OPINION

by Prof. Desislava Ivanova Paneva-Marinova, PhD
Institute of Mathematics and Informatics, Bulgarian Academy of Sciences

on the Dissertation for awarding educational and scientific degree "**doctor**" (PhD),

in the Area of Higher Education 4. Natural Sciences, Mathematics and Informatics,

Professional Field 4.6. Informatics and Computer Sciences

PhD Program „Informatics"

Author: Emiliano Maksim Mankolli

Topic: Optimization methods for machine learning applications

Scientific supervisor: Prof. Vassil Guliashki, PhD, Institute of Information and Communication Technologies, Bulgarian Academy of Sciences.

1. General presentation of the procedure and the PhD student

In accordance with Order № 319 from 06.12.2023 of the Director of the Institute of Information and Communication Technologies, Bulgarian Academy of Sciences (IICT-BAS) I have been appointed as a member of the Scientific Jury to provide the procedure for the defense of a dissertation titled "Optimization methods for machine learning applications" Emiliano Maksim Mankolli for awarding the educational and scientific degree "doctor" in the Area of Higher Education 4. Natural Sciences, Mathematics and Informatics, the Professional Field 4.6. Informatics and Computer Sciences of the PhD Program "Informatics". The author is a PhD student at the Department "Information Processes and Decision Support Systems" at IICT-BAS, with scientific supervisor Prof. Vassil Guliashki, PhD, IICT-BAS.

The presented Opinion is made in accordance with the Act for the Development of the Academic Staff in the Republic of Bulgaria, the Rules for its implementation and the Rules on the Specific Conditions for Acquiring Science Degrees and Holding Academic Positions in IICT-BAS.

The presented by Emiliano Maksim Mankolli set of materials is in accordance with Article 6 (1) of the Rules on the Specific Conditions for Acquiring Science Degrees and Holding Academic Positions in IICT-BAS.

2. Relevance of the topic

This dissertation presents research results on creating optimization methods and models for machine learning applications. In particular, the goal is to provide a state-of-the-art recruitment tools based on machine learning and natural language processing. They will provide HR profes-

sionals with new algorithms to optimize job candidate screening, advanced recruitment, and a streamlined initial filtering process, while maintaining computational efficiency and algorithmic simplicity. The development is highly relevant to the current dynamic job market and is of great scientific and applied interest.

3. Knowledge of the problem

The realization of the dissertation goal requires in-depth theoretical knowledge and practical skills. It is evident from the dissertation and the materials presented that the PhD student has a solid theoretical background and extensive insight into modern technologies required to achieve the research objectives. He demonstrates good knowledge of the research object and performs clearly formulated the tasks leading to specific results. The research is presented competently and with well-founded analyses and inferences.

4. Characteristics and evaluation of the dissertation and contributions

The dissertation of Emiliano Maksim Mankolli contains 128 pages, presented by a table of contents, a dissertation structure, key words, a glossary of terms and abbreviations used in the dissertation, an introduction, three chapters, a conclusion - summary of results, contributions, list of author's publications on the dissertation topic, declaration of originality, list of figures, list of tables, bibliography of 131 literature sources in English.

The aim and objectives of the dissertation are presented in the **"Structure of the dissertation" section** and at the end of **Chapter 1**, a natural conclusion of the state-of-the-art review on the problem.

The **Introduction** and **Chapter 1** provide an overview of the current state-of-the-art and recent advances in machine learning and natural language processing techniques, highlighting the most innovative developments in the field and the most effective methods of relevance to the in-domain recruitment industry. Optimization problems of these methods are discussed and an optimization of their objective functions is proposed to improve their efficiency and applicability.

Chapter 2 presents hybrid algorithms to reduce the number of candidates based on the position axis and industry relevance. The goal is to rationalize the set of candidates by optimizing the accuracy and efficiency in job similarity.

Chapter 3 presents a job success prediction model that integrates both quantitative and textual data. The main focus is the optimization of the candidate selection strategy.

In the **Conclusion** relevant summaries are made on the problems raised, the results obtained and directions for future development.

The dissertation is thoroughly developed. The problem area is competently and critically analyzed. The presentation of the developed models, algorithms and methods is detailed, well-argued and appropriately illustrated.

5. Assessment of publications and personal contribution of the PhD student. Remarks

The author's list of publications on the subject of the dissertation includes 5 titles, 4 of which are currently indexed in Scopus. All publications are in proceedings of international and national conferences. One publication is in a scientific edition with SJR - Communications in Computer and Information Science. All publications are in English. In 4 publications Emiliano Mankolli is the first author. In 4 from 5 publications are co-authored.

Having read the dissertation and the submitted materials, I believe that the formulated applied results are the personal work of the PhD student. There is no doubt that the PhD student is the real author in his publications as he is first author in most of his publications.

I have no critical remarks.

6. Abstract

The abstract is 39 pages long and correctly reflects the structure of the dissertation, the results obtained and the conclusions drawn from the study. The requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria, the Rules for its implementation and the Rules on the Specific Conditions for Acquiring Science Degrees and Holding Academic Positions in IICT-BAS have been met.

7. Recommendations for future use of the dissertation contributions and results

The topic and results provide certain opportunities for development and new applications. I recommend of Emiliano Maksim Mankolli to continue his research and expand their popularization.

CONCLUSIONS

The dissertation ***contains scientific and applied results, which represent an original contribution to science*** and ***meet all the requirements*** of the Law for the Development of Academic Staff in the Republic of Bulgaria, the Rules for its Implementation and the Rules on the Specific Conditions for Acquiring Science Degrees and Holding Academic Positions in IICT-BAS.

The dissertation shows that the PhD student Emiliano Maksim Mankolli **possesses** in-depth theoretical knowledge and professional skills in the scientific specialty "Informatics", **demonstrating** qualities and skills for independent scientific research.

Due to the above, I confidently give my ***positive evaluation*** for the conducted research, presented in the dissertation, abstract, achieved results and contributions, and ***I propose the honorable Scientific jury to award educational and scientific degree "doctor"*** to Emiliano Maksim Mankolli

in the Area of Higher Education 4. Natural Sciences, Mathematics and Informatics, Professional Field 4.6. Informatics and Computer Sciences, PhD Program "Informatics".

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07.02.2024 **Scientific jury men**

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