Can AI Models Capture Natural Language Argumentation?

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ABSTRACT

Formal AI models of argumentation define arguments as reasons that support claims (which may be beliefs, decisions, actions, etc.). Such arguments may be attacked by other arguments. The main issue is then to identify the accepted ones. Several semantics were thus proposed for evaluating the arguments. Works in linguistics focus mainly on understanding the notion of argument, identifying its types, and describing different forms of counter-argumentation. This paper advocates that such typologies are instrumental for capturing real argumentations. It shows that some of the forms cannot be handled properly by AI models. Finally, it shows that the use of square of oppositions (a very old logical device) illuminates the interrelations between the different forms of argumentation.

Keywords: Argumentation, Natural Language Argumentation, Non-Monotonic Reasoning

INTRODUCTION

Argumentation is a social activity of reason in which a proponent agent tries to convince an opponent one that a certain statement is true (or false) by putting forward arguments. While reasoning looks for the truth of a statement, argumentation looks only for persuading agents. Indeed, the proponent may succeed to persuade the opponent even if himself is not convinced by the statement.

Argumentation is an interdisciplinary topic. It has been studied by philosophers like Hamblin (1970), Rescher (1977), Perelman and Olbrechts-Tyteca (1969) and Toulmin (1958). Patterns of argumentation are studied in a pedagogical perspective for identifying fallacies in reasoning and avoiding them (Blackburn, 1989). Argumentation has also become an Artificial Intelligence keyword since early nineties. It is particularly used for nonmonotonic reasoning (e.g., Dung, 1995, Simari & Loui, 1992) and for modeling dialogues between agents (e.g., Amgoud, Dimopoulos, & Moraitis, 2007, Prakken, 2005). See also Bench-Capon, and Dunne (2007), Besnard and Hunter (2008), and Rahwan et al. (2009) for descriptions of research on argumentation in AI. Whatever the application is, the same kind of argumentation model is considered. It consists of a set of...
arguments supporting statements and attacks among those arguments. Acceptability semantics are then used in order to evaluate the arguments and to decide on which statements to rely on. In all existing models, an argument has mainly three parts: a conclusion, a set of premises (called support) and a link between the support and the conclusion.

Besides, argumentation has been extensively studied by linguists like Salavastru (2007) and Apothéloz (1989, 1993) (Quiroz, Apothéloz, & Brandt, 1992). The main focus here is on the notion of argument and its different types in real dialogues. In Apothéloz (1989, 1993), four argumentative types are defined. Two of them are arguments and two others are rejections of arguments. In addition, Apothéloz defined four modes of counter-argumentation. Each of them may be divided into at least two distinct cases.

Our aim in this paper is to analyze the typologies of arguments and the four modes of counter-argumentation proposed in Apothéloz (1989, 1993) and Quiroz et al. (1992), and to investigate whether they can be captured by the argumentation models developed in AI. Comparing research originating in the two communities (computer science and linguistics) is important since it allows a better understanding of work in both communities and may lead to the development of richer models of argumentation.

The paper is organized as follows: We start by presenting and analyzing the notion of argument as defined by Apothéloz (1989). In the definition, not only the reason and the conclusion of an argument are represented but also the functions of reason and conclusion are considered. We show how this may lead to four argumentative forms where only two of them are arguments. In a subsequent section, we present in detail the four modes of counter-argumentation proposed by Apothéloz (1989). We analyze them through several examples. We show that the notion of a counter-argument in Apothéloz (1989) takes into account the intention behind the counter-argument. The next section is devoted to AI formalizations of arguments and counter-arguments. It shows how arguments are defined using an underlying logic. In this paper, we do not focus on a particular logic. We assume a general and abstract logic in which negation is encoded. We show that the notion of argument is richer in linguistics than in AI. Then, we show that some of the modes of counter-argumentation cannot be handled properly by AI models. There are two reasons for that: The first one is due to the fact that in AI models, rejections of arguments are not modeled. The second reason is related to the fact that linguists encode intentions behind arguments when defining counter-arguments while this is not possible in AI models. Finally, we show that the use of square of oppositions (a very old logical device) illuminates the interrelations between the different forms of argumentation.

ARGUMENTATIVE FORMS IN LINGUISTICS

In Apothéloz (1989), an argument is a pair $C(x):R(y)$ where $C$ is the function of concluding and $x$ its content, $R$ is the function of reason and $y$ its content. The argument is read as follows: $y$ is a reason for concluding $x$. We say that $y$ is argumentatively oriented toward $x$. The contents $x$ and $y$ may either be premises (propositions) or arguments as we will see in the next section. Moreover, an argument is an enthymeme, i.e., an incomplete syllogism. Indeed, some generic rules relating $y$ to $x$ are left implicit. For instance, the argument “Mary will miss her exams (me) since she did not work hard (wh)” is written as $C(me):R(-wh)$. Thus, the rule stating that “not working hard leads to failing exams” is not made explicit in the reason part of the argument. This is not surprising since linguists are concerned by natural language arguments, which are very often enthymemes (see (Black & Hunter, 2012, de Saint-Cyr, 2011) for examples of works in AI on enthymemes).
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