Masaryk University

Faculty of Informatics

Czech Republic

Reviewer Report on the Habilitation Thesis of Mgr. Jan Outrata, Ph.D.

"Computing and Applying Formal Concepts: Algorithms and Methods"

Habilitation thesis of Jan Outrata consists of introduction, two chapters and a big appendix containing reprints of 10 most important publications of the author in peer-reviewed proceedings of international conferences and journals. The first chapter is devoted to efficient computation of formal concepts from contexts. Jan Outrata describes his most important contribution in this field, "Fast Close-by-One" (FCbO) algorithm, which uses a very efficient heuristic. FCbO computes concepts of a formal context much faster than many other algorithms known before in Formal Concept Analysis (FCA). Several versions of Close-by-One (CbO) algorithm are considered, including recursive and parallel ones. Another heuristic, attribute sorting, proposed by the author for the preprocessing phase allows one to compute concepts even faster.

The second chapter of the thesis dwells on applications of FCA and formal concepts in machine learning and data analysis. First, a new approach to generation of decision trees within FCA framework is described. FCA-based decision trees have high accuracy and perform quite well as classifiers. Second, the author describes an algorithmic approach to Boolean matrix factorization based on formal concepts. Boolean factors obtained in this way can be used as new attributes in models of machine learning and data analysis.

The results presented by Jan Outrata in both chapters are well-known worldwide and recognized in the international community of Formal Concept Analysis. The thesis is very well written and meets the strictest standards of mathematical and scientific writing. Correct proofs of all theoretical results are provided, empirical observations are supported by numerous computer experiments.

The habilitation thesis of Jan Outrata meets all formal requirements of Masaryk University: Original results in peer-reviewed international scientific forums are published in more than 20 papers, from which more than 10 papers are published in journals with impact factors, indexed in Scopus and/or Web of Science. The number of citations of the papers by Jan Outrata exceeds 300 in GoogleScholar, 100 (without self-citations) in Scopus and 70 (without self-citations) in Web of Knowledge. The individual pedagogic experience of Jan Outrata exceeds 10 years.

My questions for the habilitation thesis defense of Jan Outrata would be as follows:

1. What is the benefit of using FCbO compared to AddIntent when computing the covering relation of the concept lattice?
2. How you estimate the complexity/accuracy trade-off when comparing classical decision trees with decision trees computed according to your approach?

Conclusion. The habilitation thesis by Jan Outrata entitled "Computing and Applying Formal Concepts: Algorithms and Methods" meets the requirements applicable to habilitation theses in the field of Informatics.

Moscow,

May 30

Professor Dr. Sergei O. Kuznetsov

https://www.hse.ru/en/staff/skuznetsov