Gathering and Using Linguistic Evidence for Determining the Scope and Role of Natural Language Arguments

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Abstract. The role and scope of arguments in a natural debate are not always well enough understood to build an adequate formal representation of the debate. In this paper, we examine some sources of linguistic evidence that contribute to assessing which of potential candidate roles and scope of an argument are more plausible than others. In concrete, we elaborate the evidence provided by discourse parsers and modules checking logical entailment and discuss its consequence on interpreting the contribution of an argument. The results have the potential of increasing the accuracy of formal representations of a natural debate, so that advanced logical reasoning services are improved or can be enabled at all.

Keywords. Natural language, scope of arguments, role of arguments

1 Introduction

Interpreting natural language specifications for logical reasoning purposes is an ambitious task (e,g., Digital Aristotle [2]). In the field of argumentation, Wyner and others [12, 13] have shown how NLP techniques are applied to build abstracted representations to be used by argumentation frameworks [1] under some simplifications – the use of controled English and user cooperation to specify the role and scope of arguments.

Building representations adequate for advanced logical reasoning, such as checking validity of arguments and finding suitable places for new arguments, relies on determining the precise (1) *scope* and (2) *role* of the arguments raised in the debate. People may be sloppy in doing this. Using Wyner's example [12], we have argued [3] about: (1) indicating an indirect support or attack rather than the direct one, and (2) providing additional details or another view (*fact* or *rule* variant of a *modus brevis* form, see [9]), of an argument already raised rather than a new one. In order to address this problem, we examine some linguistic evidence that contributes to assessing which of potential candidate roles and scope of an argument are more plausible than others. In concrete, we elaborate the evidence provided by discourse parsers and modules checking logical entailment and discuss its consequence on interpreting the contribution of an argument.

This paper is organized as follows. We build a set of implications related to argumentative purposes whose plausibility can be examined through linguistic analysis, and we elaborate the consequences on the role and scope of arguments in context. We illustrate the use of evidence obtained by comparing discrepancies between the original representation in Wyner's running example and our version previously argued as being more accurate [3]. Finally, we discuss the state of affairs and future prospects.

Implications	*none*	*Claim → Argument*	*Claim → ¬Argument*
none	–	no attack, support unclear	attack, no support
Argument → Claim	no attack, no support	no attack, no support	inconsistent
Argument → ¬Claim	no support	inconsistent	attack, no support

Table 1: Possible implications between a claim (a previously raised argument) and a new argument

2 Gathering Argumentation-Relevant Impact from Linguistic Evidence

We consider only the simple *attack* relation here, as used in argumentation frameworks [1], and the somehow converse *support* relation, since it appears frequently in public debates (see also [12, 13]). These relations require considerable background knowledge to verify or assess their plausibility. However, some simpler linguistic relations are to a certain extent accessible to a formal analysis, and they bear some consequence on the plausibility of argumentative relations: the *logical implication* and *rhetorical* relations, as defined in *Rhetorical Structure Theory* [6, 8]. Implications are examined by *logical entailment* tools, while rhetorical relations are hypothesized by *discourse parsers*.

Typical patterns that have impact on assessing the plausibility of argumentative relations are illustrated in Table 1 for *logical* and in Table 2 for *rhetorical* relations. Relations of interest hold between a new argument to be incorporated in an argumentative graph and previously raised arguments, prominently the original claim. In Tables 1 and 2, we write *Claim* for a previously raised argument and *Argument* for a newly given one. Implications may hold in one of the two directions, and the conclusion may be negated, which yields the combinations listed in Table 1. Consequences on argumentative relations are mostly inhibitive. For example, a *negative implication* between the new argument and a previously raised one is simply inconsistent with a *support* relation. Conversely, a *positive implication* is inconsistent with an *attack* relation. In addition to that, if the new argument is implied by the previously raised one, a *support* relation hardly can be justified, because there is no new information. In particular, if the implication is bi-directional, this indicates the presence of a variant or another viewpoint of the previously raised argument rather than a support relation. Similar considerations hold for the rhetorical relations, in dependency of their category. Some semantic relations (the logical ones) bear similar impact as the relations discussed above, most others bear an even stronger account of the constellation in which the new argument conceptually expands on the previous one rather than providing argumentative support. Informative evidence is given by *interpersonal* relations, which correlate with *support* (for positive relations) resp. *attack* (for negative relations).

Relations	*Argument related to Claim (reverse direction unusal)*
Logical Relations	(e.g., CONSEQUENCE, REASON): impact similar to that of the logical relations (see Table 1)
most other Semantic Relations	(e.g., ELABORATION, CIRCUMSTANCE): no attack, support unlikely - only adds information
Interpersonal Relations	positive ones (e.g., MOTIVATION) suggest support, negative ones (e.g., WARNING) suggest attack

Table 2: Possible rhetorical relations between a claim (a previously raised argument) and a new argument

1. Every householder should pay tax for the garbage which the householder throws away.
2. No householder should pay tax for the garbage which the householder throws away.
3. Paying tax for garbage increases recycling.
4. Recycling more is good.
5. Paying tax for garbage is unfair.
6. Every householder should be charged equally.
7. Every householder who takes benefits does not recycle.
8. Every householder who does not take benefits pays for every householder who does take benefits.
9. Professor Resicke says that recycling reduces the need for new garbage dumps.
10. A reduction of the need for new garbage dumps is good.
11. Professor Resicke is not objective.
12. Professor Resicke owns a recycling company.
13. A person who owns a recycling company earns money from recycling.
14. Supermarkets create garbage.
15. Supermarkets should pay tax.
16. Supermarkets pass the taxes for the garbage to the consumer.

Figure 1: The 16 assertions that make up Wyner's example

3 A Case Study – Suggesting Alternative Representations

In this section, we illustrate how evidence gained through examining linguistic relations as discussed in the previous section can be exploited for (re-)interpreting the role of a new argument. Since tools for assessing logical entailment and discourse parsers are not yet strong, we envision an interactive approach, as outlined in our previous work [3]. We discuss the example by Wyner et al. [12, 13] who have shown how a set of arguments (Figure 1) is transduced into an argumentative graph (Figure 2), for which these views are automatically computed (labels associated with assertions in Figure 1 are node labels in Figure 2, full arrows are supporting and dashed arrows attacking links). We illustrate the improvements proposed in [3], depicted in Figure 3.

In the interactive approach, there are categories of questions, patterns to build formulations and instantiate them, as well as suitable operations to change the logical representation in case of a positive response –all given in Table 3; the last category, which checks the presence of a standard argumentative situation (captured by argumentation schemes [10, 11]), is not dealt with here. Questions are generated selectively, on the basis of the new argument raised by the user and evidence for the presence of situations the questions aim to address:

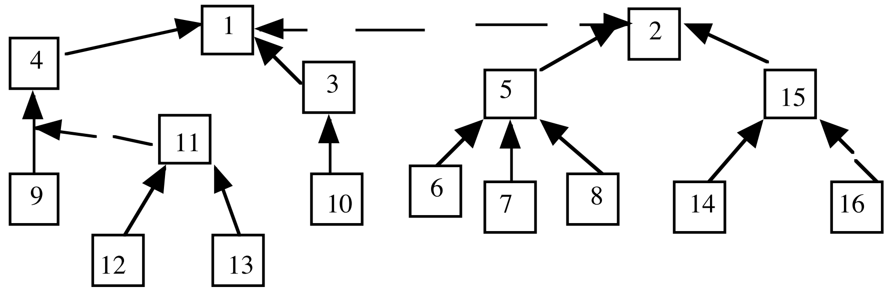

Figure 2: The original argumentative graph by Wyner

Potential deficits	Questions addressing them	Operations on representation
1. views on same argument	"Is <argument1> similar to <argument2>"	conflation of two arguments
2. details to an argument	"Does <argument1> give details to <argument2>"	conflation of two arguments
3. better argument place	"Does <argument1> support/attack <argument3>"	reordering argument. chain
4. contextual knowledge relevant (not a deficit)	Depends on the concrete piece of knowledge e.g., "Is <Person1> an expert?"	adjoining and instantiating a schematic argumentative structure

Table 3: Relations between question categories, deficits addressed, and operations involved

1. In order for this category of question to be meaningful, three conditions must be met: 1) the new argument has a sister argument when placed as proposed by the user, 2) these two arguments appear in complementary form according to the *modus brevis* form [9], one taking the form of a *fact*, the other one the form of a *rule*, so that 3) the conclusion of the *rule* is semantically identical to the *fact*. Checking condition 1 is simple. In order to test condition 2, we apply key word matching, including discourse markers such as "because", "if - then", and verbs of change such as "increase", "reduce", to treat an argument as a *rule*; as a *fact* otherwise. For testing condition 3, we rely on tools for checking textual entailment.
2. In order to test evidence for this category of question, a discourse parser is used. If the discourse relation hypothesized between the new argument and the argument the user intends to link it to is different from CAUSE (for a *support* relation) and CONTRAST (for an *attack* relation) but rather ELABORATION (or a similar one), a conceptual relation appears to be a more plausible view than an argumentative one.
3. Testing evidence for this category of question is similar to the previous one. A discourse parser is invoked, which compares two argumentative chains: 1) the new argument, the argument the user intends to link it, and an ancestor argument of that argument, and 2) the same three arguments, with reversed order of the ancestors. If the discourse parser hypothesizes a CAUSE or CONTRAST chain for variant 2), but not for variant 1), a different argument for linking the new one is proposed.

If evidence for some of these categories is positive, suitable questions are built. We concentrate on differences to Wyner's argumentative graph, assuming positive user response to system questions. We also refer to results of the tools used, the web-based versions of the textual entailment checker EDITS [4] and the discourse parser PDTB [5].

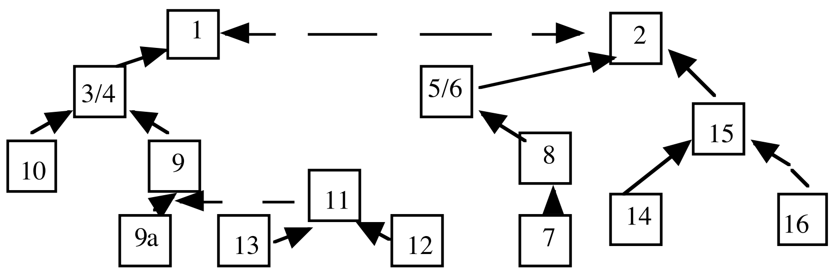

Figure 3: The revised argumenative graph according to [3]

- "Recycling more is good" (4), is conceived as a *fact* form, and its sister node, (3), "Paying tax for garbage increases recycling" as a *rule* form (through the presence of "increases"). Moreover, EDITS predicts ENTAILMENT with a score of 0.66 (though low confidence - 0.02) – thus, (3) and (4) are reified.
- We would expect "Every householder should be charged equally." (6) to elaborate "Paying tax for garbage is unfair." (5). However, PDTB predicts CAUSE. Thus, we need to hope for more informed discourse parsers that could be used later on.
- "Every householder who does not take benefits pays for every householder who does take benefits," (8), does not yield a causal chain with "Every householder who takes benefits does not recycle" (7) and "Every householder should be charged equally" (6) as ancestors in this order, according to PDTB. However, with (7) and (8) reversed, it does; thus, the order of (7) and (8) in the support chain is reversed.

5 Conclusion and Future Work

In this paper, we have examined the evidence that can be gained from analysing linguistic relations between new arguments and those previously made in a debate. We have shown the incorporation of the evidence gained in an interactive process in which the system examines intermediate states of an argumentation framework to find possibly more accurate logical representations than those proposed by the user. The method relies on user cooperation, but users may find it easier to recognize an accurate one out of a set of alternatives than to produce explicit and accurate descriptions by themselves.

In the future, we will use linguistic tools with better capabilities, e.g., discourse parsers with a more varied repertoire and weighted hypotheses on discourse relations. Moreover, we intend to incorporate more functionalities, such as the use of argumentation schemes, and distinguishing among rebutting and undercutting attacks [7] by inspecting discourse structure. Finally, we want to conduct controled user experiments.

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