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Hybrid artificial neural networks for adaptive philology in unstable or crisis conditions

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Abstract. *This paper explores how hybrid artificial neural networks enhance adaptive and targeted philology during periods of instability or crisis. As language rapidly transforms in volatile social and informational environments, hybrid neural systems–combining deep learning, statistical methods, symbolic linguistics and optimization techniques–provide higher accuracy, flexibility and resilience when processing complex textual data. The study outlines key applications of hybrid artificial neural networks, including large-scale corpus analysis, crisis-oriented discourse monitoring, lexicographic automation, multilingual research and multimodal communication processing. Results show that hybrid models effectively detect emerging linguistic trends, manipulative discourse and emotional signals, supporting information stability and improving philological analytics in turbulent conditions. Despite challenges such as computational cost and model opacity, hybrid artificial neural networks form an essential technological basis for the future development of digital philology.*
Keywords: *philology, artificial neural networks, hybrid AI, instability, crisis*.

Introduction.

Philological science today is entering a period of deep digital modernization, when the previous methods of language analysis cannot cope with the scale of modern information flows and the speed of their change. The volume of text data is growing exponentially, communicative formats are becoming increasingly diverse, and language dynamics are accelerating under the influence of social networks, digital media, and hybrid forms of communication. All these processes are especially noticeable in moments of socio-political, economic, informational, or cultural uncertainty, and especially - shocks [1]. In such difficult periods, language is rapidly

updated: new expressions appear, emotional and propaganda signals intensify, and the degree of uncertainty and chaos in communication increases.

In this situation, hybrid artificial neural networks – complex intelligent systems [2] that combine the capabilities of deep neural network models, statistical and symbol-oriented techniques, optimization methods and adaptive algorithms for processing data structures of all types, especially semi-structured and unstructured [3], begin to play a significant role. These networks serve as the technological foundation of adaptive and targeted philology, which focuses on operational analysis of language, sensitive to context, social changes and the characteristics of specific audiences.

The adaptive approach allows you to monitor rapid changes in discourse, identify hidden trends, recognize deviant language phenomena, and model emotional and pragmatic aspects of communication. Targeted philology, in turn, focuses on the analysis of individual groups, genres, thematic niches and information segments, which is extremely important in moments of crisis, when different social strata and media environments demonstrate unique language manifestations.

By combining neural network algorithms and linguistic models, hybrid artificial neural networks provide high accuracy, robustness, and the ability to adapt to unstructured and unpredictable data. This makes them one of the most promising tools for modern humanitarian analytics and for ensuring the information resilience of society in times of instability. Thus, hybrid neural architectures form the basis of a new research paradigm that combines technological capabilities, humanitarian methods, and interdisciplinary approaches for in-depth study of language under uncertainty.

The Main Part.

1. Theoretical and methodological foundations of hybrid deep neural network systems.

Hybrid deep neural networks are integrative models that combine:

- deep learning mechanisms (transformational structures, recurrent and convolutional models);
- elements of classical statistical methods;
- symbolic-linguistic algorithms and rules;
- evolutionary [4, 5], heuristic and optimization procedures for parameter tuning;
- ensemble combinations of several models.

Such a combination increases the accuracy of data interpretation, strengthens noise resistance and expands the capabilities of analyzing complex language phenomena, which makes hybrid systems in demand in the field of humanitarian analytics.

2. The main areas of application of hybrid deep neural networks in philology.

In research and applied activities, hybrid neural network complexes are used to solve a wide range of tasks:

2.1. Complex processing of large-scale text collections: models allow to detect latent semantic connections, track discursive transformations and implement automatic thematic structure of texts.

2.2. Linguistic monitoring in crisis and unstable situations: hybrid deep neural networks accelerate the detection of manipulative language constructions, disinformation, emotionally colored and aggressive statements, which is especially valuable in conditions of information pressure.

2.3. Automation of lexicographic and terminological research. Such systems help to record new terms, neologisms and word combinations that arise in conditions of rapid social change.

4. Interlinguistic and comparative cultural research. Hybrid architectures improve the quality of machine translation, intercultural interpretation and comparative analysis of texts.

5. Multimodal data processing - systems allow combining the analysis of written speech, audio and visual signals, revealing communication processes more fully.

3. The significance of hybrid models in conditions of instability.

In times of crisis, philological analytics performs key functions:

- assessment of public discourse and sentiments;
- identification of language threats and toxic communications;
- study of language dynamics under the influence of social cataclysms;
- preservation and digital archiving of cultural heritage;
- strengthening the information stability of society.

Hybrid deep neural networks in such conditions provide:

- increased accuracy based on a combination of different methods;
- rapid adaptability to new linguistic trends;
- resistance to distorted, noisy and fragmented data;
- efficiency of processing larger volumes of information;
- versatility of application in various disciplinary contexts.

4. Problems, limitations and risks of application.

Despite the obvious advantages, the use of hybrid neural network systems is accompanied by a number of challenges:

- significant computational costs of training complex models;
- the likelihood of statistical bias and interpretation errors;
- low transparency of deep architectures;
- lack of specialists who combine the skills of a philologist and an AI developer;
- ethical difficulties when analyzing sensitive data in unstable situations.

Conclusions.

The study of the use of hybrid artificial neural networks in adaptive and targeted philology during crises allows us to identify a number of key patterns and conclusions.

Firstly, hybrid artificial neural networks demonstrate high performance in processing big SEMI-structured data [5] (text arrays), which are dynamic – rapidly changing. Their use ensures timely detection of new language trends, recognition of manipulative and conflict-generating statements, analysis of the emotional component

of messages and systematization of multi-genre data. In the event of instability, such capabilities become strategic.

Secondly, hybrid neural architectures combine the advantages of different types of analysis: deep learning, linguistic rules, contextual knowledge, semiotic approaches and optimization techniques. This allows us to obtain more accurate, interpretable and stable results even in the presence of information chaos. HINs are able to detect the hidden structure of the text, take into account the pragmatic context and model discursive processes in real time.

Thirdly, the use of hybrid artificial neural networks significantly expands the functionality of modern philology. It is turning into an analytical field actively involved in monitoring public communication, preventing information threats, analyzing media content, identifying crisis narratives, and studying the dynamics of social sentiment. Thus, philology becomes not only an area of language study, but also a tool for ensuring information security and stability.

Fourthly, despite all the advantages, certain difficulties remain: high resource requirements, the possibility of algorithmic distortions, insufficient transparency of some models, the need for specialists with mixed competencies - both linguistic and technological. These factors require a responsible approach to the development and application of hybrid artificial neural networks, as well as the improvement of educational and methodological standards [6].

In general, hybrid artificial neural networks set the direction for the further development of digital philology. They form new mechanisms for understanding communication in times of crisis, provide deeper and more accurate research into language, and strengthen the intellectual tools necessary for modern society to function sustainably in times of instability.

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