ideas and models. That is why the authors tried to implement game theory within ADEPT agents and test it on those.

The next section describes what makes this idea unique and the following sections outline how it works. This is followed by the problems of the implementation and a conclusion. Therefore those parts will be summarized in the following sections of this text.

3 General Idea

The main reason for the authors to combine artificial agents and game theory is, that it provides a classification of interacting situations based on their extensive forms. This means, that situations, which seem to be totally different, could have more in common. So an negotiation algorithm could be used for both, even if they seem to be totally different.

An agent can also be in many different bargaining setups, as the environment can change, or he has to bargain with another one. Therefore it is also not useful to take the same strategy for every situation. The systems could get sensitive to this with the implementation of game theory.

The authors tested such a setup within ADEPT by the British Telecom. The sensitivity there depends on the amount of agents, which offer the same services. The system could determine the amount of other players before the negotiation.

4 What makes it unique?

According to the authors, bargaining agents are mostly programmed with rules-of-thumb. This leads to human behavioural, which could be badly exploited by other agents. To overcome this problem an agent should be designed to optimize on behalf of the decision maker. This means, that only the information and preferences of the user are needed and the bargaining is completely implemented into the agent.

The unique part of implementing game theory is, that the bargaining strategy will be provided immediately. There is no need for any simulation of the negotiation, as game theory predicts the outcome and the optimal strategy can be chosen upon this prediction.

5 What can be improved?

The authors stated, that there are a few minor problems. The prediction from the game theory needs to contribute an equilibrium. This means that a protocol should be standardized for all agents, as many of the problems for contributing the equilibrium come from the protocols, as this might be different in those. Different protocols are therefore also problematic, as different equilibrium could be exploited.

6 Conclusion

In their conclusion the authors stated, that the field of agent technology will have a huge impact in the future. They also stated that applying game theory could be a good solution to a lot of the problems that come with designing and modelling such agents. The initial experience of them also showed them, that considerable changes in the existing agents need to be done, to become useful in the settings with game theory.

References

[1] N. Binmore, K. Vulkan. Applying game theory to automated negotiation. *NETNOMICS*, 1(1):1–9, 1999.