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Concept Lattices and Their Applications

Preface

This special issue contains extended versions of selected papers presented at the International Conference on Concept Lattices and Their Applications (CLA 2010) held in Seville, Spain, from October 19 to 21, 2010.

CLA 2010 provided 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. The conference program included presentations of 26 regular papers and three short papers selected as a result of the reviewing process, as well as three invited talks.

Traditionally, extended versions of selected high-quality conference papers are later published in a special issue of a well-established journal. We are grateful to Damian Niwinski, Editor-in-Chief of Fundamenta Informaticae, for accepting our proposal to prepare such a special issue. Authors of the best CLA 2010 papers have been invited to submit extended versions of their papers to this special issue. Each submission was reviewed by at least two reviewers who are renowned experts in the field. Seven papers were ultimately selected. We are pleased to present them in this special issue.

Vera V. Pankratieva and Sergei O. Kuznetsov show in their paper “Relations between Proto-fuzzy Concepts, Crisply Generated Fuzzy Concepts, and Interval Pattern Structures” that proto-fuzzy concepts are closely related to crisply generated fuzzy concepts in the sense that the mappings involved in the definitions coincide for crisp subsets of attributes. Moreover, they prove that a proto-fuzzy concept determines a crisp subset of attributes, which generates a (crisply generated) fuzzy concept, whereas for a given crisp subset of attributes, there is a proto-fuzzy concept whose intent includes the given subset of attributes. Also, the authors show that interval pattern concepts are related to crisply generated formal concepts and, in particular, every crisply closed subset of objects is an extent of an interval pattern concept.

In the paper “Row and Column Spaces of Matrices over Residuated Lattices”, Radim Belohlavek and Jan Konecny generalize the theory of Boolean matrices to matrices populated with elements of residuated lattices. In this setting, the authors identify interior- and closure- row and column spaces, describe their properties, and show the relation to concept lattices.

A generalization of the theory of Chu correspondences for the fuzzy setting is developed in the paper "The Category of L-Chu Correspondences and the Structure of L-Bonds" by Ondrej Krídlo, Stanislav Krajci, and Manuel Ojeda-Aciego. The authors define correspondences between fuzzy contexts, as well as describe the relationship between bonds and extents of direct products of fuzzy contexts.

The paper "Fixing Generalization Defects in UML Use Case Diagrams" by Xavier Dolques, Marianne Huchard, Clémentine Nebut, and Philippe Reitz describes an application of concept lattices in software engineering. Formal concept analysis and its modification called relational concept analysis provide a framework for refactoring use-case diagrams specified in UML.

Rokia Missaoui, Lhouari Nourine, and Yoan Renaud present in their paper "Computing Implications with Negation from a Formal Context" an approach to exhaustive generation of both implications without negation and implications with negation. In their approach, keys of the apposition of a formal context and its complementary context whose attributes are negative are generated first. Then implications are inferred from implications whose premises are these keys.

In the paper "Attribute Exploration of Properties of Functions on Sets", Artem Revenko and Sergei O. Kuznetsov propose an approach to discovering potential relations between properties of functions on sets. This approach is based on the attribute exploration method. In addition, the authors prove a number of such relations.

The paper "Computing Formal Concepts by Attribute Sorting" by Petr Krajca, Jan Outrata, and Vilem Vychodil presents an algorithm for computing formal concepts of a formal context, which applies dynamic context reduction and sorting of attributes. The authors prove the soundness of the algorithm, discuss its complexity, and experimentally investigate its efficiency. The results of the experiments show that the number of formal concepts computed multiple times by their algorithm is substantially lower than in the case of applying other related algorithms from so-called CbO family.

We would like to thank all authors who submitted papers to this special issue and also the reviewers for their careful and constructive evaluations. We are grateful to the editors of Fundamenta Informaticae who assisted us in preparing this special issue.

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