

Handbook of Fuzzy Sets Comparison

Theory, Algorithms and Applications

Edited by George A. Papakostas
Anestis G. Hatzimichailidis
Vassilis G. Kaburlasos



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Science Gate Publishing

Gate to Computer Science and Research, Volume 6

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Gate to Computer Science and Research (GCSR), Book Series
ISSN 2241-9055 (print) - ISSN 2241-9063 (online)
DOI 10.15579/gcsr

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Xanthi, Greece
www.sciencegatepub.com

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ISBN 978-618-82628-1-2 (print) - ISBN 978-618-82628-2-9 (e-book)
DOI 10.15579/gcsr.vol6

Printed in Greece

Printed in non-acid paper

Preface

After 50 years, since the first publication of Prof. Lotfi Zadeh in 1965 introducing the fuzzy sets, as alternative to the crisp sets, fuzzy sets are established as a powerful data representation and processing framework. The ability of fuzzy sets to handle the uncertainty occurring in several applications due to imprecise data and/or incomplete information, makes them a multidisciplinary, indispensable tool. In order to improve the uncertainty handling of the traditional fuzzy sets, several different types of fuzzy sets (e.g. intuitionistic, interval-valued, hesitant fuzzy sets) with enhanced description capabilities have been proposed through the years.

A common operation in all types of fuzzy sets is the comparison of two sets subject to a predefined measure, a useful operation for many applications (e.g. clustering, decision making, classification). Therefore, a great number of distance, similarity, dissimilarity, entropy, divergence, inclusion measures have been proposed for all types of fuzzy sets.

This edited book aims to capture the recent activity in the field of developing measures for fuzzy sets comparison, to emphasize the applicability of these measures and to set the perspectives and challenges for future actions.

The first chapter titled *“On Constructing Distance and Similarity Measures based on Fuzzy Implications”* written by the editors presents a unified methodology for the construction of distance and similarity measures utilizing the theoretical properties of fuzzy implications. The proposed methodology owns a high degree of flexibility, which enables several types of fuzzy implications as well as different fuzzy sets to be incorporated, by resulting to a huge number of fuzzy measures.

The second chapter titled *“Toward a Synergy of a Lattice Implication Algebra with Fuzzy Lattice Reasoning – A Lattice Computing Approach”* written by Yi Liu, Vassilis G. Kaburlasos, Anestis G. Hatzimichailidis and Yang Xu paves the way toward a synergy of lattice implication algebra (LIA) and fuzzy lattice reasoning (FLR).

The third chapter titled *“Relationships Among Several Fuzzy Measures”* written by Yingfang Li, Xingxing He and Keyun Qin focuses on discussing the relationships

among similarity, divergence, subsethood measures and fuzzy entropy.

The fourth chapter titled *“Pattern Classification using Generalized Recurrent Exponential Fuzzy Associative Memories”* written by Marcos Eduardo Valle and Aline Cristina de Souza provides theoretical results concerning the storage capacity and noise tolerance of a single-step generalized recurrent exponential fuzzy associative memories (GRE-FAM), with application in pattern classification.

Chapter five titled *“Fuzzy Set Similarity using a Distance-Based Kernel on Fuzzy Sets”* written by Jorge Guevara, Roberto Hirata Jr. and Stephane Canu proposes a new kind of similarity measure based on the idea of plugging fuzzy distances into kernel definitions.

Chapter six titled *“FSSAM: A Fuzzy Rule-Based System for Financial Decision Making in Real-Time”* written by Penka V. Georgieva presents a fuzzy based real-time software application that collects and processes the data autonomously, and produces outputs that support the process of financial management.

The last chapter of the book, titled *“Application of Fuzzy Rule Base Design Method”* written by Peter Grabusts presents a method for fuzzy rules construction for fuzzy rule base systems.

In conclusion, we consider that this book could be a useful tool for every researcher using any kind of measure for comparing any type of fuzzy sets. The editors would like to thank all the authors for their contributing chapters, without whom this book would have been just wishful thinking. Finally, the editors would also like to thank Maria Katefidou and Science Gate Publishing for the continuous support and providing all the necessary resources in order to compile this book.

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