OPINION
for a competition for the academic position "Associate Professor"

in the field of higher education:	4. Natural Sciences, Mathematics, and Informatics
professional field:	4.6. Informatics and Computer Science
scientific speciality:	Informatics (Neural Network Architectures)
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for the needs of:	Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences (IMI-BAS) Software Engineering and Information Systems Department
prepared by:	Assoc. Prof. Krassimira Minkova Ivanova, IMI-BAS
member of the scientific jury of the competition, according to:	Order No. 467 / 10.10.2023 of the Director of IMI-BAS

Only one candidate has submitted documents for participation in the announced competition:

Dr. Galina Dimitrova Momcheva

I. General Description of the Submitted Materials

1. Application Details

For participation in the competition, Dr. Galina Momcheva has attached all the required documents, lists, and references, and at the request of the scientific jury, after discussion at the first meeting, she has made some clarifications and has added missing bibliographic information.

Regarding the fulfillment of the minimum requirements by a candidate in the competition for the academic position of "Associate Professor" at IMI-BAS, Dr. Galina Momcheva presented:

- diploma for PhD degree (completed 50 points under group „А");
- monograph (completed 100 points according to group „В");
- 1 article with IF in Q3, 1 article with IF in Q4, 7 articles in SJR publications, 5 articles only indexed in Scopus and 1 in Web of Sciences, 1 book chapter (total 291 points, with required 220 points under group „Г");
- 18 citations in Scopus and 1 citation in IEEExplore of 7 of her publications (total 111 points, with required 70 points under group „Д");

– according to the requirements of RCPASDOAP[1] in IMI, under group „E“ there are required 20 points. Dr. Galina Momcheva has presented information about 1 defended doctoral student (50 points), one university textbook with three authors (13 points) and one university handbook with a single author Galina Momcheva (20 points), as well as participation and/or leadership in national and international projects (sums of attracted funds are also indicated – given the fact that the other activities in this group are sufficient, I will skip the assessment of these points, as far as I have no information about them).

Dr. Galina Momcheva has submitted 2 articles in journals with IF and 7 articles in issues with SJR, which exceeds the requirement of art. 3, para. 1, item 3 of RCPASDOAP in IMI where the candidate has to have at least 7 of the publications presented for the competition publications in IF or SJR publications.

The presented publications, citations, and other evidence according to the various indicators were not used for the acquisition of the educational and scientific degree “PhD”, as well as in the previous procedure for occupying the academic position “Associate Professor” in PF 4.6 at Varna Free University in 2012.

In the previous procedure, the book “Programming Techniques. Divide and Conquer”, VFU, 2012 is pointed as based on the dissertation defended in 2010 “Heuristic Schemes for Solving Tasks in the Discipline “Data Structures and Algorithms” in University Courses”. As a material for this competition, Dr. G. Momcheva presents another published book based on the dissertation – “Algorithmic Design and Artificial Intelligence”, VFU, 2022. The second chapter of this book is devoted to “Algorithmic Approaches and Practices in the Design of Neural Networks” and, in the words of the author herself, this theme has entered in her research from 2016. Due to the possibility of controversial interpretation of which book is based on the dissertation, I will not consider this material among those presented in the competition.

From 17.01.2005 to 14.11.2022, Dr. Galina Momcheva worked at Varna Free University “Chernorizets Hrabar”, starting from Assistant to Associate Professor and Head of Department, which fully satisfies the requirement of Art. 24, para. 1, item 2 of the ADAPRB[2].

2. Content Analysis of the Applicant's Scientific and Scientific-Applied Achievements Contained in the Materials for Participation in the Competition

The following can stand out as the most significant contributions in the publications submitted for the competition related to the theme:

1. Proposing methods to support the classification of gene expression in biological samples based on Haralick textural features [6] or on features generated by Gabor energy filters [7], for replacing subjective expert evaluation with an automated process. For the classification of images with similar levels of gene expression, the use of an autoencoder is proposed, and the performance of the model is optimized by balancing the length and complexity of the hidden layers and tuning the network hyperparameters [15].

2. Proposing a method for generating defects and artifacts in microscopic images using Perlin noise and Voronoi diagrams to create artificial images for training neural networks [12].

[1]RCPASDOAP – Regulations for the Conditions and the Procedure for Acquiring Scientific Degrees and for Occupying Academic Positions
[2]ADAPRB – Act for Development of the Academic Personnel of the Republic of Bulgaria

3. Proposing an extension of the standard U-Net architecture with the inclusion of fuzzy layers to achieve better segmentation quality in biomedical images [1][2].

4. Proposing artificial neuron models, which use dendrites analogously to the natural neuron, and experiments show that this type of model performs well enough compared to the classic perceptron model [14] [monograph].

5. Proposing an application of the process knowledge mining approach to data on the development of organisms to enhance the symbiosis between data science and process modeling. In support of the hypothesis of the suitability of this technology transfer, an example of the application of process knowledge extraction techniques to a developmental data set of the roundworm C. elegans is examined [9].

Experiments have also been conducted on the application of distributed Machine Learning techniques in the field of Natural Language Processing [3], also various techniques of encoding categorical data to numerical ones to provide opportunities for applying regression models of neural networks [4].

Part of the developments are related to risk analysis of various ecosystems and methods to support their management. In [5], a methodology for researching the sustainability of regional entrepreneurial ecosystems by using key point indicators (KPI) and network models, on the example of the BioMed-Varna ecosystem is proposed. In [11], a quantitative method for assessing the cybersecurity risk of suppliers by building attack trees and assigning a risk factor to each supplier is proposed, to assess the supplier's cybersecurity risk, which is critical to the infrastructure of the smart city and the sustainability of the autonomous mobility ecosystem. In [13], a method for detecting faults in played videos by tracking color histograms in the sequence of frames is proposed, to improve the performance of TV data centers (it is not clear from the description whether all frames are subject to processing or quantization is performed).

Another part of the development is aimed at analyzing the state of the educational process. The research presented in [10] examines the development of education programs in Canada in the field of information technology. In [8], an objective method for studying the functional literacy of students is presented by analyzing the relationship between the readability of instruction texts (task texts, technical documentation) and the corresponding source code (task solution) from a specific educational resource. This type of research has both research and business-added value as an opportunity to create objective recommendations for teachers and authors of computer science textbooks.

3. Evaluation of Projects Work and Other Activities

The presented materials show the active participation of Dr. Galina Momcheva in research and educational projects, most aimed at implementing integration between research and training.

Over the years, she led various courses for students, most often related to new directions in Data Science and Artificial Intelligence, and the curricula for these courses were developed by her. She actively participates in the preparation of master's programs on these subjects. She is also the author/co-author of textbooks and handbooks (two of which are presented in the materials of this competition).

She is also active in attracting young talents in the field of Informatics. She was the head of national programming teams (in editions of the Balkan Olympiad in Informatics and the Romanian International Competition in Mathematics and Informatics), she was also one of the initiators in

building the Small Learning and Research Community jVarnaBioImage, which operates very successfully within the framework of Student Institute of the BAS. In practice, a large part of the efforts of Dr. Galina Momcheva over the years have been devoted to the construction of a complete ecosystem for the development of scientific, educational, and entrepreneurial activities.

4. Recommendations

Dr. Galina Momcheva has a good publication activity, works in topical areas of Informatics, and has the ability to successfully lead teams of young people. My recommendation is to focus her research activities to achieve more in-depth and comprehensive results to be published in journals with a high impact factor.

5. Application Conclusion

The scientific achievements of Dr. Galina Momcheva meet the requirements of ADAPRB, its rules for implementation, RCPASDOAP at BAS, and the specific requirements of IMI-BAS. The presented results are completely sufficient to satisfy the minimum national and institutional requirements in the professional field and no plagiarism was found in the scientific works submitted to the competition. I give my **positive** assessment of the application.

II. General Conclusion

After getting acquainted with the materials and scientific works presented in the competition, analyzing their significance and the scientific, scientific-applied, and applied contributions contained in them, I find it reasonable to give my positive assessment and recommend that the Scientific Jury propose to the Scientific Council of the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences to elect Galina Dimitrova Momcheva to take the academic position “Associate Professor” in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.6. Informatics and Computer Science (Neural Network Architectures).

Sofia

21.11.2023 (Assoc. Prof. Krassimira Ivanova)