

A Dependence-Based Model for Social Reasoning in Multi-Agent Systems

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Abstract

This work presents the core notions of a *social reasoning mechanism*, based on dependence theory. This model enables an agent to reason about the others, in particular to calculate his dependence relations and dependence situations. An agent is said to be dependent on another if the latter can help/prevent him to achieve one of his goals. We consider our social reasoning mechanism as an essential building block for the design of really autonomous artificial agents, which are immersed in an open multi-agent world. By open, we mean that agents may enter or leave the society at any moment. In such systems, as the organization of the agents can not be conceived at design time, the cooperative problem solving paradigm is based on *dynamic coalition formation*. In this context, agents must be able to *adapt* themselves to dynamically changing conditions, by evaluating at execution time if their goals are *achievable* and if their plans are *feasible*. As we do not suppose that agents are benevolent, our model proposes a criterion to evaluate which partners are more susceptible to accept a proposition of coalition. Finally, as in these kind of systems agents usually do not have a complete and correct representation of each other, our model helps them to detect an *agency level inconsistency* and to choose a context to be maintained. We believe that this model may be used in two different scientific perspectives. On one hand, concerning social simulation, our model may provide a computational tool for the analysis and prediction of the occurrence of several interesting patterns of social interactions, and for the evaluation of the agents' social power. On the other hand, with respect to problem solving, our model can be used to design dynamic agents' organizations in a context of open multi-agent systems.

Keywords: Distributed AI, Multi Agent Systems, Cognitive Modelling, Open Systems, Dynamic Organizations.