

OPINION

by Associate professor Boriana Vatchova Ph.D. at the Institute of Information and
Communication Technologies-BAS

Member of the Scientific Jury appointed by the Director of IICT-BAS

Order №177/29.06.2026

About: Dissertation thesis of Kristel Gjergj Vula entitled “Transformer -Based
Detection and Epidemic-Model Analysis of Fake-News Dynamics on Social
Networks” presented for acquisition of educational and scientific degree "Doctor"
in a doctoral program “Informatics”, professional field: 4.6. “Informatics and
Computer Science”

At the first meeting of the scientific jury, which took place on 30.06.2026, I was
appointed to prepare an opinion on the procedure, for which I received all necessary
documents submitted by the doctoral student.

ACTUALITY

The dissertation investigates a current and important problem related to fake news as a
combined phenomenon of content and distribution, rather than a task of text
classification alone. The analysis of the epidemic model of fake news dynamics on social
networks is extremely important because it enables the mathematical prediction,
tracking, and containment of disinformation using the same scientific methods that
govern the spread of real viruses and epidemics. Since fake news spreads through social
contacts (shares, likes, and comments), they follow patterns very similar to biological
infections. The use of epidemiological models (such as SIR – Susceptible-Infected-
Recovered) allows researchers and platforms to calculate when a fake news story will
reach its peak of viral spread. The models can be used to calculate when and where it is
most effective for fact-checkers to intervene to break the chain of infection. Epidemic
models help to detect key nodes in the network – fake profiles (bots), troll farms, or
influential accounts that act as “superspreaders” of disinformation. All of this also
determines the relevance of the dissertation research.

KNOWLEDGE OF THE PROBLEM

From the overview made, as well as from the published results on the subject of the
dissertation work, it can be concluded that the PhD student is well prepared with the

nature of the research. Additional proof of this is the number of literatures sources used and good publication records.

ANALYTICAL CHARACTERISTIC

The doctoral study has a total volume of 210 pages, 47 figures, 111 tables and 191 literary sources. It is structured as follows: 3 chapters, conclusion, possibilities for future development, scientific and scientific-applied contributions, list of publications on the topic of the dissertation, list of citations, declaration of originality of results, bibliography.

Chapter 1 presents the theoretical foundations of fake-news detection, Transformer-based language modelling, temporal networks, SIR/SEIZ epidemic models and Approximate Bayesian Computation. It identifies the research gaps that motivate the integrated framework.

Chapter 2 defines the proposed Transformer-ABC-Epidemic framework. It presents dataset selection, preprocessing, binary label harmonization, temporal cascade construction, SIR/SEIZ modelling, ABC/ABC-SMC inference, posterior prediction, intervention scenarios, ethics and reproducibility boundaries.

Chapter 3 reports the experimental results. It evaluates Transformer-based fake-news detection across content datasets, reconstructs temporal cascades, compares SIR and SEIZ diffusion models, estimates posterior uncertainty using ABC and ABC-SMC, and tests counterfactual intervention scenarios.

The concluding section summarizes the obtained results, limitations and future research. The thesis contributions and the publications connected to the dissertation are presented after the conclusions.

The main objective is to develop and evaluate an integrated framework for detecting fake news by analysing its spread in social networks. The results obtained support this goal by showing that textual credibility, temporal amplification and subsequent uncertainty should be analysed together. A detection model can identify questionable content, but cannot determine the social impact without temporal data. Similarly, a diffusion model can describe how content spreads, but remains incomplete without the probability of risk from the content and the derivation of parameters with conscious uncertainty. The final synthesis highlights both the scientific value and the methodological limits of the thesis. The proposed framework is not presented as a universal solution to all fake news problems. It is presented as a traceable and replicable content-to-cascade methodology that integrates detection, temporal propagation, epidemic modeling and Bayesian uncertainty into a single analytical structure.

OBJECT AND METHODOLOGY OF THE RESEARCH

The object of the study is to consider fake news as a combined phenomenon of content and distribution, and not as a task related only to text classification.

The methodology used to achieve the goals is based on multi-criteria analysis, mathematical modeling, numerical experiments, data processing methods, optimization of management decisions. The dissertation work makes a significant contribution to the scientific community dealing with the field of fake news detection.

ABSTRACT

The submitted abstracts in Bulgarian and English, faithfully reflect the content of the dissertation research and correspond to the requirements of Law and on the Development of the Academic Staff in the Republic of Bulgaria and the Rules of its Implementation. From the submitted declaration of originality, as well as of the publication records on the subject of the dissertation, it can be determined that described results are personal work of the author.

EVALUATION OF COMPLIANCE WITH THE MINIMUM NATIONAL REQUIREMENTS AND THE ADDITIONAL REQUIERMENTS UNDER ART.1A, AL.2

The doctoral student has 5 published articles indexed in the world's scientific information databases, 4 of which are indexed in SCOPUS.

The publications presented on the topic of the dissertation fully satisfy the specific requirements of IICT-BAS for the acquisition of the educational and scientific degree "Doctor", since out of the required 30 points, the doctoral student has 56 points.

CONTRIBUTIONS

I fully accept the formulated contributions of the doctoral student.

CRITICAL REMARKS AND RECOMMENDATIONS

I do not have any critical remarks about the dissertation work, but only editorial ones.

FINAL COMPREHENSIVE ASSESMENT

The results obtained on the subject of the dissertation work show that Kristel Gjergj Vula possesses the necessary theoretical knowledge and practical skills in the field of informatics and computer science as well as proven abilities for independent scientific research. The presented dissertation meets the requirements of the Law and Development of the Academic Staff in the Republic of Bulgaria, the Rules for its implementation, as well as the Rules for Specific Conditions for Acquiring Scientific Degree and Holding

Academic Position at IICT-BAS. The obtained results on the topic of the dissertation research give me sufficient reason to give a categorically positive assessment of the presented dissertation work and I propose to the respected Scientific Jury to award Kristel Gjergj Vula the educational and scientific degree "Doctor" in the doctoral program "Informatics", professional field 4.6 "Informatics and Computer Science".

3 September 2026

Ass

D

