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Automated Multiagent Preference Aggregation Using Fuzzy Quantifiers

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An issue that is of considerable interest in distributed systems is the selection of a solution acceptable to a collection agents when each agent has their own preferences among a set of alternative possible solutions. Recently Rosenchein and Zlotkin [1] have presented a comprehensive work discussing this issue. The process of finding such a solution can be seen as a kind of negotiation amongst these agents. This class of problems have a long history in the economic literature. In the fuzzy set literature one finds a considerable body of literature devoted to the closely related problem of multi-criteria aggregation starting with the classic work of Bellman and Zadeh [2]. The goal of the work presented here is to provide mechanisms to enable automated negotiations, aggregation of preference functions, between multiple agents in he spirit of the framework initiated by Bellman and Zadeh.

In cases of a single agent the problem of solution selection is easily solved by just selecting the alternative that best satisfies our single agent. In the multiple agent environment we are faced with the problem of combining the preferences of these multiple agents to obtain an overall preference. This process of multi–agent preference aggregation can be seen as a process of negotiation. Thus the fundamental problem that arises in this task is to provide an ability to model different types of aggregation / negotiation rules in a way that can automated. Starting with the classic work of Bellman and Zadeh [2] fuzzy logic has been used as a tool to develop and model multicriteria decision problems. Using this framework the preferences of the agents can be represented as fuzzy subsets and fuzzy set operators can be used to aggregate the individual agent preferences. The choice of operators used to aggregate these individual agent preferences reflects the choice of negotiation rules used. As originally suggested by Bellman and Zadeh the agents preferences can be combined by the use of an intersection operation which implicitly implies a requirement that **all** the agents be satisfied by a solution to the problem. This condition may not always be the appropriate relationship between the agents. Do all agents need be satisfied? Do some agents have priority over others? Are some agents more important than others? For example an acceptable solution may be obtained if ***most of the agents are satisfied.*** In this work we look at the issue of the formulation of these softer negotiation / aggregation rules which we call **quantifier guided aggregations.** In [3] we suggested the use of the Ordered Weighted Averaging (OWA) operators as a tool to implement these kinds of aggregations. We here further develop this approach by considering environments in which the individual agents have importances associated with them [4].

References

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