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Rough Sets, Fuzzy Sets, Data Mining and Granular Computing

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Volume Editors

Aijun An
York University, Toronto,Canada
E-mail: aan@cse.yorku.ca

Jerzy Stefanowski
Poznań University of Technology, Poland
E-mail: Jerzy.Stefanowski@cs.put.poznan.pl

Sheela Ramanna
University of Winnipeg, Canada
E-mail: s.ramanna@uwinnipeg.ca

Cory J. Butz
University of Regina, Canada
E-mail: butz@cs.uregina.ca

Witold Pedrycz
University of Alberta, Canada
E-mail: pedrycz@ee.ualberta.ca

Guoyin Wang
Chongqing University of Posts and Telecommunications, P.R. China
E-mail: wanggy@ieee.org

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Vol. 4289: M. Ackermann, B. Berendt, M. Grobelnik, A. Hotho, D. Mladenič, G. Semeraro, M. Spiliopoulou, G. Stumme, V. Svátek, M. van Someren (Eds.), Semantics, Web and Mining. X, 197 pages. 2006.

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Preface

This volume contains the papers selected for presentation at the 11th International Conference on Rough Sets, Fuzzy Sets, Data Mining, and Granular Computing (RSFDGrC 2007), a part of the Joint Rough Set Symposium (JRS 2007) organized by Infobright Inc. and York University. JRS 2007 was held for the first time during May 14–16, 2007 in MaRS Discovery District, Toronto, Canada. It consisted of two conferences: RSFDGrC 2007 and the Second International Conference on Rough Sets and Knowledge Technology (RSKT 2007).

The two conferences that constituted JRS 2007 investigated rough sets as an emerging methodology established more than 25 years ago by Zdzisław Pawlak. Rough set theory has become an integral part of diverse hybrid research streams. In keeping with this trend, JRS 2007 encompassed rough and fuzzy sets, knowledge technology and discovery, soft and granular computing, data processing and mining, while maintaining an emphasis on foundations and applications.

RSFDGrC 2007 followed in the footsteps of well-established international initiatives devoted to the dissemination of rough sets research, held so far in Canada, China, Japan, Poland, Sweden, and the USA. RSFDGrC was first organized as the 7th International Workshop on Rough Sets, Data Mining and Granular Computing held in Yamaguchi, Japan in 1999. Its key feature was to stress the role of integrating intelligent information methods to solve real-world, large, complex problems concerned with uncertainty and fuzziness. RSFDGrC achieved the status of a bi-annual international conference, starting from 2003 in Chongqing, China.

In RSFDGrC 2007, a special effort was made to include research spanning a broad range of theory and applications. This was achieved by including in the conference program a number of special sessions, invited talks, and tutorials.

Overall, we received 319 submissions to the Joint Rough Set Symposium. Every paper was examined by at least two reviewers. The submission and review processes were performed jointly for both conferences that together constituted JRS 2007, i.e., RSFDGrC 2007 and RSKT 2007.

Out of the papers initially selected, some were approved subject to revision and then additionally evaluated. Finally, 139 papers were accepted for JRS 2007. This gives an acceptance ratio slightly over 43% for the joint conferences.

Accepted papers were distributed between the two conferences on the basis of their relevance to the conference themes.

The JRS 2007 conference papers are split into two volumes (LNAI 4481 for RSKT 2007 and LNAI 4482 for RSFDGrC 2007). The regular, invited, and special session papers selected for presentation at RSFDGrC 2007 are included within 12 chapters and grouped under specific conference topics.

This volume contains 69 papers, including 4 invited papers presented in Chap. 1. The remaining 65 papers are presented in 11 chapters related to

fuzzy-rough hybridization, fuzzy sets, soft computing in medical image processing, soft computing in information retrieval, clustering, text and Web mining, learning, data mining and rough classifiers, granular computing, soft computing in multimedia processing, soft computing applications, and rough and complex concepts.

We wish to thank all of the authors who contributed to this volume. We are very grateful to the chairs, advisory board members, Program Committee members, and other reviewers not listed in the conference committee for their help in the acceptance process.

We are grateful to our Honorary Chairs, Setsuo Ohsuga and Lotfi Zadeh, for their support and visionary leadership. We also acknowledge the scientists who kindly agreed to give the keynote, plenary, and tutorial lectures: Andrzej Bargiela, Mihir K. Chakraborty, Bernhard Ganter, Sushmita Mitra, Sadaaki Miyamoto, James F. Peters, Andrzej Skowron, Domenico Talia, Xindong Wu, Yiyu Yao, Chengqi Zhang, and Wojciech Ziarko. We also wish to express our deep appreciation to all special session organizers.

We greatly appreciate the co-operation, support, and sponsorship of various companies, institutions and organizations, including: Infobright Inc., MaRS Discovery District, Springer, York University, International Rough Set Society, International Fuzzy Systems Association, Rough Sets and Soft Computation Society of the Chinese Association for Artificial Intelligence, and National Research Council of Canada.

We wish to thank several people whose hard work made the organization of JRS 2007 possible. In particular, we acknowledge the generous help received from: Tokuyo Mizuhara, Clara Masaro, Christopher Henry, Julio V. Valdes, April Dunford, Sandy Hsu, Lora Zuech, Bonnie Barbayanis, and Allen Gelberg.

Last but not least, we are thankful to Alfred Hofmann of Springer for support and co-operation during preparation of this volume.

May 2007

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Xiaoping Qiu
Claudius Schnoerr
Raj Singh
Ying Weng
Sebastian Widz
Yang Xu

Table of Contents

Invited Papers

Fuzzy-Rough Hybridization

Fuzzy Sets

Soft Computing in Medical Image Processing

Soft Computing in Information Retrieval

Clustering

Text and Web Mining

Learning, Data Mining and Rough Classifiers

Granular Computing

Soft Computing in Multimedia Processing

Soft Computing Applications

Rough and Complex Concepts

Toward Rough-Granular Computing
Extended Abstract

Andrzej Jankowski[1] and Andrzej Skowron[2]

[1] Institute of Decision Processes Support
and
AdgaM Solutions Sp. z o.o.
Wąwozowa 9 lok. 64, 02-796 Warsaw, Poland
andrzejj@adgam.com.pl
[2] Institute of Mathematics,
Warsaw University
Banacha 2, 02-097 Warsaw, Poland
skowron@mimuw.edu.pl

Developing methods for approximation of compound concepts expressing the result of perception belongs to the main challenges of Perception Based Computing (PBC) [70]. The perceived concepts are expressed in natural language. We discuss the rough-granular approach to approximation of such concepts from sensory data and domain knowledge. This additional knowledge, represented by ontology of concepts, is used to make it feasible searching for features (condition attributes) relevant for the approximation of concepts on different levels of the concept hierarchy defined by a given ontology. We report several experiments of the proposed methodology for approximation of compound concepts from sensory data and domain knowledge. The approach is illustrated by examples relative to interactions of agents, ontology approximation, adaptive hierarchical learning of compound concepts and skills, behavioral pattern identification, planning, conflict analysis and negotiations, and perception-based reasoning. The presented results seem to justify the following claim of Lotfi A. Zadeh: "In coming years, granular computing is likely to play an increasingly important role in scientific theories-especially in human-centric theories in which human judgement, perception and emotions are of pivotal importance". The question of how ontologies of concepts can be discovered from sensory data remains as one of the greatest challenges for many interdisciplinary projects on learning of concepts.

The concept approximation problem is the basic problem investigated in machine learning, pattern recognition and data mining [24]. It is necessary to induce approximations of concepts (models of concepts) consistent (or almost consistent) with some constraints. In the most typical case, constraints are defined by a training sample. For more compound concepts, we consider constraints defined by domain ontology consisting of vague concepts and dependencies between them. Information about the classified objects and concepts is partial. In the most general case, the adaptive approximation of concepts is performed under interaction with dynamically changing environment. In all these cases, searching for sub-optimal models relative to the minimal length principle (MLP) is

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