

OPINION

by Dr. Vladimir Vassilev Monov,

Professor at the Institute of Information and Communication Technologies - BAS

regarding

dissertation for the award of the educational and scientific degree "**Doctor**"

field of higher education: 4. "*Natural Sciences Mathematics and Informatics*"

professional field: 4.6. "*Informatics and Computer Sciences*"

doctoral program: "*Informatics*"

Author: M.Sc. Iliyan Magdalenov Barzev

Topic: "Research and analysis of the possibilities for detecting malicious software using machine learning"

Scientific supervisor: Prof. Dr. Daniela Borisova, IICT-BAS

1. General description of the procedure and the submitted materials

By order No. 27 of 30.01.2026 of the Director of IICT, I have been appointed a member of the Scientific Jury for conducting the defense of the dissertation. By decision of the Scientific Jury at a meeting held on 03.02.2026, my participation in the work of the Scientific Jury was determined with the preparation of an opinion on the dissertation.

The set of materials presented by M.Sc. Iliyan Barzev includes the following documents:

- dissertation;
- abstract in Bulgarian and English;
- list of publications on the topic of the dissertation;
- copies of publications on the dissertation;
- declaration of originality of the results obtained;
- reference of fulfillment of the minimum national requirements for acquiring the educational and scientific degree "doctor";
- similarity report from the StrikePlagiarizm.com system

The attached documents meet the regulatory requirements for acquiring the educational and scientific degree "doctor", set by the Law on the Development of Academic Staff in the Republic of Bulgaria, the Regulations for its implementation and the Regulations for the specific conditions for acquiring scientific degrees and for holding academic positions in IICT.

2. Relevance of the topic

The dissertation is dedicated to research in the field of cybersecurity and, more specifically, to the development of methods for detecting and analyzing malware using machine learning methods. The topic of the dissertation is relevant and promising, given the increasing growth and evolution of modern cyberattacks, which in turn give rise to the need to develop effective algorithms for detecting malware and ensuring information security in the modern digital environment.

3. Understanding the problem

The first chapter of the dissertation provides an overview and description of methods for detecting and classifying malware using supervised and unsupervised machine learning algorithms. A detailed analysis and assessment of the performance, classification efficiency and prediction accuracy of models using deep learning neural networks has been carried out. A systematic approach and a specific methodology have been applied to evaluate the models under consideration, using a set of IoT data, including both benign and malicious network activities. Prerequisites for developing improved models and applications to achieve better results in detecting and classifying malware have been substantiated. The overview and analysis demonstrate a thorough knowledge of the subject and current problems in the research area, on the basis of which the goal and objectives of the dissertation have been formulated in a reasoned manner.

4. Characteristics and evaluation of the dissertation work and contributions

The dissertation is 143 pages long and consists of an Introduction, 3 chapters, Conclusion and Bibliography. It contains a list of abbreviations used, 20 tables and 43 figures. Five scientific and scientifically applied contributions are formulated. The list of bibliographic sources includes 155 titles, and the list of publications on the dissertation topic contains 4 titles. A list of noticed citations of the publications is presented. According to the requirements, a Declaration of originality of the obtained results is attached to the dissertation.

The problem area of the dissertation is thoroughly and competently analyzed and presented. The individual chapters are developed in detail and systematically and present the author's solutions to the tasks set. In terms of content, the main results of the dissertation research are the developed models and a methodological approach for detecting, analyzing and classifying malicious software. Data from experimental studies are presented, which establish the practical applicability of the obtained results. The conclusion lists the contributions of the dissertation work and indicates planned future research.

I accept and positively evaluate the contributions noted in the dissertation and the abstract. In summary, they can be listed as follows.

- Mathematical optimization models for selecting a virtual machine for the purposes of testing and detecting malware have been proposed.
- An improved approach for analyzing and detecting malware by combining various machine learning algorithms has been developed.
- Software models (frames) for classifying malware have been developed using machine learning algorithms, a self-aware model classifier, and an adaptive method for classifying malware with feedback.
- A software application “Shipka Guard” has been developed, implementing the malware classification frame with an adaptive layer and feedback correction.

The contributions of the dissertation work are specifically related and fully meet the set goal and objectives of the study. The tests conducted confirm the applicability of the developed models and software application.

5. Assessment of the publications and personal contribution of the doctoral student

Four publications on the dissertation topic are presented, published in the period 2023-2025. The publications are co-authored, in English and are in editions indexed in the Scopus database. Three of them are in editions with an impact rank in the Scopus Q4 quartile. The publications reflect essential parts and main results of the research conducted and meet the requirements for acquiring the educational and scientific degree "doctor". Additionally, a list of publications that have been accepted for publication is presented, as well as a list of noted citations of the doctoral student's works. They show that the results of the author's scientific research have become known and have aroused interest in the scientific community on the topic under consideration.

My familiarity with the dissertation and the publications on the dissertation topic gives me reason to believe that the dissertation work and the contributions therein are the personal work of the doctoral student, obtained under the direct supervision of his scientific supervisor. I am not aware of any evidence of plagiarism.

6. Abstract

The abstract is 45 pages long and meets the requirements for its formatting. Its content corresponds to the content of the dissertation and accurately presents the main results of the dissertation work. An abstract of the dissertation in English is also presented.

7. Assessment of the fulfillment of the minimum national requirements and additional requirements under Art. 1a, para. 2 of the Law on the Development of Academic Staff in the Republic of Bulgaria

According to the Law, to obtain the educational and scientific degree "doctor" in professional field 4.6. "Informatics and computer sciences", a minimum of 50 points is required for indicator A and 30 points for group of indicators Γ . The same number of points is also required in the Regulations on the specific conditions for acquiring scientific degrees and occupying academic positions at IICT-BAS. From the submitted Report on the fulfillment of the requirements for obtaining the educational and scientific degree "doctor", it is evident that the doctoral student fulfills the requirement for indicator A, and for indicators from group Γ he has scored 108 points, which significantly exceeds the required minimum number of points.

8. Opinion, recommendations and remarks

As a whole, the dissertation is distinguished by a thorough analysis of the researched problems and the successful use of mathematical models, software tools and experimental methods for their solution. Original scientific and applied scientific results in the field of prevention and protection from malicious software in the modern information environment are proposed. The results obtained fully meet the set goal and objectives of the dissertation.

I have no critical remarks on the essence of the dissertation and the presented results. It could be noted that all publications on the dissertation are co-authored, which indicates established abilities

for teamwork. In view of the future publication activity and the doctoral student's capabilities for successful conduct of scientific research, I would also recommend the preparation and publication of self-authored publications in prestigious international journals.

CONCLUSION

I positively assess the scientific research work carried out and the results obtained in the dissertation. The dissertation work meets all the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria, the Regulations for its implementation and the Regulations for the specific conditions for acquiring scientific degrees and occupying academic positions at the Institute of Information and Communication Technologies of the Bulgarian Academy of Sciences.

I strongly propose to the esteemed Scientific Jury to award M.Sc. Iliyan Magdalenov Barzev the educational and scientific degree "doctor" in the field of higher education: 4. "Natural Sciences, Mathematics and Informatics", professional field: 4.6. "Informatics and Computer Sciences", doctoral program: "Informatics".

04.03.2026

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