ANNOTATION
The dissertation work of Bagitova Kalamkas on the topic «Development and research of methods and models for political extremism detection in online social networks» submitted for the degree of Doctor of Philosophy (Ph.D.) on the specialty «8D06301- Information security systems»

Relevance of the research topic. In the age of advanced information technologies, online social networks such as Telegram, YouTube, Twitter, VKontakte, Facebook, etc. are becoming increasingly popular among Internet users. These platforms, which offer the opportunity to create profiles, communicate and exchange information with a worldwide audience, attract millions of people from all over the world. They have become an integral part of our lives, changing the ways we communicate, find new friends and do business. One of the key reasons for the growing popularity of online social networks is their accessibility. Thanks to the development of smartphones and high-speed Internet, people can easily access their accounts on social platforms anytime and anywhere. This allows them to be always up to date with the latest news, communicate with friends and family and share their thoughts and ideas instantly. Online social networks also give people the opportunity to find new friends and partners of interest. Thanks to the search functions and the suggestion of suitable contacts, users can find people who have common interests, hobbies and professional skills. This allows them to expand their social network and find new opportunities for development. Online social networks have also become an indispensable tool for business and marketing. Thanks to the ability to create brand pages and advertising campaigns, companies can reach their target audiences and promote their products and services. Moreover, thanks to the analytical tools of social networks, companies can analyze the behavior of their customers and optimize their marketing strategy.

However, as with any new technological breakthrough, online social networks also have their risks and negative aspects. Privacy and data security issues are one of the main problems faced by users of online social networks. In addition, online social networks provide a convenient platform for extremists to attract new supporters, exchange information and coordinate their actions. One such example is the January events in 2022. They were started by rallies of the population in the West of Kazakhstan against doubling the price of gas for refueling cars. There were other more significant reasons for the growing discontent of the population with the deterioration of living standards not only in the Western part of the republic, but also in other regions of Kazakhstan. Peaceful protests were picked up by looters, as well as extremists whose actions were coordinated by someone and their goal was to seize power in Kazakhstan. One of the tools for coordinating the riots was social networks.

The fight against extremism in online social networks is a difficult task, but it can be solved. The development of effective systems and models for detecting and suppressing political extremism is the basis for ensuring security and stability in the country, which requires scientific research and the implementation of a set of effective and timely measures aimed at identifying, preventing and suppressing any manifestations of extremism. The problem is of a global nature and is very relevant for many countries, including Kazakhstan.

The scientific contribution of this work is to develop models and methods for detecting political extremism in text and graphic resources of online social networks.

Purpose of the research work. Research and development of models and methods for effectively political extremism detection in text and graphic resources of online social networks.

Research objectives. To achieve this goal, the following tasks are envisaged:

1. creation of a corpus texts in the Kazakh language displaying signs of political extremism in online social networks;

2. creation of methods and models for identifying texts of political extremism in the Kazakh language in online social networks.

3. creation of models for processing and neural network analysis of graphic resources of online social networks for the detection of political extremism.

4. creation of a neural network method for detecting political extremism in graphic resources of online social networks.

5. experimental verification of the developed solutions.

The object of the study – the processes of detecting political extremism in text and graphic resources of online social networks.

The subject of the study – models and methods of detecting political extremism in text and graphic resources of online social networks.

Research method. As research methods used were machine and deep learning methods, text classification methods, video, natural language processing methods, neural networks, social network analysis methods, statistical processing methods, and system analysis methods.

Scientific novelty of the work:

created a method for generating the input field of the LSTM network, which, through the combined use of TF-IDF procedures and linguistic analyzer of socio-political lexemes for proving the ability to increase the accuracy of determining political extremism in Kazakh language texts;

created preprocessing method, which, through the combined use of stemming procedures and modification of the SpellChecker spelling correction algorithm, provides the opportunity to increase the accuracy of determining political extremism in Kazakh language texts;

created a corpus of Kazakh language texts, which by displaying signs of political extremism, provides the opportunity to develop models and methods for political extremism detection in online social networks;

created a model for pre-processing images and video materials of online social networks, which due to the proposed approach to using the wavelet transform apparatus for filtering typical noise and created mathematical apparatus for correcting the brightness and contrast of images, provides the opportunity to increase the accuracy of neural network analysis of graphic resources of online social networks;

created a neural network analysis model, which, due to the reasonable determination of the architectural parameters that make up its structure of convolutional and recurrent neural networks, provides the opportunity to develop an effective method for political extremism detection in images and video materials of online social networks;

created a method for political extremism detection in images and video materials of online social networks, which, through the use of the proposed models of pre-processing and neural network analysis, as well as the proposed approach to adapting the input field of the neural network model to the variability of the sizes of graphic resources, provides increased accuracy and reduced resource for political extremism detection in images and video materials from online social networks.

Theoretical significance of the work. The theoretical significance of the dissertation work is based on a set of knowledge in the field of methods and algorithms for determining political extremist actions and organizations. The obtained fundamental results can be used by the world scientific community.

Practical significance of the work. Applied results in the form of a method, author's certificates can be used by authorized bodies to ensure information security, critical infrastructure, and the fight against Internet extremism.

The main wording to be submitted for defense.

1. *created* a corpus of Kazakh language texts displaying signs of political extremism in online social networks;

2. *created* a method of forming a set of features taking into account the peculiarities of the Kazakh language and a model to identify texts of political extremism in the Kazakh language in online social networks;

3. *created* a model of processing and neural network analysis of graphic resources of online social networks for political extremism detection;

4. *created* a neural network method for political extremism detection in graphic resources of online social networks;

5. as a result of the developed models and methods, *created* software to identify political extremist in Kazakh language texts and graphic resources of online social networks.

The degree of reliability and the results of testing. The reliability and validity of the research results are supported by the reasoned responsibility of setting tasks, the examination of criteria and the state of research in this area, a large number of experiments conducted, as well as their successful implementation in practice. The results of the dissertation were reported and discussed at the following scientific and methodological conferences:

Articles in journals recommended by the Committee for Quality Assurance in the Field of Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan:

1. K. Bagitova, I. Tereikovskyi, I. Babayev, L. Tereikovska, O. Tereikovskyi. Model for processing images of online social networks used to recognize political extremism. Vol. 118 No. 2 (2023): Journal of Mathematics, Mechanics and Computer Science *(indexed in Web of Science)*

2. Ш.Ж. Мусиралиева, М.А. Болатбек, М. Сағынай, Ж.Ы. Елтай, К.Б. Багитова. Экстремистік мәліметтер түсінігі және экстремизмге қарсы күрес жобаларына жүйелік шолу. NEWS OF THE NATIONAL ACADEMY OF SCIENCESOF THE REPUBLIC OF KAZAKHSTANPHYSICO-MATHEMATICAL SERIESISSN 1991-346XVolume 3. Namber 347 (2023). 112–130

3. Багитова К.Б., Мусиралиева Ш.Ж, Болатбек М.А, Оспанов Р.К.

Разработка программного обеспечения ExWeb для выявления экстремистского контента в сети Интернет. УДК 004.056.5. «Известия НАН РК. Серия физика и информатики». ISSN 2518-1726 (Online), ISSN 1991-346X (Print). SERIES PHYSICS AND INFORMATION TECHNOLOGY 2 (346) APRIL – JUNE 2023. Стр. 81 – 95.

4. М.А. Болатбек, К.Б. Багитова, Ш.Ж. Мусиралиева. Киберқауіпсіздік мәселелерін табиғи тілді өңдеу әдістері арқылы шешу тақырыбына жүйелік шолу. NEWS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN PHYSICO-MATHEMATICAL SERIESISSN 1991-346XVOLUME 3, NUMBER 343 (2022), 52-70

5. М.А. Болатбек, Ш.Ж. Мусиралиева , К. Багитова, А.Т.Нюсупов , Е. Абайұлы. Веб-ресурстардағы фишингтік хабарламалар және оларды машиналық оқыту әдістері арқылы анықтау. NEWS OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN PHYSICO-MATHEMATICAL SERIES ISSN 1991-346X Volume 4, Namber 344 (2022), 16-29

Scientific article in journals indexed in Scopus:

1. Shynar Mussiraliyeva, Kalamkas Bagitova and Daniyar Sultan, "Social Media Mining to Detect Online Violent Extremism using Machine Learning Techniques" International Journal of Advanced Computer Science and Applications (IJACSA), 14(6), 2023. http://dx.doi.org/10.14569/IJACSA.2023.01406146

Articles in materials of the international conference:

1. Ш.Ж. Мусиралиева, К.Б. Багитова, И.А. Терейковский, А.М. Усманова. Әлеуметтік желілердегі суреттер мен бейнелерді өңдеудің ерекшеліктері VIII - международная научно-практическая конференция «Информатика и прикладная математика», 26-27 октября 2023 года, Алматы, Казахстан, 305 – 310 стр.

2. S. Toliupa, I. Tereikovskyi, L. Tereikovska, S. Mussiraliyeva and K. Bagitova, "Deep Neural Network Model for Recognition of Speaker's Emotion," *2020 IEEE International Conference on Problems of Infocommunications. Science and Technology (PIC S&T)*, 2020, pp. 172-176, doi: 10.1109/PICST51311.2020.9468017. https://ieeexplore.ieee.org/document/9468017

3. Mussiraliyeva, S., Bolatbek, M., Omarov, B., Bagitova, K. Detection of Extremist Ideation on social media Using Machine Learning Techniques. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 2020, 12496 LNAI, стр. 743–752 (scopus indexed, процентиль 50) https://link.springer.com/chapter/10.100/978-3-030-63007-2_58 12th International Conference, ICCCI 2020, Da Nang, Vietnam, November 30 – December 3, 2020, Proceedings

Personal contribution of the applicant. The applicant solved the tasks of the dissertation work. Developed a model and method for identifying texts in the Kazakh language and graphic resources of extremist orientation in online social networks. Created a corpus of political-extremist texts in Kazakh for teaching and testing machine learning algorithms. Developed a model for processing and neural network analysis graphic resources of social networks to identify political extremism and created a neural method. Conducted experiments to determine the accuracy of created model and method.

Connection of the topic of the dissertation with the plans of scientific research. This work was commissioned by the Ministry of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan as part of the research work of the project "Development of models and methods for extremist content detecting in social networks", IRN AP15473408. Priority area: national security and defense. Specialized area: information security.

Publication of results. In the course of the research work, 10 scientific papers were written. Of these, 1 article was published in the journal indexed on the basis of Scopus, 5 articles in publications recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan and 3 articles in the materials of international conferences.

Structure and scope of work. The dissertation work consists of an introduction, 3 chapters, a conclusion, a list of references and appendices. The full volume of the dissertation: 103 pages of typewritten text, including 59 figures, 12 tables, 89 references.

The introduction substantiates the relevance of the topic of the dissertation work. The purpose, object and subject of research work are formulated. At the same time, scientific novelty and practical significance are shown. Information about the approbation and publication of research results is provided.

The first section provides the concept and classification of extremism, the analysis of means of identifying political –extremist texts and graphic resources in online social networks

The second section describes the classification of models for identifying politico–extremist text content, a neural network model for processing and analyzing graphic resources of social networks.

In the third section, describes a comparative analysis of various machine learning methods and the proposed method for calculating the identification of political extremist texts in the Kazakh language and graphic resources in social networks

In conclusion, the main conclusions and results of the work are formulated