

**opinion**  
**by Prof. Dr. Radoslav Yoshinov**  
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On thesis for awarding the educational and scientific degree "Doctor" under the Doctoral Program "Informatics", professional direction **4.6. Informatics and Computer Science** authored by **Ivan Ivanov Blagoev** on the topic: "**Methods and means of data analysis in information systems using time lines**"

By order No 130/27.05.21 of the Director of the Institute of Information and Communication Technologies at BAS, I am appointed as a member of the scientific jury in a procedure for the defence of the dissertation work on "METHODS AND MEANS OF DATA ANALYSIS IN INFORMATION SYSTEMS USING TIME LINES" for the award of the educational and scientific degree "Doctor" under the Doctoral Program "Informatics", professional direction 4.6. Informatics and computer science of Ivan Ivanov Blagoev.

As a member of the scientific jury, I have received:

1. Dissertation material
2. Author's short thesis;
3. Copies of the articles included in the dissertation work;
4. Reference for meeting the minimum requirements of the Institute of Information and Communication Technologies – BAS for the acquisition of the educational and scientific degree "Doctor".
5. Other documents accompanying the procedure.

### **1. Actuality of the dissertation work**

The need for research and implementation of innovative technological solutions is crucial for the development of society in the coming years. The collection and processing of big data in relevant time sequences is to be used in the description and modelling of new processes. This makes the development of new methods and means for research with time lines and processing of large data an up-to-date tool for the development of science and technology. I find that the purpose and the tasks thus formulated are up to date and the content proves the importance of the thesis.

### **2. Degree of knowledge of the state of the problem and general characteristic of work**

The purpose of the dissertation is to develop new methods and means of data analysis in information systems using time lines.

The dissertation work is structured in an introduction, four chapters, a conclusion and a summary of the results achieved, publications on the subject of the dissertation, a list of found citations, a list of participation in projects, a declaration of originality of results, a bibliography and an application with experimental results. The dissertation work has a volume of 125 pages.

The bibliography of the dissertation cited 122 literary sources: books, scientific articles and internet publications. On the basis of the overview analysis, the PhD student formulates the purpose and tasks of the dissertation work.

To solve this goal, the following tasks are formulated: Developing a method for analyzing and predicting price movements in the financial field using time lines; Development of an algorithm for training artificial neural networks in forecasting financial time lines; Development of solutions to increase cryptographic protection of information systems by applying methods of analysis of time lines; Carrying out experimental studies to verify the proposed methods of

enhancing cryptographic protection in solving cybersecurity tasks; Develop program methods to overcome problems when working with large amounts of data in time rows.

Guidelines for future research and development have been set. A list of scientific publications on the topic and noted citations is presented.

All this proves that the PhD student has an in-depth knowledge in the subject of the studies carried out.

### **3. Compliance with the proposed research methodology and the objectives and tasks of the dissertation work**

The selected methods correspond to the main purpose and tasks assigned by the PhD student. Experiments are done through a JAVA program where artificial neural networks are performed using the API provided by the Encog Machine Learning Framework. Applying mathematical and statistical analyses with time lines to solve cybersecurity problems is effective.

### **4. Characterisation of the nature and assessment of the reliability of the material on which the dissertation contributions are based**

The methods and models that are created and used correspond to the target task. Some have received statistical results from their implementation, while others have presented concepts of solutions and given guidance for future studies.

I have not noticed any errors in either the specific or the conceptual models. I also find that the proposed strategies are well founded.

### **5. Contributions of the dissertation work**

The contributions are described in the part summary of the results received.

The more substantial results obtained in the dissertation work are summarized in author's claims for six scientific and applied contributions:

The author's claims for scientific and applied contributions are:

1. A method entitled MA Volatility Indicator has been developed by combining indicators for analysis and predicting price movements with new approaches when using time lines of financial data;

2. An algorithm has been developed to train the neural network in predicting financial time lines by increasing the size of the neural network input and creating self-building three-layer MLP.

3. A method has been developed to increase cryptographic protection in information systems based on studies on the quality of random number generators by applying methods of analysis of time lines.

4. Experimental studies have been carried out to verify the proposed methods for solving cybersecurity problems in public widespread hosting services.

5. Programming methods have been developed for efficient work with big data in time lines with means in the R language.

6. The developed methods for increasing cryptographic protection are implemented in the technological infrastructure of IICT-BAS.

The reviewer accepts the scientific and applied contributions (1,2,3,5,6).

The reviewer accepts the contributions described, recommending that the PhD student learn to set out his achievements more briefly.

## **6. Degree of personal participation of the dissertant in contributions**

For the personal participation of the PhD student, I judge by the audience activity of the PhD student reflected in the materials published under the dissertation. The PhD student convincingly presents the achieved results with a very good and thorough argumentation, as well as uses professional graphical layout of the materials.

The nature of the study implies very good and broad preparation in the field of innovative methods and applications, through the means of information and communication technologies

I believe that the PhD student has done well by not questioning her personal involvement in the development of the dissertation material.

## **7. Assessment of publications under the dissertation work**

The attached list of publications contains 9 titles. Two of the publications are co-authored, the rest are independent. This shows the PhD student's ability to conduct independent research. So far, the independent citations found are 5. The PhD student's participation in two projects is indicated

The publications reflect the more substantial results achieved in the dissertation work. They have been reported in reputable scientific forums, which I accept as an approbation in scientific circles.

## **8. Compliance of the author with the requirements for its preparation and adequacy of reflection of the basics and contributions of the dissertation work**

The submitted draft author's **summary** is in accordance with the rules for the preparation of the summary of the dissertation papers, specified on the website of IICT-BAS. The 36-page authorship reflects the nature and results achieved, as well as the author's contributions. It is graphically shaped very well and includes the necessary information describing the dissertation work in summary.

## **9. Opinions, recommendations and notes**

The dissertation work develops a very complex, dynamically developing and promising field - developing new methods and means of data analysis in information systems using time lines.

I recommend that the PhD student continue his active audience activity in scientific journals with impact factor.

I recommend a shorter verbalization by the PhD student of his achievements - to learn clearly and firmly to lay out his achievements.

Some not essential (language)) notes I have reflected on the copy that was provided to me.

### **conclusion**

The content and contributions of the dissertation work of mag. Ivan Ivanov Blagoev fully covers the requirements of the Law on development of the academic staff of the Republic of Bulgaria, the Regulations for its application and the Rules of Procedure for acquiring scientific degrees at IICT-BAS. Significant research has been carried out in volume and content. There are a sufficient number of scientific and applied contributions. A sufficient number of publications on the dissertation published in prestigious scientific forums are presented. The educational doctoral minimum set in the individual plan is covered. It is undeniable that the PhD student's

personal involvement in the development and the contributions received. This gives me reason to strongly recommend to the Honorable Scientific Jury to award to **Mag. Ivan Ivanov Blagoev** the educational and **scientific degree "Doctor" in** professional field 4.6 "Informatics and Computer Science", specialty "Informatics"

Reviewer:

**NOT FOR  
PUBLIC RELEASE**

/Prof.. Dr. R. Yoshinov/

Sofia, 2021