

ANNOTATION

**to the dissertation work of the PhD student Bolatbek Milana Aslanbekkyzy in the specialty
"Information security systems" 6D100200 on the topic:
"Development and research of semantic analysis models in web resources for defining extremist
orientation in the text"**

Relevance of the research topic. Currently, the Internet information and communication network has become an integral part of human life. People use social networks "Twitter", "VKontakte", "Facebook", etc. for global communication, exchange of opinions, gaining knowledge, etc. The active participation not only of individual users, but also of information organizations throughout the world space determines the need to develop measures to ensure national security that correspond to current trends in the development of information and communication technologies, in particular, the organization of events related to countering the strengthening of ideas of extremism and terrorism. Extremist organizations use new information technologies in order to attract new members to groups, plan and carry out extremist activities, conduct training, exchange confidential information in the management and coordination of socially dangerous activities, search for sources of funding for extremist activities, create closed sites for the purpose of targeted ideological propaganda of users, including young people, etc. in the rational execution of actions. The problem is of a global nature and is very relevant for the Republic of Kazakhstan as one of the key participants in the global political process.

The Internet information space consists of various resources. At the same time, the vast majority of them are not mass media, as a result of which the application of the norms of legislation on mass media becomes impossible. To counteract the spread of ideas of extremism, law enforcement agencies currently use the norms of criminal legislation No. 31 dated February 18, 2005 "On Countering extremism", "On Approval of the State program on countering religious extremism and terrorism in the Republic of Kazakhstan for 2018-2022", Resolution of the Government of the Republic of Kazakhstan No. 124 dated March 15, 2018.

Currently, 22 organizations are included in the national list of banned terrorist groups on the territory of Kazakhstan.

In November 2020, President of the Republic of Kazakhstan Tokayev K. K. called on the SCO member states to create an Information Security Center aimed at combating separatism, terrorism and extremism.

Unfortunately, in recent years, Kazakhstanis have also been among the extremist organizations. According to the National Security Committee (NSC), about 800 citizens of Kazakhstan have left for the Middle East since the beginning of the war in Syria and Iraq. Many of them are children. As of July 2018, 120 Kazakhstani men, more than 250 women and 500 minor children are in international terrorist organizations in Syria and Iraq.

On behalf of Elbasy Nursultan Nazarbayev, since January 2019, citizens of Syria and Iraq have been returned as part of Operation "Zhusan". The committee's response of November 2019 states that 277 adults (57 men, 220 women) and 547 minor children were returned to Kazakhstan from Syria and Iraq, and more than 90 citizens are in Syria.

These issues can be considered as a threat to the national security of the Republic of Kazakhstan. The situation in the sphere of countering extremist activity on the Internet remains complex, 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 giants Google, Facebook and Twitter have promised to use artificial intelligence (AI) technology to quickly detect and destroy terrorist content on the Internet. IBM has a Watson development that can analyze all the data from the aforementioned social networks. In Russia, Plato's IT author is creating a system for monitoring social networks and forecasting risks. The German government has announced the creation of a new cybersecurity unit called ZITiS to combat terrorists on the Internet after terrorist attacks. There are no such systems in Kazakhstan yet. For this reason, the analysis of web resources on the Internet,

automation of timely detection of texts of extremist content are the most relevant for organizations to combat extremism.

The development of social networks contributes to the rapid spread of groups of supporters of violence, propagandists of extremism and radicalism. Microblogging sites and work to identify extremist content in social media groups are a complex and developing area of research. The problem of extremism has been studied in domestic and foreign scientific literature since the twentieth century to the present day. To date, extremism is the object of research of various scientific papers.

Currently, the vast majority of works related to the identification of extremist texts on web resources are written for the English language. Scientists effectively use machine learning and deep learning methods to identify extremist trends in web resources. Recently, various systems have been created on web resources to identify texts containing extremist content written in German, Russian, and Arabic.

A number of scientific studies have been conducted on the identification and analysis of criminal texts for the Kazakh language. In particular, it is possible to cite the works of scientists of the Research Institute "Artificial Intelligence" at the L. N. Gumilev Eurasian National University under the leadership of A. A. Sharipbay, as well as in the RSE on REU "Institute of Information and Computing Technologies" Mamyrbayev O. Zh. These works describe a rule-based method using a dictionary to analyze the sentiments of texts in the Kazakh language related to terrorist threats. It provides an overview of polar analysis methods, a parser analyzing pages by the content of keywords in the database, morphological, syntactic and sentimental analysis of texts in the Kazakh language. A database of ontological knowledge has been created that is used to develop a software package for identifying a user of social networks while ensuring information security, monitoring and preventing threats.

Taking into account the above conclusions, it can be concluded that **the most urgent** task is to build models to identify extremist texts in the Kazakh language on web resources.

The purpose of the dissertation work. A comprehensive study and construction of a model and method of semantic analysis to identify extremist texts in the Kazakh language on web resources. The study of the accuracy of the definition of extremist texts using the constructed model and method.

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

- 1) creation of a corpus of extremist texts in the Kazakh language for teaching and testing machine and deep learning methods to identify extremist texts in the Kazakh language on web resources;
- 2) Creation of a semantic analysis model to identify extremist texts in the Kazakh language on web resources;
- 3) Creation and research of methods to identify extremist texts in the Kazakh language on web resources;
- 4) compiling a list of extremist keywords in the Kazakh language;
- 5) creation and testing of software to identify extremist texts in the Kazakh language on web resources based on the developed models and methods.

The object of the study. Identification of extremist texts on web resources.

The subject of the study. Methods of machine and deep learning to identify extremist texts on web resources.

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

Scientific novelty of the work:

- 1) for the first time, a corpus of extremist texts in the Kazakh language has been created for training and testing machine learning methods to identify extremist texts in the Kazakh language;
- 2) for the first time, taking into account the peculiarities of the Kazakh language, a semantic analysis model has been constructed, characterized by the application of the TF-IDF method to bigrams previously applied by the stemming algorithm to the LSTM network word embedding layer and increasing the accuracy of determining extremist texts;
- 3) a method of forming a set of features has been developed, which is based on combinations of N-grams and the method of word embedding and improves the quality of classification of extremist texts;
- 4) for the first time, a list of extremist keywords in the Kazakh language has been created.

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 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. A corpus of extremist texts in Kazakh has been created for teaching and testing machine learning methods. A semantic analysis model has been developed to identify extremist texts in the Kazakh language on web resources. It is established that in the LSTM model, it is possible to increase the accuracy of defining extremist texts in the Kazakh language on web resources by using the TF-IDF method on bigrams, previously applied by the stemming algorithm.

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:

- 1) Mussiraliyeva Sh., Bolatbek M., Omarov B., Bagitova K. Detection Of Extremist Ideation On Social Media Using Machine Learning Techniques // 12th International Conference on Computational Collective Intelligence. – Vietnam, 2020. – P.743-752, https://doi.org/10.1007/978-3-030-63007-2_58
- 2) Mussiraliyeva Sh., Bolatbek M., Omarov B., Medetbek Zh., Baispay G., Ospanov R. On Detecting Online Radicalization and Extremism Using Natural Language Processing // 21st International Arab Conference on Information Technology (ACIT'2020). – Egypt, 2020, DOI: 10.1109/ACIT50332.2020.9300086
- 3) Mussiraliyeva Sh., Omarov B., Bolatbek M., Ospanov R., Baispay G., Medetbek Zh., Yeltay Zh. Applying Deep Learning for Extremism Detection // International Conference on Advanced Informatics for Computing Research. – Singapore, 2021. – P.597-605. https://doi.org/10.1007/978-981-16-3660-8_56
- 4) Mussiraliyeva Sh., Bolatbek M., Omarov B., Bagitova K., Alimzhanova Zh. Bigram based Deep Neural Network for Extremism Detection in Online User Generated Contents in the Kazakh Language // International Conference on Computational Collective Intelligence. – Greece, 2021. – P.559-570. https://doi.org/10.1007/978-3-030-88113-9_45
- 5) Болатбек М.А., Создание словаря экстремистских слов для казахского языка, Международная научная конференция студентов и молодых ученых «ФАРАБИ ӘЛЕМІ», Казахстан, Алматы, 2018
- 6) Мусиралиева Ш.Ж., Болатбек М.А., Әлеуметтік желідегі экстремистік мәтіндерді жіктеу дәлдігін грамматикалық қателерді анықтау және түзету арқылы арттыру, Международная научно-практическая конференция "Актуальные проблемы информационной безопасности в Казахстане, 2020
- 7) Болатбек М.А., Экстремизм түсінігі. Экстремистік мәтіндерді анықтауға арналған белгілер жинағына шолу, Международная научная конференция студентов и молодых ученых «ФАРАБИ ӘЛЕМІ», Казахстан, Алматы, 2020
- 8) Болатбек М.А., Экстремистік мәтіндерді сентимент талдау арқылы анықтау, Международная научная конференция студентов и молодых ученых «ФАРАБИ ӘЛЕМІ», Казахстан, Алматы, 2020
- 9) Байдулла А.М., Мусиралиева Ш.Ж., Болатбек М.А. Экстремистік топтарды анықтау және талдау // Матер. Междунар. научн. конф. студентов и молодых ученых «Фараби әлемі». – Алматы: Қазақ университеті, 2021. – С. 74.
- 10) Мусиралиева Ш.Ж., Болатбек М.А. Веб-ресурстардағы экстремистік мәтіндерді анықтаудың семантикалық үлгілерін құру және зерттеу // Матер. Междунар. научн. конф. студентов и молодых ученых «Фараби әлемі». – Алматы: Қазақ университеті, 2021. – С. 77.

11) Маден М.Т., Мусиралиева Ш.Ж., Болатбек М.А. Онлайн ортада экстремизмнің лингвистикалық маркерлерін анықтау // Матер. Междунар. научн. конф. студентов и молодых ученых «Фараби әлемі». – Алматы: Қазақ университеті, 2021. – С. 101.

12) Шәріпбекова С.Е., Мусиралиева Ш.Ж., Болатбек М.А. Қазақ тіліндегі оң қанатты экстремизмді анықтау үшін веб-контентті жинауға арналған бағдарламалық модуль әзірлеу // Матер. Междунар. научн. конф. студентов и молодых ученых «Фараби әлемі». – Алматы: Қазақ университеті, 2021. – С. 118.

13) Ынтықбай Б.Н., Мусиралиева Ш.Ж., Болатбек М.А. Әлеуметтік желілердегі қауіпсіздік пен конфиденциалдықты машиналық оқыту тәсілдерін қолдану арқылы талдау // Матер. Междунар. научн. конф. студентов и молодых ученых «Фараби әлемі». – Алматы: Қазақ университеті, 2021. – С. 119.

14) Мусиралиева Ш.Ж., Омаров Б.С., Болатбек М.А., Жастай Е. Веб-ресурстардағы қазақ тіліндегі экстремисттік сипаттағы мәтіндерді анықтау // Матер. Междунар. научн. конф. в области информационных технологий, посвященной 75-летию профессора У.А.Тукеева. – Алматы, 2021. – С. 98-104.

Personal contribution of the applicant. The applicant solved the tasks of the dissertation work. A semantic model and a method for identifying extremist texts in the Kazakh language on web resources have been developed. A corpus of extremist texts in Kazakh has been created for training and testing machine learning algorithms. Experiments were carried out to determine the accuracy of the developed model and method. A list of extremist keywords in the Kazakh language has been created.

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, algorithms for semantic analysis to identify extremist content in web resources and creation the tool for cyber forensics", IRN AP06851248. Priority area: national security and defense. Specialized area: information security. The research carried out on the dissertation work is included in the report of this project for 2020-2021.

Structure and scope of work. The dissertation work consists of an introduction, 4 chapters, a conclusion, a list of references and appendices. The full volume of the dissertation: 112 pages of typewritten text, including 71 figures, 14 tables, 137 references and 4 appendices.

Publication of results. In the course of the research work, 19 scientific papers were written. Of these, 1 article was published in the journal "Computers, Materials & Continua", indexed on the basis of Scopus, 4 articles in publications recommended by the Committee for Control in the Field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, 14 articles in collections of international scientific and practical conferences.

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 of extremism, the classification of extremism. An overview of global extremist resources is provided. The definition of countering extremism is given, international projects of countering extremist activity are considered.

The second section discusses the task of creating a corpus necessary for building a semantic model for detecting extremist data on web resources. The paper describes the operation of software for collecting and analyzing web content to determine extremist orientation. The statistics on the compiled corpus are given and the features of texts in the corpus categories are given. In addition, morphological analysis tasks are provided for the corpus data and a list of keywords is formed. As a result of this section, a corpus of extremist texts in the Kazakh language was created for the first time for teaching and testing machine learning methods to identify extremist texts in the Kazakh language.

In the third section, the task of constructing a semantic model for identifying extremist texts on web resources is considered, and the architecture of the constructed model is analyzed and its modules are characterized. In order to determine a highly accurate method of detecting extremist texts in the Kazakh language, experiments are conducted on web resources using various methods of word embedding and n-grams. As a result of the conducted research, a method of forming a set of features based on combinations

of N-grams and word embedding methods was developed, which improves the quality of classification of extremist texts and, for the first time, taking into account the peculiarities of the Kazakh language, a semantic analysis model was developed, characterized by the application of the TF-IDF method to bigrams previously applied by the stemming algorithm to the word embedding layer of the LSTM network and increasing the accuracy of the definition of extremist texts.

The fourth section provides a comparative analysis of various machine learning methods and the proposed method for identifying extremist texts in the Kazakh language on web resources.

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