Chapter 8

Some Issues on Capturing the Meaning of Negated Statements

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ABSTRACT

Negation is present in all human languages, and it is used to reverse the polarity of parts of a statement. It is a complex phenomenon that interacts with many other aspects of language. Besides the direct meaning, negated statements often carry positive implicit meaning. Negation can be interpreted in terms of its scope and focus. This chapter explores the importance of both scope and focus to capture the meaning of negated statements. Some issues that must be taken into account for representing negation are outlined, the forms in which negation occurs are depicted, and heuristics to detect scope and focus of negation are proposed and evaluated.

INTRODUCTION

Capturing the meaning of text is a long term goal in the natural language processing community. Whereas philosophers and linguists have proposed several theories, along with models to represent the meaning of text, the field of computational linguistics is still far from doing so automatically. The ambiguity of natural language, the need to detect implicit knowledge, and the demand for commonsense knowledge and reasoning are only a few of the difficulties to overcome to understand text. We must say that significant progress has been made, especially on detection of semantic relations, ontologies and reasoning methods. However, existing approaches are relatively shallow and mostly ignore complex linguistic phenomena such as metaphor and negation.

Negation is present in all languages and it is always the case that statements are affirmative by default. Negation is marked and it typically signals something unusual or an exception. It may
be present in all units of language, e.g., words (incredible), clauses (He doesn’t have friends). Negation and its correlates (truth values, lying, irony, false or contradictory statements) are defining and exclusive characteristics of the human species (Horn, 1989, Horn & Kato, 2000). Simply put, negation is a process that turns parts of a statement into its opposite, but rarely reverses the polarity of the whole statement.

Negation is well-understood and described in grammars; the valid ways to express a negation are formulated and documented. In other words, it is clear how negation might appear in English. However, there has not been much research on automatically detecting it, or more importantly, on representing the semantics of negations from natural language.

At first glance, negation might seem easy to deal with. One might think that the problem could be reduced to find negative polarity items, determine their scope and reverse its polarity. Actually, it is much more problematic. Negation plays a remarkable role towards understanding text and poses considerable challenges. Negation interacts with many other phenomena and it is used for so many different purposes that a deep analysis is needed. The following are some issues found when dealing with negation.

Detecting the scope of negation in itself is challenging: All vegetarians do not eat meat means that vegetarians do not eat meat and yet All that glitters is not gold means that it is not the case that all that glitters is gold (so out of all things that glitter, some are gold and some are not). In the former example, the universal quantifier all has scope over the negation; in the latter, the negation has scope over all.

In logic, two negatives always cancel each other out. On the other hand, in language that is only theoretically the case: she is not unhappy does not mean that she is happy; it means that she is not fully unhappy, but she is not happy either.

Some negated statements carry a positive implicit meaning. For example, cows do not eat meat implicates that cows eat something other than meat. Otherwise, the speaker would have stated cows do not eat. A clearer example is the correct and yet puzzling statement tables do not eat meat. The sentence sounds unnatural because the underlying positive statement (i.e., tables eat something other than meat) contradicts the fact that tables do not eat.

Negation can express less than or in between when used in a scalar context. For example, John does not have three children probably means that he has either one or two children, but it does not mean that he does not have any children at all. Contrasts may use negation to disagree about a statement and not to negate it. For example, That truck is not big, it is massive defines the truck as massive, and therefore, big.

In this paper, we investigate the significance of negation in semantic representation of natural language. We illustrate the importance of detecting both its scope and focus and propose a semantic representation that benefits from focus detection.

RELATED WORK

Negation has been widely studied outside of computational linguistics. In logic, it is usually the simplest unary operator and it reverses the truth value. The seminal work on negation by Horn (1989) presents the main thoughts in philosophy and psychology. We follow him in the next two paragraphs.

Two of the most basic philosophical laws put forth by Aristotle are the Law of Contradiction (LC, it is impossible to be and not be at the same time) and the Law of Excluded Middle (LEM, in every case we must either affirm or deny). LEM is not always applicable to statements involving negation of scalar values (e.g., one can deny being cold and not being cold). Philosophers also realized that a negative statement can have latent positive meaning. Socrates is not well implicitly states that Socrates is alive.
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