Preface

The FCA4KD workshop (FCA4KD 2017) was an international workshop on applications of Formal Concept Analysis in Knowledge Discovery and Data Mining held in National Research University Higher School of Economics (Moscow). All of the contributed research papers reported on research where models based on Formal Concept Analysis were extensively used. Formal concept analysis (FCA) is a branch of lattice theory motivated by the need for a clear formalization of the notions of concept, conceptual hierarchy, and implicative dependence. It has been successfully used for developing models of clustering, machine learning and association-rule mining. We believe that formal concept analysis and its extensions can contribute to knowledge discovery in medicine, social networks, text mining, and economical studies, among other fields. The objective of the FCA4KD workshop was to bring together researchers and practitioners to discuss the ways FCA can be used in various applications related to these domains. The proceedings of FCA4KD workshop include ten papers that were reviewed by at least two reviewers. We would like to thank all the authors for their contributions and the reviewers for their careful reviews of the submissions and their useful comments and suggestions. Finally, we would like to acknowledge the support of Basic Research Program and the Russian Academic Excellence Project '5-100' within the International Laboratory for Intelligent Systems and Structural Analysis of National Research University Higher School of Economics and National Research Foundation of South Africa (grant no. 92187) for financial support of research collaboration and organization of the workshop.

September 2017

Sergei O. Kuznetsov Bruce Watson

Program Committee

Aleksey Buzmakov Orpailleur team, INRIA-LORIA (CNRS-Université de Lorraine), Nancy, France **Dmitry Ignatov** National Research University Higher School of Economics, Moscow, Russia Dmitry Ilvovsky National Research University Higher School of Economics, Moscow, Russia Sergei O. Kuznetsov National Research University Higher School of Economics, Moscow, Russia Tatiana Makhalova National Research University Higher School of Economics, Moscow, Russia Alexey Neznanov National Research University Higher School of Economics, Moscow, Russia Sergei Obiedkov National Research University Higher School of Economics, Moscow, Russia National Research University Higher School of Eco-Andrey Parinov nomics, Moscow, Russia Artem Revenko Semantic Web Company GmbH, Vienna, Austria Bruce Watson Stellenbosch University, Stellenbosch, South Africa Ekaterina Chernyak National Research University Higher School of Economics, Moscow, Russia

Table of Contents

Knowledge Discovery from Texts with Conceptual Graphs and FCA Mikhail Bogatyrev and Kirill Samodurov	1
Pattern Structures for Risk Group Identification	13
Analysis of Strong and Weak Ties in Oil&Gas Professional Community	22
Necessary and Sufficient Conditions for Bank Participation in Multi-stakeholder Agreements: A Formal Concept Analysis	34
An Incremental Algorithm for Computing N-concepts	43
The Ontology Analysis Based on Relations on Arcs of the Formal Context Sato Merdygeev and Sesegma Dambaeva	53
A Neural-Network Like Logical-Combinatorial Structure of Data and Constructing Concept Lattices	62
Application of Boolean-valued models and FCA for the development of ontological models	77
Notes on Relation Between Symbolic Classifiers	88
Accidental Formal Concepts in the Presence of Counterexamples 10 $Dmitry\ Vinogradov$)4