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Evolutionary Computations for Contemporary Folklore Studies AMID SHIVA- and WARMI Conditions of Modern Philology

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Abstract. The article considers the features of the application of evolutionary computing in modern folklore research in the context of the SHIVA and WARMI concepts of modern philology. The advantages of using genetic algorithms and other evolutionary methods for analyzing, classifying, and modeling folklore data are substantiated. The prospects for their integration with artificial intelligence, machine learning, and big data analysis technologies are shown.

Keywords: modern philology; computational linguistics; evolutionary computation; digital folklore; genetic algorithms; artificial intelligence; machine learning; SHIVA concept; WARMI concept.

INTRODUCTION.

The current stage of development of philological science is characterized by the rapid complication of research tasks, caused by the large-scale digitalization of humanitarian knowledge [1], the exponential growth of text data volumes, the development of digital archives of cultural heritage, artificial intelligence technologies [2], as well as the transition of scientific research to the processing of large arrays of various information [3]. Such trends are especially relevant in the study of folklore, which is a complex self-organized system that combines texts, oral traditions, cultural codes, ethnographic materials, historical sources, regional features and numerous implementation options. In such conditions, traditional methods of data analysis (especially Big Data) are not always able to provide effective processing of multidimensional, dynamic and poorly structured data [4].

Additional complexity of modern research is given by the growing dynamics of the external environment, a high level of

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uncertainty, turbulence and systemic risks, which are increasingly described using modern concepts of the SHIVA and WARMI world. If the SHIVA concept reflects the high speed of change, hyper-uncertainty, nonlinearity of development, intellectual complexity and constant variability of the research environment, then the WARMI concept emphasizes the growing role of flexibility of scientific systems, adaptability, sustainability, collective intelligence, interdisciplinarity and digital transformation of research. For modern philology, such conditions mean the need to use fundamentally new computational tools of prescriptive modeling [5], capable of functioning effectively in conditions of incomplete knowledge, ambiguity of interpretations and constant updating of research data.

One of the most promising directions for solving such problems is Evolutionary Computation, which is a class of intelligent optimization methods based on modeling the processes of natural evolution [6]. Due to the ability to effectively work with multi-criteria, nonlinear, multidimensional and poorly formalized problems [7], evolutionary algorithms are gradually becoming a popular tool in digital humanities, computational linguistics, digital folklore and intellectual analysis of cultural heritage.

Despite the active development of artificial intelligence and machine learning in modern philology [8], the specifics of the application of evolutionary computations in modern folklore remain insufficiently studied. The issues of choosing appropriate evolutionary algorithms, the specifics of their integration with technologies of intelligent data analysis, machine learning and natural language processing, as well as determining the advantages of using such methods for the study of complex cultural objects, require further scientific understanding. Therefore, the main goal of this article is to study the features and specifics of the application of evolutionary computing in modern folklore studies in the context of the SHIVA and WARMI concepts of modern philology, as well as to determine the prospects for using these technologies for the intellectual analysis of digital cultural heritage.

MAIN PART.

Evolutionary computing as a modern tool for intellectual processing of folklore data. Evolutionary computing is a set of methods for intellectual optimization based on the principles of biological evolution, natural selection,

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inheritance, mutation, and adaptation [9]. Unlike classical algorithms focused on finding a single optimal solution to a predefined algorithm [10], evolutionary methods search for a multitude of alternative solutions simultaneously, gradually improving the quality of the results over successive generations [11]. Such a mechanism is especially effective in the study of folklore, since the objects of research themselves have pronounced variability, nonlinearity of development, a high degree of uncertainty, and a multitude of possible interpretations. Each folklore tradition is formed as a result of long-term evolutionary processes, during which texts, plots, motifs, and cultural images change repeatedly under the influence of social, historical, and regional factors. Thus, the very nature of folklore turns out to be close to the principles of functioning of evolutionary algorithms, which creates favorable prerequisites for the application of appropriate computational technologies.

Specifics of evolutionary modeling of folklore systems.

Modern folklore is a complex adaptive system, the elements of which are constantly changing over time. The same plot can exist in hundreds of different variants, differing in vocabulary, syntax, sequence of events, characters, symbolism and cultural context. In such conditions, the task of the researcher is not limited solely to finding one "correct" version of the text. Much more important is the identification of patterns of evolution of folklore structures, reconstruction of historical paths of plot development, modeling of processes of transformation of cultural traditions and forecasting possible directions of development of folklore systems. Evolutionary calculations allow building such models by forming populations of alternative solutions, assessing their quality according to a set of criteria and gradually improving research models. Unlike traditional statistical methods, such an approach provides a much higher level of adaptability to variable data.

The main types of evolutionary computation in modern digital folklore studies. In modern research practice, the most promising areas are:

- genetic algorithms, which are effectively used to search for optimal classification structures for folklore texts;
- genetic programming, which allows for the automatic formation of analytical models for processing text corpora;
- evolutionary strategies, oriented solutions to problems

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of continuous multi-criteria optimization;

- evolutionary programming, which is used in modeling the processes of changing cultural traditions;

- differential evolution, which provides effective optimization of the parameters of intellectual models;

- coevolutionary algorithms, which model the parallel development of different cultural traditions and the mutual influence of individual folklore schools;

- memetic algorithms, which combine global evolutionary search with local intellectual optimization methods.

Each of the above approaches has its own scope and provides solutions to various research problems of modern digital humanities.

Features of the application of evolutionary computing in the conditions of the SHIVA world. The SHIVA concept characterizes the modern scientific environment as a space of high speed of change, complexity, nonlinearity, uncertainty and constant transformation of knowledge. In the study of folklore, such features are manifested in the continuous replenishment of digital archives, the emergence of new sources of information, the expansion of multimedia collections, the integration of text, audio and video, as well as the constant updating of analysis methods. In such conditions, evolutionary computing has a number of significant advantages: high adaptability; resistance to incomplete data; effective work with multidimensional search spaces; the possibility of multi-criteria optimization; the absence of the need for a strict mathematical model of the object under study; the ability to find solutions close to the global optimum. It is these properties that make evolutionary algorithms especially promising for the study of complex humanitarian objects.

Evolutionary computing in the conditions of the WARMI concept of modern philology. If SHIVA focuses on the complexity of the environment, then the WARMI concept orients scientific research towards intellectual sustainability, digital adaptation, the development of collective knowledge and interdisciplinary integration. From this point of view, evolutionary computing becomes not only an optimization tool, but also a technology to support intelligent decision-making. Their integration with modern artificial intelligence technologies allows for the formation of hybrid intelligent systems of the new generation, which combine: machine learning; natural language processing; big data analysis;

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semantic modeling; intelligent knowledge search; digital libraries; expert systems; cognitive analytics. Such integration significantly expands the capabilities of modern digital folklore studies.

Prospects for the development of evolutionary computing in folklore studies. Further development of digital humanities will be accompanied by a constant increase in the volume of research data. Already today, digital archives contain millions of units of text, audio and visual information. In this regard, intellectual methods for automatic classification of folklore works, identification of hidden semantic patterns, reconstruction of historical relationships between cultural traditions, construction of evolutionary maps of the distribution of plots and automatic formation of digital ontologies of cultural heritage are of particular relevance. Of particular interest is the creation of hybrid intellectual systems that combine evolutionary computing with deep neural networks, transformative architectures, agent models, technologies of understandable artificial intelligence (Explainable AI), semantic knowledge graphs and intelligent analytics. It is such systems that are able to provide a new level of research into the dynamics of folklore processes in the conditions of uncertainty and complexity of the modern scientific environment.

CONCLUSIONS.

Modern folklore research is increasingly carried out in conditions of high uncertainty, digital transformation and complexity of the research environment, which corresponds to the characteristics of the SHIVA and WARMI concepts of modern philology. Traditional methods of analysis do not always allow for the effective study of multidimensional, dynamic and weakly structured folklore data, which necessitates the introduction of new generation intelligent computing technologies.

It has been established that evolutionary computing has a number of fundamental advantages for solving such problems due to its high adaptability, ability to perform global multi-criteria optimization, effective work with nonlinear models and the ability to process large arrays of heterogeneous information. The most promising for digital folklore studies are genetic algorithms, genetic programming, evolutionary strategies, evolutionary programming, differential evolution, coevolutionary and memetic algorithms.

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It is shown that the integration of evolutionary computing with artificial intelligence, machine learning, natural language processing, Big Data analysis and semantic modeling technologies forms the basis of new generation intelligent research platforms. Their application opens up opportunities for automated classification of folklore materials, identification of hidden patterns in the development of cultural traditions, reconstruction of plot evolution, intellectual analysis of digital cultural heritage and support for scientific decision-making. Prospects for further research are related to the development of hybrid intelligent systems that combine evolutionary computing, modern artificial intelligence models, digital humanitarian technologies and methods of understandable artificial intelligence, which will significantly increase the effectiveness of folklore research in conditions of increasing dynamics of uncertainty and turbulence.

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