

Studies in Computational Intelligence

Volume 671

Series editor

Janusz Kacprzyk, Polish Academy of Sciences, Warsaw, Poland
e-mail: kacprzyk@ibspan.waw.pl

About this Series

The series “Studies in Computational Intelligence” (SCI) publishes new developments and advances in the various areas of computational intelligence—quickly and with a high quality. The intent is to cover the theory, applications, and design methods of computational intelligence, as embedded in the fields of engineering, computer science, physics and life sciences, as well as the methodologies behind them. The series contains monographs, lecture notes and edited volumes in computational intelligence spanning the areas of neural networks, connectionist systems, genetic algorithms, evolutionary computation, artificial intelligence, cellular automata, self-organizing systems, soft computing, fuzzy systems, and hybrid intelligent systems. Of particular value to both the contributors and the readership are the short publication timeframe and the worldwide distribution, which enable both wide and rapid dissemination of research output.

More information about this series at <http://www.springer.com/series/7092>

Vicenç Torra · Anders Dahlbom
Yasuo Narukawa
Editors

Fuzzy Sets, Rough Sets, Multisets and Clustering

Editors

Vicenç Torra
School of Informatics
University of Skövde
Skövde
Sweden

Yasuo Narukawa
Toho Gakuen
Tokyo
Japan

Anders Dahlbom
School of Informatics
University of Skövde
Skövde
Sweden

ISSN 1860-949X ISSN 1860-9503 (electronic)
Studies in Computational Intelligence
ISBN 978-3-319-47556-1 ISBN 978-3-319-47557-8 (eBook)
DOI 10.1007/978-3-319-47557-8

Library of Congress Control Number: 2016953293

© Springer International Publishing AG 2017

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

To Prof. Sadaaki Miyamoto



Professor Sadaaki Miyamoto in MDAI 2010, in Perpinyà

This book is a token of appreciation to Prof. Sadaaki Miyamoto for his scientific work that has influenced us much in our own research, for his unconditional support to MDAI conference series, and last but not least for his friendship.

Long and interesting scientific discussions as well as long and interesting non-scientific discussions have helped us to understand the fuzzy world better.

Preface

In April 2016, Prof. Sadaaki Miyamoto retired from the University of Tsukuba. He was born in Osaka in 1950. He obtained his Ph.D. from Kyoto University in March 1978. He joined the University of Tsukuba in 1978 (until 1990) and then again from 1994. During 1990–1994, he was Professor in the University of Tokushima. During these years, he had a fruitful career producing some inspiring works.

We have prepared this book as a token of appreciation to him. The book collects chapters written by colleagues and friends of Miyamoto. Authors of these chapters have met Miyamoto in different occasions and all wanted to express their appreciation.

The book includes a first chapter that presents an introduction on when we met Miyamoto, a personal outline of some of his works, and a description of the contents of the book. Then, the book contains its chapters divided into four parts that roughly correspond to the terms in the title of the book.

Skövde, Sweden
Skövde, Sweden
Tokyo, Japan
June 2016

Vicenç Torra
Anders Dahlbom
Yasuo Narukawa

Contents

On This Book: Clustering, Multisets, Rough Sets and Fuzzy Sets.	1
Vicenç Torra, Yasuo Narukawa and Anders Dahlbom	
Part I Clustering and Classification	
Contributions of Fuzzy Concepts to Data Clustering.	9
Sadaaki Miyamoto	
Fuzzy Clustering/Co-clustering and Probabilistic Mixture Models-Induced Algorithms.	29
Katsuhiko Honda	
Semi-supervised Fuzzy c-Means Algorithms by Revising Dissimilarity/Kernel Matrices.	45
Yuchi Kanzawa	
Various Types of Objective-Based Rough Clustering.	63
Yasunori Endo and Naohiko Kinoshita	
On Some Clustering Algorithms Based on Tolerance.	87
Yukihiro Hamasuna and Yasunori Endo	
Robust Clustering Algorithms Employing Fuzzy-Possibilistic Product Partition.	101
László Szilágyi	
Consensus-Based Agglomerative Hierarchical Clustering.	123
José Luis García-Lapresta and David Pérez-Román	
Using a Reverse Engineering Type Paradigm in Clustering. An Evolutionary Programming Based Approach.	137
Jan W. Owsinski, Janusz Kacprzyk, Karol Opara, Jarosław Stańczak and Sławomir Zadrozny	

On Hesitant Fuzzy Clustering and Clustering of Hesitant Fuzzy Data	157
Laya Aliahmadipour, Vicenç Torra and Esfandiar Eslami	
Experiences Using Decision Trees for Knowledge Discovery	169
Eva Armengol, Àngel García-Cerdaña and Pilar Dellunde	
Part II Bags, Fuzzy Bags, and Some Other Fuzzy Extensions	
L-Fuzzy Bags	195
Fateme Kouchakinejad, Mashaallah Mashinchi and Radko Mesiar	
A Perspective on Differences Between Atanassov's Intuitionistic Fuzzy Sets and Interval-Valued Fuzzy Sets	221
Eulalia Szmidt and Janusz Kacprzyk	
Part III Rough Sets	
Attribute Importance Degrees Corresponding to Several Kinds of Attribute Reduction in the Setting of the Classical Rough Sets	241
Masahiro Inuiguchi	
A Review on Rough Set-Based Interrelationship Mining	257
Yasuo Kudo and Tetsuya Murai	
Part IV Fuzzy Sets and Decision Making	
OWA Aggregation of Probability Distributions Using the Probabilistic Exceedance Method	277
Ronald R. Yager	
A Dynamic Average Value-at-Risk Portfolio Model with Fuzzy Random Variables	291
Yuji Yoshida	
Group Decision Making: Consensus Approaches Based on Soft Consensus Measures	307
Francisco Javier Cabrerizo, Ignacio Javier Pérez, Francisco Chiclana and Enrique Herrera-Viedma	
Construction of Capacities from Overlap Indexes	323
José Antonio Sanz, Mikel Galar, Radko Mesiar, Anna Kolesárová, Humberto Bustince, Javier Fernandez and Javier Montero	
Clustering Alternatives and Learning Preferences Based on Decision Attitudes and Weighted Overlap Dominance	337
Camilo Franco, Jens Leth Hougaard and Kurt Nielsen	