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Editors

Applications of Fuzzy Techniques

Proceedings of the 2022 Annual Conference of the North American Fuzzy Information Processing Society NAFIPS 2022

Springer

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Preface

Applications of Fuzzy Techniques

Human knowledge and judgement are essential both in designing technological systems and in evaluating their outcomes. Human engineers design systems to serve some purpose, and human users must judge whether or not those systems are creating trustworthy results. However, humans think and communicate in imprecise concepts, not numbers. Engineers must traditionally translate their design concepts into precise constructs, and users must interpret numerically precise answers in the wider context of their goals and experiences. There is thus a gap, in both directions, between human understanding and machine (or software) calculations.

Fuzzy sets and logic are well-known, widely used approaches to bridging the human–machine gap, which have been studied for nearly 60 years. Beginning with Lotfi Zadeh's seminal work, the fuzzy systems community has striven to build useful real-world systems whose behaviour is defined by intuitive, comprehensible rules of action. In so doing, it at once becomes easier to design the system and to explain its conclusions. It is no accident that this is congruent to the goals of Explainable Artificial Intelligence (XAI); indeed, the fuzzy systems community has been working on "explainable" AI for virtually our whole existence!

The 2022 Annual Meeting of the North American Fuzzy Information Processing Society (NAFIPS) brought together researchers studying both the theoretical foundations of fuzzy logic and its application to real-world problems. Their work examined fuzzy solutions to problems as diverse as agriculture, astronomy, chemical engineering, economics, energy engineering, health care, and transportation engineering. Following the well-established tradition of hybridizing fuzzy logic with other approaches to learning and uncertainty, many papers combined fuzzy logic with interval or probabilistic computing, machine learning (particularly neural networks), and optimization (e.g. genetic algorithms). A number of papers also explore extensions to type-1 fuzzy sets, delving into type-2 and complex fuzzy sets. This book contains all of the papers presented at the 2022 Annual Meeting. It is our hope that researchers and practitioners in fuzzy systems and related fields will find both helpful guidance and fresh inspiration in these pages.

We want to thank the local Organizing Committee, headed by our General Chair Dr. Pawan Lingras, for organizing this event. Our thanks also to the authors whose works are the *sine qua non* for this conference; the Program Committee and reviewers for their hard work in ensuring the quality of the contributions; the participants for their interest and enthusiasm; and—last but not least—we want to thank Professor Janusz Kacprzyk and the Springer staff for their help and guidance in producing this volume. Our sincere gratitude to all of you!

With warmest regards,

Pawan Lingras
Scott Dick
Vladik Kreinovich

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