

ARGUER: Using Argument Schemas for Argument Detection and Rebuttal in Dialogs*

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Abstract

This paper presents a computational method for argumentation on the basis of a declarative characterization of the structure of arguments. The method can be used to implement a computational agent that is both able to detect arguments and to generate candidate arguments for rebuttal. The method makes no *a priori* assumptions about *attack* and *support* relations between propositions that are advanced by the agents participating in a dialog. Rather, using the method, these relations are dynamically established while the dialog is taking place. This allows incremental processing since the system need only consider the current utterance advanced by the dialog participant, along with the prior context, to be able to continue processing.

1 Introduction and Motivation

Argument detection is an important task in building an intelligent system that can understand and engage in an argument. An intelligent dialog system (IDS) (Bordegoni *et al.* (1997)) is an interactive system that tailors its responses according to the user's needs and intentions. In an IDS, it is necessary to detect whether an utterance given by the user is an argument against an utterance advanced by the system, because two agents, *e.g.* the system and the user, may not always agree. Each of them may attempt to resolve issues either by attacking an agent's claim or by defending its position. Thus, an IDS must be able to determine whether a proposition advanced by an agent in a dialog attacks a claim currently held by the other agent, supports it, or does neither. An IDS must also be able to generate rebuttals (utterances that attack or support previous utterances). Finally, an IDS must be able to process arguments incrementally, while the dialog is taking place. This work extends our prior work on detecting and correcting misunderstandings during the course of a dialog (McRoy and Hirst (1995), McRoy (1995), and McRoy (1998)).

The method that we describe here, which is used in our system ARGUER, uses argument schemata that match the deep meaning representation of propositions that have been advanced in a dialog. In contrast to Birnbaum *et al.* (1980), we present a general computational method of establishing relations between propositions. Argument schemata characterize important patterns of argument that are used to establish whether propositions *support* or *attack* other propositions. These patterns are instantiated by propositions expressed by the agents during a dialog, as well as related beliefs that the agents might hold. To account for disagreements, separate models of the agents' beliefs are maintained, both for the system and the user. Hence, a proposition believed by the system might not necessarily be believed by the user. To generate a correct and convincing response, the system considers both its own beliefs and those beliefs held by the user. In addition to allowing for incremental processing of arguments, this method is *symmetric* because it can be used for interpretation or generation of arguments. This is important because the system can have the role of observer or participant.

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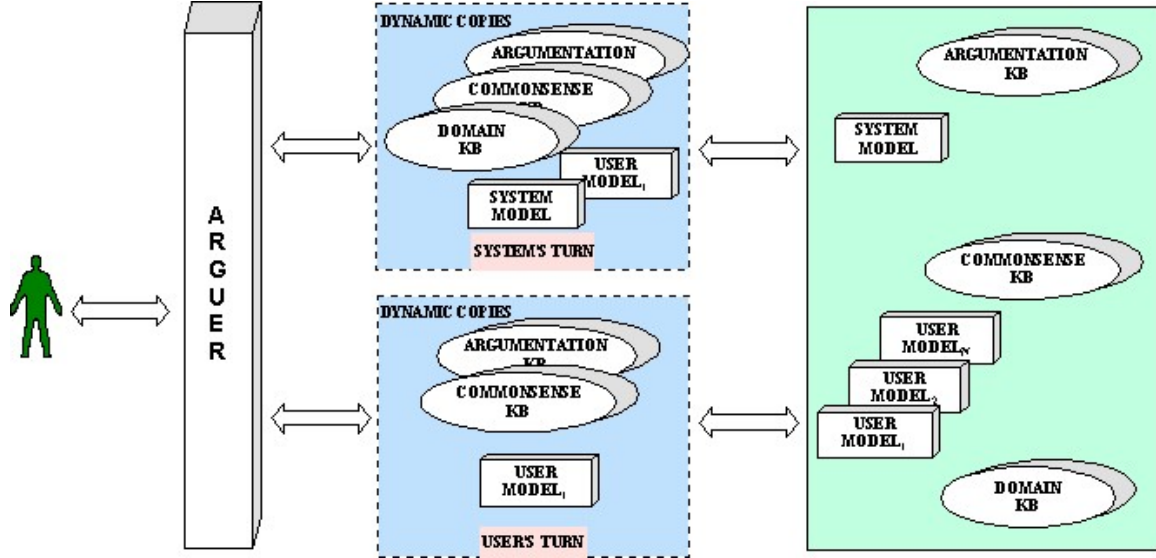


Figure 1: Architecture of ARGUER

2 Argument Detection and Rebuttal

The architecture of ARGUER is depicted in Figure 1. The system has access to the Domain Knowledge Base (KB) (domain knowledge), Argumentation KB (argumentation knowledge, *i.e.* knowledge about the structure of arguments), and the Commonsense KB. (The underlying knowledge representation used by ARGUER is SNePS Shapiro and Rapaport (1992), which provides facilities for reasoning, truth-maintenance and knowledge partitioning.) The system is presumed to be the domain expert. During turn-taking (the dotted boxes in Figure 1 represent the extensions of the knowledge base used for each turn), the system has access to the users' belief models (because it is the system's models of the users). Depending on whose turn it is, the system attempts to interpret whether the current utterance attacks or supports previous claims (which may be any prior utterance).

When the user inputs an utterance, the system will attempt to interpret the user's utterance as an attack or support on a prior utterance of the system. It does so by asking, *What does the user's utterance attack?* and second, *What does the user's utterance support?* All reasoning to answer these questions occurs in an extension of the user's belief model that includes the argumentation and common sense knowledge (which are presumed to be shared knowledge).

When the system generates a reply, it will attempt to attack or support the previous utterances of the user. Otherwise, the system will attempt to provide utterances that support its prior utterances. To generate a response, the system will reason with an extension of its knowledge including domain, argumentation, and common sense knowledge, along with a relevant set of the user's beliefs (Ali *et al.* (1999)). (The latter is determined by considering applicable argument schemata).

Figure 2 is an example dialog that includes an argument. In the figure, S1 and S2 are utterances of the system. U1 is the user's utterance. To detect that U1 attacks S1, the system makes use of the argument schema rule: *If X is an utterance implying Y, then NOT Y is an attack to X* (which is in the Argumentation KB). A rule in the common-sense KB allows the system to derive that requiring something of an agent (which follows from the imperative form of S1) implies that there is a need for that thing by the agent. S1 implies Y ("There is a need for a blood pressure check.") Thus, using the above argument schema rule, (*NOT Y*) ("there is no need for a blood pressure check") is an attack to X ("system requires the user to have a blood pressure check").

This argument schema can also be used to generate a rebuttal. Suppose the user said S1. Using the argument schema rule describe above, Y is instantiated as "there is a need for a blood pressure check". This, in turn, allows the system to select (*NOT Y*) as an attack to X to make the utterance U1 to rebut S1.

S1 Have your blood pressure checked.
U1 There is no need.
S2 Uncontrolled high blood pressure can lead to heart attack, heart failure,
stroke or kidney failure.

Figure 2: An Example Argument

3 Related Work

This work deals with issues closely related to understanding arguments in an interactive environment, more specifically, in a dialog. Recent work in interactive argumentation systems include IACAS (Vreeswijk (1995)) and NAG (Zukerman *et al.* (1998)). IACAS allows the users to start a dispute and find arguments. However, it does not address the issue of maintaining separate belief models for each participant in a dialog. NAG, on the other hand, uses tagged words from the input and uses Bayesian networks to find the best set of nodes that can be formed as an argument for a proposition. Neither system, however, addresses argument detection; they deal with issues different from the ones that concern us. Chu-Carroll and Carberry (1995) focus on a different, but related, problem within dialog, the collaborative construction of a plan. This work considers the problem of deciding whether the system should accept or reject a user's proposal, on the basis of its consistency with the system's beliefs and the evidence offered by the user. Unlike ARGUER's approach to deciding whether some evidence supports a belief, which relies on domain-independent schemata, their system's approach relies on domain-specific patterns of evidence. Other approaches to argumentation, like ABDUL/ILANA (Birnbaum *et al.* (1980)) and HERMES (Karacapilidis and Papadias (1998)), do not address the issue of how attack and support relations between propositions may be established computationally. Alvarado's OpEd (Alvarado (1990)), although designed to understand arguments, is limited to processing editorial text and does not address issues that arise in dialog.

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