

Preface to special issue on concept lattice and their applications 2008

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The present special issue contains extended versions of selected papers that were presented at CLA 2008, the Sixth International Conference on Concept Lattices and Their Applications. CLA 2008 was held in Olomouc, Czech Republic, from October 21 to October 23, 2008, and was organized jointly by the Palacky University, Olomouc, and the State University of New York at Binghamton. CLA is an international conference dedicated to formal concept analysis (FCA) and areas closely related to FCA such as data mining, information retrieval, knowledge management, data and knowledge engineering, logic, algebra and lattice theory. In particular, the areas of interest to CLA include foundations of FCA, concept lattices and related structures, attribute implications, association rules and other data dependencies, algorithms, visualization, data preprocessing, redundancy and dimensionality reduction, classification and clustering, information retrieval, ontologies, and applications of FCA. The program of CLA 2008 consisted of presentations of regular papers and posters, and three invited talks. It is a tradition of CLA that the program chairs organize a special issue. It is our pleasure that Professor Golumbic, the Editor in Chief of the Annals of Mathematics and Artificial Intelligence, accepted our proposal to organize such special issue. We therefore invited the authors of the best CLA 2008 papers to submit extended versions of their papers to this special issue. Each submitted paper was reviewed by two to three reviewers who are renowned experts in the field. According to the journal policy, the paper co-authored by Radim Belohlavek was handled by the Editor in Chief. Based on the reviewers' reports, eight papers were selected. We are pleased to present these papers in this special issue.

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Eduard Bartl, Radim Belohlavek, and Jan Konecny show in their paper “Optimal decompositions of matrices with grades into binary and graded matrices” how so-called crisply generated formal concepts can be used to factorize matrices with grades, representing e.g. “bad”, “good”, “excellent”, in an optimal way and present a greedy algorithm for computing such decompositions. The paper “An application of formal concept analysis to semantic neural decoding” by Dominik Endres, Peter Földiák, and Uta Priss describes an application of Formal Concept Analysis in the area of neural decoding, i.e., reconstructing the stimulus from the observed pattern of activation in a given population of neurons. Here FCA is used for exploring semantic relationships between neural representations of stimuli by visualizing them using concept lattices. Tarek Hamrouni, Sadok Ben Yahia, Engelbert Mephu Nguifo’s paper “Generalization of association rules through disjunction” investigates the well-known concept of an association rule provided disjunctions and negations are allowed on both sides of the rules. The authors provide theoretical foundations and algorithms for extracting such rules and provide experimental results. In “On the connection between many-valued contexts and general geometric structures”, Tim Kaiser extends the already known one-to-one correspondence between attribute-complete many-valued contexts and complete affine ordered sets and obtains new results regarding Pi-lattices, class geometries, lattices with classification systems, and further interesting structures. Michal Krupka shows in his “Factorization of fuzzy concept lattices with hedges by modification of input data” how previously known results on factorization of fuzzy concept lattices with so-called hedges may be rephrased in a framework, also developed in this paper, of factor residuated lattices with hedges. Léonard Kwuida and Hajime Machida show in their paper “On the isomorphism problem of concept algebras” that weakly dicomplemented lattices with negation are equivalent to Boolean algebras. Moreover, even if they are not always isomorphic to concept algebras, they can be embedded in concept algebras. Tobias Schlemmer and Stefan E. Schmidt, the authors of the paper “Formal concept analysis of harmonic forms and interval structures” discuss concept lattices of tone systems. They present different ways of describing these tone systems as formal contexts and show the differences between the respective concept lattices by examples. Even though concept lattices of tone systems may be too big to make out all details of their line diagrams, the general structure can still be made apparent by using the structural properties of tone systems to order the concepts when drawing the diagram. The paper “Parallel algorithm for computing fixpoints of Galois connections” by Petr Krajca, Jan Outrata, and Vilem Vychodil presents a parallel version of the algorithm “Close by One” (CbO) for computing the set of formal concepts of a formal context. Performance of both parallel and serial versions, as well as other well-known algorithms, is compared through a series of experiments.

We would like to express our thanks to the authors who submitted their papers to this special issue as well as to the reviewers for their diligent work. We hope that the special issue will become a useful source of information on concept lattices and their applications.