Stochastic Semantic Analysis

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Abstract: Speech is the most natural way of human communication. Therefore, there is an effort to incorporate speech control into human-computer interfaces. However, nobody likes the idea of remembering a large amount of specific commands. Hence, the ability of natural language understanding is crucial for many speech-enabled computer systems.

Natural Language Understanding (NLU) [1] is a process whereby a computer algorithm extracts the meaning of an utterance and embeds the meaning in the computer model of the world. Semantic analysis is the first step (apart from the preprocessing) of the NLU process. The goal of semantic analysis is to represent what the subject intended to say in a way that would facilitate the process of interpretation (reasoning about the meaning of the utterance; interpretation is explained in [2]).

In this paper, we concentrate on the spoken language dialogue systems (this work is a part of the project of City Information Dialogue (CID) system [3]). A semantic analyzer of a spoken language system must be able to deal with spontaneous speech effects such as unconstrained formulations, ill formed expressions, repairs, false starts and unknown words. Due to grammatical problems of spoken input, syntax should not play significant role during utterance processing. The CID corpus is in Czech language. Therefore, the issue of Czech language is considered in this work.

Recent trends in the area of Natural Language Processing (NLP) are heading towards making all the processes of NLP stochastic [4]. This paper follows this trend, therefore it is focused on stochastic semantic analysis.

Problem definition

This section specifies the problem of semantic parsing by the definition of the input that enters into the semantic parsing algorithm and the output that results from the algorithm.

Input: the orthographic transcription of an utterance. The form of the transcription can be either the most likely transcription of the utterance or even better a word lattice. Prosody or some nonverbal features may be included as well. Stochastic semantic analysis methods in particular profit from the presence of other information sources (prosody, etc.).

Output: the context-independent meaning of the utterance in a suitable meaning representation. The requirements about the output of semantic analysis are stated in [5]. In short, the result of semantic parsing is required to support the interpretation that follows the process of semantic analysis (see Figure 1).

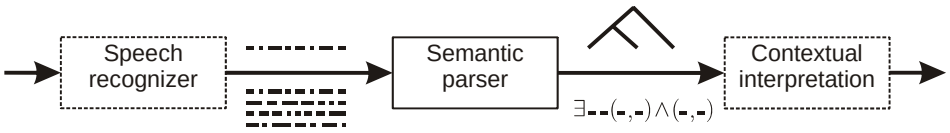

Figure 1. The interaction of the semantic analysis system with other modules. The semantic parser input is indicated as the most likely utterance transcription (top) or a word lattice (bottom). The output is either a tree (top) or a logic representation (bottom).

References

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