

REVIEW

From: Prof. Magdalena Zlatkova Garvanova, PhD
University of Library Studies and Information Technologies
PF 4.6. "Informatics and Computer Sciences"

Subject: Dissertation for awarding an educational and scientific degree "Doctor"
in professional field 4.6. "Informatics and Computer Sciences", PhD program
"Informatics"

Grounds for submitting a review: participation in the scientific jury for the defense
of the dissertation according to Order No. 177/29.06.2026 of the Director of the
IICT-BAS.

Author of the dissertation:	Kristel Gjergj Vula
Topic of the dissertation:	Transformer-Based Detection and Epidemic- Model Analysis of Fake-News Dynamics on Social Networks
Supervisor of the PhD student:	Prof. Vassil Georgiev Guliashki, PhD

1. Information about PhD student

The PhD student Kristel Vula studied in the doctoral program "Informatics" at the IICT-BAS in the Department of Information Processes and Decision Support Systems. According to Order No. 138/29.05.2026 of the Director of the IICT-BAS, she was expelled with the right of defense.

2. General characteristics of the presented dissertation

At the first meeting of the scientific jury, held on 17.06.2026 in accordance with Order No. 155/10.06.2026 of the Director of the IICT-BAS, I was chosen to write a review and received the following documents in an electronic format:

- Dissertation in English;
- Abstract in English;
- Declaration of originality;
- List of publications, etc.

The submitted dissertation consists of 210 pages, including 47 figures and 111 tables. The bibliography contains 191 information sources, which demonstrates an extremely in-depth knowledge of the state of the problem under study.

The topic of the dissertation research is relevant and scientifically significant in the context of the modern information society. The spread of disinformation (“fake news”) on social networks poses a serious threat to public trust, economic stability, and public health. *The innovative approach* of the dissertation consists of combining two main areas: natural language processing for text classification through modern Transformer architectures and epidemiological mathematical modeling to predict time range and sharing dynamics.

The purpose of the study is to develop and evaluate an integrated scientific framework (called Transformer-ABC-Epidemic), which connects the detection of fake news at the text level (through modern language models of the Transformer type) with mathematical modeling of their distribution in social networks.

The structure of the dissertation is logically sound and consistent. The dissertation consists of an introduction, three chapters, a conclusion with guidelines for future research, contributions, a list of 5 publications on the topic, a declaration of originality and a bibliography.

The Introduction outlines the motives, significance, scope, scientific apparatus and hypotheses of the study.

Chapter I provides a detailed review of the literature and outlines the need to create an integrated framework. Terminological differences (misinformation, disinformation, rumors, etc.) are analyzed, as well as classical approaches with machine learning (SVM, Naive Bayes, Random Forest) as a basis for comparison.

In *Chapter II*, the hybrid framework “Transformer-ABC-Epidemic” is defined, and the content-to-cascade model is introduced. The research methodology as well as the selection of data sets, the construction of time cascades, the SIR and SEIZ models and the method of approximate Bayesian computation (ABC and ABC-SMC) for estimating the uncertainty of parameters without an analytical probability function are presented.

In *Chapter III*, the experimental results are analyzed. Various Transformer models were tested: BERT and RoBERTa for general classification, BigBird for long texts to avoid loss of information, as well as XLM-RoBERTa for low-resource languages (specifically Albanian). The second part compares epidemic models, proving that the more complex SEIZ model (including latent exposure states and skepticism) describes the real cascades much more accurately (e.g., COVID-19 data on Twitter/X and the “Three million votes” cascade in Hoaxy) compared to the baseline SIR model. Controlled scenarios are proposed for the early detection of fake news, as well as limiting their visibility.

The *Conclusion* summarizes the results and draws the main results.

3. Evaluation of the scientific and applied scientific results obtained

Kristel Vula’s dissertation is independent, logically structured and

methodologically sound scientific research with a clear practical orientation.

The goal has been achieved, the tasks have been realized, and the working hypothesis has been proven through the scientific results obtained. The author demonstrates very good theoretical training and skills in applying methods for extracting knowledge from data.

In view of the above, I consider that the dissertation meets the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria (ADASRB) and the Regulations for Application of the ADASRB (RAADASRB).

I have not noticed plagiarism in the publications and the dissertation under this procedure.

4. Evaluation of scientific and applied scientific contributions

The results of Kristel Vula's research enrich an existing scientific field with new knowledge.

I would summarize the contributions as:

An integrated framework (Content-to-Cascade) has been created, which successfully links the credibility assessment of the text from the Transformer model to the intensity of distribution on the network.

Successfully overcoming the limitations of long texts through the effective application of BigBird for long articles and research of Bulgarian-Albanian or specifically Albanian language models.

Diffusion modeling by SEIZ and ABC has been improved, confirming the advantages of accounting for "skepticism" and "waiting" in social network modeling, accompanied by Bayesian quantification of uncertainty (ABC-SMC).

Simulation models have been developed to assess the effect of platform governance policies (reduction of visibility and fast fact-checking).

5. Evaluation of dissertation publications

The PhD student Kristel Vula has verified parts of her dissertation in five scientific publications that fully cover the topic of the work.

Three of the publications are visible on Scopus, and one of them has the scientometric indicator SJR. These publications are sufficient to cover the minimum national requirements for a PhD degree in professional field 4.6. "Informatics and Computer Sciences".

6. Evaluation of the abstract

The presented abstract reliably reflects the structure and the content of the dissertation and corresponds to the requirements of the ADASRB and the RAADASRB.

7. Critical notes, recommendations, and questions

I allow myself to recommend Kristel Vula to continue working and publishing her results in publications, refereed and indexed in the world's leading databases with scientific information Scopus and WoS.

8. Conclusion

I believe that the presented dissertation meets the requirements of the ADASRB, the RAADASRB and the specific requirements of the IICT-BAS. The results achieved give me grounds to give *a positive assessment* with full conviction and I recommend to the esteemed scientific jury to award the educational and scientific degree "Doctor" to Kristel Vula in professional field 4.6. "Informatics and Computer Sciences".

30.07.2026

Sofia

