REVIEW

by prof. Dr. Radoslav Yoshinov

of a dissertation for awarding the educational and scientific degree “Doctor”

in field of higher education 4. Natural sciences, mathematics and informatics

professional field 4.6. Informatics and Computer Science

doctoral program “Informatics”

Author: Miroslav Trendafilov Trankov

Topic: “Application of Machine Learning Methods in Textile Fiber Production”

Scientific supervisors: Prof. Emil Nikolov Hadzhikolev, PhD and Assoc. Prof. Silvia Nikolaeva Gaftandzhieva, PhD– University of Plovdiv “Paisii Hilendarski”

1. General presentation of the procedure

By order No. RD-22-771/27.03.2025 of the Rector of the University of Plovdiv Paisii Hilendarski I have been appointed as a member of the scientific jury to ensure a procedure for the defence of dissertation work on the topic “Application of Machine Learning Methods in Textile Fiber Production” for the acquisition of the educational and scientific degree Doctor in the field of higher education 4. Natural sciences, mathematics and informatics, professional field 4.6. Informatics and Computer Science, Doctoral Program “Informatics”. The author of the dissertation is Miroslav Trendafilov Trankov - a full-time PhD student at the Department of Computer Informatics, supervised by Prof. Emil Hadzhikolev, PhD and Assoc. Prof. Silvia Gaftandzhieva, PhD from PU.

The set of materials presented by Miroslav Trankov is under Article 36 (1) of the Regulations for the Development of the Academic Staff of the PU and includes the following documents:

– a request to the Rector of the PU to disclose the procedure for the defence of a dissertation work;

– curriculum vitae in European format;

– protocol from the departmental council for the preliminary discussion of the dissertation work and opinion from the scientific supervisors regarding readiness for preliminary discussion;

– abstract in English and Bulgarian;

– declaration of originality and authenticity of the attached documents;

– certificate of compliance with the minimum national requirements;

– list of publications;

– dissertation work;

– copies of the publications on the topic of the dissertation work.

2. Short biography of the PhD student

In 2018, PhD student Miroslav Trankov obtained the Master's degree at PU in Software Technologies. In 2019, he was enrolled as a full-time doctoral student at the Department of Computer Informatics at the Faculty of Mathematics and Informatics in PU.

The PhD student has professional experience as a data administrator a data processing expert.

3. Actuality of the dissertation

In the context of the Internet of Everything (IoT) paradigm, involving people, data, things and processes, a radical change is needed through the optimization of management processes in all areas. Automation of quality management is a key priority for manufacturers, aiming to optimize processes and minimize losses. Management systems must be continuously developed to cope with the complexity of production processes, changes and to support management decision-making. In the textile industry, for example, technological advances improve the efficiency of the production process, but due to unforeseen events and the need to optimize processes, often the governing bodies in factories face challenges in managing the quality and productivity of machines.

I positively evaluate the topics and the research done in the dissertation.

4. Degree of knowledge of the state of the problem and general characteristics of the work

In the dissertation, an overview analysis of methods and tools for management, automation and optimization of the process for the production of textile fibers is carried out.

The dissertation is structured in an introduction, 4 chapters, contributions, a list of publications made, literature used.

In the introduction , the objectives and tasks of the dissertation are formulated as follows:

The purpose of the dissertation is to design and develop a prototype of a software system for automating production planning using machine learning methods.

To achieve this goal, four tasks have been formulated:

Task 1: Review of research in the field;

Task 2: Design of a software system for planning and optimization of textile fiber production;

Tasks 3: Development of a software prototype of a system for planning and optimization of textile fiber production;

Task 4: Conducting experiments and improving the system.

Chapter One reviews the research in the field and presents a study of the main stages of the textile production process, classical and modern approaches to the organization and optimization of production and quality control.

Chapter Two is the design of a software system for managing the production process in a textile fiber factory, taking into account the technological process, functional and non-functional requirements, identification of the main activities in the production of textile fibers. It also shows where it is appropriate to apply artificial intelligence methods to be improved through machine learning in the production of textile fibers.

In Chapter Three, a software implementation of an application is developed, integrating 4 key functions in the production process of a textile fiber factory - Production control, Production Organization, Statistics and Maintenance of Machines. Process of Textile Fiber Factory presented a multi-component information model for successful transformation of the educational process, as well as the toolkit of the teacher innovator.

Chapter Four describes an experiment with the implemented system conducted by four groups of employees: production operators who control the machines and respond to daily problems; production planning specialists responsible for planning and optimization; quality managers monitoring quality and efficiency; and maintenance administrators responsible for equipment maintenance. The implementation was made in "Südvole Group Italia – Bulsafil KCHT EAD branch" for planning the production of worsted yarns.

The Conclusion provides a summary of the results of the development. The main contributions of the dissertation are given.

Guidelines for future research and development have been set. A list of scientific publications on the topic and noticed citations are presented.

In the bibliography of the dissertation, 181 literary sources are cited: books, scientific articles and Internet publications. Based on the overview analysis, the PhD student formulates the purpose and tasks of the dissertation.

The dissertation is presented in 164 pages and contains 52 figures and 11 tables. It includes an introduction, 4 chapters, a conclusion, 1 appendix, a list of scientific and applied contributions, a list of figures in the text, a glossary of terminology, a declaration of originality, a list of used literature from 181 literary sources and a list of 4 publications of the author (2 of which are independent) related to the presented dissertation and one noted citation.

This proves that the PhD student has in-depth knowledge of the research carried out.

5. Correspondence of the proposed research methodology and the goals and objectives of the dissertation

The object of the dissertation research is the performance of an overview analysis of methods and tools for management, automation and optimization of the process for the production of textile fibers.

The purpose of the dissertation is to design and develop a prototype of a software system for automating production planning using machine learning methods.

For the study of this goal, the PhD student has formulated four tasks through the solution of which to achieve the set goal.

The development has interesting summaries and directions for future development.

The methodology of scientific research is based on research methods - theoretical, sociological and methods of modeling and implementation of models in a real production environment.

The chosen methods correspond to the main goal and tasks set by the PhD student.

6. Characterization of the nature and assessment of the credibility of the material on which the contributions of the dissertation are built

The methods and models that are created and used correspond to the target task. For some, statistical results of their implementation have been obtained, while for others, solutions concepts have been presented and guidelines for future research have been given.

I have not noticed any errors in either the concrete or the conceptual models. I also find that the proposed strategies are well founded.

7. Contributions of the dissertation

The contributions are described in the **chapter Conclusion.**

The more significant results obtained in the dissertation are summarized in author's claims for two applied scientific and three applied contributions:

The author's claims for applied scientific contributions are:

NP1. Proposed architecture of a software system for managing the production process in a textile fiber factory;

NP2. Realized software prototype of a software system for managing the production process in a factory for the production of textile fibers.

The author's claims for applied contributions are:

P1. Implementation of the developed prototype of a software system in the company Südvole Group Italy – branch of Bulsafil KCHT EAD

P2. Conducted experiments to test the developed modules of the system;

P3. Experiments were carried out for automated generation of reports and sending notifications.

The reviewer accepts applied scientific contributions (NP1, NP2,).

The reviewer accepts the applied contributions (P1, P2, P3).

The reviewer accepts the contributions described in this way, recommending the PhD student to learn to present his achievements more briefly.

8. **Degree of personal participation of the dissertation in the contributions**

The personal participation of the PhD student is judged by the publication activity of the PhD student, reflected in the materials published on the dissertation. The PhD student convincingly presents the results achieved, with very good and in-depth argumentation, as well as uses a professional graphic layout of the materials.

The nature of the research implies a very good and broad training in the field of innovative methods and applications in the design and development of a prototype software system for automating production planning using machine learning methods.

I believe that the PhD student has done a successful job, and I do not question his personal participation in the development of the dissertation material.

9. **Evaluation of the publications on the dissertation**

On the topic of the dissertation, 4 publications have been made, of which 2 are independent. Two are in Bulgarian in scientific works of the Union of Scientists in Bulgaria and two are in English in prestigious international conferences and journals. One citation was also noticed

The reviewer reports the high publication activity on the topic of the dissertation, covering the period 2021-2024, as well as the large number of independent publications.

The publications reflect the more significant results achieved in the dissertation. They have been reported at reputable scientific forums, which I consider to be approbation in scientific circles.

10. **Compliance of the abstract with the requirements for its preparation and adequacy of reflecting the main provisions and contributions of the dissertation**

The presented draft abstract is in accordance with the rules for the preparation of abstracts on dissertations, listed on the website of the University of Plovdiv "Paisii Hilendarski". It reflects the results achieved, as well as the contributions of the author. Graphically, it is very well formatted and includes the necessary information describing the dissertation in summary.

11. **Opinions, recommendations and notes**

The dissertation develops a complex, dynamically developing and promising area – analysis of methods and tools for management, automation and optimization of the process for the production of textile fibers. Designed and developed a prototype software system for automating production planning using machine learning methods.

The role of the labor market and globalization for the dynamic development of these processes is taken into account. This presupposes sufficiently in-depth knowledge, the ability to interpret and formulate strategies for effective development of the field. Content and graphic, the material is developed very well. I recommend the PhD student to continue his active publication activity in scientific journals with an impact factor.

A major remark is the lack of numbering of the literature used, which makes it difficult to index it in the text. I recommend a shorter verbalization by the PhD student of his achievements - to learn to clearly and concisely present his achievements.

I have reflected some non-essential remarks on the copy that was provided to me.

CONCLUSION

The content and contributions of the dissertation of M.SC.MIROSLAV TRENDAFILOV TRANKOV fully covers the requirements of the Law on the Development of the Academic Staff of the Republic of Bulgaria, the Regulations for its implementation and the Regulations on the terms and conditions for acquiring scientific degrees at the University of Plovdiv "Paisii Hilendarski". A significant amount of research work has been carried out. He has a sufficient number of applied scientific, and applied contributions. A sufficient number of

publications on the dissertation published on prestigious scientific forums are presented. The educational minimum for doctoral students, set out in the individual plan, is covered. Undoubtedly, is the personal participation of the PhD student in the development and the contributions received.

This gives me reason to confidently give my positive assessment and recommend to the Honorable Scientific Jury to award to **M.SC. MIROSLAV TRENDAFILOV TRANKOV** the educational and scientific degree **"Doctor"** in the professional field 4.6 "Informatics and Computer Science", specialty "Informatics"

REVIEWER:

/Prof. Dr. R. Yoshinov/

Sofia, 29 April 2025