OPINION

concerning a competition for academic position "Associate Professor"
professional field "5.3. Communication and computer equipment", specialty „Synthesis and analysis of algorithms"
announced in Gov. Newspaper № 31 / 19.04.2022
with applicant Principal Assistant PhD Eng. Neli Ananieva Arabadjieva Kalcheva
Member of the scientific jury Assoc. Prof. PhD Eng. Ivaylo Plamenov Penev

1. General characteristics of the applicant's research and scientific and applied activities.

The applicant's research and scientific and applied activities are focused on the following areas:

- Mathematical methods and algorithms used in engineering sciences
- New teaching models by applying scientific approaches to training students from technical universities
- Synthesis and analysis of methods and algorithms used in computer science

In each area the applicant has formulated relevant contributions, each of which is supported by publications.

2. Evaluation of the pedagogical training and activity of the applicant.

The candidate's teaching activity is mainly concentrated in the discipline "Synthesis and analysis of algorithms", of which Dr. N. Arabadzhieva-Kalcheva is a leading lecturer at Technical University of Varna. In addition, the candidate teaches the disciplines "Basic programming" for Bachelor and "Machine Learning" at the Master's Degree. For the last three years the candidate has been supervisor of 11 students and a reviewer of 6 successfully defended graduates from specialties CST and SIT at TU-Varna. The candidate led 24 programming teams, some of which achieved prizes in national student competitions.

On the basis of the reports provided, I consider that the applicant has a successful teaching and pedagogical activity.

3. Main scientific and applied contributions.

The candidate has submitted 26 scientific papers representing publications in scientific journals and published papers delivered in scientific forums. 16 papers are written in English language and 10 papers are written in Bulgarian language. The monographic work is presented with 11 equivalent publications, which are combined thematically with the title "Mathematical methods and algorithms used in engineering sciences". The other publications are combined thematically with the titles "New teaching models by applying scientific approaches in the training of students from technical universities" and "Synthesis and analysis of methods and algorithms used in computer science".

3.1. Contributions in publications equivalent to monographic work

I consider that the contributions into the equivalent publications can be assigned to the following groups:

3.1.1. Proving by new means essential new features of pre-existing scientific fields, problems, theories, hypotheses

- Comparative analysis of the accuracy and speed of various methods and algorithms for classification of texts in Bulgarian [B.4.4] and in English [B.4.3, B4.7, B4.9] is carried out.

- Comparative analysis of the accuracy, precision, sensitivity and F-measure of machine learning algorithms is carried out in the classification of authors of works in English and classification of authors of the same works translated in Bulgarian language [B.4.10].

3.1.2. Creation of new classifications, methods, constructions, technologies; receipt of confirmatory facts

- A new mathematical methodology is proposed to assess the feasibility of algorithms to find the shortest path in a maze [B.4.1].
- Proposed and evaluated new statistical methodology for validating a code for calculating distracted X-rays reaching the operator's eyes during intervention procedures based on Monte Carlo techniques [B.4.2].
- A new mathematical approach is proposed and evaluated to obtain realistic climatic data on the temperature distribution in gradation [B.4.5].
- New models of teaching mathematical methods and algorithms are proposed for students from technical universities [B.4.6, B.4.8, B.4.11].

3.2. Contributions in publications outside the monographic work

I consider that the contributions into the publications outside the monographic work can be assigned to the following groups:

3.2.1. Proving by new means essential new features of pre-existing scientific fields, problems, theories, hypotheses

- Algorithms are analyzed to search for the shortest path in a maze: A* (A star), backtracking algorithm and genetic algorithm (GAPP – Genetic Algorithm Path Planning) [B.4.1]. An algorithm for finding the shortest path in a maze [Г.8.7] is proposed and validated.
- Risk management methods are studied: causality analysis (Ishikawa diagram) [Г.8.9], analysis of types of refusals and their consequences (FMEA)[Г.8.12] and analysis of the Bow Tie Node algorithm.

3.2.2. Creation of new classifications, methods, constructions, technologies; receipt of confirmatory facts

- A new model of teaching Naive Bayesian Classifier is proposed when classifying text using interactive training of students from technical universities [B.4.11].
- A new model of teaching non-linear programming tasks is proposed with the application of scientific approaches: inductive and deductive. It is applied in teaching theory and examples of Hooke-Jeeves search, the method of the fastest descent and the method of Lagrange multipliers to students from technical universities [B.4.6].
- A new model of teaching the Bayes formula is proposed using the educational strategy for active training of students from technical universities [B.4.8].
- Algorithms for building the Trie tree structure and its Integer trie variety are analyzed. Their advantages and disadvantages are examined and applications of the wood structures examined are proposed [Г.8.9].
- The Blender application which is suitable for creating 3D models and animation is studied. Its advantages and disadvantages [Г.8.6] are presented.
- Synthesis and analysis of methods and algorithms used in machine learning: BERT [B.4.9], ALBERT [B.4.9], XLNet [B.4.9], Bernuli Naïve Bayes Classifier [B.4.9, B.4.10], Multinomial Bayes classifier [B.4.4, B.4.9, B.4.10], Gaussian Naïve Bayes classifier [B.4.7, B.4.9], K – nearest neighbour [B.4.10], Solution tree [Г.7.1, Г.7.2, Г.4.10],

Support vector method [Г.7.10], Method of support vectors [Г.7.1-Г.7.3, В.4.3, В.4.4, В.4.10], Ensemble algorithms [Г.7.1 - Г.7.3], Naïve Bayes Classifier [Г.7.1], Random Forest [В.4.4, В.4.10] and AdaBoost [В.4.4, В.4.10]. An overview of publications of classification methods and algorithms [Г.8.1, Г.8.3-Г.8.5] and clustering [Г.8.2, Г.8.5] is presented.

Based on the publications presented and the personal impressions I have from the candidate's work, I can confirm that all the listed contributions are her personal work.

In the report on the implementation of the minimum national requirements for achieving the position "Associate Professor", data are presented for 20 citations, of which 10 are indexed in Scopus. Two of the equivalent publications were quoted ten times in Scopus.

The publications submitted are articles in journals and papers presented at conferences, some of which are organized by IEEE (e.g. International Black Sea Conference on Communications and Networking (BlackSeaCom), International Conference on Biomedical Innovations and Applications). Participation in well-established scientific forums is a testament to the representativeness of the applicant's publications.

4. Significance of the contributions for science and practice.

The presented contributions concern the creation of mathematical models, synthesis and analysis of algorithms, research of machine learning algorithms and methods. The contributions are applicable in engineering sciences and teaching them in technical universities. I consider that the applicant has sufficient contributions for achieving the academic position "Associate Professor".

The citation data prove that the applicant is recognizable among the scientific circles in the professional field in the country and beyond.

From the submitted report on the fulfilment of the minimum national requirements, as well as from the other documents presented, I can conclude that the requirements for "Associate Professor" on all groups of indicators are satisfied.

5. Critical notes and recommendations.

I recommend the applicant to work on projects with national and international funding.

CONCLUSION

On the basis of the knowledge of the scientific papers submitted, their importance, the scientific and applied contributions contained therein, **I propose Principal Assistant PhD Neli Ananieva Arabadzhieva-Kalcheva** to take up the academic position "Associate Professor" in the professional field "5.3. Communication and computer equipment" in the specialty "Synthesis and analysis of algorithms".

Data: 19.08.2022   MEMBER OF THE JURY:

/Assoc. Prof. PhD I. Penev/