Ph.D. Thesis Opponent’s Report

Thesis title: Data relationships and their visualization

Author: Martin Radvanský
Reviewer: Michał Woźniak

Thesis objectives and main contributions

The thesis reaches a standard adequate for its public defense as an international Ph.D. thesis. The methodology used in the thesis is adequate. Author provides a complete overview of the state of the art, with special attention to previous models. The thesis presents a detailed presentation of proposed algorithms and it includes the results of a wide range of tests carried out on real datasets. The main contributions of the thesis are as follows:

- Applying FCA (Formal Concept Analysis) to analysis of the social networks, with the special attention to co-author networks, e.g., to follow the author profile or to identify the key author (expert) in a given domain.

- Using FCA to data stream analysis with the illustration to anomaly detection and author trends prediction.

- Employing Sammon projection to visualize the social networks.

- Proposition of short-term prediction method applied to photovoltaic power station.
Structure and organization of the Thesis

The thesis consists of the 5 chapters. The first one presents the motivations and the main contributions of the work. Then short survey on methods used to network and data analysis is presented, while next section focuses on the particular algorithms used by author. In chapter 4, author presents the results of the experimental study of the chosen algorithms applied to the real-world problems as co-author network analysis, network visualization, solar power station data prediction, data stream analysis. The last part concludes the work and presents the future research directions.

Critical comments

There are a few minor comments and remarks related to this work.

- The thesis is a quite well written and structured, but author should improve the English. It is understandable, but several sentences should be reformulated.

- Author should comment the presented taxonomy of the attribute's domain (sec. 3.1). Usually, 3 types of domain are distinguished: continuous, discrete nominal (i.e., it is impossible to use such an attribute to order the examples) and discrete ordinal (it is possible to order the examples according to the attribute value). Such proposition is very useful especially when the distance between data is important. Author presents different taxonomy, where according to this proposition binary values are subset of categorical values. I’d like to ask author for the comments.

- In sec 3.2.4 several similarity measures between concepts have been presented, but they have not been used in the thesis. I’d like ask author if this measures could be used to extract the communities (sec. 4.1.4) and which of them are recommended by the author.

- The deeper analysis, using a statistical tool, of the experimental results is required, especially for the power profile prediction. In my opinion presenting the average value of RMSE (see Tab. 25) is meaningless.

Publication activities

Mr. Martin Radvanský is co-author of 14 papers directly related to the thesis and 4 other works. Among them one of the article was published in
ISI indexed journal *Swarm and Evolutionary Computation* which has a pretty high IF (2.963) and 5-years IF = 5.770. Rest of the works were published in the proceedings of the prestigious peer-review conference proceedings, where 14 papers are included in Scopus database and 11 in WoS. Such publication activity is more than satisfactory. Additionally, Mr. Radvanský has been involved in 1 EU grant and 2 national student’s projects.

**Conclusion**

This challenging and innovative research has led to very interesting results, which were published in prestigious international refereed publications.

I recommend to award Martin Radvansky PhD degree on the basis of the thesis “Data relationships and their visualization”. Author presented interesting and innovative techniques which are the significant steps forward in social network analysis domain.

Wroclaw, 8th August 2016

Prof. Michal Woźniak, Ph.D., D.Sc., IEEE SM

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