OPINION

by Assoc. Prof. Dr. Velizar Shalamanov

Institute of Information and Communication Technologies -

Bulgarian Academy of Sciences

on dissertation for awarding the educational and scientific degree "Doctor" in the doctoral

program "Informatics", professional field 4.6. Informatics and computer science

Author of the dissertation: Ivan Ivanov Blagoev

Topic of the dissertation: "Methods and tools for data analysis in information systems using time series"

The opinion was prepared according to order № 130 / 27.05.21 of the Director of the Institute of Information and Communication Technologies at BAS, which appointed me as a member of the scientific jury to ensure the procedure for defense of the dissertation on "METHODS AND MEANS FOR ANALYSIS OF DATA IN INFORMATION SYSTEMS USING TIME SERIES" for awarding the educational and scientific degree "Doctor" under the doctoral program "Informatics", professional field 4.6. Informatics and computer sciences by Ivan Ivanov Blagoev.

As a member of the scientific jury I received:

1. Dissertation for awarding the educational and scientific degree "Doctor";

2. Abstract of the dissertation;

3. Copies of the articles included in the dissertation;

4. Information on the fulfillment of the minimum requirements of the Institute of Information and Communication Technologies - BAS for acquiring the educational and scientific degree "Doctor", as well as other documents accompanying the procedure.

In the evaluation of the dissertation, the requirements of the Law and the Regulations for its implementation are decisive. According to Art. 6 (3) of the Law on Dissertation "The dissertation work under para. 2 must contain scientific or scientific-applied results, which are an original contribution to science ". According to Art. 27 (2) "The dissertation must be presented in a form and volume corresponding to the specific requirements of the primary scientific unit. The dissertation must contain: title page; content, introduction; exposition; conclusion - summary of the results obtained with a declaration of originality; bibliography. "

The dissertation is 125 pages long. Its structure includes an introduction, four chapters, conclusion and summary of the achieved results, publications on the topic of the dissertation, list of found citations, list of participation in projects, declaration of originality of results, bibliography with 122 literature sources and application with experimental results .

The aim of the dissertation is to develop new methods and tools for data analysis in information systems using time series. For this purpose, the following tasks are assessed as well formulated:

1. to develop a method for analysis and prediction of price movements in the financial field using time series;

2. to propose an algorithm for training of artificial neural networks in forecasting financial time series;

3. to propose solutions for increasing the cryptographic protection in the information systems by applying methods for analysis of time series;

4. to conduct experimental research for verification of the proposed methods for increasing cryptographic protection in solving the tasks for ensuring cybersecurity;

5. To develop program methods for overcoming problems when working with large volumes of data in time series.

I find that the set goal and the tasks formulated in this way are relevant, and the content proves the importance of the presented dissertation.

The attached list of publications contains 9 titles. Two of the publications are co-authored, the others are independent. This shows the doctoral student's ability to conduct independent research. The citations found so far are 5. This proves the necessary publicity of the achieved results.

The participation of the doctoral student in two projects, incl. on National Scientific Program on ICT in Science, Education and Security and a project of important practical importance for digital transformation and security of IICT-BAS. I note that Ivan Blagoev also received an award from IICT-BAS for excellent scientific achievements in 2019 in the category "Doctoral Students".

The formulated contributions in the dissertation can be considered as scientific-applied (2) and applied (4):

1. A method called MA Volatility Indicator has been developed to combine price detection indicators with new approaches using time series from financial data (scientific-applied).

2. The apparatus of artificial neural networks is applied in order to study financial time series. An algorithm for training the neural network by increasing the size of the neural network input and creating a hybrid structure has been developed, and a model for self-upgrading three-layer MLP has been proposed.

3. A method has been developed for increasing the cryptographic protection in the information systems on the basis of researches of the quality of the generators of Random numbers (scientific-applied).

4. Experimental studies have been conducted to address cybersecurity issues in public hosting services. The obtained results confirm the validity of the proposed method for increasing cybersecurity.

5. Software methods for efficient work with large data with means of the R language have been developed.

6. The developed methods for increasing cryptographic protection have been implemented in the technological infrastructure of IICT-BAS. A study of cryptographic tests and the quality of entropy on real-world loaded server systems with public Internet services was conducted.

The participation in two projects in which I have directly observed the work of Mr. Blagoev shows the relevance and applicability of the results. These projects can be considered as a field for implementing some of the results. The work on the National Scientific Program on ICT in Science, Education and Security is also related to the

preparation of e-courses for training, and in the work I can evaluate Mr. Blagoev as a scientist with qualities for teaching and project management.

1 National Research Program "Information and Communication Technologies for a Digital Single Market in Science, Education and Security" (ICT in NOS) -2018-2021.

2 Zora Project under Order No. 147 / 14.06.2019 "Digital and cyber sustainable IICT"

The 36-page abstract reflects the essence and content of the dissertation.

Notes to Mr. Blagoev:

1. In practice there are two applied areas - financial forecasting and cybersecurity - of the main research of time series analysis and implementation of the developed methods / algorithms, which prove the practical applicability of the results of time series research, but the connection can be better clarified.

2. The author's abstract could more systematically describe the subject, scope, main methods of the research with evaluation of the achieved results by key indicators related to the goal and tasks.

3. Knowing far more of the extensive scientific and applied activity of the doctoral student, I believe that other projects can be indicated (including outside IICT), where the developed methods and algorithms have been successfully applied.

My joint work with Mr. Blagoev allows me to add an extremely positive assessment of his scientific independence, ability to work and capacity for practical verification and implementation of scientific results. Along with this, Mr. Blagoev has a serious, decisive

contribution to the development of the e-Infrastructure of IICT and for increasing its security by directly using elements of his research in his doctoral dissertation.

Conclusions

I accept that the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria, the Regulations for its implementation, the Regulations of BAS for application of the Act, the Regulations for the specific conditions for obtaining scientific degrees and for holding academic positions in IICT-BAS are met. After getting acquainted with the dissertation and publications, analysis of their significance and contributions contained in them, I give my positive assessment and recommend the esteemed scientific jury to award the educational and scientific degree "Doctor" to Ivan Ivanov Blagoev in professional field 4.6. Informatics and Computer Science, doctoral program "Informatics".

Sofia

28.06. 2021

Velizar Mateev Shalamanov
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Member of the jury: ....

/ Assoc. Dr. Velizar Shalamanov /