

To the Specialized Academic Council
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at the West Ukrainian National University
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of Ukraine
Doctor of Technical Sciences, Professor,
Anatoliy Sachenko

REVIEW

*of the reviewer Roman Pasichnyk
Doctor of Technical Sciences, Professor, Professor of the Cybersecurity Department
of the Western Ukrainian National University,
on the qualification thesis of Pan Tiande on the topic:
" Methods and Software Tools for Recognizing Fake or Irrelevant Information in the
Content of News-Oriented Social Networks ", submitted for the degree of Doctor of
Philosophy in
specialty 121 "Software Engineering "*

1. Relevance of the Dissertation Topic.

Modern news social networks have become the main source of information, which has radically changed the structure of information flows. However, this accessibility is accompanied by a significant increase in the risk of spreading false, manipulative and irrelevant content. Due to the lack of editorial control, mass generation of content by users and the dominance of emotional posts, social media create an ideal environment for rapid disinformation, which threatens public opinion and information security.

The problem of reliability is particularly acute due to the high update rate and heterogeneity of unverified data in these networks. Existing fact-checking tools are only able to partially solve the task, focusing on identifying suspicious statements or searching for verified facts. They do not provide the necessary comprehensive, multi-level analysis that would take into account the complex behavioral dynamics of users, the structure of interactions and the uncertainty of data inherent in social networks.

Therefore, there is an urgent need to develop innovative methods and software solutions for comprehensive recognition of false information. This requires the integration of various analytical tools to identify key parameters for assessing the reliability of news content and dynamics of its distribution, methods for classification and adaptation to the content of messages, and flexible software tools for identifying false messages in real time. The analyzed study uses interval approaches for analytical modeling, ontological modeling for analyzing message content and community reactions, and intelligent agents for automated validation. The goal of this approach is to increase the speed and accuracy of fake news detection, reducing the impact of disinformation and strengthening information security..

2. Analysis of the Dissertation Content. Degree of Validity of the Scientific Provisions, Conclusions, and Recommendations Formulated in the Dissertation.

2.1. The dissertation is a completed scientific research work, which consists of an abstract, introduction, 4 chapters, conclusions, a list of sources used and appendices. The logical structure of the work is determined by its purpose and formulated scientific and practical tasks.

The introduction contains a justification of the relevance of the chosen topic, the formulation of the goal and main tasks of the research. A generalized characteristic of the scientific novelty and practical value of the achieved results is provided. The approbation of the key provisions of the work, a list of publications based on the materials of the dissertation are also highlighted, and the author's personal contribution to collective scientific works is determined in detail.

Section 1 is devoted to the theoretical clarification of the problem of identifying fake information in the dynamic digital space. The main factors that complicate the automated assessment of the reliability of social network content are identified. A classification review of existing methods for detecting fakes is conducted, with an emphasis on their advantages and limitations. The analysis showed that existing fact-checking software tools cover only fragments of the problem and do not provide the necessary comprehensive analysis.

Based on this analysis, the need to create a hybrid method for assessing credibility, which would integrate interval, behavioral and network models, is justified. The main task of the research is formulated: to increase the efficiency of detecting false content through the development of interval models of user behavior and software agents for automated information verification.

Section 2 is devoted to the analysis of quantitative behavioral metrics of users, such as the speed of spread, virality, the number of likes and comments, which are identified as important indicators of potentially false content. On this basis, an interval mathematical model for assessing the reliability of information is proposed for the first time. This model presents the degree of reliability as an interval value that reflects the integrated influence of behavioral and content factors.

Additionally, a hybrid method for identifying interval user patterns was developed for the first time, which combines a metaheuristic algorithm (bee colony model) with gradient methods for parameter refinement. This provided a reduction in computational complexity and standardization of optimization procedures. The method was successfully verified on the example of modeling audience reactions to news content.

It is emphasized that quantitative indicators are effective for the initial detection of suspicious messages, but require further contextual and content analysis for final classification.

Section 3 justifies the use of a multi-agent approach for automated collection and deep analysis of news content. Based on the developed method, an integral credibility indicator was formed, which synthesizes trust in the source, network confirmation, time relevance, consistency of statements and emotional coloring. The implementation of the software agent architecture and the integration of interval user models increased

the accuracy of the assessment. Experiments on real data confirmed the effectiveness of the system and the classification accuracy of over 90%.

Section 4 describes the created complex software environment that combines interval behavioral modeling, NLP methods, analytical credibility assessment and visual analytics tools. A modular architecture was developed (with subsystems for collection, processing, modeling, a knowledge base based on MongoDB and a web interface). The effectiveness of the system is confirmed by an integral indicator of 0.92, which indicates high accuracy, adaptability and a significant advantage over known analogues.

The conclusions of the work highlight the results obtained and, in terms of their level, meet the requirements set for dissertations.

The appendices to the work are meaningful, confirm and reflect the results of the work and contain certificates and acts on the implementation and use of the results of the dissertation research.

The structure of the dissertation fully corresponds to the logic and sequence of solving the tasks set.

2.2. The presented scientific results of the dissertation research are sufficiently substantiated. The scientific provisions, conclusions and recommendations are developed on the basis of a comprehensive analysis of the results obtained using advanced scientific approaches of modern theory and practice, in particular methods of interval data analysis, assessment of the reliability of the content and their program interpretation. The reliability of all the obtained provisions and conclusions is confirmed by the results of experimental studies conducted, as well as the successful practical implementation of the developed solutions. Based on the analysis of the content, it can be stated that the goal of the dissertation work was fully achieved, and the work meets the criteria for a completed scientific qualification work.

3. Scientific Novelty of the Dissertation.

The principal scientific provisions, results, and conclusions of the dissertation were obtained independently by the author. They are original, sufficiently substantiated, and confirmed by computer-based experiments as well as by the approbation of the main findings at national and international scientific conferences.

The scientific novelty obtained by the author includes the following:

For the first time:

- an interval mathematical model has been developed that establishes a relationship between the credibility of content in news-oriented social networks and users' behavioral profiles. In contrast to existing approaches, the model is based on the analysis of interval data under limited sample conditions, which enhances the efficiency of early detection of unreliable information;

- a hybrid method for identifying interval models of user profiles in social networks has been proposed and substantiated. Unlike known approaches, it combines a metaheuristic algorithm for model-structure synthesis based on the behavioral model of an artificial bee colony with gradient-based methods for parameter identification of candidate models. This integration has reduced the computational complexity of the identification process and improved the early-stage recognition of content credibility.

Further developed:

- software agents for assessing the credibility of content in news-oriented social networks, which, unlike existing solutions, integrate both traditional criteria—redundancy, inconsistency, timeliness, reliability, and completeness—and new characteristics of the digital environment, including network confirmation and emotional tone. This significantly increases the effectiveness of fake-content detection;

- software environments for detecting and analyzing fake content in news-oriented social networks, which, unlike known systems, combine automated tools for retrieving data from social platforms with credibility-assessment modules capable of functioning under limited data conditions, and are adapted to operate as intelligent assistants supporting the creation and deployment of news services.

4. Compliance with Academic Integrity Requirements and Completeness of the Presentation of Scientific Results in Published Works.

4.1. The dissertation comprises 156 pages of printed text, including 126 pages of the main content, which contains 38 figures and 4 tables. The list of references includes 126 sources, and the work contains 3 appendices.

The dissertation is written in English and demonstrates a high stylistic quality. The scientific terminology used is generally accepted, and the style of presenting the results of theoretical and applied research, novel scientific provisions, conclusions, and recommendations ensures their clarity and accessibility for perception and practical use. The content of the dissertation provides a clear understanding of the author's main statements, conclusions, and recommendations. The style of presentation guarantees an adequate comprehension of the research materials and scientific findings. The formatting of the dissertation fully complies with the required attestation standards.

4.2. Compliance with Academic Integrity Requirements. The dissertation has undergone an academic plagiarism check, and the results confirm its high degree of originality. The author's individual style is distinctly observed throughout the text. No textual borrowings or usage of results from other researchers without proper referencing were identified.

4.3. Completeness of the Presentation of Scientific Results in Publications. The main research results have been published in 8 scientific works, including 6 articles in scientific periodicals and 2 publications in the proceedings of international scientific and technical conferences. Five of these works are indexed in international scientometric databases such as Scopus and Web of Science.

5. Practical Significance of the Dissertation Results.

The practical significance of the dissertation lies in the development of methods and software tools for automated detection and analysis of unreliable content in news-oriented social networks. The proposed interval models, hybrid evaluation methods, and multi-agent software environment can be applied in fact-checking systems, information-space monitoring platforms, digital analytics, and content-moderation services.

The developed solutions improve the accuracy, timeliness, and explainability of credibility assessment processes and can be integrated into web-oriented analytical platforms and news services.

6. Comments on the Dissertation.

Along with the high-quality execution of the dissertation research, it is worth paying attention to some discussion issues present in the work:

1. Interval models were used to select relevant parameters in the content reliability model and its identification, however, in the description of the logic of the functioning of software agents, it would be worth describing the use of interval models more fully.

2. It would be desirable to substantiate the structure and parameters of the integral reliability indicator in more detail in specific cases.

3. The procedure for determining the threshold value of the integral indicator requires greater detail.

However, the above remarks are not of fundamental importance and do not reduce the scientific value of the dissertation work as a whole.

7. Conclusions. The presented dissertation “Methods and Software Tools for Recognizing Fake or Irrelevant Information in the Content of News-Oriented Social Networks” is well justified in terms of its relevance and contains completed scientific research whose results demonstrate scientific novelty and practical significance. The dissertation successfully addresses the important scientific task of improving the efficiency of detecting and analyzing fake content in news-oriented social networks under conditions of limited data samples through the development of appropriate mathematical models and software agents. The obtained results play an important role in the advancement of the field of knowledge 12 Information Technologies and the specialty 121 Software Engineering.

Therefore, considering the relevance of the dissertation topic, the established scientific novelty and practical value of the obtained results, the completeness of their presentation in scientific publications, and the absence of violations of academic integrity, I conclude that the dissertation meets the requirements of the Order of the Ministry of Education and Science of Ukraine No. 40 of January 12, 2017 “On the Approval of Requirements for Dissertation Formatting”, as well as the Procedure for Awarding the Doctor of Philosophy Degree and Revoking Decisions of Ad Hoc Specialized Academic Councils of Higher Education Institutions and Research Institutions on Awarding the Doctor of Philosophy Degree (Resolution of the Cabinet of Ministers of Ukraine No. 44 of January 12, 2022).

The author, Pan Tiande, deserves to be awarded the degree of Doctor of Philosophy in the field of knowledge 12 Information Technologies, specialty 121 Software Engineering.

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