Group Decision Making and Temporal Reasoning

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by

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To the memory of my father
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Abstract

The more capable and autonomous computer systems become, the more important it is for them to be able to act collaboratively, whether in groups consisting solely of other computers or in heterogeneous groups of computers and people. To act collaboratively requires that systems have effective group decision-making capabilities. This thesis makes four important contributions to the design of group decision-making mechanisms and algorithms for deploying them in collaborative, multi-agent systems. First, it provides an abstract framework for the specification of group decision-making mechanisms that computer agents can use to coordinate their planning activity when collaborating with other agents. Second, it specifies a combinatorial auction-based mechanism that computer agents can use to help them decide, both individually and collectively, whether to engage in a collaborative activity. Third, it extends the theory of Simple Temporal Networks by providing a rigorous theoretical analysis of an important family of temporal reasoning problems. Fourth, it provides sound, complete and polynomial-time algorithms for solving those temporal reasoning problems and specifies the use of such algorithms by agents participating in the auction-based mechanism.

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