International Conference on Mathematics of Fuzziness
ICMF

Abstract Book

Department of Mathematics
Institute for Advanced Studies in Basic Sciences (IASBS)
Zanjan

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Preface

The International Conference on Mathematics of Fuzziness (ICMF) is organized by Institute for Advanced Studies in Basic Sciences (IASBS), in cooperation with Iranian fuzzy systems society on April 27-29, 2016. ICMF is aimed to bring experts and researchers who are working on mathematical foundations of fuzzy sets and systems and their applications.

The conference provides a platform for researchers and practitioners to interact with each other and discuss the state-of-the-art developments in the field. ICMF brings together scientists, engineers, students, and practitioners working in fuzzy logic and related areas to present their recent research accomplishments.

The topics of the conference cover all aspects of theoretical researches and applications in fuzzy systems and soft computing, including but not limited to:

- Mathematical foundations of fuzzy sets and fuzzy systems;
- Mathematical fuzzy logic;
- Fuzzy differential equations and set valued differential equations;
- Interval analysis and Interval differential equations;
- Fuzzy optimization and fuzzy Linear systems;
- Fuzzy approximations, fuzzy arithmetic and ranking of fuzzy numbers;
- Fuzzy analysis and algebra;
- Type-2 fuzzy systems and modeling;
- Fuzzy probability and statistics;
- Fuzzy neural networks and fuzzy control;
- Approximate reasoning, fuzzy inference models and soft computing;
- Fuzzy data analysis, fuzzy clustering, classification and pattern recognition;
- Applications of fuzzy mathematics in the real world problems.

We would like to thank all of the participants, the members of the organizing and scientific committee and most importantly the administration staff of IASBS for putting this conference together.

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Plenary Lectures
L. A. Zadeh, the founder of fuzzy set theory, demonstrated in many of his papers (see [7, 9, 10, 11, 12]), that his theory makes it possible to develop a special mathematical model of the semantics of some expressions of natural language and to apply it in solution of various practical problems. One of the most successful applications of this methodology is fuzzy control ([2, 8]). The main reason for such success is the possibility to realize control by transforming operator’s (expert’s) knowledge formulated in natural language into an algorithm.

The fundamental role in these applications is played by expressions of natural language such as “small, very weak, medium, extremely large, significantly expensive” etc. Zadeh suggested to model their meaning using special fuzzy sets defined on an ordered universe. Moreover, he also came with the idea that semantics of the, so called, linguistic hedges can be modeled by special operations on the corresponding membership functions. This made it possible to compute semantics of more complex expressions.

Many papers that appeared in recent years are focused on the topic of linguistic fuzzy models. A closer inspection of them, however, discloses that they deal with categories characterized by verbal labels taken from a fuzzy rating scale rather than with linguistic expressions.

In this talk we will explain the distinction between verbal labels and a special class of linguistic expressions called evaluative. We will provide a brief linguistic analysis of evaluative linguistic expressions and show that (mathematical) fuzzy logic makes it possible to develop an advanced mathematical model of their semantics. One of the results are algorithms that behave as if “understanding” linguistic expressions.

Then we will analyze the concept of a fuzzy rating scale with verbal labels, describe their semantics and demonstrate that they should not
be identified with the evaluative linguistic expressions. Finally, we suggest a method for construction of verbal labels from the latter.

The theory of evaluative expressions is a part of a wider program of fuzzy natural logic (FNL). Its goal is to develop a mathematical model of human reasoning whose typical feature is the use of natural language. Among results of FNL, let us mention the sophisticated theory of intermediate (linguistic) quantifiers or an inference method called Perception-based Logic Deduction (PbLD) (cf., [1, 3, 5]) that effectively works with evaluative expression.

PbLD was already applied many times in control, multiple-criteria decision-making, time-series forecasting, and other ones. It can be demonstrated that using PbLD, we can control a wide variety of processes such as helicopter, magnetic levitation, water tank level and many other kinds of special appliances. We can also apply it in sophisticated decision making problems [6], in forecasting of time series and mining non-trivial information from them [4], and various other areas. We conclude that a realistic mathematical model of the semantics of (some parts of) natural language is a strong tool using which we can realize applications in which information is provided in genuine natural language and which lead to systems that function as if “understanding” it.

REFERENCES

