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REVIEW

by Acad. Janusz Kacprzyk, PhD, DSc, Dr. h.c.
on the Promotion Procedure for the Academic Position „Full Professor”
in Professional Area 4.6. “Informatics and Computer Sciences”,
Scientific Specialty 01.01.12 “Informatics”,
for the Intelligent Systems Department
in the Institute of Information and Communication Technologies
at the Bulgarian Academy of Sciences

Candidate: Associate Professor Lyubka Atanassova Doukovska, PhD, DSc

In accordance with Order No. 90 from 21.05.2018 of the Director of the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences Corr. Member Prof. Svetozar Margenov, PhD, DSc, I have been appointed as a member of the Scientific Jury in a promotion procedure for the academic position „Full Professor” in professional area 4.6. “Informatics and Computer Sciences”, scientific specialty 01.01.12 “Informatics”, that has been announced in the State Gazette, Volume 26 from 23 March 2018.

In this relation, I have received all the relevant documents in the procedure of the single candidate Assoc. Prof. Lyubka Atanassova Doukovska, PhD, DSc. I have familiarized with the requirements in the *Development of Academic Staff Act in the Republic of Bulgaria*, as well as with the state regulation and the institutional regulation for the Act’s implementation.

I wish to reconfirm that I understand the Bulgarian language and have fully understood those documents related to the above mentioned procedure which are in Bulgarian.

Assoc. Prof. Lyubka Atanassova Doukovska fulfills the requirement in Article 29 (1), § 1 from the *Development of Academic Staff Act in the Republic of Bulgaria*. In January 2007, the candidate was awarded PhD in the scientific specialty 01.01.12 "Informatics" for a successfully defended thesis titled "Hough transform in the constant false alarm rate algorithms in presence of randomly arriving impulse interference." In addition, in March 2017, Assoc. Prof. Lyubka Doukovska was awarded the scientific degree DSc in the specified specialty with a successfully defended thesis titled "Moving targets detection and parameters estimation in randomly arriving impulse interference environment."

The candidate also fulfills the requirement in Article 29 (1), § 2 from the Act, as she has been elected for the academic position "Associate Professor" in May 2009. At present, she has more than 21 years of academic experience.

Assoc. Prof. Lyubka Atanassova Doukovska fulfills the requirement in Article 29 (1), § 3 from the *Development of Academic Staff Act in the Republic of Bulgaria* by participating in the promotion procedure with publications in specialized scientific journals. According to the Regulation for the Act's implementation of the Institute of Information and Communication Technologies, the candidate must present six publications, four of which must be published in journals with Journal Impact Factor or with Scientific Journal Rank (SJR). Pursuant to the Institutional Regulation, the candidate has provided a total number of six publications, of which five published and one accepted for publication, all of them in journals with Journal Impact Factor.

Pursuant to the Institutional Regulation, the candidate has fulfilled the obligatory requirement to have a successfully defended supervised PhD student in the scientific specialty 01.01.12 "Informatics" (February 2016).

In addition, Assoc. Prof. Lyubka Doukovska has provided a complete list of 144 publications in the period 1996–2018, a list of 201 citations to 46 publications by the candidate published in the period 1998–2017. She has been the coordinator of ten projects and participant in 28 projects in the period 1996–2018. In the period 2011–2018, she has been the Chairman and member of the organizing committee of eleven international conferences, symposiums, workshops and seminars. In the period 2007–2010, she lectured in the Faculty of Mathematics and Informatics of Sofia University "St. Kliment Ohridski" in the bachelor's degree course on *Contemporary Communications* and the master's degree course on *Mobile Communications*.

The main contributions of the research activity of the candidate Assoc. Prof. Lyubka Atanassova Doukovska for the present procedure are in the area of Intelligent Systems, specifically in the following two fields:

- Intelligent technical diagnostics and predictive maintenance of technological equipment;
- InterCriteria Analysis as a new approach to decision making.

These can be formulated in details, as follows:

1. Predictive maintenance and technical diagnostics methods have been developed, using artificial intelligence techniques. In particular, a sufficiently complete approach employing Case-Based Reasoning has been elaborated for prediction of the future state of complex objects. The research has been closely related to important classes of power industry objects. Many experiments on operating objects have been conducted, and a package of numerical experiment programs has been developed for predictive maintenance of technological equipment in the power industry.
2. Algorithms for technical diagnostics of real technological objects have been developed using intelligent methods of control. As a result of the work, detailed tests of the mill fan motor block vibrations in the system of air coal mixture system of a steam generator (640 t/h) in Maritsa Iztok 2 Power Plant. A model has been elaborated that describes the normal working conditions, where fault detection is being conducted in accordance with either the residual information, or the differences in the quality parameters of the control process. A package of numerical experiment programs has been developed for technical diagnostics of technological equipment in the power industry.
3. Results have been achieved from the application of InterCriteria Analysis in the process of reduction of the number of inputs of a feed-forward neural network. It has been determined that a part of the inessential data (parameters), used in the training of the neural network, can be eliminated by reducing the number of the inputs and of the weight coefficients, which leads to decrease of the demanded memory, implementation time and number of iterations, and results in reduction of the number of neural network inputs, thus reducing the mean squared error.
4. Using the apparatuses of intuitionistic fuzzy sets and of index matrices, data for the competitiveness of the efficiency-to-innovation-driven economies, sourced from the World Economic Forum's Global Competitiveness Reports, has been analysed with InterCriteria Analysis. Specific detected dependences and trends have been outlined between the twelve pillars of competitiveness in the World Economic Forum's methodology. The specific contribution to the theory of InterCriteria Analysis is the application of the method to a set of elements, which varies over time, i.e. the elements' belongingness to the set is not constant but depends on their performance according to some criteria within some predefined thresholds, and this problem formulation differs from the prior applications of the method over sets with predefined and constant elements.

All of the above gives all the evidence that the candidate Assoc. Prof. Lyubka Atanassova Doukovska completely fulfills the general requirements in the *Development of Academic Staff Act in the Republic of Bulgaria* and the specific requirements in the Act's Institutional Regulation for promotion to the academic position „Full Professor”, with respect to Article 3, Paragraphs 3.6 and 3.7 from the Regulation of the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences.

In conclusion, all criteria and requirements of the *Development of Academic Staff Act in the Republic of Bulgaria* and the Regulation for the specific requirements for academic promotion to scientific degrees and positions in the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences, have been accomplished. I give my positive conclusion on the election of Assoc. Prof. Lyubka Atanassova Doukovska in the promotion procedure to the academic position „Full Professor” in the scientific specialty 01.01.12 “Informatics”.

I also wish to mention that over the years I have been a frequent reviewer in similar procedures of academic promotion to the (full) professor degree in virtually all countries, from Europe, through the USA, Canada, Australia to China, Japan, etc. I wish to reconfirm that Assoc. Prof. Lyubka Atanassova Doukovska fulfills all criteria which are adopted in such a procedure by prestigious universities and other scientific institutions all over the world. This is certainly amplifying my positive opinion about her credentials and scientific results.

Therefore, I wish to propose to the Scientific Jury to unanimously make a recommendation to the Scientific Council of the Institute of Information and Communication Technologies at the Bulgarian Academy of Sciences to elect Assoc. Prof. Lyubka Atanassova Doukovska, PhD, DSc, for the academic position „Full Professor” in professional area 4.6. “Informatics and Computer Sciences”, scientific specialty 01.01.12 “Informatics”.

4 June 2018
Warsaw, Poland

