O P I N I O N

regarding the application of Assoc. Prof. Dr. Tatiana Vladimirovna Atanasova for participation in
a competition for the academic position "Full Professor" in the professional direction
4.6. Informatics and computer sciences, specialty Informatics

by Prof. DrSc Galia Angelova, Institute of Information and Communication Technologies, BAS

By order No. 41/09.02.2024 of the Director of IICT, I have been appointed as a member of the Scientific Jury in a competition for the academic position of "Full Professor" in professional direction 4.6. Informatics and computer sciences, specialty Informatics, announced in the "State Gazette" no. 103/12.12.2023 for the needs of IICT-BAS, Department "Modeling and Optimisation". The only candidate is Ass. Prof. Dr. Tatiana Vladimirovna Atanasova.

The thresholds in the Regulations for occupying academic positions in IICT-BAS regarding the fulfillment of the minimum national requirements for occupying the position of "Full Professor" specify that candidates for this position in IICT must have at least 50 points in indicator A, 100 points in indicator B, 260 points on indicator D, 140 points on indicator G and 150 points on indicator E. Dr. Atanasova presents a completed template for NACID, which contains 50 points on indicator A, 110 points on indicator B (from three publications with IF/SJR published in 2019-2022), 322 points on indicator D, 402 points on indicator G for citations and 420 points on indicator E. The candidate has over 39 years of work experience as a researcher and lecturer in maths and computer science in high educational institutions (of which over 20 years as a qualified "Associated Professor" in institutes of the BAS), as well as a diploma of the High Attestation Commission dated 2001 for being awarded the educational and scientific degree "PhD" in the scientific specialty 02.21.10 "Application of the principles and methods of cybernetics in various fields of science".

The scientific publications submitted for the competition (20 papers selected from a total list of over 160 titles) were published after 2016 – i.e. well after the last habilitation procedure, and have not been presented in other procedures for obtaining a scientific degree or holding a scientific position. In this way the formal requirements of the IICT's Regulations are not only met, but also exceeded, especially for indicators D and E.

Extracts from the CV of Dr. Tatiana Atanasova

The candidate graduated as an engineer with honors from the Moscow Energy Institute (now a National Research University of the Russian Federation), Faculty of Automation and Computer Science. In Bulgaria, she became a PhD student and defended her doctoral dissertation on the topic "Study of control systems with distributed intelligence". Dr. Atanasova holded positions in the Central Laboratory of Control Systems - BAS, the Institute of Control and System Research - BAS, the Institute of Information Technologies - BAS (where she defended her PhD thesis) and is currently an Assoc. Prof. at IICT-BAS, head of the "Modeling and Optimization" department.

Dr. Atanasova taught various disciplines at the Higher School of Telecommunications and Posts (Sofia) and at Southwestern University "Neofit Rilski" (Blagoevgrad). She was leader of the Bulgarian team in projects under the 6th Framework Program for Research and Innovation of the European Commission and leader of bilateral EBR-projects (equivalent non-currency exchange) between the Bulgarian Academy of Sciences and the Russian Academy of Sciences. After 2018, she participated in the IICT teams in three national research programs: ICTvNOS, Intelligent Animal Husbandry and Security and Defence. She was a member of the Editorial Boards and/or Councils of a number of scientific journals, as well as a Program Committee member for many

international scientific conferences. In the period 2020-2022, 4 PhD theses were defended under the supervision of Assoc. Prof. Atanasova. She is currently supervising two PhD students.

General description of the documents presented for the competition

20 scientific papers published mostly in the last 3-4 years (4 in journals with Impact Factor of Web of Science and 14 in volumes with SJR of Scopus) are submitted for the competition. One publication is authored by Dr. Atanasova only; the other papers are co-authored and characterise the active joint work of the candidate with young scientists and Bulgarian partners. Co-authorship in the publications does not diminish the importance of Prof. Atanasova's achievements, but rather emphasizes the importance of her position as a valued and sought-after collaborator, partner and supervisor. The list of citations submitted for the competition contains 366 citations for 62 of Dr. Atanasova's articles, but Google Scholar lists 596 citations of her works, of which 432 citations were made after 2019 by a wide international circle of scientists. The latter shows that although Dr. Atanasova publishes mostly with Bulgarian co-authors (often her PhD students), her publications in international conference Proceedings are recognisable and foreign experts use them as useful references and source of information.

As research topics, the submitted publications can be grouped in three areas: *(i)* gathering and analysis of information and applications of the obtained models in different prototypes; *(ii)* security assessment and protection of computer systems and data; *(iii)* use of virtual and augmented reality in education.

Research contributions in the publications submitted for the competition

I accept Dr. Atanasova's proposed division of the contributions in the presented papers into two groups – **Research** and **Applied research** contributions, as follows::

- **Research Contributions:** *(i)* An approach for streaming heterogeneous data from IoT devices with built-in machine learning functionality is proposed, system architecture features are derived, and a data-driven intelligent system for monitoring target parameters in a cloud environment is developed; *(ii)* A multidimensional classification of health status of dairy cows into three categories using machine learning and cloud services is proposed. The practical value of the model for animal husbandry is tested by its predictive power and confirmed by its reproducibility; *(iii)* An extensible IoT architecture model for working with different communication protocols is proposed, which enables centralised device management and big data processing; *(iv)* An toolbox of methods for gathering, aggregating and structuring data from heterogeneous sources on the Internet according to predefined rules and user requirements has been developed, which covers various approaches to data processing: sensor data analysis and machine learning; *(v)* A cognitive approach is proposed for modeling human-computer interaction in a distributed environment, which considers the human factor as a set of cognitive user characteristics.
- **Applied Research Contributions**: *(i)* A scalable cloud-based architecture has been implemented in an intelligent livestock monitoring system that includes monitoring of animals' environment, health, growth, behavior, reproduction, emotional state, and stress levels and uses automated scaling mechanisms; *(ii)* A methodology has been created for the implementation of a workflow of heterogeneous data by applying several data processing methods; *(iii)* Digital twins have been created for modeling and simulations in smart agriculture using a cloud environment; *(iv)* Areas of application of machine learning methods enriched with ensemble methods for boosting, stacking, and packaging are established. An application of regression analysis in modeling target variables in a

predictive model is evaluated; *(v)* Techniques for finding hidden dependencies in collected datasets in an open source machine learning software environment have been established; *(vi)* Possible ways to breach the security of IoT devices/systems are determined and countermeasures are proposed; *(vii)* An approach to track data in an IoT system by combining TSA and Blockchain technologies is proposed; *(viii)* A correlational approach is proposed to identify indirect relationships between different types of incidents in information infrastructure via the integration of AI in monitoring IT operations (AIops); *(ix)* Tests were designed and conducted in an experimental environment for virtual and augmented reality and a positive effect of their use in STEM education with increased assimilation of the learning material was found; *(x)* A composition of atomic functions in different IoT services is proposed in information service modeling in order to ensure QoS.

The subject matter of the presented publications characterises the broad field of research of Assoc. Prof. Atanasova, the variety of considered tasks and applications, as well as the multitude of collaborators in various projects and developments.

Personal impressions

For a long time I knew the candidate vaguely as a colleague from a neighboring institute, but only in the last 5-6 years I had the opportunity to closely observe her work. In addition to her competence and breadth of knowledge and experience, I was greatly impressed by her dedication to working with PhD students (as well as her modesty). Through her own efforts, she managed to attract young people and build a group of scientists who remained her collaborators after completing their doctoral studies. I was a reviewer for the defense of two doctoral dissertations prepared under her supervision and I noted the comprehensive consideration of the tasks in the PhD research plans. Creating results for publication in the Q1-Q2 quartiles and cultivating an aspiration to achieve the highest possible quality shows a tenacity not seen every day. I am also impressed by the approach to the development of the team led by her in contracts such as the National Research Programme "Intelligent Animal Husbandry". The prototypes created there are based on modern information technologies, allow upgrading and will be a good basis for future developments.

Conclusion

I believe that Assoc. Prof. Atanasova combines the qualifications of an excellent engineer and a competent computer scientist. The materials submitted for the competition prove the presence of in-depth knowledge, a leading role in formulating ambitious research goals, the ability to work in a team, as well as professional activity, persistence, precision and the desire to reach a high scientific level. **I strongly support the election of Assoc. Dr. Tatiana Atanasova as a full professor in the "Modeling and Optimisation" department of IICT-BAS and I suggest the respected members of the Scientific Jury to vote unanimously in support of such a decision.**

30 March 2024 г.
Sofia

Member of the Scientific Jury for the

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