Using Decision Trees to Infer Semantic Functions of Attribute Grammars

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In this paper we investigate attribute grammars from the aspect of inductive learning. More precisely, we introduce the LAG method, which is able to infer semantic functions for attribute grammars from examples.

Attribute grammars can be considered as an extension of context-free grammars, where attributes are related to the grammar symbols, and semantic functions define the values of the attributes.
The learning task is to complete the description of a given attribute grammar, where some of the semantic functions are unknown. During the learning, training examples and background knowledge are employed. The examples are words taken from the language generated by the context-free grammar. The incomplete attribute grammar is used as background knowledge. This background grammar might be a grammar in the L-attributed or S-attributed subclasses of non-circular attribute grammars.

The LAG method handles the learning problem as a classification problem and solves it by employing decision tree learning system, C4.5 [Qui93]. Building decision trees has been proved effective in attribute value learning and representing finite, discrete-valued functions. The input data of the C4.5 system expressed as attribute-value tuples are generated from the initial training example set. The decision trees created by the C4.5 are transformed back to semantic functions.

In [GyiHor97], the AGLEARN algorithm has been presented, which uses concept learning approach to infer the unknown semantic functions. Namely, the examples are positive or negative and the unknown semantic functions are generated by propositional learner. The LAG method can be viewed as an improvement of the AGLEARN algorithm. The former uses an attribute-value language instead of the propositional representation, and the background knowledge is more effectively used during the learning than in case of AGLEARN.

The LAG method is applied to the part-of-speech (PoS) tagging of Hungarian sentences. Linguistic phrases and structural information are described by attribute grammars. Based on this information, disambiguation rules for the tagging problem are produced. The main results has been presented in [AleZvaGyi99].

This approach gives rise to use attribute grammars to solve new sorts of problems.

References

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