

Peng Wen Yuefeng Li Lech Polkowski
Yiyu Yao Shusaku Tsumoto
Guoyin Wang (Eds.)

Rough Sets and Knowledge Technology

4th International Conference, RSKT 2009
Gold Coast, Australia, July 14-16, 2009
Proceedings



 Springer

Series Editors

Randy Goebel, University of Alberta, Edmonton, Canada
Jörg Siekmann, University of Saarland, Saarbrücken, Germany
Wolfgang Wahlster, DFKI and University of Saarland, Saarbrücken, Germany

Volume Editors

Peng Wen
University of Southern Queensland, Toowoomba, Australia
E-mail: wen@usq.edu.au

Yuefeng Li
Queensland University of Technology, Brisbane, Australia
E-mail: y2.li@qut.edu.au

Lech Polkowski
University of Warmia and Mazury, Olsztyn, Poland
and Polish-Japanese Institute of Information Technology
Warszawa, Poland
E-mail: polkow@pjwstk.edu.pl

Yiyu Yao
University of Regina, Canada
E-mail: yyao@cs.uregina.ca

Shusaku Tsumoto
Shimane University, Izumo, Japan
E-mail: tsumoto@computer.org

Guoyin Wang
Chongqing University of Posts and Telecommunications
Chongqing, China
E-mail: wanggy_cupt@yahoo.com.cn

Library of Congress Control Number: Applied for

CR Subject Classification (1998): H.3, F.4, F.1, H.4, I.2

LNCS Sublibrary: SL 7 – Artificial Intelligence

ISSN 0302-9743
ISBN-10 3-642-02961-2 Springer Berlin Heidelberg New York
ISBN-13 978-3-642-02961-5 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

springer.com

© Springer-Verlag Berlin Heidelberg 2009
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 12715138 06/3180 5 4 3 2 1 0

Preface

The Rough Sets and Knowledge Technology (RSKT) conferences serve as a major forum that brings researchers and industry practitioners together to discuss and deliberate on fundamental issues of knowledge processing and management and knowledge-intensive practical solutions in the current knowledge age. Experts from around the world meet annually to present state-of-the-art scientific results, to nurture academic and industrial interaction, and to promote collaborative research in rough sets and knowledge technology. The main theme of the RSKT conference is to explore the synergy between rough sets and advanced knowledge technology and applications, including knowledge discovery, data mining, knowledge processing and management, granular computing, evolutionary computing, biocomputing and bioinformatics, cognitive computing and cognitive informatics, natural and artificial intelligence, Web intelligence, complex systems, and many others.

The first RSKT conference was held in 2006 in Chongqing, P.R. China, followed by RSKT 2007 in Toronto, Canada and RSKT 2008 in Chengdu, P.R. China. This volume contains the papers selected for presentation at the 4th International Conference on Rough Sets and Knowledge Technology (RSKT 2009), which was held during July 14-16 on the Gold Coast, Australia.

Following the success of the previous conferences, RSKT 2009 continued the tradition of a very strict quality control policy in selecting and publishing excellent papers. A double-blind review process was adopted and each paper was evaluated by at least two reviewers. A decision of acceptance, conditional acceptance, or rejection was made for each paper. The conditionally accepted papers went through a second round and only top-quality revised papers were finally accepted. From 229 papers submitted from 29 countries/regions, the Program Committee accepted 85 papers for inclusion in this volume. The acceptance rate is 37%. We would like to thank all authors for submitting their best results and the Steering Committee members, Program Committee members, and external reviewers for their invaluable contributions in the review process.

The RSKT 2009 technical program focused on the following research topics:

- Rough Sets and Computing
- Rough Sets and Data Reduction
- Data Mining and Knowledge Discovery
- Granular Computing and Cognitive Computing
- Fuzzy Sets and Computing
- Rough Sets and Fuzzy Sets
- Knowledge Technology and Intelligent Systems
- Computational Intelligence and Applications
- Image Processing and Understanding
- Formal Concept Analysis

- Decision-Theoretic Rough Sets
- Web Mining and Web Recommender Systems

The program was further enriched by three keynote papers and two special sessions. We are grateful to our keynote speakers, David Powers, Andrzej Skowron, and Guoyin Wang, for their visionary talks on rough sets and knowledge technology. We express our sincere thanks to Joseph P. Herbert and Pawan Lingras, for great efforts in organizing the special session Decision-Theoretic Rough Sets; and Yue Xu and Raymond Y.K. Lau, for their great efforts in organizing the special session Web Mining and Web Recommender Systems.

We wish to express our deep appreciation to the Honorary Chair, Lotfi A. Zadeh, the Conferences Chairs, Frank Bullen and Peter Bruza, Workshop Chairs, David Powers and Richard Watson, Special Session Chairs, Duoqian Miao, Jing-Tao Yao, and Wojciech Ziarko, Publicity Chairs, Yue Xu, Chumin Li, and Jerzy W. Grzymala-Busse, Local Organizing Chairs, Yan Li, Michael Blumenstein, and Shlomo Geva, and Steering Committee Chairs, Guoyin Wang, Andrzej Skowron, Mark Toleman, Jiannong Cao, for their great support and contributions. We would also like to acknowledge Feng Hu, Jin Dai, Xiaohui Tao, and Tianshu Peng for their valuable assistance.

We greatly appreciate the co-operation, support, and sponsorship of various institutions, companies, and organizations, including the University of Southern Queensland, Australia, Queensland University of Technology, Australia, Chongqing University of Posts and Telecommunications, China, University of Regina, Canada, International Rough Set Society (IRSS), and the Rough Sets and Soft Computation Society of the Chinese Association for Artificial Intelligence (CRSSC).

We are thankful to Alfred Hofmann and his team at Springer for their support and co-operation during the preparation of this volume.

April 2009

Peng Wen
Yuefeng Li
Lech Polkowski
Yiyu Yao
Shusaku Tsumoto
Guoyin Wang

Organization

Organizing Committee

Honorary Chair	Lotfi A. Zadeh (USA)
Conference Chair	Frank Bullen (USQ, Australia)
Conference Co-chair	Peter Bruza (QUT, Australia)
Program Chair	Peng Wen (USQ, Australia)
Program Co-chairs	Yuefeng Li (QUT, Australia)
	Yiyu Yao (Canada)
	Shusaku Tsumoto (Japan)
	Lech Polkowski (Poland)
Workshop Chair	David Powers (Flinders, Australia)
Workshop Co-chair	Richard Watson (USQ, Australia)
Special Session Co-chairs	Duoqian Miao (China)
	JingTao Yao (Canada)
	Wojciech Ziarko (Canada)
	Yue Xu (QUT, Australia)
	Chumin Li (France)
	Jerzy W. Grzymala-Busse (USA)
	Yan Li (USQ, Australia)
	Michael Blumenstein (Griffith, Australia)
	Shlomo Geva (QUT, Australia)
	Guoyin Wang (China)
	Andrzej Skowron (Poland)
	Mark Toleman (Australia)
	Jiannong Cao (Hong Kong)

Steering Committee

Aijun An (Canada)	Masahiro Inuiguchi (Japan)
Malcolm Beynon (UK)	Etienne Kerre (Belgium)
Hans-Dieter Burkhard (Germany)	Chumin Li (France)
Cory Butz (Canada)	Jiye Liang (China)
Gianpiero Cattaneo (Italy)	Tsau Young Lin (USA)
Nicholas Cercone (Canada)	Pawan Lingras (Canada)
Mihir K. Chakraborty (India)	Jiming Liu (Canada)
Juan-Carlos Cubero (Spain)	Qing Liu (China)
Didier Dubois (France)	Jie Lu (Australia)
Ivo Duentzsch (Canada)	Victor Marek (USA)
Jiannong Cao (Hong Kong)	Ernestina Menasalvas-Ruiz (Spain)
Aboul E. Hassanien (Kuwait)	Duoqian Miao (China)

Sadaaki Miyamoto (Japan)
 Masoud Nikraves (USA)
 Setsuo Ohsuga (Japan)
 Ewa Orłowska (Poland)
 Sankar K. Pal (India)
 Witold Pedrycz (Canada)
 Vijay V. Raghavan (USA)
 J.F. Peters (Canada)
 Lech Polkowski (Poland)
 Sheela Ramanna (Canada)
 Da Ruan (Belgium)
 Władysław Skarbek (Poland)

Program Committee

Rakesh Agrawal	Zhimin Gu	Harry Ku
Tony Ahfock	Gong Guo	Yasuo Kudo
Qiusheng An	Maozu Guo	Halina Kwasnicka
Mohua Banerjee	Jianchao Han	Geuk Lee
Haider Banka	Joseph P. Herbert	John Leis
Jan Bazan	Zdzisław Hippe	Yee Leung
Theresa Beaubouef	Shoji Hirano	Fanzhang Li
Rajan Bhatt	Bingrong Hong	Guohe Li
Maciej Borkowski	Jiman Hong	Guozheng Li
Tom Burns	Tzung-Pei Hong	Tianrui Li
Mihir Chakraborty	Dewen Hu	Weisheng Li
Cornelis Chris	Qinghua Hu	Zushu Li
Chien-Chung Chan	Xiaohua Tony Hu	Jiuzhen Liang
Davide Ciucci	Ryszard Janicki	Xiaofeng Liao
Jianhua Dai	Jeroen Janssen	Churn-Jung Liao
Martine De Cock	Jouni Jarvinen	Zhiwei Lin
Jitender Deogun	Richard Jensen	Chunnian Liu
Patrick Doherty	Chaozhe Jiang	Zengliang Liu
Timur Fayruzov	Licheng Jiao	Eric Louie
Jiali Feng	Wenbiao Jin	Nicolas Marin
Lin Feng	Janusz Kacprzyk	German Hurtado Martin
Maria C. Fernandez-Baizan	Taghi M. Khoshgoftaar	Benedetto Matarazzo
Philippe Fortemps	Tai-hoon Kim	Rene Mayorga
Bernhard Ganter	Jan Komorowski	Lawrence Mazlack
Xinbo Gao	Mieczysław A. Kopotek	Max Q.H. Meng
Yang Gao	Jacek Koronacki	Jusheng Mi
Xun Gong	Krzysztof Krawiec	Wojtek Michalowski
Salvatore Greco	Vladik Kreinovich	Fan Min
	Marzena Kryszkiewicz	Pabitra Mitra

Jerzy Stefanowski (Poland)
 Zbigniew Suraj (Poland)
 Mark Toleman (Australia)
 Julio V. Valdes (Canada)
 Hui Wang (UK)
 S.K. Michael Wong (Canada)
 Huanglin Zeng (China)
 Justin Zhan (USA)
 Bo Zhang (China)
 Wen-Xiu Zhang (China)
 Ning Zhong (Japan)

Sushmita Mitra	Robert Susmaga	Zhaohui Wu
Hongwei Mo	Katia Sycara	Wei Xiang
Mikhail Moshkov	Piotr Synak	Keming Xie
Hiroshi Motoda	Andrzej Szalas	Jiucheng Xu
Tetsuya Murai	Marcin Szczuka	Yang Xu
Michinori Nakata	Noboru Takagi	Zongben Xu
Hung Son Nguyen	Xiaohui Tao	Ronald Y. Yager
Sinh Hoa Nguyen	Murai Tetsuya	Jie Yang
Tuan Trung Nguyen	Soe Than	Yan Yang
Krzysztof Pancierz	Ruppa Thulasiram	Simon X. Yang
Selvan Pather	Li-Shiang Tsay	Jingtao Yao
Georg Peters	I. Burhan Turksen	Dongyi Ye
Henri Prade	Gwo-Hshiung Tzeng	Yilong Yin
Keyun Qin	Dimiter Vakarelov	Jian Yu
Yuhui Qiu	Jue Wang	Hong Yu
Anna M. Radzikowska	Lipo Wang	Philip Yu
Zbigniew W. Ras	Patrick S.P. Wang	Bonikowski Zbigniew
Kenneth Revett	Paul P. Wang	Ling Zhang
Ingrid Rewitzky	Xizhao Wang	Yanqing Zhang
Leszek Rutkowski	Alicja Wakulicz-Deja	Zili Zhang
Henryk Rybinski	Anita Wasilewska	Jun Zhao
Hiroshi Sakai	Richard Weber	Minsheng Zhao
Lin Shang	Alicja Wiczorkowska	Yan Zhao
B. Uma Shankar	Szymon Wilk	Yixin Zhong
Kaiquan Shi	Arkadiusz Wojna	Shuigen Zhou
Arul Siromoney	Marcin Wolski	Zhi-Hua Zhou
Dominik Slezak	Jakub Wroblewski	William Zhu
Roman Slowinski	Dan Wu	Yan Zhu
Jaroslav Stepaniuk	Weizhi Wu	Li Zou
Yuefei Sui	Zhaocong Wu	

Sponsoring Institutions

University of Southern Queensland, Australia
 Queensland University of Technology, Australia
 Chongqing University of Posts and Telecommunications, China
 University of Regina, Canada
 International Rough Set Society
 Rough Set and Soft Computation Society of Chinese Association for Artificial Intelligence

Table of Contents

Keynote Papers

- Interactive Granular Computing in Rightly Judging Systems 1
Andrzej Jankowski, Andrzej Skowron, and Marcin Szczuka
- Rough Diamonds in Natural Language Learning 17
David M.W. Powers and Richard Leibbrandt
- KT: Knowledge Technology—The Next Step of Information Technology
(IT) 27
Guoyin Wang

Rough Sets and Computing

- Rough 3-Valued Lukasiewicz Algebras and MV-Algebras 30
Jianhua Dai and Xiaochun Liu
- Mechanisms of Partial Supervision in Rough Clustering Approaches 38
*Rafael Falcón, Gwanggil Jeon, Kangjun Lee, Rafael Bello, and
J. Jeong*
- Lattice Derived by Double Indiscernibility and Computational
Complementarity 46
Yukio-Pegio Gunji, Taichi Haruna, and Eugene Schneider Kitamura
- Double Approximation and Complete Lattices 52
Taichi Haruna and Yukio-Pegio Gunji
- Integrating Rough Sets with Neural Networks for Weighting Road
Safety Performance Indicators 60
Tianrui Li, Yongjun Shen, Da Ruan, Elke Hermans, and Geert Wets
- Evolutionary Rough K-Means Clustering 68
Pawan Lingras
- Rough Sets under Non-deterministic Information 76
Michinori Nakata and Hiroshi Sakai
- Development of the Data Preprocessing Agent's Knowledge for Data
Mining Using Rough Set Theory 86
*Zulaiha Ali Othman, Azuraliza Abu Bakar, Zalinda Othman, and
Suzanna Rosli*

Improving Rules Quality Generated by Rough Set Theory for the Diagnosis of Students with LDs through Mixed Samples Clustering	94
<i>Tung-Kuang Wu, Shian-Chang Huang, Ying-Ru Meng, and Yu-Chi Lin</i>	

Topological Residuated Lattice: A Unifying Algebra Representation of Some Rough Set Models	102
<i>Xiaohong Zhang</i>	

Rough Sets and Data Reduction

A Time-Reduction Strategy to Feature Selection in Rough Set Theory	111
<i>Hongqing Chen, Yuhua Qian, Jiye Liang, Wei Wei, and Feng Wang</i>	

Reducts Evaluation Methods Using Lazy Algorithms	120
<i>Pawel Delimata and Zbigniew Suraj</i>	

Knowledge Reduction in Formal Contexts Based on Covering Rough Sets	128
<i>Tong-Jun Li</i>	

On New Concept in Computation of Reduct in Rough Sets Theory	136
<i>Faizah Shaari, Azuraliza Abu Bakar, and Abd Razak Hamdan</i>	

Research of Knowledge Reduction Based on New Conditional Entropy	144
<i>Jiucheng Xu and Lin Sun</i>	

Research on Complete Algorithms for Minimal Attribute Reduction	152
<i>Jie Zhou, Duoqian Miao, Qinrong Feng, and Lijun Sun</i>	

Data Mining and Knowledge Discovery

A Comparison of Composed Objective Rule Evaluation Indices Using PCA and Single Indices	160
<i>Hidenao Abe and Shusaku Tsumoto</i>	

An Incremental Rule Induction Algorithm Based on Ordering Relations	168
<i>Xiuyi Jia, Lin Shang, Jiajun Chen, and Xinyu Dai</i>	

On Construction of Partial Association Rules	176
<i>Mikhail Ju. Moshkov, Marcin Piliszczuk, and Beata Zielosko</i>	

Forecasting Change Directions for Financial Time Series Using Hidden Markov Model	184
<i>Sang-Ho Park, Ju-Hong Lee, Jae-Won Song, and Tae-Su Park</i>	

Learning to Extract Web News Title in Template Independent Way	192
<i>Can Wang, Junfeng Wang, Chun Chen, Li Lin, Ziyu Guan, Junyan Zhu, Cheng Zhang, and Jiajun Bu</i>	

Multiagent Framework for Bio-data Mining	200
<i>Pengyi Yang, Li Tao, Liang Xu, and Zili Zhang</i>	

Granular Computing and Cognitive Computing

EEG Analysis on Skull Conductivity Perturbations Using Realistic Head Model	208
<i>Md. Rezaul Bashar, Yan Li, and Peng Wen</i>	

An Approach for the Neuropsychological Diagnosis of Alzheimer's Disease: A Hybrid Model in Decision Making	216
<i>Ana Karoline Araujo de Castro, Plácido Rogerio Pinheiro, and Mirian Caliope Dantas Pinheiro</i>	

Machine Learning in Granular Computing	224
<i>Hong Hu and Zhonghi Shi</i>	

Mental Imagery Knowledge Representation Mode of Human-Level Intelligence System	232
<i>Hongdi Ke, Dejiang Zhang, and Wen You</i>	

Mining Fuzzy Ontology for a Web-Based Granular Information Retrieval System	239
<i>Raymond Y.K. Lau, Chapmann C.L. Lai, and Yuefeng Li</i>	

A Cognitive Evaluation for Meetings in Software Development Process	247
<i>Sanjay Misra and Ibrahim Akman</i>	

Granule Oriented Data Warehouse Model	255
<i>Jingtong Wu and Yuefeng Li</i>	

A Prototype Biometric Security Authentication System Based upon Fingerprint Recognition	264
<i>Wei Xiang, Bhavin Desai, Paul Wen, Yafeng Wang, and Tianshu Peng</i>	

Intelligent Failure Diagnosis Algorithm Based on Binary Granule Neural Network	273
<i>Jun Xie, Feng Li, Keming Xie, and Xinying Xu</i>	

Fuzzy Sets and Computing

Closures of Intuitionistic Fuzzy Relations	281
<i>Guilong Liu</i>	

Protein Comparison by the Alignment of Fuzzy Energy Signatures	289
<i>Dariusz Mrozek, Bożena Matysiak-Mrozek, and Stanisław Kozielski</i>	

Some Invariant Properties of Fuzzy Information Systems under Homomorphism	297
<i>Changzhong Wang and Wenju Du</i>	

Rough Sets and Fuzzy Sets

Kernelized Fuzzy Rough Sets	304
<i>Qinghua Hu, Degang Chen, Daren Yu, and Witold Pedrycz</i>	

On Fuzzy Rough Set Algebras in Infinite Universes	312
<i>Wei-Zhi Wu and You-Hong Xu</i>	

The Basis Algebra in L-Fuzzy Rough Sets	320
<i>Zhengjiang Wu, Lingxiao Yang, Tianrui Li, and Keyun Qin</i>	

An Interpretation of Rough Sets in Incomplete Information Systems within Intuitionistic Fuzzy Sets	326
<i>Xiao-Ping Yang</i>	

Knowledge Technology and Intelligent Systems

Comparison of Two MCDA Classification Methods over the Diagnosis of Alzheimer's Disease	334
<i>Amaury T. Brasil Filho, Plácido R. Pinheiro, André L.V. Coelho, and Nathanael C. Costa</i>	

Efficient Information Propagation in Service Routing for Next Generation Network	342
<i>David Lai and Zhongwei Zhang</i>	

Monitoring the Depth of Anesthesia Using Discrete Wavelet Transform and Power Spectral Density	350
<i>T. Nguyen-Ky, Peng Wen, and Yan Li</i>	

Nested Proof Compilation and Proof Checking in Universal Pattern Logic	358
<i>Wuming Pan and Bing Guo</i>	

Positive Linear Correlation Particle Swarm Optimization	367
<i>Yuanxia Shen, Guoyin Wang, and Chunmei Tao</i>	

Classification of EEG Signals Using Sampling Techniques and Least Square Support Vector Machines	375
<i>Siuly, Yan Li, and Peng Wen</i>	

Stability Analysis of Model-Based Networked Control System with Unreliable Links	383
<i>Lanzhi Teng and Peng Wen</i>	

Estimation of Mutual Information: A Survey	389
<i>Janett Walters-Williams and Yan Li</i>	

A Novel Multimodal Probability Model for Cluster Analysis	397
<i>Jian Yu, Min-Shen Yang, and Pengwei Hao</i>	

Computational Intelligence and Applications

OFDM Channel Estimation and Signal Detection on Nonintegral-Delay and Fast Time-Varying Channels	405
<i>Weihua Chen, Xia Lei, and Shaoqian Li</i>	

A Novel Frequency Offset Estimation Method for Distributed MIMO Systems with Large Estimation Range	413
<i>Jian Du, Xia Lei, and Shaoqian Li</i>	

The Application of Support Vector Machine in Classifying the Causes of Voltage Sag in Power System	421
<i>Noraliza Hamzah, Hanim Ismail, and Zuhaina Zakaria</i>	

Fault Diagnosis Based on Artificial Immune and Principal Component Analysis	429
<i>Xiaoming Han and Keming Xie</i>	

Teaching of Critical Path Networks Using Software Packages	435
<i>H. Ku</i>	

A RFID Based Agile Manufacturing Planning and Control System	441
<i>Li-Chih Wang, Sian-Kun Lin, and Li-Ping Huang</i>	

Object-Oriented Inheritance Metrics: Cognitive Complexity Perspective	452
<i>Deepti Mishra and Alok Mishra</i>	

Research Design for Investigation of Nigeria Manufacturing Management	461
<i>U.M. Mustapha, H. Ku, and S. Goh</i>	

Real-Time Pressure Monitoring and Control of a Hydraulic System without Sensor	467
<i>Tianshu Peng, Craig Struthers, and Peng Wen</i>	

Automated Grammar Checking of Tenses for ESL Writing	475
<i>Nazlia Omar, Nur Asma Mohd. Razali, and Saadiyah Darus</i>	

Using Coding Technology to Improve the Communication Efficiency of a Person with Multiple Disabilities	483
<i>Ching-Tien Shih, Ching-Hsiang Shih, and Ching-Hsing Luo</i>	
Time Synchronization for OFDM Systems with Narrowband Interference	491
<i>Yuan Tian, Xia Lei, Yue Xiao, and Shaoqian Li</i>	
Electromagnetism-like Mechanism with Force Decay Rate Great Deluge for the Course Timetabling Problem	497
<i>Hamza Turabieh, Salwani Abdullah, and Barry McCollum</i>	
A Model Based on SVM for Predicting Spontaneous Combustion of Coal	505
<i>Jingyi Du and Lu Wang</i>	
Using Genetic Algorithm for Traffic Light Control System with a Pedestrian Crossing	512
<i>Ayad M. Turky, M.S. Ahmad, M.Z.M. Yusoff, and Baraa T. Hammad</i>	
Cross Language Information Extraction Knowledge Adaptation	520
<i>Tak-Lam Wong, Kai-On Chow, and Wai Lam</i>	
Temporal Reasoning in Urban Growth Simulation	529
<i>Jun Wu, Chongjun Wang, Xiaosong Tu, Junyuan Xie, and Lijie Pu</i>	
Novel H/ACA Box snoRNA Mining and Secondary Structure Prediction Algorithms	538
<i>Quan Zou, Maozu Guo, Chunyu Wang, Yingpeng Han, and Wenbin Li</i>	
Image Processing and Understanding	
Self-adapting Cyclic Delay Diversity System	547
<i>Aoyang Zheng, Yafeng Wang, Dacheng Yang, and Wei Xiang</i>	
Using Wavelets and Independent Component Analysis for Quantization Index Modulation Watermarking	555
<i>Jinhua Liu, Kun She, and William Zhu</i>	
Granular Approach to Object-Oriented Remote Sensing Image Classification	563
<i>Wu Zhaocong, Yi Lina, and Qin Maoyun</i>	
Image Transformation on Hexagonal Structure Based on Conversion between 1D and 2D Coordinates	571
<i>Yuhuang Ye, Xiangjian He, Jianmin Li, Wenjing Jia, and Qiang Wu</i>	

Formal Concept Analysis

Conceptual Graph Interchange Format for Mining Financial Statements	579
<i>Siti Sakira Kamaruddin, Abdul Razak Hamdan, Azuraliza Abu Bakar, and Fauzias Mat Nor</i>	
The Reduction Theory of Object Oriented Concept Lattices and Property Oriented Concept Lattices	587
<i>Min-Qian Liu, Ling Wei, and Wei Zhao</i>	
Correlation Analysis Between Objects and Attributes	594
<i>Jian-Jun Qi, Ling Wei, and Yan-Ping Chen</i>	
Fuzzy Concept Lattices Determined by (θ, σ) -Fuzzy Rough Approximation Operators	601
<i>Yan-Qing Yao and Ju-Sheng Mi</i>	

Special Session: Decision-Theoretic Rough Sets

Learning Optimal Parameters in Decision-Theoretic Rough Sets	610
<i>Joseph P. Herbert and JingTao Yao</i>	
Entropy Measures of Flow Graphs with Applications to Decision Trees	618
<i>Puntip Pattaraintakorn</i>	
Rough Set Analysis for Sudan School Certificate	626
<i>Moawia Elfaki Yahia and Nasrin Dalil Ali Arabi</i>	
Reasoning Decision Rules of an Uncertain System	634
<i>Huanglin Zeng and Xiaohui Zeng</i>	
Three-Way Decision: An Interpretation of Rules in Rough Set Theory	642
<i>Yiyu Yao</i>	
A Multi-View Decision Model Based on Decision-Theoretic Rough Set	650
<i>Xianzhong Zhou and Huaxiong Li</i>	

Special Session: Web Mining and Web Recommender Systems

A User Profiles Acquiring Approach Using Pseudo-Relevance Feedback	658
<i>Xiaohui Tao and Yuefeng Li</i>	

XVIII Table of Contents

Tag Based Collaborative Filtering for Recommender Systems	666
<i>Huizhi Liang, Yue Xu, Yuefeng Li, and Richi Nayak</i>	
Exploring Concepts' Semantic Relations for Clustering-Based Query Senses Disambiguation.....	674
<i>Yan Chen and Yan-Qing Zhang</i>	
Average Transitive Trustworthy Degrees for Trustworthy Networks	682
<i>Yixiang Chen, Min Zhang, Hong Zhu, and Tianming Bu</i>	
News Recommender System Based on Topic Detection and Tracking ...	690
<i>Jing Qiu, Lejian Liao, and Peng Li</i>	
A Collaborative Filtering Algorithm with Phased Forecast	698
<i>Jingyu Sun, Jiguang Zhao, and Xueli Yu</i>	
Author Index	707