REVIEW

on competition for academic position "Professor" in the professional field "5.3 Communication and Computer Engineering", subject "Artificial Intelligence", announced for the needs of the Faculty of FITA, Department of "Computer Science and Technology", published in State Gazette 38 / 10.05 .2019.

with the candidate: Assoc. Prof. Dr. Todor Dimitrov Ganchev

Reviewer: Prof. Ph.D. Andon Dimitrov Lazarov

1. Background and biography

Associate Professor Todor Dimitrov Ganchev, PhD, holds the position of Deputy Rector for Scientific Activity of the Technical University of Varna. He headed the Research Laboratory "Applied Signal Processing and Analysis" at the Faculty of Computer Engineering and Automation. He has worked in the departments of Computer Science and Technology, Faculty of Computer Engineering and Automation, Electronic Engineering and Microelectronics, Faculty of Electronics, in the Laboratory of Cable Communications, Faculty of Electrical Engineering and Computer Technology, Patra University, Greece. He has been the lead and lead researcher in a number of international and national projects.

General description of the materials presented

In order to meet the minimum requirements for the academic position of "Professor" in the different groups of indicators ("C.4", "D.7" and "D.8"), the applicant submits a total of 50 publications, of which:

• 35 publications are in SCOPUS, covering metric requirements

"C.4 – Scientific promotion work - scientific publications (not less than 10) in publications that are referenced and indexed in world-renowned scientific information databases", "D.7 - Scientific publication in peer-reviewed publications and indexed in world-renowned databases of scientific information. "and

• 15 non-SCOPUS indexed publications, grouped by indicator

"D.8 - Scientific publication in non-refereed peer-reviewed journals.

Of the 50 entries submitted for the competition:

• 14 are scientific articles in journals, [B4.8; B4.9; B4.10; D7.3; D7.4; D7.5; D7.6; D7.9; D7.10; D8.1; D8.2; D8.4; D8.5; D8.15],

- of which 9 are indexed in SCOPUS, [B4.8; B4.9; B4.10; D7.3; D7.4; D7.5; D7.6; D7.9; D7.10],

- of which 7 have been published in Thomson Reuters impact factor magazines [B4.8; B4.9; B4.10; D7.3; D7.4; D7.5; D7.10], and

• 36 have been published in conference proceedings,

- of which 26 are indexed in SCOPUS, [B4.1-B4.7; B4.11-B4.13; D7.1; D7.2; D7.7; D7.8; D7.11-D7.22],

- 7 are in ISBN reports, [D8.3; D8.7; D8.8; D8.9; D8.11; D8.12; D8.13],

- 3 are in the Yearbook of TU-Varna with ISSN, [D8.6; D8.10; D8.14].

All publications are thematically related to the competition and are accepted for review with the exception of study aid tools, national and international projects submitted for the competition, as they have undergone a review procedure. In accordance with the data of the National Center for Information and Documentation (NACID), the science-metric indicators of the published scientific production and project activity of Assoc. Prof. T.D. Ganchev repeatedly exceed the minimum requirements for acquiring an academic position of "professor".

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

Thematically scientific reports are grouped in three scientific fields: Analysis and synthesis of signals from biological and physiological measurements; Construction of a machine-human interface and evaluation of emotional state; Acoustic pattern recognition tools.

Analysis and synthesis of signals from biological and physiological measurements

A critical review of existing methods for modeling the reliability of phonetics and representation in [G7.6]. Perform comparative analysis of ten model methods, perform: decision tree, linear regression, memorization training algorithms. The hypothesis for using speech signal descriptor generation to achieve models of model performance in spontaneous speech is defined in [D7.5].

Markov's hidden screen models have developed a method for automatic segmentation of speech in order to determine the boundaries of the model to reset the creation of a speech synthesis system [D7.13]. An original method for such precision in segmenting speech signals to tones is presented in [G7.9]. A hybrid architecture has been proposed for automatically aligning speech signals corresponding to tone imports without known background boundaries [G7.18].

Methods for extracting descriptors for machine speech distribution - ODWPFs overlapping functions - Overlapping descriptors are used for packets [G7.20], [D7.22], what are the methods for a given level of speech the economy of photography, currently integrating predictions into a group of heterogeneous models, such as regression with reference vectors [G7.11]. [D7.12] uses a database of rewrites responsible for creating statistical parametric systems for speech synthesis. The applicability of statistical descriptors of EEG signals to detect negative emotional states has been examined in [D8.2]. A comparative analysis of different methods for calculating speech descriptors in order to assess their suitability for improving the accuracy of automatic speech recognition in modern dialogue systems is presented in [D8.5].

Qualitative modeling of phoneme duration is a prerequisite for synthesizing emotional speech with natural sound. Modeling and predicting the duration of phonemes by Support Vector Regression SVR in the context of emotional speech and evaluating performance is made in [D8.15] - an original authorial approach in speech recognition theory and practice.

Building a machine-human interface and assessing emotional state

Modular mobile real-time stress assessment system with intelligent wireless sensors and data processing system, concept of multi-modal and multi-sensory database for monitoring and evaluation of human behavior in unlimited indoor and outdoor environments, as well and a system for checking speakers, regardless of the linguistic content of speech, are presented in [D7.2], [D7.3], [D7.16]. A method using a hierarchical structure to model the parameters of the human voice, in accordance with the universal acoustic model and speaker identification system with a growing number of clients is proposed in [D7.17].

Speech exchange for noise effects, speech recognition in conditions of physical and cognitive stress, speech recognition in voice control systems combined with the concept of human-machine interface are examined in [D7.7], [D7.10] [D7. 14] [D7.15]. Structure and contents of a database of audio recordings for acoustic evaluation of public spaces An original idea for determining the height of unknown speakers for evaluating the characteristics of their voice in spontaneous speech is proposed in [D7.19].

Descriptors for the recognition of emotions by EEG assessment of brain activity, as well as the detection of disorders associated with periodic movement of the limbs on the recording of EEG signals are examined in [D8.6]. The possibility of recognizing thought commands by evaluating the short-term energy variations of EEG signals in the development of thought management interfaces for objects has been investigated [D8.8]. The effectiveness of statistical descriptors of EEG signals in the detection of epileptic seizures B was evaluated [D8.9]. The results of the experimental evaluation of EEG signal descriptors calculated in the time domain are presented in [D8.11].

Studies of statistical descriptors of EEG signals in recognition of negative emotional states are presented in [D8.12]. Recognition of four types of negative emotional states from spoken speech: "hot anger", "cool anger", "contempt", "disgust", as well as neutral emotional state through descriptors of EEG signals is examined in [D8.13]. [D7.8] outlines the general architecture of the PlayMancer platform, designed to create serious computer-based therapy rehabilitation games using biological feedback and an extended multi-modal user interface.

Acoustic pattern recognition tools

The hardware FPGA implementation of a locally recurrent layer of probabilistic neural network (LRPNN) and the results of its performance test are presented in [D7.1]. Structures and algorithms of neural networks used for speech recognition are offered. [D7.21] presents a probabilistic model for notating parts of speech in natural language texts through a B-PNN hybrid classifier combining a Bayesian network and a probability neural network. Modification of a locally recurrent probabilistic neural network (LRPNN), in which neurons in the locally recurrent layer are realized with an activating function by the ReLU family, is proposed in [D8.1]. Evolutionary methods for training a probabilistic neural network with optimal classification accuracy, computational complexity, memory volume and population size of elemental agents [D8.3].

Modified LRPNNs that utilize ReLU, Leaky ReLU, and Clipped ReLU neurons in the locally recurrent layer activating hardware-enabled features, as well as hardware-based PNN implementation with Altera Cyclone IV for the classification of binary images designed to detect heart disease are presented in [D8.7] and [D8.10]. Предложени са резултати от изследване на влиянието на точността на апроксимация на активираща експоненциална функция на невроните върху точността при класификация на изображения [Г8.14].

Project activity

Assoc. Prof. T.D. Ganchev presents a list of 5 international projects, 2 national projects and 4 projects funded by TU - Varna. He provided funding for 3 projects developed by TU-Varna team. The applicant's project activity reveals his research capacity and ability to lead to the realization and implementation of the research results.

4. Assessment of the candidate's pedagogical preparation and activity

Assoc. Prof. T.D. Ganchev has extensive academic experience as a teacher and researcher at national and international universities. He skillfully combines research project, teaching and pedagogical activities as a teacher and administrative manager. A considerable part of his publications have been co-authored with other authors, which indicates that he is skilled in team work, an important quality for the academic position of professor**.**

For the period 2016 - 2019 Assoc. Ganchev presents evidence of his workload, which includes 444 hours of lectures in the following disciplines:

• "Artificial Intelligence", studied in the 8th semester of Bachelor's Degree program by students in the specialties "SIT" and "CST", "E" BME ", "Microprocessor Systems ", studied in the 6th semester of Bachelor Degree in Bachelor of Science in CST".

Together with other authors, a learning tool has been developed: E. Bekov, T. Ganchev, O. Stanchev. "RES Monitoring and Information Systems", E-Learning project TU-Varna, ISBN 978-954-20-0692-3, Technical University-Varna, 2014.

He is the supervisor of five doctoral students, two of whom successfully defended their doctoral theses.

3. Basic scientific and applied scientific contributions

Scientific contributions:

A system of methods and tools for building high-functional intelligent human-machine interfaces has been developed, which includes:

3.1. Methods for retrieving biometric, linguistic and para-linguistic information [D7.3; D7.7; D7.14; D7.16; D7.17; D7.20; D7.21; D7.22; D8.4; D8.5; D8.13].

3.2. Methods for recognizing stress and negative emotional states from physiological signals, [D7.2; D8.2; D8.6; D8.9; D8.11; D8.12; D8.15].

3.3. Methods for improving the quality of speech synthesized, [D7.5; D7.6; D7.9; D7.11; D7.12; D7.13; D7.18].

Scientific and applied contributions:

The following are implemented:

3.4. Classifiers based on local recurrent probabilistic neural networks for the evaluation of biological and physiological measurement data [D7.1; D8.1; D8.3; D8.7; D8.10; D8.14].

3.5. Intelligent human-machine interfaces with high noise immunity, [D7.4; D7.8; D7.10; D7.15; D7.19; D8.8].

The works in Sections D.7 and D.8 can be interpreted as creating new classifications, methods, constructs, technologies and obtaining confirmatory facts in the theory and practice of recognizing and interpreting biological measurement data. To cover the minimum requirements for a group of indicators in category "B", Assoc. Prof. T.D. Ganchev submits thirteen publications (239 NACID points). These publications, equivalent to habilitation work, are thematically grouped as "Methods for the Evaluation of Emotional Conditions by Biological Measurements in Machine-Human Interaction" and are in publications referenced and indexed in world-renowned databases of scientific information. The following scientific and applied scientific contributions should be indicated here:

Scientific contributions:

Developed:

1. New technological methods for recognition of the basic types of human emotions, detection of negative emotional states and detection of stress states by voice or by physiological signals (EEG electro-encephalogram, ECG electrocardiogram, ST and GSR - measurements of temperature and surface galvanic resistance). skin), [B4.1; B4.2; B4.3; B4.4; B4.6; B4.7; B4.11; B4.13].

2. New methods and modification of existing methods for recognizing and interpreting emotional speech in conditions of intense physical and cognitive stress, [B4.8; B4.9; B4.12],

Scientific and applied contributions:

Developed:

1. Adaptive multi-modal voice-based dialogue systems that synchronize the dialogue with the end user in the detection of negative emotional states or stressful states [B4.9; B4.10; B4.12; B4.13].

2. Methods and systems for the integrated assessment of emotional states from biological measurement data, [B4.9; B4.10; B4.12].

3. Integrated multi-parameter databases of synchronized records of biological EEG, ECG, ST, GSR measurements under intense external noise conditions [B4.5; B4.8].

The high scientific and applied value of the works of the B.4 group is confirmed by the fact that they have been published in Impact Factor (Thomson Reuters) journals indexed in SCOPUS [B4.8;

B4.9; B4.10] and in proceedings of conferences and symposia indexed in SCOPUS [B4.1; B4.2; B4.3; B4.4; B4.5; B4.6; B4.7; B4.11; B4.12; B4.13].

Scientific contributions to works equivalent to monographic work can be regarded as proving with new means the essential new sides of pre-existing scientific fields, problems, theories, hypotheses, as well as creating new classifications, methods, constructs, technologies and obtaining confirmatory facts in the theory and practice of recognizing and interpreting biological measurement data. The scientific and applied value of the contributions to the works of Assoc. Prof. T.D. Ganchev is confirmed by the high number of citations to his publications. Evidence for 152 citations is provided. The large number of research projects thematically related to his research reveals the author's potential to further develop his research activity to the level of implementation.

Although the dominant part of the work is co-authored, the author undoubtedly has a significant share in the contributions, which can be considered as contributions - the personal work of the applicant. The scientific and applied value of the contributions to the works of Assoc. Prof. T.D. Ganchev is confirmed by the high number of citations to his publications. Evidence for 152 citations is provided. The large number of research projects thematically related to his research reveals the author's potential to further develop his research activity to the level of implementation. Although the dominant part of the work is co-authored, the author undoubtedly has a significant part in the contributions, which can be considered as a contributory work of the candidate.

6. Significance of contributions to science and practice

The importance of the contributions from the applicant's scientific output is confirmed by the large number of citations to his publications, as well as by the significant number of international and national projects in which he participates as a lead or lead researcher. This confirms the recognition of the candidate among the scientific circles in Bulgaria and abroad.

The presented evidence and the reference to the scientific-metric indicators in the NACID, which is widely available, shows that the scientific production of Assoc. Prof. T.D. Ganchev covers the quantitative indicators of the criteria and has repeatedly exceeded the minimum requirements for occupying an academic position of "professor".

7. Critical notes and recommendations

The applicant may be advised to direct candidate’s efforts to increase the number of development of teaching and teaching aids necessary for his teaching activity.

8. The personal impressions and opinion of the reviewer

Assoc. Prof. T.D. Ganchev is a highly eroded researcher with extensive academic experience, distinguished by high quality research and impressive volume and quality of scientific publications and projects. Undoubtedly, he has all the qualities to occupy the academic position of "professor".

CONCLUSION

Scientific papers of high scientific and applied value, as evidenced by the high Impact Factor of the scientific journals and the authority of the scientific forums where they were reported, as well

as the results of national and international projects in which the applicant participated, are presented for review. Undoubtedly, sufficient scientific, scientific and applied contributions have been received. Proof of which is the high national science-metric indicator - 3073.3. On the basis of acquaintance with the presented scientific works, their importance, the scientific, applied and applied contributions contained therein, I find it reasonable to propose Assoc. Prof. Dr. Todor Dimitrov Ganchev to take the academic position of "Professor" in the professional field 5.3 Communication and Computer Engineering.

27.08.2019 Reviewer:…….

(Prof. Dr.Sc. A.D. Lazarov)