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Foreword

In recent years rough set theory has attracted the attention of many researchers and practitioners all over the world, who have contributed essentially to its development and applications.

We are observing a growing research interest in the foundations of rough sets, including the various logical, mathematical and philosophical aspects of rough sets. Some relationships have already been established between rough sets and other approaches, and also with a wide range of hybrid systems. As a result, rough sets are linked with decision system modeling and analysis of complex systems, fuzzy sets, neural networks, evolutionary computing, data mining and knowledge discovery, pattern recognition, machine learning, and approximate reasoning. In particular, rough sets are used in probabilistic reasoning, granular computing (including information granule calculi based on rough mereology), intelligent control, intelligent agent modeling, identification of autonomous systems, and process specification.

Methods based on rough set theory alone or in combination with other approaches have been discovered with a wide range of applications in such areas as: acoustics, bioinformatics, business and finance, chemistry, computer engineering (e.g., data compression, digital image processing, digital signal processing, parallel and distributed computer systems, sensor fusion, fractal engineering), decision analysis and systems, economics, electrical engineering (e.g., control, signal analysis, power systems), environmental studies, informatics, medicine, molecular biology, musicology, neurology, robotics, social science, software engineering, spatial visualization, Web engineering, and Web mining.

The conferences on Rough Sets and Current Trends in Computing foster the gathering of researchers from different areas actively engaged in the theory and application of rough sets. A large number of high quality submissions from many countries to the Fourth International Conference on Rough Sets and Current Trends in Computing (RSCTC 2004) has proved that the decision made in 1998 to start such a series of conferences was very beneficial not only to the rough set community but also to other research communities.

We would like to thank all colleagues for submitting papers to the conference.

On behalf of the whole rough set community we would like to express our deep appreciation to our colleagues, especially to the Chairs, the members of the Program Committee and the members of the Organizing Committee for their excellent work in organizing the RSCTC 2004 conference in Uppsala, Sweden.

We hope that all participants of the RSCTC 2004 conference enjoyed a very successful meeting, which led to the discovery of new research directions, stimulating scientific cooperation, and will bring about further development of the rough set foundations, methods, and real-life applications in many areas, including bioinformatics.

June 2004 Zdzisław Pawlak Andrzej Skowron

Preface

This volume contains the papers selected for presentation at the Fourth International Conference on Rough Sets and Current Trends in Computing (RSCTC 2004) held at Uppsala University, Uppsala, Sweden, June 1–5, 2004. There were 248 online submissions for RSCTC 2004, excluding for three keynote papers and one paper on our bibliography project, which was the largest number of submissions in this conference series. Papers went through a rigorous review process. Each paper was reviewed by at least three program committee members. Whenever the reviews were conflicting, another PC member was asked to review the paper again.

After the reviews, the four PC chairs reviewed the papers again and checked all the comments of the reviewers. Since we had 248 good papers, we had to select them carefully. Of the 248 papers submitted, 45 were accepted as full papers, and an additional 60 were accepted as short papers. In total, 105 papers were accepted, the acceptance ratio was only 42.3%.

RSCTC 2004 provided a forum for exchanging ideas among many researchers in the International Rough Set Society (IRSS, URL: http://www.roughsets.org) and in various areas of soft computing and served as a stimulus for mutual understanding and cooperation. In recent years, there have been a number of advances in rough set theory and applications. Hence, we have witnessed a growing number of international workshops/conferences on rough sets and their applications. In addition, it should be observed that one of the beauties of rough sets and the rough set philosophy is that it tends to complement and reinforce research in many traditional research areas and applications. This is the main reason that many international conferences are now including rough sets into their lists of topics.

The papers contributed to this volume reflect advances in rough sets as well as complementary research efforts in the following areas:

- Rough set theory and applications
- Bioinformatics
- Computing with words
- Decision support systems
- Fuzzy set theory
- Hybrid intelligent systems
- Integrated intelligent systems
- Intelligent information systems
- Multi-agent systems
- Neural networks
- Pattern recognition
- Soft computing
- Statistical inference
- Web intelligence
- Approximate reasoning
- Computational intelligence
- Data mining
- Evolutionary computing
- Granular computing
- Image processing
- Intelligent decision support systems
- Machine learning
- Multi-criteria decision analysis
- Non-classical logic
- Petri nets and concurrency
- Spatial reasoning
- Uncertainty

It is our great pleasure to dedicate this volume to Professor Zdzisław Pawlak, who created rough set theory about a quarter of a century ago. The growth of rough sets and applications owes a great deal to Professor Pawlak's vibrant enthusiasm and wit as well as his great generosity towards others. His energetic style has stimulated and encouraged researchers, including the beginners in rough sets, for the last 25 years.

The depth, breadth, and richness of current rough set research directly originated from Professor Pawlak's inventiveness and the richness of his many insights and ideas concerning almost all areas of computer science. Actually, all four PC chairs were led to rough set theory by his diligent research, including his talks and lectures. Readers of this volume will be aware of the enthusiasm of all the authors for rough sets and related areas.

We wish to express our gratitude to Professors Zdzisław Pawlak and Lotfi A. Zadeh, who accepted our invitation to serve as honorary chairs and to present keynote papers for this conference. We also wish to thank Professors Lech Polkowski, Masahiro Inuiguchi, and Hiroki Arimura for accepting our invitation to be plenary speakers at RSCTC 2004.

We wish to express our thanks to all the PC members, each of whom reviewed more than ten papers in only one month. Without their contributions, we could not have selected high-quality papers with confidence.

We also want to thank all the authors who submitted valuable papers to RSCTC 2004 and all conference attendees.

All the submissions and reviews were made through the Cyberchair system (URL: http://www.cyberchair.org/). We wish to thank the staff of Cyberchair system development team. Without this system, we could not have edited this volume in such a speedy way.

Our special thanks go to Dr. Shoji Hirano, who launched the Cyberchair system for RSCTC 2004 and contributed to editing this volume, and Ms. Hiroko Ishimaru, who helped to compile all the manuscripts. Our gratitude also goes to Ms. Ulla Conti and her colleagues at Akademikonferens whose professionalism in organizing scientific meetings helped make it such an attractive conference. We also wish to acknowledge the help of Mr. Vladimir Yankovski for his design and maintenance of the conference Web pages and his ever cheerful approach to dealing with the daily chores created by such a big event.

Finally, we wish to express our thanks to Alfred Hofmann at Springer-Verlag for his support and cooperation.

June 2004

Shusaku Tsumoto
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