Scenario Argument Structure vs Individual Claim Defeasibility: What Is More Important for Validity Assessment?

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Abstract. We conduct comparative analysis of two sources of argumentation-related information to assess validity of scenarios of interaction between agents. The first source is an overall structure of a scenario, which included communicative actions in addition to attack relations and is learned from previous experience of multi-agent interactions. In our earlier studies we proposed a concept-based learning technique for this source. Scenarios are represented by directed graphs with labeled vertices (for communicative actions) and arcs (for temporal and attack relations). The second source is a traditional machinery to handle argumentative structure of a dialogue, assessing the validity of individual claims. We build a system where data for both sources are visually specified, to assess a validity of customer complaints. Evaluation of contribution of each source shows that both sources of argumentation-related information are essential for assessment of multi-agent scenarios. We conclude that concept learning of scenario structure should be augmented by defeasibility analysis of individual claims to successfully reason about scenario truthfulness.

1 Introduction

Understanding and simulating behavior of human agents, as presented in text or other medium, is an important problem to be solved in a number of decision-making and decision support tasks [3]. One class of the solutions to this problem involves learning argument structures from previous experience with these agents, from previous scenarios of interaction between similar agents [8]. Another class of the solutions for this problem, based on the assessment of quality and consistency of argumentation of agents, has been attracting attention of the behavior simulation community as well [1].

In the context of agent-based decision support systems, the study of dynamics of *argumentation* [14] has proven to be a major feature for analyzing the course of interaction between conflicting agents (e.g. in argument-based negotiation or in multiagent dialogues. The issue of argumentation semantics of communicative models has also been addressed in the literature (eg [15]). Formal models of valuables norms and procedures for rational discussion have been introduced ([12]). However, when there

P. Eklund and O. Haemmerlé (Eds.): ICCS 2008, LNAI 5113, pp. 282–296, 2008.

is a lack of background domain-dependent information, the evolution of *dialogues* ought to be taken into account in addition to the communicative actions these arguments are attached to. Rather than trying to determine the epistemic status of those arguments involved, in one of our previous studies [8] we were concerned with the emerging *structure* of such dialogues in conflict scenarios, based on inter-human interaction. The structure of these dialogues is considered in order to compare it with similar structures for other cases to mine for relevant ones for the purpose of assessing its truthfulness and exploration of a potential resolution strategy.

In our earlier studies we proposed a concept learning technique for scenario graphs, which encode information on the sequence of communicative actions, the subjects of communicative actions, the causal [4,], and argumentation attack relationships between these subjects [6,8]. Scenario knowledge representation and learning techniques were employed in such problems as predicting an outcome of international conflicts, assessment of an attitude of a security clearance candidate, mining emails for suspicious emotional profiles, and mining wireless location data for suspicious behavior [7]. A performance evaluation in these domains demonstrated an adequateness of graph-based representation in rather distinct domains and applicability in a wide range of applications involving multi-agent interactions.

In this study we perform a comparative analysis of the *two sources* of argumentation-related information mentioned above to assess validity of scenarios of interaction between agents. The *source* 1) of information on argumentation is an overall structure of a scenario, which included communicative actions in addition to attack relations and is learned from previous experience of multi-agent interactions. Scenarios are represented by directed graphs with labeled vertices (for communicative actions) and arcs (for temporal and causal relationships between these actions and their parameters) [4]. The *source* 2) is a traditional machinery to handle argumentative structure of a dialogue, assessing the validity of individual claims, which has been a subject of multiple applied and theoretical AI studies.

2 Learning Argumentation in Dialogue

We approximate an *inter-human interaction scenario* as a sequence of communicative actions (such as *inform, agree, disagree, threaten, request*), ordered in time, with *attack* relation between some of the subjects of these communicative language. Scenarios are simplified to allow for effective matching by means of *graphs*. In such graphs, communicative actions and attack relations are the most important component to capture similarities between scenarios. Each vertex in the graph will correspond to a communicative action, which is performed by an (artificial) agent. As we are modeling dialogue situations for solving a conflict, we will borrow the terms *proponent* and *opponent* from dialectical argumentation theory [14] to denote such agents. An arc (oriented edge) denotes a sequence of two actions.

In our simplified model of communication semantics [6] communicative actions will be characterized by three parameters: (1) *agent name*, (2) *subject* (information transmitted, an object described, etc.), and (3) *cause* (motivation, explanation, etc.) for this subject. When representing scenarios as graphs we take into account all these parameters. Different arc types bear information whether the subject stays the same or