

Automated Multi-Attribute Negotiation Using Incomplete Preference Information

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Recent years have seen a surge of interest in negotiation technologies, seen as a key coordination mechanism for the interaction of providers and consumers in future electronic markets that transcend the selling of uniform goods. Such technologies could prove especially useful in the case of multi-attribute negotiations, where the agents have an incentive to cooperate in searching for jointly profitable outcomes. Negotiations of this type represent non-zero sum games, where “as values shift along multiple directions it is possible for both parties to be better off” [3].

One of the main obstacles that arises in applying the results from cooperative game theory is the assumption that complete information of both parties is available in order to compute optimal outcomes. This does not usually hold in many applications, for a variety of reasons (e.g. fear the other may abuse this information to get a better deal, privacy concerns). In classical multi-attribute-utility theory [2], the solution proposed is the use of an independent, trusted mediator. However, in an electronic or open system settings, it can be difficult to establish whether a mediator is indeed impartial or trustworthy. By contrast, our approach is to use a distributed design, in which each agent computes its own bids, possibly using partial information about the preferences of the opponent.

Our negotiation follows an alternating-offers protocol. A bid in such a negotiation has the form of values assigned to a number of attributes. We distinguish between two types of attributes: discrete-valued (i.e. having a finite set of values, assigned evaluations by the user) and continuous-valued. The overall utility of a bid is then computed as the weighted sum of attribute evaluations (such as in [2]). If the negotiation is about the sale of a car, for example, the discrete-valued attributes are the accessories to be provided (having different quality levels), while price or mileage are continuous-valued (see [1] for a detailed example).

Our paper pursues two main directions of research:

- A novel mechanism where the agents are allowed to exchange and take into account partial preference information from the negotiation partner (in the form of attribute preference/importance weights) is proposed and studied.

- A heuristic by which an agent can estimate the preferences of the other using his past bids is also studied. Here we start from the assumption that the way the negotiation partner is bidding may reveal something about his preferences. For this mechanism we use the term “guessing” to clearly show it is a heuristic.

Experimental results show that the proposed model is an efficient one, in which sharing some partial preference weights and guessing can lead to gains in the negotiation outcome for both parties. These gains scale up with the level of asymmetry in preference for different attributes between parties. We also found that a combination of partial preference information sharing and guessing can lead to Pareto-optimal outcomes, even in the absence of complete information about the preferences of both parties (such as in [2]).

References

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