S T A T E M E N T R E P O R T

on the procedure for defence of a Ph.D. thesis entitled
"Adaptive Neural Network for Processing Satellite Data
with Different Spatial and Spectral Characteristics"
for obtaining the Educational and scientific degree "Doctor"
by Ventsislav Yuriev Polimenov,
Supervisor: Assoc. Prof. Krassimira Ivanova, Ph.D.

Scientific field: **4. Natural Sciences, Mathematics, and Informatics**
Professional field**: 4.6. Informatics and Computer Science**
Ph.D. program: **"Informatics"**
Department: **"Software Technologies and Information Systems",**
Institute of Mathematics and Informatics (IMI),
Bulgarian Academy of Sciences (BAS)

The statement report has been prepared by: Assoc. Prof. Kaloyan Mariyanov Yovchev, Faculty of Mathematics and Informatics, Sofia University "St. Kliment Ohridski", in my capacity as a member of the Scientific jury for the defence of this Ph.D. thesis according to Order # 44 / 18.05.2026 of the Director of the Institute of mathematics and informatics, BAS.

1. General characteristics of the Ph.D. thesis and the presented materials

The presented Ph.D. thesis is written in English and contains 138 pages and consists of five chapters, bibliography, list of figures, list of table and list of abbreviations. The thesis contains 25 tables and 26 figures. The bibliography contains 127 entries. Ventsislav Polimenov has presented all required documents and materials that concern the procedure. The documents show that the applicant fully meets the minimal national requirements according to the Art. 2b, para. 2 and 3 of the Act on Development of the Academic Staff in the Republic of Bulgaria (ADASRB), The Rules for Implementation of the ADAS in the Republic of Bulgaria as well as the Rules on the Terms and Requirements for Acquisition of Scientific Degrees and Occupation of Academic Positions of the Institute of Mathematics and Informatics and Bulgarian Academy of Sciences.

2. Short CV and personal impressions of the candidate

Ventsislav Yuriev Polimenov obtained his Bachelor of Science degree in Computer Science in 2014 at the University of Essex in Colchester, UK. In 2016, he obtained his Master of Science degree in Computer Science (Machine Learning, Data Mining and High-Performance Computing) at the University of Bristol in Bristol, UK. In the period 2022-2026, he is a doctoral student at the Software Technologies and Information Systems section of IMI-BAS, doctoral program "Informatics". Since December 2022, he has been working as a young scientist, researcher at IMI-BAS. He has 3 publications and 2 citations in SCOPUS. Since March 2017, he has been working as a machine learning engineer and has extensive professional experience. Since December 2025, he has held the position of Senior Machine Learning Engineer at Dreamix. I have excellent impressions of Ventsislav Polimenov from the report he gave during the preliminary defence of his dissertation.

3. Content analysis of the scientific and scientific-applied achievements of the candidate, contained in the presented dissertation thesis and the publications to it, included in the procedure

The dissertation examines tasks in the field of modern computer vision. The goal is to develop an adaptive neural network that can estimate the leaf area index (LAI) by processing images with different spatial and spectral characteristics.

The first chapter is introductory and defines the problem, goal, objectives and hypotheses. The second chapter contains literature review and systematically presents the methods and approaches for estimating biophysical parameters based on satellite images.

The third and fourth chapters contain the main scientific and scientific-applied contributions of the dissertation. A methodology for estimating LAI is presented, in which a 10-step workflow is described in detail. An original multi-sensor model for deep learning has been developed, combining the U-Net, Conditional Batch Normalization and Atrous Spatial Pyramid Pooling architectures into a single framework for sensor-invariant learning, which allows for the joint use of data from different sensors without the need for prior normalization of the input data and has been successfully applied to LAI estimation using Sentinel-2 and Landsat 8/9 data. A method for balancing training on multi-sensor data, based on augmentation and controlled participation of individual sensors in the training process, has been proposed and experimentally substantiated. The presence of degradation in the imbalance of training examples has been proven, leading to the dominance of the majority sensor and a decrease in the generalization ability of the model. It has been shown that balanced training provides higher

stability and efficiency of sensor-invariant modelling. An approach has been developed to generate pseudo-reference LAI data by ensemble combining Beer–Lambert transformed vegetation indices (NDVI, GNDVI and SAVI), which provides the opportunity to create reliable training data in the limited availability of field measurements and creates prerequisites for effective training of deep neural models in conditions of lack of reference information. An original framework with 5 levels has been proposed for validation of LAI estimation models in the presence of circularity in the training labels. In this way, an approach has been created for evaluating the developed models.

In the final fifth chapter, the contributions and directions for future development are systematized. The obtained results are presented clearly and in detail, with the necessary distinction made between the known results and the new results obtained in the dissertation. The originality of the scientific results and contributions obtained by Ventsislav Polimenov is beyond doubt. There is no doubt about plagiarism in the dissertation.

4. Approbation of the results

The publications on which the dissertation work is based are three according to the submitted documents. These publications are indexed in SCOPUS. The first of the submitted publications is in an edition with an impact rank SCOPUS SJR = 0.141. The other two are indexed in IEEE Xplore. The publications are co-authored, with the candidate being the first author of two of them. The three publications carry a total of 66 points in the corresponding group of indicators with a minimum requirement of 30 points. The candidate also has two citations in publications indexed in SCOPUS. The results of the dissertation have been reported at five scientific forums in Bulgaria, three of which are with international participation.

The published works meet the minimum national requirements (according to the Art. 2b, para. 2 and 3 of the Act on Development of the Academic Staff in the Republic of Bulgaria), and, accordingly, the additional requirements of IMI, and of BAS for the acquisition of the Educational and scientific degree “Doctor” in the scientific field and professional direction of the procedure. The results presented by the candidate in the Ph.D. thesis and related scientific works do not repeat those from previous procedures for acquiring a scientific degrees and academic positions. From the submitted documents it can be seen that there is no proven plagiarism in the submitted Ph.D. thesis and the accompanying publications.

5. Qualities of the abstract

The abstract in Bulgarian is 46 pages long and meets the requirements for its preparation. The results of the dissertation work and its content are correctly presented. The abstract in English is 45 pages long and also accurately presents the scientific contributions of the candidate.

6. Critical notes and recommendations

I have no substantial criticisms. I recommend that the candidate continue to actively engage in scientific research on the topic in the future. I recommend that the candidate work on independent publications, as well as report the results of his scientific research to a wider audience at international scientific forums.

7. Conclusion

Having become acquainted with the dissertation thesis presented in the procedure and the accompanying scientific papers and on the basis of the analysis of their importance and the scientific and applied contributions contained therein, I give my positive opinion and **I confirm** that the Ph.D. thesis presented and the scientific publications to it, as well as the quality and originality of the results and achievements presented in them, meet the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria, the Rules for its Implementation and the corresponding Rules at the IMI, and at the BAS, for the acquisition by the candidate of the educational and scientific degree "Doctor" in the Scientific field: 4. Natural 4 Sciences, Mathematics, and Informatics, Professional field: 4.6. Informatics and Computer Science (Informatics). In particular, the candidate meets the minimal national requirements in the professional field, and no plagiarism has been detected in the Ph.D. thesis, and in the scientific papers submitted for this procedure.

Based on the above, **I recommend** the scientific jury to award Ventsislav Yuriev Polimenov the Educational and scientific degree "Doctor" in the Scientific field: 4. Natural Sciences, Mathematics and Informatics, Professional field: 4.6. Informatics and Computer Science (Informatics).

22.06.2026 Signature: .....

(Assoc. Prof. Kaloyan Yovchev, Ph.D.)