OPINION

By Assoc. Prof. Dr. Boris Ivanov Evstatiev,

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On a dissertation thesis for obtaining the educational and scientific degree **"Doctor"** in professional field 5.3 "Communication and computer engineering", scientific specialty "Communication networks and systems".
Author of the dissertation: **mag. eng. Dionisia Antimos Daskalaki.**
Topic of the dissertation: **Detection and analysis through communication channels of the physical characteristics of metals by using of ultrasonic sensors**.

1. General description of the dissertation and the materials attached to it

The presented dissertation includes a list of used notations, introduction, exposition in four chapters, conclusion, contributions, list of publications and list of used literature, in a total volume of 153 pages.

2. Relevance of the problem

The topic of the dissertation is related to data processing and machine learning, aimed at sensory measurements and data traffic in communication channels. The influence of a number of interferences and noises on the readings of the sensors is considered, with a focus on the strain gages of the primary transducers. Modeling is also performed in order to predict the traffic of sensor data. Given the modern development of information and communication technologies, sensor technologies, wireless sensor networks, the Internet of Things (IoT) and cloud technologies, the collection, transmission and storage of accurate sensor data is particularly relevant.

3. Degree of knowledge of the state of the problem

The PhD student shows very good knowledge in the field of sensors, technologies for the implementation of sensor networks and the application of machine learning. The realized literature review includes 132 sources, of which 130 in English and 2 in Bulgarian.

4. Approach and solution to the problem

The methodology of the dissertation follows the following sequence: analysis of the main sensory technologies and the problems related to them; analysis of some methods of machine learning and the possibilities for their application in the considered issues; development and selection of models for recognition of digital signals with noise; development of models for forecasting force effects on metals based on sensory readings; development of models for forecasting the load of traffic on server stations.

The modeling is realized on the basis of several types of methods and tools: Levenberg-Marquardt and Scaled Conjugate Gradient training algorithms; several types of neural networks with forward signal propagation - Generalized Regression Neural Networks, Feed-Forward Neural Network and Cascade Forward Neural Networks; Markov chains. The analysis and data processing is realized with several software tools: LabView, Statistica and Matlab.

5. Main contributions

I accept the scientific-applied and applied contributions presented by the PhD student in the dissertation and consider them as relevant and significant. The scientific-applied contributions are expressed in the developed and selected models for identification of disturbing impacts and forecasting of the capacity of the service traffic, the created neural networks with different training algorithms for quantitative identification and forecasting of forces on metals; synthesized models for traffic forecasting in simulated information and communication units. The applied contributions include the system for studying the characteristics of strain gage sensors, as well as the obtained regression

and polynomial models. These contributions are of great importance for science and practice and can be attributed to the following groups: enrichment, specification and refinement of existing scientific knowledge; creation of new research methods; application of existing methods for solving a specific problem.

6. Publications on the topic of the dissertation and personal contribution of the author

The publications on the dissertation are 6, three of which in Scopus indexed journals or conferences, and another three - at conferences in Bulgaria. The article in a foreign magazine has an SJR rank. In one of the publications the PhD student is the only author, and the others are co-authored with three other authors, including the research supervisor. I do not know the doctoral student personally, but from what has been said so far, I believe that the results obtained in the dissertation are her personal contribution.

7. Critical notes and recommendations on the dissertation

I have the following critical notes, recommendations and questions for the dissertation:

1. It is good to give units of measurement (where applicable) in the "List of symbols and abbreviations".

2. The term "ultrasonic sensors" is used in the title, but it is not mentioned anywhere in the text of the dissertation.

3. Some figures and tables are in English and should be in Bulgarian.

4. There are a number of spelling mistakes in the dissertation. It is good to do a proofread.

5. Why are Levenberg-Marquardt and Scaled Conjugate Gradient algorithms used? Are there other algorithms that could be applied in this case?

6. What does the x-axis in fig. 3.19 mean (Samples 1 to 7)?

7. In order to improve the perception of the dissertation by a casual reader, I recommend to describe in a suitable place in it the connection between the results of the different chapters.

8. Has the efficiency/accuracy of the Chapter 4 models (for traffic load forecasting) been compared with other existing models?

8. Conclusion

The critical remarks and recommendations made do not decrease the contribution of the author. The formulated notes and recommendations aim to improve the future work of the PhD student Dionysia Daskalaki.

The presented dissertation meets all requirements of the Law for the development of the academic staff in the Republic of Bulgaria and the Regulations for its implementation. **I give a positive assessment of the dissertation and suggest mag. eng. Dionisia Antimos Daskalaki to be awarded the educational and scientific degree "Doctor"** in the scientific specialty "Communication Networks and Systems", professional field 5.3. "Communication and computer technology", field of higher education 5 "Technical sciences".

13.06.2022   Member of the scientific jury: ……/signature/………

/Assoc. Prof. Dr. B. Evstatiev/