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Sentence meaning as argumentative dialogues

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Introduction

In formal semantics the meaning of a sentence A is defined using the truth condition of the sentence and formalized using possible worlds semantics. We twist the classical view by stating that: the meaning of a sentence A asserted by speaker P is defined as the set of all possible justifications of A, which are argumentative dialogues starting with A won by speaker P. The idea of explaining the meaning of sentences in terms of how they can be justified in an argumentative dialogue goes back to [3]. We propose to apply this idea to sentences of natural language.

Definitions

Argumentative dialogue for S: sequences of utterances

\[ D = U_0, U_1, \ldots, U_n \]

where:

- \( U_i \) are utterances i.e. sentence prefixed by ! (assertion) or ? (question)
- \( D \) starts with 1S that is \( U_0 \) is 1S
- \( D \) is an alternate sequence: even utterances \( U_{2i} \) are said by \( O \) odd utterances \( U_{2i+1} \) are said by \( O \)
- the sequence respects answering rules i.e. what \( U_{2i+1} \) might be according to the previous utterances \( U_0, \ldots, U_i \)
- \( P \) wins the dialogue when the last utterance is by \( P \) and \( O \) cannot answer — otherwise \( O \) wins the dialogue.
- For each \( U_i \), \( i \) is the position in the dialogue.

Rules

There are two kinds of answering rules when constructing a formal dialogue.

Logical rules: stipulating how an utterance can be questioned or answered according to its main logical operator.

Structural rules: imposing global conditions on the shape of the dialogue

Conditional rule

| \( X \) \( \left( S_i \rightarrow S_j \right) \) | \( Y \) \( S_i \) | \( S_j \) |
| \( X, Y \in \{ P, O \} \) | \( X \neq Y \) |

Atomic structural rule: \( P \) may assert an atomic sentence \( \phi \) only if \( O \) has previously asserted \( \phi \)

Structural rule 1: a question may be answered at most once

Structural rule 2: if \( i \) is a position and if at \( i-1 \) there are several questions that are waiting for an answer only the last of them can be answered

Advantages of this approach

1. The class of models of a sentence \( S \) can be badly infinite. On the contrary the set of Argumentative dialogues won by \( P \) can be recursively enumerated.
2. This kind of semantics is more fine-grained than traditional truth theoretic semantic. In the traditional approach two sentences having the same class of models are identified in terms of meaning e.g. \( [S_1 \land S_2] \equiv [S_2 \land S_1] \) whereas they are distinct in terms of argumentative dialogues.

Example

\[ S_1: \text{John kills Mary} \]
\[ S_2: \text{John will go to jail} \]
\[ S_3: \text{John will pay for his crime} \]

\[ 0 \text{ P } S_1 \rightarrow S_2 \rightarrow (S_2 \rightarrow S_3 \rightarrow (S_1 \rightarrow S_3)) \]
\[ 1 \text{ Q } S_1 \rightarrow S_2 \rightarrow (S_2 \rightarrow S_3 \rightarrow (S_1 \rightarrow S_3)) \]
\[ 2 \text{ P } S_2 \rightarrow S_3 \rightarrow (S_1 \rightarrow S_2) \]
\[ 3 \text{ Q } S_2 \rightarrow S_3 \rightarrow (S_1 \rightarrow S_2) \]
\[ 4 \text{ P } S_3 \rightarrow S_1 \]
\[ 5 \text{ Q } S_3 \rightarrow S_1 \]
\[ 6 \text{ P } S_1 \rightarrow S_1 \]
\[ 7 \text{ Q } S_1 \rightarrow S_1 \]
\[ 8 \text{ P } S_2 \rightarrow S_2 \]
\[ 9 \text{ Q } S_2 \rightarrow S_2 \]
\[ 10 \text{ P } S_3 \rightarrow S_3 \]

Forthcoming Research

Our approach is related to the inferentialist view of meaning [2, 1]. The central tenet of inferentialism is Manifestability: The knowledge of the meaning of a sentence or expression must be in principle completely observable and publicly testable

Disagreement about word-meaning frequently emerge in real life dialogues:

\[ 0 \text{ P } \text{John is not a murderer} \]
\[ 1 \text{ P } \text{John is a murderer since he killed Mary} \]
\[ 2 \text{ Q } \text{I grant that he killed Mary, but it was by accident.} \]

- We plan to characterize manifestability, that is to find the conditions that would guarantee the emergence — in formal dialogues — of any possible disagreement about word meaning.
- Computing a dialogue exhibiting a disagreement can be viewed as a machine-learning procedure for axioms.
- In order for this procedure to be effective we are developing our line of research into two parallel directions:

1. We are developing rules for argumentative dialogue expressed in decidable fragment of first order logic involving sentence with generalized quantifiers like in [4]
2. the practical development of natural language processing tools using such ideas can only be achieved if a very precise topic has been circumscribed. Indeed, a prototype would require sophisticated linguistic resources (lexicons e.g. \( \lambda e^s(\text{snoring}^s) \) , knowledge representation e.g. \( \text{snore}^s \rightarrow \text{sleep}^s \)). We are currently studying how such resources can be integrated in formal argumentative dialogues.

References