BraveCat

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This is a brief description of our agent, BraveCat agent, which was mainly developed to participate in the Fourth International Automated Negotiating Agents Competition (ANAC 2014).

Since this agent is consistent with the BOA framework devised by Baarslag et al [1], so the description provided briefly explains each BOA component of our BOA agent in isolation, and the negotiation strategy of our agent is the result of the collaboration between the following components inside the BOA framework.

Bidding Strategy:

Our agent uses a novel hybrid bidding strategy for choosing the bids in order to send to the opponent in each round of the negotiation. This hybrid strategy combines a time dependent strategy, a random strategy, and an imitative strategy. Firstly, a time dependent strategy produces a real number called target utility which determines the utility value that the agent is willing to obtain at that time of the negotiation session. A tough strategy is used for this time dependent component. Then this real number is randomized using a normal distribution function, so that a random behavior can also be exhibited. This normal distribution function is designed such that a gradual transition from a random behavior to a deterministic behavior happens as the time passes in the negotiation. Then we add imitative behavior by temporarily awarding the opponent each time it makes a nice move. By temporarily awarding the nice moves of the opponent, we try to strike a balance between the cooperative behavior and the competitive behavior of our agent. The behavioral strategy we use is quite similar to a Tit for Tat strategy [2], but it is different from it in the sense that it is only reciprocative not retaliative. In other words, our agent tracks the moves made by the opponent, recognizes the nice moves, and reciprocates them with a nice deviation from the target utility value that is calculated before.

Opponent Model:

Since the designed agent is to be used in ANAC 2014 which includes the nonlinear negotiation scenarios, we don't have any access to information as to the exact structure of the utility function, which is to be used to calculate the utility of a bid. So we designed a new special purpose opponent model to be merely used in nonlinear scenarios. For this end, we assume that two bids having similar Euclidean Distance values would probably have similar utilities. We refer to this similarity value as the natural similarity. We also assumed that the similar bids in utility are sent in similar times. So we calculated another similarity value and referred to this value as the temporal similarity in our model. We also assumed that the opponent is following some kind of a concession based strategy. Then based on these two calculated values, we designed and implemented a new Distance based model for nonlinear scenarios and incorporated this model into our Agent inside the BOA framework.

Acceptance Strategy:

We used a combined strategy to decide whether to accept an incoming bid from the opponent. The acceptance strategy of BraveCat Agent is comprised of two parts: 1) initial rounds, 2) final rounds. As for the final rounds, the acceptance strategy is to accept the probable last bid unconditionally. The reason for this tactic is that we consider a Break-Off the worst outcome that could be obtained in a negotiation session, provided that the opponent is sending a bid with a greater utility than the agent's reservation value. As for the initial rounds, the agent accepts the incoming bid if the utility of that bid for the agent is greater than or equal to **0.8**. The agent also accepts an incoming bid, if its utility is equal to or greater than the mean value of the worst bid and the best bid it has ever sent during that negotiation session.

References:

[1]   T. Baarslag, K. Hindriks, M. Hendrikx, A. Dirkzwager, and C. Jonker, "Decoupling negotiating agents to explore the space of negotiation strategies," in *Proceedings of the 5th International Workshop on Agent-based Complex Automated Negotiations, ACAN*, 2012.

[2]   T. Baarslag, K. Hindriks, and C. Jonker, "A Tit for Tat Negotiation Strategy for Real-Time Bilateral Negotiations," in *Complex Automated Negotiations: Theories, Models, and Software Competitions*. vol. 435, T. Ito, M. Zhang, V. Robu, and T. Matsuo, Eds., ed: Springer Berlin Heidelberg, 2013, pp. 229-233.

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