Multiagent Negotiation : A Dual Behaviour Approach

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1 Abstract

This agent is inspired by how some people negotiate in the real world by not showing their cards initially and later act hostile after gaining knowledge about their opponent's move. Our negotiation agent has two phases:

Tough Phase In this we stick on a particlar bid for exponential amount of time, which keeps on decreasing exponentially from one bid to the other.

Hostile Phase We enter this phase after total time spent in the **Tough Phase** exceeds some threshold value. In this phase agent tries to decrease utility of bid linearly with time along with placing bids which serve common interests.

We also keep modeling the preferences of our opponents since once we know what our opponents want, we can steer the entire negotiation towards bid which are highly likely to be accepted and are profitable to us.

2 Procedure

The agent begins in **Tough Phase**. We set number of rounds to be spent on first bid to be $round/expFactor$. For the purpose of our agent we used $expFactor = 2$ (empirically decided). So number of rounds we spend on first bid is $round/2$.

After the assigned rounds are over, the time spent on the second bid is $round/(expFactor^2)$. Similarly time spent per i^{th} bid in **Tough Phase**:

$$round/(expFactor^i)$$

In our case,

$$round/(2^i)$$

We remain in the **Tough Phase** until the value of the time spent on a bid goes beyond a threshold $thresh$. For the purpose of our agent we took threshold to be:

$$thresh = \sqrt{round}$$

The value of the threshold above is empirically decided.

After the time spent on a bid goes beyond threshold, we enter **Hostile Phase**. During the time in the **Tough Phase**, we keep recording the bids proposed and accepted by the other players.

Now after entering **Hostile Phase**, we keep rolling down to the next bid (a bid with lower utlity) until we reach a utility equal to **Reservation Value**. Also if a bid with better utility than the roll down version utility was accepted/proposed by all the agent in some past, we propose that utility with some probability.

Initially the probability of proposing is set to 1 but it decreases by a constant factor as that bid is continously ignored (Here, using randomization prevents our agent from getting stuck in a loop).

Apart from having above Phases, we also have following (acting as saftey mode) implemented in our agent:

- Accept last utility if it's above **Reservation Value** and if we're not the first bidder of the last round.
- If the **Discount Factor** is less than 1.0, we accept any bid giving us a utility above some threshold. This threshold metric is:

  $$threshold\_util = max(preferable\_util, median(UtilitySpace))$$

  We chose the $threshold\_util$ to be maximum of some preferable utility value (In our agent we keep it as 0.9) and median of Utility Space, so if a lot of Bids with utility more than preferable utility are availaible, we chose them as our threshold since there is a hope for better negotiation.

3 Future Extension

- We hope to define all the metrics mathematically rather than just being empirical.
- We'll like to include **Discount Factor** for setting up the pace of negotiation.
- We'll like to follow BOA framework for negotiation agents

4 References

http://ii.tudelft.nl/genius/?q=article/quick-start-tutorials