$\begin{array}{c} {\rm CLA}\ 2010 \\ {\rm Proceedings}\ {\rm of}\ {\rm the}\ 7{\rm th}\ {\rm International}\ {\rm Conference}\ {\rm on}\\ {\rm Concept}\ {\rm Lattices}\ {\rm and}\ {\rm Their}\ {\rm Applications} \end{array}$

Sevilla, Spain

ISBN 978-84614-4027-6

University of Sevilla, Sevilla, Spain

The 7th International Conference on Concept Lattices and Their Applications

Sevilla, Spain October, 2010

Edited by

Marzena Kryszkiewicz Sergei Obiedkov Technical Editor: Francisco J. Martín Mateos

Published and printed by: University of Sevilla, Sevilla, Spain

Preface

This volume contains the papers selected for the presentation at the International Conference on Concept Lattices and Their Applications (CLA 2010) held in Seville, Spain, from October 19 to 21, 2010.

CLA 2010 was to provide researchers, practitioners, and students interested in Formal Concept Analysis (FCA) a forum to share innovative theories, methodologies, and applications in FCA and areas closely related to FCA such as data mining, information retrieval, knowledge management, data and knowledge engineering, logic, algebra and lattice theory.

There were 42 paper submissions. Each submission was examined by at least two and, on average, three reviewers. As a result of the reviewing process, 26 submissions were accepted as regular papers and three as short papers. The conference program also includes three invited talks.

We wish to thank all authors and all conference participants for their contribution and support. We wish to express our thanks to the members of the Program Committee and the external reviewers for their help in the reviewing process. We are grateful to the researchers who kindly agreed to give the invited talks: Bernhard Ganter, Barış Sertkaya, and Rudolf Wille. We also wish to express our appreciation to Radim Belohlavek for organizing a tutorial and to Uta Priss for organizing a workshop.

We are thankful to the members of the Steering Committee for their valuable suggestions and support throughout the organization process. The support of the conference organizer, Computational Logic Group at Universidad de Sevilla, is gratefully acknowledged. We express our thanks to the members of the Organizing Committee and, in particular, to its Chair, Gonzalo A. Aranda-Corral, for devoting much of their precious time to the conference arrangements.

We appreciate the use of the EasyChair conference system in organizing the processes of papers submission and reviewing as well as the proceedings preparation.

September 2010

Marzena Kryszkiewicz Sergei Obiedkov

Conference Organization

Local Organization

Organizing Conference Chair

Gonzalo A. Aranda-Corral Universidad de Huelva, Spain

Conference Organization Committee

Joaquín Borrego-Díaz Universidad de Sevilla, Spain Antonia M. Chávez-González Universidad de Sevilla, Spain José Luis Ruiz Reina Universidad de Sevilla, Spain Francisco Jesús Martín-Mateos Universidad de Sevilla, Spain María del Carmen Pérez Cardona Universidad de Sevilla, Spain José Antonio Alonso Jiménez Universidad de Sevilla, Spain María José Hidalgo Doblado Universidad de Sevilla, Spain José Carpio Cañada Universidad de Huelva, Spain

Program Chairs

Marzena Kryszkiewicz Warsaw University of Technology, Warsaw,

Poland

Sergei Obiedkov State University Higher School of Economics,

Moscow, Russia

Steering Committee

Radim Belohlavek State University of New York at Binghamton,

USA

Sadok Ben Yahia Faculté des Sciences de Tunis, Tunisia Jean Diatta Université de la Réunion, France Peter Eklund University of Wollongong, Australia

Sergei O. Kuznetsov State University Higher School of Economics,

Russia

Michel Liquière LIRMM, Montpellier, France

Engelbert Mephu Nguifo LIMOS - CNRS UMR 6158, Université de

Clermont-Ferrand 2, France

Program Committee

Radim Belohlavek State University of New York at Binghamton, USA

Sadok Ben Yahia Faculté des Sciences de Tunis, Tunisia Karell Bertet University of La Rochelle, France Claudio Carpineto Fondazione Ugo Bordoni, Roma, Italy Jean Diatta Université de la Réunion, France

Vincent Duquenne Université Pierre et Marie Curie, Paris, France

Peter Eklund University of Wollongong, Australia Samir Elloumi Faculté des Sciences de Tunis, Tunisia Sébastien Ferré Irisa/Université de Rennes 1, France Bernhard Ganter TU-Dresden, Dresden, Germany Alain Gély University of Metz, France

Tarek Hamrouni Faculté des Sciences de Tunis, Tunisia

Marianne Huchard LIRMM, Montpellier, France Derrick Kourie University of Pretoria, South Africa Stanislav Krajči P. J. Safarik University, Slovakia

Sergei O. Kuznetsov State University Higher School of Economics, Russia Léonard Kwuida Zurich University of Applied Sciences, Switzerland

Lotfi Lakhal Aix-Marseille Université, Marseille, France

Michel Liquière LIRMM, Montpellier, France

Mondher Maddouri Faculté des Sciences de Gafsa, Tunisia Raoul Medina LIMOS, Université Blaise Pascal, France

Engelbert Mephu Nguifo LIMOS - CNRS UMR 6158, Université de Clermont-

Ferrand 2, France

Rokia Missaoui UQO, Gatineau, Canada Amedeo Napoli LORIA, Nancy, France

Lhouari Nourine LIMOS, Université de Clermont Ferrand, France

Manuel Ojeda-Aciego Universidad de Málaga, Málaga, Spain Pascal Poncelet École des Mines dAlès, Nîmes, France

Uta Priss Napier University, Edinburgh, United Kingdom

Camille Roth CNRS/EHESS, France

Sebastian Rudolph Institute AIFB, University of Karlsruhe, Germany

Barış Sertkaya SAP Research Center, Dresden, Germany Petko Valtchev Université du Québec à Montréal, Canada Vilem Vychodil Palacky University, Czech Republic

Serhiy Yevtushenko Luxoft, Kiev, Ukraine

External Reviewers

Alain Casali Philippe Fournier-Viger Jesús Medina Moreno Pablo Cordero Nathalie Girard Sébastien Nediar Mélanie Courtine Mehdi Kaytoue Viet Phan-Luong Felix Distel Ondrej Krídlo Violaine Prince Xavier Dolques Jean-Yves Lafaye Yoan Renaud Roland Ducournau Florence Le Ber Agustin Valverde

Table of Contents

Invited Talks

Granular FCA—An Introduction	1
A Survey on how Description Logic Ontologies Benefit from Formal Concept Analysis	2
Lifeworld and Mathematics	22
Regular Papers	
L-Fuzzy Concepts and linguistic variables in knowledge acquisition processes	38
Relations between proto-fuzzy concepts, crisply generated fuzzy concepts, and interval pattern structures	50
Operators and spaces associated to matrices with grades and their decompositions II	60
L-Bonds vs extents of direct products of two L-fuzzy contexts Ondrej Krídlo, Stanislav Krajči, Manuel Ojeda-Aciego	70
Reducing the Size of Concept Lattices: The JBOS Approach	80
Towards attribute reduction in multi-adjoint concept lattices	92
Analysis of Large Data Sets using Formal Concept Lattices	104
General approach to triadic concept analysis	116
Triadic Factor Analysis	127

Social Tagging for Digital Libraries using Formal Concept Analysis Peter Eklund, Tim Wray	139
Using Formal Concept Analysis to Acquire Knowledge about Verbs	151
Evaluating term concept association mesaures for short text expansion: two case studies of classification and clustering	163
Modifying Logic of Discovery for Dealing with Domain Knowledge in Data Mining	175
Preprocessing input data for machine learning by FCA Jan Outrata	187
Discovering Functional Dependencies and Association Rules by Navigating in a Lattice of OLAP Views	199
Anthropocentric visualisation of optimal cover of association rules	211
Using Formal Concept Analysis for discovering knowledge patterns	223
Restrictions on Concept lattices for Pattern Management Léonard Kwuida, Rokia Missaoui, Beligh Ben Amor, Lahcen Boumedjout, Jean Vaillancourt	235
Fixing generalization defects in UML use case diagrams	247
Component-based Architecture Recovery from Object Oriented Systems via Relational Concept Analysis	259
An Inference System for Exhaustive Generation of Mixed and Purely Negative Implications from Purely Positive Ones	271
The Scaffolding of a Formal Context	283
Recognizing Pseudo-Intents is coNP-complete	294

Combining FCA Software and Sage	302
Attribute Exploration of Properties of Functions on Ordered Sets Artem Revenko, Sergei O. Kuznetsov	313
Advances in algorithms based on CbO	325
Short Papers	
Thoughts on exploiting instability in lattices for assessing the discrimination adequacy of a taxonomy	338
Using Bonds for Describing Method Dispatch in Role-Oriented Software Models	344
Linguistic processing in lattice-based taxonomy construction	350