Fuzzy Logic and Natural Language

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Abstract: One of the most important features of fuzzy set theory and fuzzy logic is their power to model semantics of a certain part of natural language. The results are further elaborated in topics such as computing with words which encompasses computing with fuzzy numbers, the theory of evaluating linguistic expressions as well as that of fuzzy IF-THEN rules and approximate reasoning.

In the talk, we will precisely characterize a small part of natural language expressions called evaluating linguistic expressions. Recall that these are expressions such "very large, extremely deep, roughly one thousand, more or less hot", etc., i.e. the expressions considered in many applications of fuzzy logic. Furthermore, we will extend this theory to fuzzy IF-THEN rules, namely, we will show that they can be taken as genuine conditional expressions of natural language. Sets of them form linguistic descriptions of some decision or classification situation, or control strategy. A logical deduction based on linguistic descriptions has a power to mimic human way of reasoning. The discussed methods can be taken as a possible concretization of the general paradigm of Precisiated Natural Language as proposed by L. A. Zadeh.

We will also mention, how evaluating expressions can be used in applications. First, we will demonstrate an application in geology where the goal was to mimic the way how geologist determines rock sequences using which movement of the ancient sea level can be estimated. The source of information was vague geologist's description of the method in natural language.

The second is application in decision-making when a system of linguistic descriptions can help in finding optimal decision on the basis of subjective knowledge of the problem characterized in natural language only. The difference in importance of various criteria is in the language naturally expressed without necessity to use sophisticated and somewhat artificial methods for weights assignment.

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Vilem Novak is Author or co-author of more than 100 publications from various fields in fuzzy set theory, fuzzy logic, fuzzy control and computer science. He is also author and/or editor of severalbooks
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