Modeling Multiagent Deliberation from an Abstract Standpoint

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1 Introduction

Simply put, a multiagent system can be understood as a collection of autonomous agents able to accomplish as a whole goals beyond the capabilities of any of its members. The traditional example depicts a heavy armchair that can be easily lifted by coordinating the effort of a group of persons despite that none of them would have been able to pick it up alone. Thus, one might argue that precisely the agent interaction is boosting the system performance. Since this interaction comes in several flavors, the literature has already explored notions such as agent coordination, cooperation, and collaboration in the context of multiagent systems. This extended abstract outlines our own understanding on this matter, summarizing the evolution of an abstract model for the particular kind of agent interaction known as deliberation. A group of agents deliberate whenever they need to come to a mutually accepted position about some issue. This interaction among agents has drawn our attention given its ubiquity: we believe that complex interactions such as coordination or cooperation might be attained as a result of accruing one or more deliberations.

Our proposal is inspired after the novel trend of reinterpreting agent interaction as if it were the result of an argumentation process. For instance, several authors [2,3,5,13,14] have recently considered recasting the main aspects of multiagent negotiation in terms of defeasible argumentation. We follow a like approach in developing our model after a set of dialectical concepts borrowed from that same area. Our approach also strives for generality, mainly after Dung's ample success with his notion of argumentative framework due to its abstract nature. In consequence, we too have decided to pursue an abstract model.

2 An abstract model for deliberation

Almost every theory introduced within the field of defeasible argumentation resembles the kind of debate between contenders customary to western courts of law, where two opposing parties argue why their own stance should prevail. Yet, this insightful analogy was somehow forsaken in the early proposals in the field, where the semantic were expressed using fix-point definitions [1,8] or obscure recursive characterizations [6,12] instead of through more intuitive dialog-based notions. Aware of this situation, many theories eventually evolved into new formalisms embodying dialectics. For instance, the argumentative system defined by Prakken and Sartor became complemented with a dialectical proof theory in [9], or the MTDR system [11] that completely rebuilds the Simari-Loui formalism in dialectical terms. Not surprisingly, almost every prominent proposal in this field can undergo a similar recast.

It should be mentioned that the philosopher Nicholas Rescher already acknowledged the fundamental role of dialectics years before reaching this consensus, particularly in the context of scientific inquiry [10]. He envisioned knowledge discovery as a dialectical process where new ideas could be discussed and analyzed, weighting reasons for and against them, and determining whether they should end up accepted. Briefly stated, his main contribution was a protocol for governing these disputes. Despite that this protocol was defined in a semi-formal fashion, many of his ideas remain influential even nowadays. Rescher also introduced a striking result largely ignored: he claimed that unilateral

dialectic and multilateral dialectic are in fact related by an apparent isomorphism. That is to say, Rescher recognized the structural similarities between the sort of debate that takes place inside the mind of a researcher exploring new ideas and the kind of dispute that takes place when a new result believed to be correct is presented in front of its skeptic peers.

Our model for the process of deliberation among agent is the result of combining these two principles we just mention:

- Most of the theories for defeasible argumentation can be recasted in dialectical terms.

- The process that occurs inside an agent reasoning in an argumentative fashion shares the same structure of a dialog between opposing parties analyzing the acceptability of an assertion.

We intend to elicit a model for the process of deliberation beginning by formulating a model for the dialectical notions involved in all the formalizations of defeasible argumentation, and then reinterpreting it as a model of the deliberation process. Clearly, we rest on Rescher's isomorphism to ensure the feasibility of this approach. Note that the model obtained through this design will be abstract in nature, since it has to capture all the shades of dialectics present in the context of the theories of defeasible argumentation. Nonetheless, this outcome is welcomed since it goes along with our objective of covering a large domain of application.

The approach we have outlined toward the modeling of multiagent interaction was initially suggested in the work of R. Loui [4], later extended by H. Prakken in [7]. However, Loui involvement with this notion was rather tangential since he was mainly concerned with representing resource-boundedness within the current formalizations of defeasible argumentation. To this end, Loui defined among other concepts a partial model for the dialectical process of defeasible argumentation. This idea motivated Prakken to fill in the gaps in Loui's model, and to use this improved model as a framework for studying dynamic multiagent debates. Unfortunately, Prakken's proposal falls short of expectations since he assumed that all the intervening parties in the debate must share the same knowledge base. Our current research intends to match their achievements without resorting to that unrealistic assumption.

3 Conclusions

This extended abstract outlines how to profit of the body of research conducted within defeasible argumentation with the purpose of defining an abstract model for the kind of deliberations that take place in multiagent systems. Moreover, this line of research is already being actively pursued. We refer the interested reader to [15], where some of the preliminary results of this line of research were published.

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