# Contents

**Keynotes, Tutorials and Expert Papers**

Advances in Rough and Soft Clustering: Meta-Clustering, Dynamic Clustering, Data-Stream Clustering ........................................... 3  
*Pawan Lingras and Matt Triff*

Clinical Narrative Analytics Challenges ........................................ 23  
*Ernestina Menasalvas, Alejandro Rodriguez-Gonzalez, Roberto Costumero, Hector Ambit, and Consuelo Gonzalo*

Modern ICT and Mechatronic Systems in Contemporary Mining Industry .... 33  
*Wojciech Moczulski, Piotr Przystańka, Marek Sikora, and Radosław Zimroz*

Rough Sets of Zdzisław Pawlak Give New Life to Old Concepts.  
A Personal View ................................................................. 43  
*Lech T. Polkowski*

Rough Set Approaches to Imprecise Modeling .................................. 54  
*Masahiro Inuiguchi*

Rule Set Complexity for Incomplete Data Sets with Many Attribute-Concept Values and “Do Not Care” Conditions. ................. 65  
*Patrick G. Clark, Cheng Gao, and Jerzy W. Grzymala-Busse*

**Rough Sets, Approximation and Granulation**

Rough Sets Are $\epsilon$-Accessible ........................................... 77  
*Mohamed Quafafou*

Refinements of Orthopairs and IUML-algebras ................................. 87  
*Stefano Aguzzoli, Stefania Boffa, Davide Ciucci, and Brunella Gerla*

Rough Approximations Induced by Orthocomplementations in Formal Contexts ................................................................. 97  
*Tong-Jun Li, Wei-Zhi Wu, and Shen-Ming Gu*

On Optimal Approximations of Arbitrary Relations by Partial Orders .... 107  
*Ryszard Janicki*

On Approximation of Relations by Generalized Closures and Generalized Kernels ................................................................. 120  
*Agnieszka D. Bogobowicz and Ryszard Janicki*
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordered Information Systems and Graph Granulation</td>
<td>131</td>
</tr>
<tr>
<td>John G. Stell</td>
<td></td>
</tr>
<tr>
<td><strong>Rough Sets, Non-Determinism and Incompleteness</strong></td>
<td></td>
</tr>
<tr>
<td>A Rough Perspective on Information in Extensive Form Games</td>
<td>145</td>
</tr>
<tr>
<td>Georg Peters</td>
<td></td>
</tr>
<tr>
<td>Towards Coordination Game Formulation in Game-Theoretic Rough Sets</td>
<td>155</td>
</tr>
<tr>
<td>Yan Zhang and Jing Tao Yao</td>
<td></td>
</tr>
<tr>
<td>Probabilistic Estimation for Generalized Rough Modus Ponens and Rough Modus Tollens</td>
<td>166</td>
</tr>
<tr>
<td>Ning Yao, Duoqian Miao, Zhifei Zhang, and Guangming Lang</td>
<td></td>
</tr>
<tr>
<td>Definability in Incomplete Information Tables</td>
<td>177</td>
</tr>
<tr>
<td>Mengjun Hu and Yiyu Yao</td>
<td></td>
</tr>
<tr>
<td>Rough Sets by Indiscernibility Relations in Data Sets Containing Possibilistic Information</td>
<td>187</td>
</tr>
<tr>
<td>Michinori Nakata and Hiroshi Sakai</td>
<td></td>
</tr>
<tr>
<td>Matrix-Based Rough Set Approach for Dynamic Probabilistic Set-Valued Information Systems</td>
<td>197</td>
</tr>
<tr>
<td>Yanyong Huang, Tianrui Li, Chuan Luo, and Shi-jinn Horng</td>
<td></td>
</tr>
<tr>
<td><strong>Rough Sets and Three-way Decisions</strong></td>
<td></td>
</tr>
<tr>
<td>Variance Based Determination of Three-Way Decisions Using Probabilistic Rough Sets</td>
<td>209</td>
</tr>
<tr>
<td>Nouman Azam and Jing Tao Yao</td>
<td></td>
</tr>
<tr>
<td>Utilizing DTRS for Imbalanced Text Classification</td>
<td>219</td>
</tr>
<tr>
<td>Bing Zhou, Yiyu Yao, and Qingzhong Liu</td>
<td></td>
</tr>
<tr>
<td>A Three-Way Decision Clustering Approach for High Dimensional Data</td>
<td>229</td>
</tr>
<tr>
<td>Hong Yu and Haibo Zhang</td>
<td></td>
</tr>
<tr>
<td>Three-Way Decisions Based Multi-label Learning Algorithm with Label Dependency</td>
<td>240</td>
</tr>
<tr>
<td>Feng Li, Duoqian Miao, and Wei Zhang</td>
<td></td>
</tr>
<tr>
<td>A Decision-Theoretic Rough Set Approach to Multi-class Cost-Sensitive Classification</td>
<td>250</td>
</tr>
<tr>
<td>Guojian Deng and Xiuyi Jia</td>
<td></td>
</tr>
</tbody>
</table>
Research on Cost-Sensitive Method for Boundary Region in Three-Way
Decision Model .......................................................... 261
Yanping Zhang, Gang Wang, Jie Chen, Liandi Fang,
Shu Zhao, Ling Zhang, and Xiangyang Wang

Determining Thresholds in Three-Way Decisions with Chi-Square Statistic .... 272
Cong Gao and Yiyu Yao

Optimistic Decision-Theoretic Rough Sets in Multi-covering Space .......... 282
Caihui Liu and Meizhi Wang

Fuzziness and Similarity in Knowledge Representation

Interpretations of Lower Approximations in Inclusion Degrees ............ 297
Wei-Zhi Wu, Chao-Jun Chen, and Xia Wang

Multigranulation Rough Sets in Hesitant Fuzzy Linguistic
Information Systems ..................................................... 307
Chao Zhang, De-Yu Li, and Yan-Hui Zhai

Multi-granularity Similarity Measure of Cloud Concept ................. 318
Jie Yang, Guoyin Wang, and Xukun Li

Multi-adjoint Concept Lattices, Preferences and Bousi Prolog .......... 331
M. Eugenia Cornejo, Jesús Medina, Eloisa Ramirez-Poussa,
and Clemente Rubio-Manzano

 Modified Generalized Weighted Fuzzy Petri Net in Intuitionistic
Fuzzy Environment ....................................................... 342
Sibasis Bandyopadhyay, Zbigniew Suraj, and Piotr Grochowski

Machine Learning and Decision Making

Similarity-Based Classification with Dominance-Based Decision Rules ..... 355
Marcin Szeląg, Salvatore Greco, and Roman Slowiński

Representative-Based Active Learning with Max-Min Distance ........... 365
Fu-Lun Liu, Fan Min, Liu-Ying Wen, and Hong-Jie Wang

Fuzzy Multi-label Classification of Customer Complaint Logs Under
Noisy Environment ....................................................... 376
Tirthankar Dasgupta, Lipika Dey, and Ishan Verma

Some Weighted Ranking Operators with Interval Valued Intuitionistic
Fuzzy Information Applied to Outsourced Software Project Risk
Assessment .............................................................. 386
Zhen-hua Zhang, Yong Hu, Zhao Chen, Shenguo Yuan, and Kui-xi Xiao
Formal Analysis of HTM Spatial Pooler Performance Under Predefined Operation Conditions ................................. 396
  Marcin Pietroń, Maciej Wielgosz, and Kazimierz Wiatr

Performance Comparison to a Classification Problem by the Second Method of Quantification and STRIM .......................... 406
  Yuya Kitazaki, Tetsuro Saeki, and Yuichi Kato

Outlier Detection and Elimination in Stream Data – An Experimental Approach ................................................ 416
  Mateusz Kalisch, Marcin Michalak, Piotr Przystała, Marek Sikora, and Łukasz Wróbel

Ranking and Clustering

Exploiting Group Pairwise Preference Influences for Recommendations ............................... 429
  Kunlei Zhu, Jiajin Huang, and Ning Zhong

Discrete Group Search Optimizer for Community Detection in Social Networks ................................. 439
  Moustafa Mahmoud Ahmed, Mohamed M. Elwakil, Aboul Ella Hassanien, and Ehab Hassanien

Social Web Videos Clustering Based on Ensemble Technique ............................................... 449
  Vinath Mekthanavanh and Tianrui Li

Learning Latent Features for Multi-view Clustering Based on NMF ............................................. 459
  Mengjiao He, Yan Yang, and Hongjun Wang

A Semantic Overlapping Clustering Algorithm for Analyzing Short-Texts ........................................ 470
  Lipika Dey, Kunal Ranjan, Ishan Verma, and Abir Naskar

Derivation and Application of Rules and Trees

On Behavior of Statistical Indices in Incremental Context ............................................. 483
  Shusaku Tsumoto and Shoji Hirano

Linguistic Variables Construction in Information Table ............................................. 493
  Shusaku Tsumoto and Shoji Hirano

Multi-objective Search for Comprehensible Rule Ensembles ............................................. 503
  Jerzy Blaszczyński, Bartosz Prusak, and Roman Słowiński

On NIS-Apriori Based Data Mining in SQL ............................................. 514
  Hiroshi Sakai, Chenxi Liu, Xiaoxin Zhu, and Michinori Nakata

Classification for Inconsistent Decision Tables ............................................. 525
  Mohammad Azad and Mikhail Moshkov
## Derivation and Application of Feature Subsets

Feature Selection in Decision Systems with Constraints .................................. 537  
*Sinh Hoa Nguyen and Marcin Szczuka*

Governance of the Redundancy in the Feature Selection Based on Rough  
Sets’ Reducts ........................................................................................................ 548  
*Marek Grzegorowski*

Attribute Reduction in Multi-source Decision Systems ................................. 558  
*Yanting Guo and Weihua Xu*

Matrix Algorithm for Distribution Reduction in Inconsistent Ordered  
Information Systems .......................................................................................... 569  
*Xiaoyan Zhang and Ling Wei*

Consistency Driven Feature Subspace Aggregating for Ordinal  
Classification ....................................................................................................... 580  
*Jerzy Błaszczyński, Jerzy Stefanowski, and Roman Słowiński*

### Author Index

............................................ 591
Rough Sets
International Joint Conference, IJCRS 2016, Santiago de Chile, Chile, October 7-11, 2016, Proceedings
(Eds.)
2016, XVII, 592 p. 122 illus., Softcover
ISBN: 978-3-319-47159-4