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PhD Thesis Review on "COMPUTATIONAL INTELLIGENCE METHODS FOR QUANTITATIVE DATA MINING" by Adrian COSTEA

"Computational intelligence methods for quantitative data mining " was elaborated by Adrian Costea, under supervision of Professor Barbro Back, Institute for Advanced Management Systems Research, Abo Akedemi University, Turku, Finland, and it was presented for public criticism on the 2nd of October 2006, with the permission of the Faculty of Economics and Social Sciences at Abo Akedemi University.

The thesis's main objectives are to investigate the benefits of introducing Computational Intelligence methods to address business problems such as economic/financial performance benchmarking of countries/companies, and to explore the use of Artificial Neural Network for process variable prediction.

In order to fulfill these objectives, Mr. Adrian Costea, explores, combine, improve and compare different methods

The author investigates the use of different Computational Intelligence (CI) methods to address different business problems. The CI methods employed are from the field of Artificial Intelligence (decision tree induction, neural network in the form of self-organizing maps and multilayer perceptions), evolutionary computation (genetic algorithms), and fuzzy logic. Classical statistical methods (e.g. C-Means, multinomial logic regression) are used as comparation methods.

This dissertation contributes to related research by exploring and combining the above mentioned methods for performing data mining tasks.

The structure of the thesis includes a first part, RESEARCH SUMMARY, and a second part ORIGINAL RESEARCH PUBLICATIONS.

The introduction presents the research context, motivation for the study, aim of the study and research questions. The author presents, also, the related works, and their relevance for the study.

In the second chapter Mr. Adrian Costea present the research methodology. There are presented some of well known research framework within the field of Information Systems and Social Science. It is, also, positioned the research by adopting a pluralistic

research strategy emphasizing constructivism and following a number of specific guidelines for constructive research approaches.

The knowledge discovery process, in general, and the data mining process, in particular, are described in the third chapter. There are, also, shown both quantitative and qualitative data mining techniques, together with agent technology. Next, it stresses the importance of quantitative data mining methods and enumerates some of the most important areas of applicability for the former ones.

Chapter four presents some key business problems that can be addressed through quantitative data mining: economic/financial performance benchmarking, and the prediction of process variables. It also presents related research that addressed these business problems.

The fifth chapter, that is the most important in terms of research contribution, presents series of computational intelligence approaches to address the problems of economic/financial performance benchmarking and process control variables prediction. It compares the advantages and disadvantages of statistics, decision trees, neural networks, fuzzy logic and genetic algorithms when applied to assessing comparatively the economic/financial performance of countries/companies. A series of improvements in the algorithmic part of the discovery process is presented: a modified version of the FCM algorithm, new ways of validating the SOMS, new ways of training the neural networks. Different technical problems related to the implementation of different computational intelligent methods are addressed. It is, also, discussed the need for hybrid approaches to solving data mining classification tasks.

Chapter six applies the methods described in the previous chapter using a number of experiments: the economic performance benchmarking of Central-Eastern European countries; the financial performance benchmarking of the most important companies from two large industry sectors – the pulp-and-paper and telecommunications sector; the prediction of process control variables for the glass manufacturing process at Schott, a glass manufacturer from Germany.

The last chapter summarizes the managerial implications and the contributions of our research in performing data mining tasks. The limitations of and the future directions for the study are, also, presented.

The authors' researches are based on the results of the original experiments, published in the following papers, presented in the second part:

- A Conceptual Model for Multiagent Knowledge Building System
- A Two-Level Approach to Making Class Predictions
- Combining Clustering and Classification Techniques for Financial Performance
- A Weightening FCM Algorithm for Clusterization of Companies as to their Financial Performances
- Assessing the Predictive Performance of ANN-based classifiers Based on Different Data Processing Methods Distributions and Training Mechanisms.

The thesis includes the original and valorous results of a young researcher and it is a mark for his future as a scientist.

[1] A short presentation of Gheorghe Nosca is available at p. 69 of JAQM current issue.