

Journal Subline

Rabi Nanda Bhaumik · Sheela Ramanna
Guest Editors

LNCS 13610

Transactions on **Rough Sets XXIII**

James F. Peters · Andrzej Skowron
Editors-in-Chief

 Springer

Founding Editors

Gerhard Goos

Karlsruhe Institute of Technology, Karlsruhe, Germany

Juris Hartmanis

Cornell University, Ithaca, NY, USA


Editorial Board Members

Elisa Bertino


Purdue University, West Lafayette, IN, USA

Wen Gao

Peking University, Beijing, China

Bernhard Steffen 

TU Dortmund University, Dortmund, Germany

Moti Yung 


Columbia University, New York, NY, USA


More information about this subseries at <https://link.springer.com/bookseries/7151>

James F. Peters · Andrzej Skowron ·
Rabi Nanda Bhaumik · Sheela Ramanna (Eds.)

Transactions on Rough Sets XXIII


Editors-in-Chief

James F. Peters 
University of Manitoba
Winnipeg, MB, Canada

Andrzej Skowron 
Systems Research Institute, Polish Academy
of Sciences
Warsaw, Poland

Guest Editors

Rabi Nanda Bhaumik
Tripura University
Agartala, India

Sheela Ramanna 
University of Winnipeg
Winnipeg, MB, Canada

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISSN 1861-2059 ISSN 1861-2067 (electronic)
Transactions on Rough Sets
ISBN 978-3-662-66543-5 ISBN 978-3-662-66544-2 (eBook)
<https://doi.org/10.1007/978-3-662-66544-2>

© Springer-Verlag GmbH Germany, part of Springer Nature 2022

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, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer-Verlag GmbH, DE,
part of Springer Nature
The registered company address is: Heidelberger Platz 3, 14197 Berlin, Germany

Preface

Volume XXIII of Transactions on Rough Sets (TRS) commemorates the 95th birthday of Zdzisław Pawlak, and part of this volume creates a special issue dedicated to the International e-conference on Rough Sets organized by Rabi Nanda Bhaumik, President of the Fuzzy and Rough Sets Association, and held during November 10–13, 2021, to celebrate the seminal work of Zdzisław Pawlak¹.

The Fuzzy and Rough Sets Association (FRSA), with an International Advisory Board, was inaugurated in January 2009 at the Department of Mathematics, Tripura University, India, and held its first International Conference on Rough Sets, Fuzzy Sets and Soft Computing during November 5–11, 2009. Several international conferences and workshops were organized under the aegis of FRSA in the subsequent years of 2011, 2012, 2013, and 2015 to encourage young researchers in the field of fuzzy and rough sets through deliberations on recent developments by well-known scientists. FRSA meetings are typically held in November to observe the birthday of Zdzisław Pawlak.

The 13 papers presented at the FRSA 2021 e-conference were submitted to this issue. After an extensive peer review process, with at least two reviewers per paper including one reviewer from TRS Editorial Board, five papers were accepted (38% acceptance rate).

The paper co-authored by Mohua Banerjee and Mihir K. Chakraborty traces their journey with rough sets since their first meeting with Pawlak. Purbita Jana investigates fuzzy α -cut, fuzzy strict α -cut, and their significance in probabilistic rough set theory and studies the properties of Gödel-like arrow. The paper co-authored by Seeratpal Jaura and Sheela Ramanna presents an application of a semi-supervised learning algorithm (TPL) based on tolerance rough sets to the task of biomedical named entity recognition (BioNER) in respect of scientific articles related to COVID-19. A. Mani discusses graded rough sets in the context of rational approximation from a granular perspective, and examines algebraic semantic aspects of granular graded rough sets. The paper coauthored by Surapati Pramanik, Suman Das, Rakhil Das, and Binod Chandra Tripathy presents two multi-attribute decision-making (MADM) strategies based on a rough-bipolar neutrosophic arithmetic mean operator and a rough-bipolar neutrosophic geometric mean operator. The paper coauthored by Binod Chandra Tripathy, Suman Das, and Rakhil Das introduces the notion of single-valued neutrosophic rough continuous mapping, single-valued neutrosophic rough compactness via single-valued neutrosophic rough topological spaces.

¹ See, *e.g.*, Pawlak, Z. Rough sets. International Journal of Computer and Information Sciences 11, 341–356 (1982). <https://doi.org/10.1007/BF01001956>. See also, *e.g.*, Pawlak, Z., A Treatise on Rough Sets, Transactions on Rough Sets IV, (2006), 1–17. See, also, Pawlak, Z., Skowron, A.: Rudiments of rough sets, Information Sciences 177 (2007) 3–27; Pawlak, Z., Skowron, A.: Rough sets: Some extensions, Information Sciences 177 (2007) 28–40; Pawlak, Z., Skowron, A.: Rough sets and Boolean reasoning, Information Sciences 177 (2007) 41–73.

Zbigniew Suraj and P. Grochowalski present an overview of a new version of the Rough Set Database System (RSDS) for creating bibliographies on rough sets and related fields, as well as sharing and analysis. The new version of the RSDS includes a number of modifications, extensions, and functional improvements. The last two papers of the volume are thoroughly reviewed PhD theses dedicated to the rough set approach. The paper by Marek Grzegorowski describes interactive feature extraction from raw sensor readings, and proposes several innovative approaches to automating feature creation and selection processes including the rough set-based feature reduction method. The paper by Anuj Kumar More presents a study of algebraic structures and logics based on categories of rough sets.

The editors of the special issue (which is a part of this volume) wish to express their gratitude to the Editors-in-Chief for agreeing to publish this special issue and for their guidance during the its preparation.

All editors would like to express gratitude to the authors of all submitted papers. Special thanks are due to the following reviewers: K. Anita, Piotr Artiemjew, Jaydip Bhattacharya, Mihir Chakraborty, Purbita Jana, Anjan Mukherjee, A. Mani, Surapati Pramanik, Dominik Slezak, Tanmay Som, Binod Chandra Tripathy, Marcin Wolski, and Wei-Zhi Wu.

All editors and authors of this volume extend their gratitude to the LNCS team at Springer for their support in making this volume of TRS possible.

August 2022

Rabi Nanda Bhaumik
Sheela Ramanna
James F. Peters
Andrzej Skowron

LNCS Transactions on Rough Sets

The Transactions on Rough Sets series has as its principal aim the fostering of professional exchanges between scientists and practitioners who are interested in the foundations and applications of rough sets. Topics include foundations and applications of rough sets as well as foundations and applications of hybrid methods combining rough sets with other approaches important for the development of intelligent systems. The series includes high-quality research articles accepted for publication on the basis of thorough peer reviews. Dissertations and monographs up to 250 pages that include new research results can also be considered as regular papers. Extended and revised versions of selected papers from conferences can also be included in regular or special issues of TRS.

Editors-in-Chief

James F. Peters and Andrzej Skowron

Managing Editor

Sheela Ramanna

Technical Editor

Marcin Szczuka

Editorial Board

Mohua Banerjee

Jan Bazan

Gianpiero Cattaneo

Mihir K. Chakraborty

Davide Ciucci

Chris Cornelis

Ivo Düntsch

Anna Gomolińska

Salvatore Greco

Jerzy W. Grzymała-Busse

Masahiro Inuiguchi

Jouni Järvinen

Richard Jensen

Bożena Kostek

Churn-Jung Liao

Pawan Lingras

Victor Marek

Mikhail Moshkov

Hung Son Nguyen

Ewa Orłowska

Sankar K. Pal

Lech Polkowski

Henri Prade

Sheela Ramanna

Roman Słowiński

Jerzy Stefanowski

Jarosław Stepaniuk
Zbigniew Suraj
Marcin Szczuka
Dominik Ślęzak
Shusaku Tsumoto
Guoyin Wang

Marcin Wolski
Wei-Zhi Wu
Yiyu Yao
Ning Zhong
Wojciech Ziarko

Contents

FRSA 2021 Conference Papers

Zdzisław Pawlak and Our Journey with Rough Sets	3
<i>Mohua Banerjee and Mihir K. Chakraborty</i>	
Fuzzy α -Cut in Rough Sets and Its Application.	12
<i>Purbita Jana</i>	
Named Entity Recognition on COVID-19 Bio-Medical Dataset with Tolerance Rough Sets.	23
<i>Seeratpal Jaura and Sheela Ramanna</i>	
Granularity and Rational Approximation: Rethinking Graded Rough Sets. . . .	33
<i>A. Mani</i>	
MADM Strategies Based on Arithmetic and Geometric Mean Operator Under Rough-Bipolar Neutrosophic Set Environment.	60
<i>Surapati Pramanik, Suman Das, Rakhal Das, and Binod Chandra Tripathy</i>	
Single-Valued Neutrosophic Rough Continuous Mapping via Single-Valued Neutrosophic Rough Topological Space	77
<i>Binod Chandra Tripathy, Suman Das, and Rakhal Das</i>	

Regular Paper

The RSDS - Bibliographic Database for Rough Sets and Related Fields.	99
<i>Zbigniew Suraj and Piotr Grochowalski</i>	

Dissertations

Selected Aspects of Interactive Feature Extraction	121
<i>Marek Grzegorowski</i>	
A Study of Algebraic Structures and Logics Based on Categories of Rough Sets.	288
<i>Anuj Kumar More</i>	

Author Index	509
-------------------------------	-----