

OPINION

by Assoc. Prof. Diana Velkova Stoyanova, PhD – Plovdiv University

„Paisii Hilendarski”

on the doctoral thesis for acquiring the educational and scientific degree "Doctor"

in: field of higher education 5. Technical Sciences

professional area 5.3. Communication and Computer Engineering

doctoral program "Automation of areas of the non-material sphere (medicine, education, science, administrative activity, etc.)"

Author: Anna Ilieva Bekyarova-Tokmakova

Topic: Technology-based solutions for process management in telecommunications

Supervisor: Prof. Nevena Stoyanova Mileva, PhD- Plovdiv University „Paisii Hilendarski”

1. General presentation of the procedure and the doctoral student

Based on the order of the Rector of Plovdiv University “Paisii Hilendarski” № ПД-22-92 from 17.01.2025, I have been appointed as a member of the scientific jury to ensure the procedure for defending the doctoral thesis on the topic "Technology-based solutions for process management in telecommunications" for the acquisition of the educational and scientific degree "Doctor" in the field of higher education 5. Technical Sciences, professional area 5.3. Communication and Computer Engineering, doctoral program "Automation of areas of the non-material sphere (medicine, education, science, administrative activity, etc.)". The author of the dissertation is Anna Ilieva Bekyarova-Tokmakova – a full-time doctoral student at the Department of ECIT (Electronics, Communications, and Information Technologies) with a supervisor Prof. Nevena Stoyanova Mileva, PhD, from PU "Paisii Hilendarski".

The set of materials presented by the doctoral student complies with Article 36 (1) of the Regulations for the Development of the Academic Staff of PU and includes the following documents:

- Application to the Rector of PU to initiate the procedure for defending the doctoral thesis;
- CV in European format;

- Minutes of the Department Council related to the readiness for initiating the procedure and the preliminary discussion of the doctoral thesis;
- Opinion from the supervisor;
- Doctoral thesis;
- Author`s Summary in Bulgarian and English language;
- List and copies of the scientific publications on the topic of the dissertation -8 publications;
- A reference to compliance with the minimum national requirements;
- Declaration of the originality and authenticity of the attached documents.

In 1995, Anna Ilieva Bekyarova-Tokmakova graduated from Paisii Hilendarski University of Plovdiv with a Master's Degree in Biological Sciences, and in 2002, she obtained a second Master's Degree in Economics again at the same university. Her professional experience includes many years as a manager in one of the leading telecommunication companies in Bulgaria. From 2013 to 2020, she held the position of Regional Manager of Corporate Sales at A1 Bulgaria EAD. From 2021 until now, she has worked as an assistant professor at the Faculty of Physics and Technology, at Paisii Hilendarski University of Plovdiv, Department of ECIT. Since 2022, she has been Head of the Research Department at Plovdiv University.

I know Anna Ilieva Bekyarova-Tokmakova personally and have an excellent impression of her as a lecturer and researcher.

2. Relevance of the topic

This dissertation aims to design and develop a technology-based system using artificial intelligence and machine learning to predict and manage the customer retention process in telecommunication companies. The relevance of the research stems from the need for the telecommunications sector to meet the challenges of rapid technological progress, including increasing customer demands and dynamic service expansion. The sector significantly contributes to the country's economy, accounting for 2.07% of Bulgaria's GDP, further underlining its strategic importance. Integrating innovative technology solutions is critical to optimizing business processes and improving the competitiveness of companies in the sector.

3. Understanding the problem

The attached documentation reveals that Anna Ilieva Bekyarova-Tokmakova has many years of experience as a Regional Manager of Corporate Sales in a Bulgarian telecommunications company. This experience contributes significantly to the in-depth

consideration of the issues addressed in the thesis. The dissertation is a carefully developed and well-structured study demonstrating the doctoral candidate's in-depth knowledge of the issues.

The dissertation cites 132 sources, nearly half of which are from the last 10 years, suggesting a thorough analysis of the current state of the problem. Almost all publications are in English—128.

4. Research methodology

The chosen research methodology fully corresponds to the dissertation's topic and the goal and tasks set in it. It includes:

1. Description and systematization of existing technology-based solutions for process management in telecommunications.
2. Development of a technology-based system for managing the Business Customer Retention process in telecommunications, including the following stages: Consideration of the problem; Model, analysis, and proposal for the redesign of the Business Customer Retention process in telecommunications companies in Bulgaria; Design and development of a system for predicting business customer churn.
3. Conduct experiments and analyze the results obtained.

5. Characterization and evaluation of the dissertation and its contributions

The presented dissertation work has a substantial scientific and applied value. I can summarize the contributions described in the dissertation in the following scientific-applicative and applicative contributions:

1. A critical analysis of existing technological solutions for business process management in the telecommunications sector has been prepared, which provides a basis for a better understanding of current practices and innovations in the industry. A new classification of business processes in the telecommunications industry has been proposed, which systematizes the key aspects and the interrelationships between them, thus facilitating the identification of the main areas for improvement.
2. An analysis of the Business Customer Retention process has been carried out, which reveals the main factors influencing customer loyalty and retention. A new process design has been developed to optimize customer interaction and increase the effectiveness of retention strategies.
3. A method for data preprocessing is proposed, including the SMOTE method, and the increase in the prediction accuracy of the used machine learning models is experimentally proven.

4. An experimental comparative assessment of the efficiency and accuracy of predicting the two main classes — “churn” and “no-churn” of different machine learning models is made, including:

- Logistic Regression
- Naive Bayes
- Random Forest Classifier
- ADABOOST with Decision Tree
- Extra Trees Classifier
- Decision Tree
- Support Vector Machine
- ADABOOST and Support Vector Machine
- Linear Discriminant Analysis

As a result of the analysis, the most suitable algorithms for predicting customer churn have been identified.

5. A system that provides flexibility and efficiency in data processing and customer churn predictions has been designed.

6. A working prototype of the system has been developed and tested, demonstrating the applicability of the proposed solutions and concepts in a practical environment.

6. Evaluation of publications and the doctoral student's personal contribution

The doctoral student has presented a total of 3 publications related to the topic of the dissertation. Two have been published in issues indexed and referenced in the Scopus databases. One of the publications is independent, and the others are co-authored; she is in first place in both. This undoubtedly shows the significance of her contribution. Two citations have been noted.

Through the presented scientific publications, Anna Ilieva Bekyarova-Tokmakova has earned 53 points, exceeding the minimum requirement of 30. This gives me reason to conclude that the necessary publicity of the research in the dissertation has been ensured.

7. Author's summary

The Author's summary is presented in Bulgarian and English. It comprises 32 pages, including contributions and publications related to the dissertation. The Author's summary faithfully reflects the content of the dissertation in a shorter form.

8. Recommendations for Future Use of Dissertation Contributions and Results

I have no critical remarks about the content of the dissertation. The doctoral student has presented her research carefully and thoroughly, and the set goals and objectives have been successfully achieved.

CONCLUSION

The dissertation contains contributions of scientific-applied and applied nature, that represent an original contribution to science and meet all the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria, the Regulations for the Implementation of the Law on the Development of Academic Staff in the Republic of Bulgaria and the corresponding Regulations of Plovdiv University "Paisii Hilendarski".

The presented dissertation demonstrates that the doctoral student Anna Ilieva Bekyarova-Tokmakova possesses theoretical knowledge and professional skills in the scientific specialty "Automation of areas of the non-material sphere (medicine, education, science, administrative activity, etc.)", showing qualities and abilities for independent scientific research.

Due to the above, I confidently give my positive assessment of the conducted research, represented by the developed dissertation, author's summary, achieved results, and contributions, and I propose to the honourable scientific jury to award the educational and scientific degree "Doctor" to Anna Ilieva Bekyarova-Tokmakova in the field of higher education: 5. Technical Sciences, professional area 5.3. Communication and Computer Engineering, doctoral program "Automation of areas of the non-material sphere (medicine, education, science, administrative activity, etc.)".

24.02.2025 г.

Author of the opinion:

/Assoc. Prof . Diana Stoyanova/