MiCRO Agent 2022

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Abstract

This document gives a short description of MiCRO Agent, an agent submitted to the ANAC 2022 competition, based on the MiCRO negotiation strategy.

1 Introduction

MiCRO Agent is an extremely simple agent that does not apply any form of learning or opponent modeling. Despite its simplicity, however, experiments have shown that it outperforms the top agents of ANAC 2012, 2013, 2018 and 2019. In fact, we can mathematically prove that in certain types of domains, and under mild assumptions about the opponents, MiCRO is a game-theoretically optimal strategy.

MiCRO is strong because it can hardly be exploited, but has the disadvantage that it also is not able to exploit weaker opponents. This means that it performs especially well against stronger agents, but in a tournament setting that includes weaker agents, it may not score very high because other agents may obtain more points against the weaker agents.

A more detailed description of our experiments and our mathematical claims can be found in our paper that has been accepted for the IJCAI 2022 main conference [1].

2 Bidding Strategy

MiCRO stands for *Minimal Concession in Reply to new Offers.* Simply stated, it works as follows: whenever the opponent proposes a *new* offer, MiCRO also replies with a new offer. The offer that MiCRO then proposes will simply be the one with highest utility that it has not yet proposed

before. On the other hand, whenever the the opponent repeats an earlier offer, MiCRO also replies with an offer it has already proposed before.

More formally, let K denote the total number of offers in the domain and let u denote the utility function of our agent. Before the negotiations begin, MiCRO Agent creates a sorted list $(\omega_1, \omega_2, \ldots \omega_K)$ containing all offers in the domain, sorted in order of decreasing utility for itself. That is:

$$u(\omega_1) \geq u(\omega_2) \geq \cdots \geq u(\omega_K)$$

Then, whenever it is our agent's turn to make a proposal, it counts how many *different* offers it has so far received from the opponent (we denote this number by n), and how many *different* offers it has so far proposed to the opponent (we denote this number by m). If $m \leq n$ then MiCRO Agent will next propose ω_{m+1}. On the other hand, if $m > n$ then it picks a random integer r such that $1 \leq r \leq m$ and proposes ω_r.

3   Acceptance Strategy

MiCRO Agent accepts any received offer if and only if it is better than or equal to the lowest offer it is, at that time, willing to propose.

More precisely, if we define :

$$\omega_{low} := \begin{cases} \omega_{m+1} & \text{if } m \leq n \\ \omega_m & \text{if } m > n \end{cases} \tag{1}$$

(with m and n defined as before) then a received offer ω is accepted by our agent iff $u(\omega) \geq u(\omega_{low})$.

4   Opponent Modeling

MiCRO Agent does not apply any form of opponent modeling.

5   Learning Method

MiCRO Agent does not apply any form of learning.

References

[1] Dave de Jonge. An analysis of the linear bilateral ANAC domains using the MiCRO benchmark strategy. In *IJCAI 2022, Vienna, Austria*, 2022.