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EVALUATION OF THE EFFICIENCY OF ARTIFICIAL NEURAL NETWORK MODELS IN THE PROCESS OF THEIR INTEGRATION INTO SYSTEMS FOR MONITORING POLITICAL INTERNET DISCOURSE

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The article highlights the problem of evaluating the effectiveness of artificial neural network models in their integration into systems for monitoring political Internet discourse with a complex integrated natural language. The author emphasizes the prospects, relevance, etc. of using innovative tools in modern linguistic research. The article is about the actualization in such studies of neural network models (in particular, with the Transformer architecture), which show high efficiency in automating the processing of textual data (including political Internet discourse). The analysis showed that evaluating the effectiveness of such models solely based on conventional computational metrics designed to work with structured data is not productive. That is why it is important to develop clear, transparent, and logical linguistic criteria, a variant of which is presented in this study. The reliability of the results of processing and analyzing textual data by neural network models correlates with integrating linguistic verification methods into their work at all stages of training and testing of the latter. This, in turn, will significantly reduce the risk of misinterpretations of politically labeled statements, which is especially productive when this tool is used in political discourse monitoring systems. Developing interpreted neural network architectures is also important, as they will ensure transparency, logic, and consistency in the text data processing process. In addition, such architectures will improve the quality of linguistic analysis and contribute to a deeper understanding of how models form semantic representations. This is also important in actualizing such systems in the political context, as a basis for making certain political decisions. The prospect of further research on the analyzed problem is to improve approaches to training neural network models that will consider the dynamic changes in political online discourse and the variability of its contexts. This improvement will significantly increase the efficiency of using neural network models in a rapidly changing information environment and changes in digitalization.

Key words: neural network modeling, neural network modeling research, applied linguistics, computer linguistics, computational linguistics, artificial neural networks, neural network models, evaluation of neural network models.

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Introduction and Problem statement. Today, communication is characterized by the intensification of transformational changes associated with digitalization processes. The latter influenced the nature of communicative transformations and led to a revision of the tools for their study. In particular, political communication is of particular interest, due to the variability of its forms, the intensity of digital technologies' integration, and the change in the environment of the latter (we are talking about political Internet discourse). Thus, this communication is now functioning in an environment composed of networking platforms, social networks, and others that form fundamentally new models of polydiscursive interaction.

In turn, such changes excite modern linguistics (in particular, its branches such as computational, applied, mathematical, and other types). Notably, this involves a certain rethinking of the concepts established in this field (text, sense, value, etc.): thus, they acquire

a fundamentally different, "mathematical" reading. We are talking about perceiving texts as data for analysis, which can and should be analyzed with the help of numerous tools specific to the mathematical paradigm: statistics, data science, etc. This approach is also logical because the aforementioned communicative modifications create a whole range of textual data, intensifying their flows, etc.

Naturally, this situation leads to the multiplicity and variability of data functioning in different discourses (in particular, political Internet discourse). Thus, their timely, qualitative, and thorough analysis becomes impossible without modern tools. First, we are talking about the growing amount of textual data in the public domain (e.g., arXiv, Springer, IEEE, etc.) that cannot be processed manually. Instead, the automation of such processes is associated with actualizing new, effective tools within modern (in particular, linguistic) research. The latter can interpret semantics, categorize, rank, and identify implicit communicative and other structures of the relevant process. In the latter context, we believe that using artificial neural networks (in particular, neural network modeling of linguistic units) is critical, as they are the core tool for processing, analyzing, visualizing, and other politically labeled content [5].

At the same time, integrating such tools into systems for monitoring political Internet discourse naturally has several problems. The latter are attracted mainly by the well-established issues in this field of knowledge, from the linguistic representation of data to the accuracy of interpreting their semantics. The above-mentioned branches of linguistic science come to the rescue here: In particular, a) *applied linguistics*, which makes it possible to evaluate the quality of neural network models not only by conventional formal metrics (accuracy, F-measure, etc.), but also by taking into account such parameters as relevance, coherence, representativeness, etc. of the reproduced senses in the context of political communication; b) *computational linguistics*, where it is productive to use methods of formalizing such structures (textual data), which, in turn, allows comparing and validating the input and output data of a neural network model; c) *mathematical linguistics*, which allows researchers to build and standardize the process of developing the above models, which integrate the static identity of textual data in correlation with their semantic, morphological and other properties, etc.

An important aspect of the analyzed problem is the lack of unified approaches to evaluating the results of artificial neural networks in general, and in analyzing political and Internet discourse. This, in the first place, creates the need to systematize the quality criteria for such models, which, in turn, implies the implementation of an integrated toolkit of modern linguistic and other research. Thus, in terms of linguistic science itself, we consider it productive to combine the knowledge of those above computational, mathematical, applied, and other linguistics in the context of neural network modeling of linguistic units. Accordingly, the automation of linguistic analysis is particularly relevant in monitoring political Internet discourse, particularly in detecting false data (misinformation, disinformation, and propaganda), hate speech, etc. The above demonstrates that artificial neural networks play a key role in the automation process, providing a high degree of formalization of language structures and analysis of the semantics of text data on a scale inaccessible for manual processing.

At the same time, the implementation of such models in real processing systems is fraught with risks, as this process requires not only engineering adaptation but also clear criteria for verifying the effectiveness of this tool. The main problem, in our opinion, is the latter, since most of the metrics used for such work (evaluation of neural network models) focus on the quantitative component. It is not a problem to extract the latter from structured data (tables, etc.), but text data is mostly unstructured. This leads to the fact that the linguistic identity (cor-

rectness of the model's interpretation of political and other senses, correspondence to the context and semantics) is not developed. We see the solution to this problem in the integration of methods of applied, computational, and mathematical linguistics, which will allow us to combine the formalization of linguistic phenomena with their quantitative analysis in the context of neural architectures. In turn, this approach will allow us to build a fundamentally new type of system (architecturally and in terms of the arrangement of layers in a particular model) capable not only of reproducing language patterns but also of interpreting them within the framework of certain discursive practices (in particular, political communication). The present study is devoted to these issues, analyzing the current state and prospects for assessing the effectiveness of these models in working with data from political Internet discourse.

Analysis of recent research and publications that have initiated the solution of this problem and on which the author relies. Thus, interdisciplinarity as the core component of our study determines the breadth of the analysis of relevant works due to the multidimensionality and originality of its nature. In particular, we are talking about discursivity as a problem of this study, within the framework of which it is logical to consider the work of P. Nedungadi et al. [1], which considers the role of artificial intelligence in intensifying the current changes in text data (personalization, tracking dynamics, developing scalable methodologies with an emphasis on protecting user data, etc.) The authors focus on the prospects of using the PRISMA framework and BERTopic modeling in key areas of artificial intelligence: in particular, they talk about detecting false data, sentiment analysis, hate speech localization, text corpus analysis, etc. Scientists note that digital technologies (dynamic memory networks, time convolutional artificial neural networks, etc.) show significant promise in tracking public opinion and combating false data. In particular, researchers believe artificial intelligence can improve modern communication (including online interaction). In addition, the authors emphasize the urgency of developing scalable artificial intelligence methodologies (e.g., multitasking frameworks) that will help modern researchers process text corpora and other content generated by social networks, users, artificial intelligence itself, and the like, while ensuring cross-platform adaptability and computational efficiency.

The study of the dynamics of the spread of false data is continued by S. Akhtar, A. Akhtar [2], which highlights an innovative approach to detecting the latter, which integrates a hybrid artificial intelligence model with natural language processing methods and machine learning algorithms. The presented neural network model actualizes multilevel feature extraction, contextual sentiment analysis, source fact-checking, and assembly learning. According to the scientists, the above parameterization specificity allows accurate identification, classification, and so on of the outlined false data. The paper also analyzes the challenges to adapting such tools to changing disinformation strategies in the context of an integrated approach to the problem. The study of sentiment analysis in the context of the issues analyzed in this article continues in the work of A. K. Upadhyay et al. [3]. In it, the authors study the methods of sentiment analysis, which are crucial for understanding the transformational changes of the latter about trends, tendencies, etc., actualized in social networks. Thus, the researchers investigated the effectiveness of machine learning on the X dataset: this dataset included posts with positive, negative, and neutral sentiments. The researchers evaluated five models (XGBoost, Multinomial Naive Bayes, the base model, Gradient Boosting Classifier, neural network with ELU activation, and Adam optimizer).

Instead, the current state, prospects, and other aspects of large-scale language models are discussed in L. Bojić et al. [4], emphasizing the latter's potential to extract significant

insights. The authors note that at this stage of development, there is a lack of comparison of the results of their work with human input, and compare the most popular models, GPT-4, Gemini, etc. Notably, the researchers decided to compare the above models with human annotators in sentiment analysis, political sympathies and preferences, and the degree of emotionality and sarcasm. The results showed that humans and most neural network models can demonstrate a fairly high inter-rater reliability when analyzing sentiment and political preferences. Paradoxically, artificial data processing proved to be more reliable than manual processing. Similarly, the analysis of emotional intensity performed by neural network models proved to be more productive: most large language models also demonstrated temporal consistency across all parameters. Thus, the authors conclude that neural network models (especially GPT-4) can effectively reproduce human analysis of moods and political preferences. At the same time, human experience remains basic in such analysis, but large language models have potential in latent content processing.

The study of the above models is continued in the work of M. Wang et al. [5], which analyzes the current state and prospects for their implementation in the study of intensifying public involvement in mega-infrastructure projects. The authors note that such projects profoundly impact society, while broad public involvement allows for the analysis of public opinion. Scientists present a new approach to creating neural network models, parsing, etc., in the context of large language models. The latter are used for massive parsing of text corpora and studying social networks. In particular, the paper identifies influential people and the identity of public engagement during the life cycle of mega-infrastructure projects. The researchers reveal the hidden dynamics of involvement and interaction between different project events, allowing them to prioritize management. Based on large-scale language models, the new concept offers decision makers practical ideas for comprehensively optimizing online communication strategies with the public and its involvement in mega-infrastructure projects.

Instead, the impact of digital technologies on democratic processes and the aforementioned public engagement is presented in G. Asimakopoulos et al. [6], in which the authors consider social networks, e-voting systems, e-government initiatives, and e-participation platforms to be the main tools of the above. Scientists note the exponential growth of the influence of digital technology tools, focusing on their impact on the development of civic engagement and good governance through transparency. In particular, the researchers study the problems that correlate with the ethical and social consequences of using technology in the context of the security paradigm, etc. In addition, the authors analyze the current regulatory framework in the context of personal data protection, privacy issues, etc., to determine the impact of such technologies on democratic governance and the communication process in general. The above approach has shown the duality of the role of digital technologies: on the one hand, they contribute to democratic processes by intensifying them, and on the other hand, they pose a threat to them. Among the potential negative consequences, scientists highlight the functioning of the aforementioned false data and the digital divide in the development of certain regions.

The functioning of false data in different contexts (in particular, information warfare) is presented in the work of D. Plikynas et al. [12], where the authors position the latter as a powerful and effective tool for influencing the social identity, attitudes, opinions, and behavior of society members. Scientists aim to explore advances in machine and deep learning implementation to identify such data. Instead, the effectiveness of convolutional neural networks, bidirectional encoders from transformers (BERT), and generative pre-trained transformers (GPT) is highlighted in the paper by K. I. Roumeliotis, N. D. Tselikas,

D. K. Nasiopoulos [13]. The authors emphasize that each of the above neural network models has a distinctive parameterization and properties that vary widely: from the ability to recognize CNN patterns to the contextual understanding of BERT and GPT in the embedding space. The paper's results demonstrate that the finely tuned GPT-4 Omni models achieve 98.6% accuracy, significantly outperforming traditional models such as CNNs, which achieved only 58.6%. At the same time, the smaller GPT-4o mini model performed as well as its larger counterpart, highlighting the cost-effectiveness of smaller models for specialized tasks. These findings emphasize the importance of fine-tuning large language models to optimize performance for complex tasks, such as developing a fake news classifier, where it is essential to consider subtle contextual relationships in the text.

An analysis of the impact of the emergence of large language models on the transformational changes in computer social sciences (humanities paradigm) is presented in S. Thapa et al. [7]. In it, the authors consider the role of such models and their place in the context of the humanities: in particular, they study the latter's potential in analyzing and generating data and prospects for researching social changes and phenomena. Thus, in the context of our article, it is interesting to see the authors' vision of using large language models in computational tasks, including sentiment analysis, hate speech detection, position and humor detection, working with false data, and more. In particular, according to the scientists, integrating such models into the humanitarian paradigm will facilitate the understanding of certain events, the analysis of text corpora, and the generation of a subtle sense of human behavior and social trends. P. Meel, C. Raj, and Bhawna [8] continue to study the identity of working with false data in Internet discourse in their work, where they identify a wide range of issues related to their detection. In particular, the authors note that Internet discourse data is analyzed by updating various content modalities (text, graphics, media, etc.) with other sources of influence. In the analyzed work, the authors consider multimodal methods of localizing false data with an intertextual, intermedial, and similar nature.

The work by I. Krak et al. [9] present a created and tested method for evaluating semantic features for localizing political propaganda using artificial neural networks-transformers. According to the authors, this method increases the level of understanding of certain decisions of the neural network model by assessing the above-mentioned level of semantic features. The researchers emphasize that this method will effectively detect gray and black propaganda technologies: in particular, it is productive to use additional semantic features for such data, along with a modified architecture (not only textual data but also a wide range of semantic features are analyzed). The authors note that the presented neural network model showed promising results in detecting five political propaganda techniques (appeals to fear-prejudice, repetition, simplification of cause and effect, minimization, and appeals to authority), and a slight increase to four (distraction, hyperbole, counterargumentation, and use of clichés). Instead, the method was very effective for eight techniques (loaded language, use of hate speech, etc.). The results of the analyzed work contribute to strengthening democratic institutions and ensuring transparency in political decision-making, which is an essential step in the fight against false data and various manipulations.

The analysis of the effectiveness of updating innovation diffusion models and artificial neural networks for predicting socio-political sentiments is presented in R. Romaniuk et al. [10]. It shows the role of social media in the context of their influence on public consciousness and analyzes the dynamics of the spread of narratives among different population groups. The authors emphasize that the study's results emphasize the

importance of adapting the content strategy in social media to influence the target audience. The researchers note that to implement the state's strategic narrative successfully, it is necessary to update the combined methods of forecasting and adapting content on social platforms. The researchers emphasize that successfully adapting the content strategy, considering changes in user behavior and trends in socio-political sentiment, is a key factor in influencing public opinion and supporting national interests in political Internet discourse. The study of the prospects for analyzing sentiment in the above environment continues in the work of A. S. Veluswamy et al. [11], which highlights the evolution of such research in social networks using the most modern methods of neuro-linguistic programming (in particular, artificial neural networks-transformers: BERT, RoBERTa, GPT, and others) and multimodal approaches. The authors emphasize that their multilingual and cross-platform neural network model can analyze content (audio, visual, and text) from various social networks (X, Facebook, Instagram, TikTok, and others). Scientists are determining the effectiveness of sentiment analysis in specific areas to improve their classifications in specialized contexts.

We consider the work by S. Shamroukh, T. Johnson [14] to be indicative in the context of the issues studied in this article, which discusses the role of artificial intelligence, machine learning, and certain large-scale language models in localizing and interpreting online threats. The authors note that developing artificial intelligence and machine learning technologies requires modern methodologies for identifying and assessing such threats. In this case, a special type of discourse is political Internet discourse, which is both an information center and a source of malicious content. Scientists emphasize that, in their opinion, neural network models based on BERT are particularly effective in detecting hate speech in different languages and platforms. In addition, such models are more transparent and their decisions can be better understood, which gives them significant advantages over other neural network models. In particular, it is said that such models (in particular, GPT-4) expand the possibilities of localizing various threats. However, there are still many challenges in processing noisy, unbalanced social media data.

Instead, the role of news content in shaping public opinion is explored in the work of A. Jannani et al. [16] explored the possibilities of using it to analyze sentiment. The authors note that they used advanced natural language processing techniques to analyze news content in modern standard Arabic: they classified headlines by topic (politics, business, education, weather and sports, etc.) and then applied sentiment analysis, positioning them (headlines) as positive or negative. The researchers also propose their own system for assessing and monitoring public well-being, within which they carried out their work: localizing public sentiment on key aspects of quality of life in Moroccan news. The researchers' approach uses thematic modeling at the Arabic Moroccan news dataset's pre-processing stage to improve the quality of the selected sample before building classification models.

The originality of the integration of cognitive computing with the aforementioned natural language processing is presented in the work of L. Orynbay et al. [15], whose authors note that this approach allows creating new architectures of systems capable of learning, reasoning, and communicating with people in a natural and meaningful way. In particular, scientists study the convergence of these technologies and highlight how they are combined to form intelligent systems capable of understanding and interpreting human speech. The researchers present a comprehensive taxonomy of cognitive computing technologies in natural language processing that categorizes key tools and techniques that improve machine understanding and language generation. In addition, they discuss practi-

cal applications, such as improving accessibility for the visually impaired using advanced AI-based tools, and analyzing political discourse on social media, where these technologies allow us to understand public sentiment and information dynamics.

We also consider the work of Z. Xu, Z. Liu, H. Luo [17], which highlights the problem of assessing the effectiveness of public policy in response to the diverse needs of citizens. The authors emphasize that traditional methods of such assessment are often not operational and accurate, which makes it challenging to achieve good governance. They see the solution in their proposed systematized online public opinion index system based on artificial neural networks and big data. The system is based on the theory of the three elements of attitude from social psychology: it allows for the recording of the public's commitment to certain strategies, campaigns, policies, etc. The researchers emphasize that using empirical data and deep learning models based on convolutional neural networks allowed their neural network model to achieve an accuracy of 93.40%. Thus, the authors propose a scientific, logical, and reasonable approach to improve government decision-making and policymaking.

Thus, the analysis of the aforementioned historiography of our study has revealed several gaps: in particular, despite numerous studies of its individual aspects, there is no comprehensive approach to its solution. This study aims to fill in the existing gaps, namely, to highlight the peculiarities of evaluating the effectiveness of artificial neural network models in their integration into systems for monitoring political Internet discourse.

Identification of previously unresolved parts of the general problem to which this article is devoted. The above-mentioned parts of our article demonstrate its relevance and complexity in the context of modern linguistic research. In particular, despite the active implementation of digital technologies, several aspects of the problem remain unresolved. Thus, modern research in the field of applied, computational, mathematical linguistics and mathematical modeling demonstrates the existence of such unresolved aspects of this problem:

1. *There is a lack of established, clear, and consistent criteria for the effectiveness of artificial neural networks in neural network modeling of linguistic units*. The point is that modern metrics are focused more on structured data evaluated according to established parameters (completeness, accuracy, etc.), without regard to the problem of semantics and others.

2. *Opacity of decision-making by different neural network models creates a misunderstanding of the reliability and quality of their content analysis (in particular, textual)*. Thus, interpreting latent semantic representations formed by such models regarding politically labeled vocabulary and certain discursive strategies seems problematic. In particular, we postulate a gap between computational vectors and linguistic categories (for example, absurdity or sense).

3. *Insufficient degree of adaptation of neural network models to the original, changing political Internet discourse*, within which language patterns and semantic markers change depending on the context, events, and social groups.

4. *There is a lack of a comprehensive, logical, and systematic approach to integrating the above models into monitoring systems*: naturally, this process involves linguistic analysis, statistical processing, etc., as well as mechanisms for adapting the model to new language data and its potential changes under the influence of the environment.

Thus, the relevance and importance of addressing these aspects necessitate a combination of applied, computational, and mathematical linguistics tools to develop a methodology for linguistically sound evaluation of the effectiveness of neural network models in political Internet discourse.

The article aims to determine the effectiveness of neural network models in the

automated analysis of political Internet discourse. *The subject* is the specifics of their integration into systems for monitoring such discourse. Achieving the above goal and subject involves the realization of the following ***objectives:***

1. To analyze the historiography and highlight current approaches to evaluating the effectiveness of neural network models in text analysis tasks.

2. To develop linguistically sound criteria for assessing the quality of such models in the analysis of political Internet discourse.

3. To test the effectiveness of the selected neural network models on corpora of political texts using the above criteria.

Findings and discussion. It is worth noting that the systems for monitoring political Internet discourse outlined in the article's title are now increasingly focused on automating content processing (in our case, text corpora). The main tool of the latter is artificial neural networks, which help to identify structural, functional, and semantic features of such data. Nevertheless, in practical terms, the issue of implementing such tools has not yet been resolved: this is primarily due not to the hardware problems of this process, but to the presence of specifically linguistic cornerstones. The methodological basis of our study is an interdisciplinary combination of applied, mathematical, and computational linguistics principles with modern machine learning methods. In particular, we are discussing using the above-mentioned neural network models to analyze the linguistic units of political Internet discourse [17].

Naturally, the main object of neural network modeling is the linguistic units that function in the discourse in question: lexical markers of political identification, evaluative units, pragmatically loaded constructions, and contextually determined discourse structures. That is why, at ***the first stage of our research***, we analyzed the existing approaches to validating such models in the prism of computational, applied, and mathematical linguistics. In turn, this analysis confirmed our hypothesis that most evaluations of their performance are based on metrics (accuracy, precision, recall, F1-score, etc.) designed to work with structured data (tables, etc.). This approach is not entirely suitable for working with text corpora in general (in particular, linguistic categories), since it cannot consider the semantic complexity of political text. This results in difficulties in determining the relevance of a particular neural network model in the context of modern political communication, which necessitates the development of a linguistically sound system for such an assessment [8].

Accordingly, ***the second stage of this study*** is devoted to developing a system of linguistic criteria for assessing the quality of neural network models in the context of political Internet discourse. Thus, the main criteria are as follows: a) *semantic relevance*, which refers to the degree to which the interpretation of textual data corresponds to the actual or contemporary political context; b) *pragmatic adequacy*, represented by the ability of a neural network model to correctly reproduce politically labeled vocabulary and its formal representation in such data; c) *contextual stability*, which consists in the invariability of the analysis result under changing contextual conditions; d) *topical consistency*, represented by the correspondence of the neural network model result to the general topic of the text, which is especially relevant for complex syntactic structures that are characterized by modification of lexical meaning according to various parameters (topic, genre, etc. of political communication); d) *discursive integration*, which is the ability of such a model to correctly recognize linguistic units in correlation with the broader discourse context, taking into account textual coherence, reference, etc. [12].

At ***the third stage***, the neural network models were tested (using Transformer-type

architectures as an example) using a specially collected text corpus. The latter included posts from social networks, fragments of political programs, and materials from news resources. The evaluation itself was based not only on the above-mentioned classical machine learning metrics, but also on the above-mentioned linguistic criteria.

Experimental design. The experimental part of this study was conducted according to the classical machine learning scheme, with the preparation of training, validation, and test samples. In particular, the text corpus was segmented accordingly in the following proportions: 70% – *training sample* (a set of text data for modeling semantic representations and forming the parameters of the neural network model); 15% – *validation sample* (a set of text data for adjusting hyperparameters); 15% – *test sample* (a set of text data for final checking the quality of recognition of politically labeled linguistic units). To reduce the impact of potential corpus bias, the textual data used was grouped by source type (mass media, social media, official communications) and chronology (chronological period).

Software used. In the aforementioned experimental part of our research, we used exclusively open and free software. In turn, this ensured the reproducibility of the results and the flexibility of settings in the development of neural network models. In addition, the use of open source software made it possible to demonstrate the transparency of the outlined stages of the study (see Table 1):

Table 1. Main research tools

№	Software name	Characteristics	Official repository/ website	License
1.	*Python*	an open source programming language that is widely used in the field of natural language processing and neural network modeling	https://goo.su/9syFDL7	Python Software Foundation License
2.	*Huggingface Transformers*	an open-source library for working with neural network architectures such as BERT, RoBERTa, DistilBERT, GPT, with support for fine-tuning on applied tasks	https://goo.su/J24r	Apache License 2.0
3.	*PyTorch*	an open-source machine learning framework for implementing and training deep neural networks	https://goo.su/u1VQP	BSD 3-Clause License
4.	*scikit-learn*	library for data analysis and building classical machine learning models	https://goo.su/5p105C	BSD 3-Clause License
5.	*spaCy*	open tools for text data preprocessing, tokenization, partial language markup, and basic linguistic analysis	https://goo.su/5RRmb	MIT License
6.	*NLTK (Natural Language Toolkit)*		https://goo.su/PYQTb2	Apache License 2.0

7.	*UMAP-learn*	tools for visualizing multidimensional latent representations in low-dimensional space	https://goo.su/y1xF1	BSD 3-Clause License
8.	*t-SNE (в рамках scikit-learn)*		https://goo.su/X96bO	BSD 3-Clause License

Notably, the training parameters of the neural network models were selected experimentally: according to the size of the corpus, the complexity of the semantic load of certain political statements, and the limitations of open and free software computing resources. The training was conducted on computing nodes with NVIDIA RTX 40xx series GPUs. The results of each experiment were recorded for further comparative analysis based on both computational and linguistic performance criteria (as described above). In particular, we postulate high processing rates of linguistic units of political Internet discourse by neural network models, which allows us to position the latter as a significant component of modern linguistic research [7].

At the same time, such models also revealed a limited ability to semantically interpret politically labeled vocabulary (particularly in contexts with a high level of political load or absurdity: irony, sarcasm, etc.). This, in turn, confirmed our hypothesis about the need to supplement the existing procedures for training and testing such models with linguistically oriented approaches to validation (for example, the ones we propose in this article) [1]. In particular, we believe integrating computational, applied, and mathematical linguistics methods at all evaluation stages, calibration, and improvement of neural network architectures used to analyze the discourse in question is productive. The results of our experiment showed that:

1. *There is a lack of correlation between high performance of computational metrics (the aforementioned accuracy, precision, F1-score, etc.) and the linguistic quality of processing textual data of political Internet discourse*. Thus, in the case of implicit sense constructions, the ability of these models is significantly reduced, which indicates the limitations of the outlined metrics for evaluating the work of neural network models (in particular, for analyzing the linguistic units of the relevant discourse) [16].

2. *Political online discourse is a distinctive and rapidly changing environment, so even the most advanced neural network models cannot adapt quickly enough to ensure the appropriate quality of their data processing without human intervention*. A striking example is the transition from an election campaign to post-election political communication. The point is that such models do not have time to consider changes in the pragmatic load of linguistic units in the chronological plane, which emphasizes the need to consider the temporal variability of discourse in teaching them [9].

3. *Including these linguistic criteria in the evaluation system of neural network models, one of the variants proposed in this study, is also important*. For example, in the task of analyzing political content, such criteria, in the form of lexical and semantic tests or other tests based on materials from real political discourses, will help to test the real ability of models to export and import sense integrity and contextual relevance, etc. [15].

Thus, it is necessary to develop further interpretable neural network architectures that would allow us to build linguistically logical, consistent, and robust processes of processing political vocabulary at the level of different language constructions. The relevance of such work is due to the need for a full linguistic verification of the results of textual data processing by neural network models, without which their use is questionable for

modern linguistic research. At the same time, the linguistic criteria and parameters that should form the basis for their evaluation are open, as well as how text data processing can be made sustainable when the discourse environment changes. Accordingly, the problem of forming mathematically accurate and linguistically valid approaches to training and testing neural network models in real-world conditions is promising and relevant for the further development of the humanities (in particular, linguistics) [8].

Conclusions from this research and prospects for further research in this area. Thus, the problem of assessing the effectiveness of artificial neural network models in their integration into systems for monitoring political Internet discourse is complex and integrated. After conducting our research, we came to the following conclusions:

1. The results of our experimental analysis confirmed the prospects, relevance, etc. of using innovative tools in modern linguistic research. We are talking about the actualization in such studies of neural network models (in particular, with the Transformer architecture), which show high efficiency in automating the processing of textual data (including political Internet discourse).

2. The analysis has shown that evaluating the effectiveness of such models solely based on conventional computational metrics designed to work with structured data is not productive. That is why it is important to develop clear, transparent, and logical linguistic criteria, a variant of which is presented in this study.

3. The reliability of the results of processing and analyzing textual data by neural network models correlates with integrating linguistic verification methods into their work at all training and testing stages. This, in turn, will significantly reduce the risk of misinterpretations of politically labeled statements, which is especially productive when this tool is used in political discourse monitoring systems.

4. Developing interpreted neural network architectures is also important, as they will ensure transparency, logic, and consistency in text data processing. In addition, such architectures will improve the quality of linguistic analysis and contribute to a deeper understanding of the process of forming semantic representations by models. This is also important in actualizing such systems in the political context, as a basis for making certain political decisions.

The prospect of further research on the analyzed problem is to improve approaches to training neural network models that will consider the dynamic changes in political Internet discourse and the variability of its contexts. This improvement will significantly increase the efficiency of using neural network models in a rapidly changing information environment and changes in digitalization.

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ОЦІНКА ЕФЕКТИВНОСТІ МОДЕЛЕЙ ШТУЧНИХ НЕЙРОННИХ МЕРЕЖ У ПРОЦЕСІ ЇХ ІНТЕГРАЦІЇ В СИСТЕМИ МОНІТОРИНГУ ПОЛІТИЧНОГО ІНТЕРНЕТ-ДИСКУРСУ

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У статті висвітлено проблему оцінювання ефективності моделей штучних нейронних мереж під час їх інтеграції в системи моніторингу політичного інтернет-дискурсу зі складною інтегрованою природною мовою. Автор підкреслює перспективність, актуальність тощо використання інноваційного інструментарію у сучасних лінгвістичних дослідженнях. Мовиться про актуалізацію у таких дослідженнях нейромережевих моделей (зокрема, з архітектурою типу Transformer), які показують високу ефективність у завданнях автоматизації процесів обробки текстових даних (в тому числі й політичного інтернет-дискурсу). Проведений аналіз показав, що оцінка ефективності таких моделей виключно на базі узвичаєних обчислювальних метрик, покликаних працювати зі структурованими даними, не продуктивна. Саме тому важливим є випрацювання чітких, прозорих та логічних лінгвістичних критеріїв, варіант яких представлений у цьому дослідженні. Надійність результатів обробки та аналізу текстових даних нейромережевими моделями корелює з інтегруванням до їх роботи методів лінгвістичної верифікації на всіх етапах навчання й тестування останніх. Своєю чергою, це дозволить суттєво знизити ризик хибних інтерпретацій політично маркованих висловлювань, що особливо продуктивно у випадку використання цього інструменту у системах моніторингу політичного дискурсу. Значущою також є розробка інтерпретованих нейромережевих архітектур, оскільки вони забезпечать прозорість, логіку та наступність процесу обробки текстових даних. Окрім того, такі архітектури підвищать якість лінгвістичного аналізу й сприятимуть глибшому розумінню користувачами процесу формування моделями семантичних репрезентацій. Також це важливо в контексті актуалізації подібних систем у політичному контексті: як бази для ухвалення тих чи тих політичних рішень. Перспективу подальших досліджень аналізованої проблеми складає удосконалення підходів до навчання нейромережевих моделей, які враховуватимуть динамічні зміни політичного інтернет-дискурсу та мінливість його контекстів. Відповідне удосконалення суттєво підвищить ефективність використання нейромережевих моделей в умовах швидко змінюваного інформаційного середовища та диджиталізаційних змін.

Ключові слова: нейромережеве моделювання, дослідження нейромережевого моделювання, прикладна лінгвістика, комп'ютерна лінгвістика, обчислювальна лінгістика, штучні нейронні мережі, нейромережеві моделі, оцінка нейромережевих моделей.

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