To the Specialized Academic Council
DF 58.082.087
at the West Ukrainian National University
of the Ministry of Education and Science of Ukraine
Doctor of Technical Sciences,
Professor,Anatoliy Sachenko

REVIEW

by Svitlana Krepych,
Candidate of Technical Sciences, Associate Professor,
Associate Professor of the Department of Computer Sciences
at the West Ukrainian National University

of the dissertation by 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 the field of knowledge 12 – Information Technologies,
specialty 121 – Software Engineering.

1. Relevance of the topic of the dissertation. Social networks have become one of the most pervasive and influential sources of information in the modern digital era. They serve as primary platforms through which millions of users access news, share opinions, and engage in public discourse. However, despite their undeniable role in shaping contemporary communication, the information disseminated through these networks cannot always be considered credible or trustworthy. A significant portion of online content is characterized by misinformation, disinformation, and deliberately fabricated narratives designed to mislead audiences.

In many instances, the spread of such fake or false content is not accidental but rather organized and purposeful, driven by political, economic, or ideological motives. These manipulative strategies pose a serious threat to the formation of an informed public opinion, distort the perception of reality, and undermine the foundations of information security within society. Consequently, ensuring the reliability and authenticity of content circulating in social media ecosystems has become an urgent and complex challenge.

Therefore, the development of effective methods and intelligent systems for detecting and preventing the dissemination of unreliable information in social networks is of paramount importance. Addressing this issue requires an interdisciplinary approach that combines advances in data analysis, artificial intelligence, linguistics, and behavioral modeling to safeguard the integrity of the digital information space.

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

The dissertation is a completed scientific research work that includes an introduction, four chapters, conclusions, a list of references, and appendices.

In the introduction, the relevance of the dissertation topic is substantiated, the purpose and objectives of the research are formulated, the scientific novelty and practical significance of the obtained results are defined, and information is provided regarding the approbation and publications of the dissertation's results with a clear indication of the author's personal contribution.

In the first chapter, " Analysis of Methods and Software Tools for Detecting False or Irrelevant Information in the Content of News-Oriented Social Networks," a systematic analysis of current approaches, methods, and software tools for detecting false or irrelevant information in social network content is presented.

To achieve the stated goal, the chapter examines the main theoretical approaches to defining the concept of information reliability, investigates models for assessing the veracity of news content, and classifies machine learning algorithms and linguistic methods used for fact-checking. Particular attention is given to the analysis of software solutions and verification services such as ClaimBuster, Logically Facts, Google Fact Check Explorer, and Hoaxy, in terms of their architecture, functional capabilities, and limitations.

The results of the conducted analysis form the theoretical and methodological foundation for the further development of an original intelligent system for recognizing unreliable information, designed specifically for the characteristics of news-oriented social network content and for operation under conditions of limited data samples.

In the second chapter, «Modeling User Profiles in a Social Network Based on Interval Data Analysis» proposed to use a mathematical model to support decision-making regarding the veracity of content published in social networks, based on establishing the relationship between the decision outcome—whether the content is deemed reliable or unreliable—and the factors influencing it. The main quantitative factors proposed for analysis include: the number of posts, shares, or likes made by users within a short time after the content appears; the number of comments or reactions observed over specific time intervals; the time it takes for information to spread across social networks (e.g., how many users interact with the content within the first minutes, hours, or days after publication); the content virality coefficient, such as the average number of reshares per user.

The resulting indicator of this model is the degree of content reliability, expressed within the range from 0 to 1. To represent and analyze this indicator based on expert evaluation of content, the study proposes and substantiates the use of interval data analysis methods.

Furthermore, the chapter formulates an optimization problem for the two-stage identification of the model based on interval data analysis, which includes: forming the current model structure based on a set of candidate models (model structure synthesis); estimating its parameters and verifying model adequacy.

A hybrid method for identifying interval models of user profiles in a social network is proposed and substantiated. This method combines a metaheuristic algorithm for synthesizing the model structure—based on the behavioral model of a bee colony—with gradient-based methods for identifying the parameters of candidate models.

In the third chapter, " Software Agents for Assessing Content Credibility in News Resources of Social Networks" the architecture of the software agents is described. The main aspects of their implementation are presented, with a particular feature being the integration of multiple evaluation criteria—redundancy, inconsistency, relevance, reliability, and completeness—along with new characteristics inherent to digital media, such as network confirmation and emotional tone. The combination of these factors ensures increased efficiency in detecting fake content within news-oriented social networks.

In the fourth chapter, " Software Environment for Detecting and Analyzing Fake Content in News-Oriented Social Networks" the proposed approaches are implemented in software and subjected to experimental evaluation. The chapter describes the features of the software implementation, which enables the integration of automated tools for retrieving content from social platforms with modules for assessing its credibility under conditions of limited data samples. The developed environment is also adapted to function as an intelligent assistant supporting the creation and deployment of news-oriented services.

Comprehensive testing of the software environment was conducted, and the chapter provides a detailed description of its practical use and potential integration into existing systems.

The conclusions of the dissertation fully reflect the obtained results and meet the requirements established for the outcomes of a dissertation study.

The structure of the dissertation fully corresponds to the logical and sequential solution of the research objectives.

Reliability and Validity of the Obtained Results and the Author's Proposed Solutions, Conclusions, and Recommendations

The reliability and validity of the obtained results and proposed solutions are ensured by the correct use of analytical and numerical research tools; the adequacy between theoretical calculations and verification results; the consistency of conclusions and findings with the physical nature of the studied phenomena; the comparison of proposed solutions with those known from the literature; and the correlation of the obtained results with data from other authors and with the objectives of the study. The research results are illustrated with tables, graphs, and figures. The decisions adopted in the dissertation demonstrate scientific novelty, are well-founded, and effectively address the research objectives, including the software implementation

3. Scientific Novelty of the Obtained Results

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

The reliability of the scientific propositions, conclusions, and results obtained by the author is ensured by the correct and appropriate use of mathematical apparatus, the methodology of information system design, and the successful software implementation of the developed solutions.

The following results obtained in the dissertation possess scientific novelty:

First obtained :

1. An interval-based mathematical model was developed for the first time, establishing a relationship between the credibility of content in news-oriented social networks and user behavioural profiles, which, unlike existing models, relies on the analysis of interval data under limited sample conditions and thereby enhances the efficiency of credibility recognition at the early stages of publication.

2. Hybrid method for identifying interval models of user profiles in social networks was proposed and substantiated, which, unlike existing approaches, combines a metaheuristic algorithm for model structure synthesis based on the behavioural model of a bee colony with gradient methods for identifying the parameters of candidate models, thereby reducing the computational complexity of the identification process and overall improving the efficiency of content credibility recognition at the early stages of its publication.

Further developed.

3. Software agents for assessing the credibility of content in news-oriented social network resources have been further developed, which, unlike existing ones, integrate both traditional criteria—redundancy, inconsistency, timeliness, reliability, and completeness—and new characteristics inherent to digital media, such as network confirmation and emotional tone, thereby enhancing the overall effectiveness of fake content detection in news social networks.

4. Software environments for detecting and analysing fake content in news-oriented social networks have been further developed, which, unlike existing solutions, integrate automated tools for retrieving content from social platforms with modules for assessing its credibility under limited data conditions, and are adapted to function as intelligent assistants supporting the creation and deployment of news services.

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

4.1. Dissertation Formatting

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

The dissertation is written in English correctly and at a high stylistic level. The scientific terminology used in the work is widely accepted, and the style of presenting the theoretical and practical research results, new scientific findings, conclusions, and recommendations ensures their clarity and accessibility for understanding and application.

The content of the dissertation provides a clear understanding of the main propositions, conclusions, and recommendations proposed by the author. The overall

presentation style guarantees appropriate perception and comprehension of the research materials and scientific statements.

The formatting and structure of the dissertation fully comply with all required academic and attestation standards.

4.2. Compliance with Academic Integrity Requirements

The dissertation has been checked for academic plagiarism, and the results confirm a high level of originality. The author's individual writing style is evident throughout the entire text. No textual borrowings or unreferenced use of other researchers' results were detected. The dissertation fully adheres to the principles of academic integrity.

4.3. The main results of the dissertation research are presented in sufficient detail in 8 scientific publications, including 5 papers indexed in international scientometric databases such as Scopus and Web of Science. In total, the author has published 6 articles in professional scientific journals and 2 papers in the proceedings of international scientific and technical conferences. These publications comprehensively reflect the key theoretical and practical results of the dissertation, confirming the completeness and reliability of the research outcomes.

6. Practical Significance of the Dissertation Results

The practical significance of the research results lies in the development of software for detecting and analyzing fake content in news-oriented social networks. The developed tools integrate automated content retrieval mechanisms from social media platforms with modules for assessing content credibility under conditions of limited data samples. The system is adapted to function as an intelligent assistant, supporting the creation and deployment of news services and ensuring higher efficiency and reliability in the verification and dissemination of information within digital media environments.

7. Remarks and Discussion Points Concerning the Content of the Dissertation

Overall, the dissertation research has been carried out at a high scientific and applied level. However, since certain aspects of the work are debatable, which is natural given the complexity of the studied domain, it is advisable to provide several clarifications, comments, and recommendations aimed at the further improvement and refinement of the investigated problem area.

1. In the second chapter of the dissertation, a hybrid method for identifying interval models of user profiles in a social network is proposed, based on metaheuristic optimization algorithms that simulate the swarm intelligence of an artificial bee colony. However, the rationale for selecting this particular approach is not sufficiently detailed in the work. It would be advisable to include, in the first chapter, a comparative analysis of the well-known algorithms of this class, and subsequently demonstrate the advantages of using bee colony behavior–based methods in comparison with alternative approaches within the same category.

2. In the fourth chapter of the dissertation, excessive attention is devoted to describing the implementation of the subsystem for information analysis and storage. It would be advisable to transfer part of this material to the appendices, thereby making the main content of the dissertation more concise and focused on the key research findings and methodological aspects.

3. It would be advisable for the dissertation to provide a more detailed description of the possibilities for integrating the proposed solutions into existing social network platforms. Such an extension would enhance the practical value of the research by demonstrating how the developed methods and software tools can be adapted for real-world implementation within current social media ecosystems.

4. The text of the dissertation contains certain stylistic inaccuracies in the formulation of several statements, as well as some grammatical errors.

However, the above remarks do not diminish the overall scientific and practical value of the dissertation research.

7. Conclusions

7.1. The dissertation by Tiande Pan is an independent, original, and completed scientific study that presents new, scientifically substantiated results. The dissertation addresses a relevant scientific problem—enhancing the efficiency of detecting and analyzing fake content in news-oriented social networks under conditions of limited data samples.

7.2. The obtained scientific and practical results represent a significant contribution to the development of the theory and practice of unreliable information identification and can be effectively applied to the implementation of methods and tools for analyzing news content. The content of the dissertation fully corresponds to the specialty 121 – Software Engineering.

7.3. Therefore, the dissertation " Methods and Software Tools for Recognizing Fake or Irrelevant Information in the Content of News-Oriented Social Networks " — in terms of the relevance of the selected topic, the scope and quality of the conducted research, the completeness of solving the defined scientific and practical tasks, the novelty and validity of the obtained results, the practical conclusions and recommendations, the comprehensiveness of presentation in scientific publications related to the dissertation topic, and the absence of violations of academic integrity — fully meets the requirements of the current legislation of Ukraine, as specified in clauses 6–9 of the "Procedure for Awarding the Doctor of Philosophy Degree and Revoking the Decision of the One-Time Specialized Academic Council of a Higher Education Institution or Scientific Institution on the Awarding of the Doctor of Philosophy Degree", approved by the Resolution of the Cabinet of Ministers of Ukraine No. 44 of January 12, 2022.

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

Reviewer:
Associate Professor of the Department of Computer Sciences
West Ukrainian National University
Candidate of Technical Sciences,
Associate Professor, Svitlana Krepych