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PREDICTING THE DEVELOPMENT OF ARTIFICIAL INTELLIGENCE: NOMOGENETIC PERSPECT

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Abstract. This article provides a comprehensive analysis of the task of scientific foresight in the realm of artificial intelligence (AI), specifically focusing on the feasibility of predicting AI's evolution in the upcoming decades. Utilizing the evolutionary model of AI, the authors propose a conceptual framework wherein AI is integrated into the broader evolutionary trajectory of human development. This perspective draws inspiration from the concept of nomogenesis, introduced by biologist L. S. Berg in 1922, which underscores the notion of stable evolutionary regularities. The article posits that embracing these regularities offers a solid foundation for anticipating a range of imminent transformations attributable to AI's evolution.Furthermore, the article delves into the intriguing prospect of humans delegating the task of foresight to the AI systems they have engineered. This aspect is particularly rel-evant in scientific and technological domains where decision-making is contingent upon a nuanced analysis of potential future scenarios. The authors present compelling arguments supporting the plausibility of predicting AI development, albeit with a certain level of prob-abilistic uncertainty. This perspective imbues a sense of optimism among researchers across various disciplines where AI has already established its presence or is anticipated to become influential. The discussion extends to the implications of such foresight on human-AI interactions, ethical considerations, and the potential shifts in scientific methodologies induced by AI's growing capabilities in predictive analysis. This analysis not only highlights the transformative impact of AI but also underscores the dynamic interplay between hu-man intellectual endeavors and AI's evolutionary journey.

Key words: artificial intelligence (AI); nomogenesis; evolutionary model of artificial intelligence; evolution; human-artificial intelligence system.

INTRODUCTION

The development of artificial intelligence has become one of the most relevant directions in scientific research and technical developments in the modern world. The application area of AI is broad and diverse, encompassing many aspects of human life. In this context, we will focus on the research direction concentrated around the question of the possibility to foresee the future development of AI systems. The acuteness of the issue is highlighted by the fact that it is the subject of active discussions and debates among scientists, as predicting events associated with the development of AI is an extremely challenging task. Many scientists, even those not inclined to pessimism, consider it not fully solvable, at least in the near future. Nonetheless, at present, there are different viewpoints regarding the forecasting of AI's future. In particular, there are researchers who defend the thesis of the fundamental possibility of predicting the future development of AI. The authors of the article share this thesis, based on the methodology of the evolutionary approach in its variant ascending to the ideas of nomogenesis. The key idea of the latter is the assumption of a regular nature of evolution, making it possible to predict the future development of AI based on the observation of its past evolutionary changes. Moreover, it is necessary to continue exploring the question of the possibility to foresee AI development, taking AI itself as the subject of such foresight. The inevitability of this aspect of research becomes apparent in the task of designing self-learning artificial intelligence systems.

The objectives of this article are:

1. Firstly, to present and justify an alternative to the pessimistic view on the problem of foreseeing the development of AI. This includes: examining the evolutionary model of AI, exploring the possibility of predicting future changes based on patterns and trends identified in past evolutionary

events, and discussing the issue of subjects involved in the evolution and prediction of its outcomes: the subject of evolution, as well as the possible planner of the changes being made, and the researcher-subject, aiming to foresee the future of evolution.

2. Secondly, to investigate and analyze key aspects of foresight in artificial intelligence, considering various methods and techniques used by AI systems to predict future events, and assessing their applicability and effectiveness in the real world.

I. Features of foresight in the evolutionary model of artificial intelligence

The scope of scientific foresight tasks in the field of AI ranges from defining the main development paths of AI systems by scientists to transferring the functions of predictive activities to the AI systems themselves. Most researchers believe that predicting events related to how AI will develop in the next 20–30 years is not only extremely difficult but also impossible. For instance, the American inventor and futurist writer R. Kurzweil, known for his already fulfilled predictions regarding the development of artificial intelligence, believes that after the year of technological singularity, which he defines as 2045, predicting anything related to AI will become practically impossible [see: 7]. Why, actually? After all, AI systems are constructed with certain goals and to perform specific functions, i.e., the developers of AI systems know what they are doing and can foresee much of what they will ultimately achieve. Therefore, we adhere to a different point of view, distinct from R. Kurzweil's opinion [see also: 14]. In justification of our position, we consider the evolutionary model of AI, in which AI is incorporated into the ongoing evolutionary development of humans and the human population. More specifically, it is about the system «human-artificial intelligence» being subject to evolution, within which its components are thought of as being in a joint evolving unity. In the modern era, marked by digitalization and rapid technological development, we are faced with a new reality where there is an increasingly close merger of natural and artificial intelligence in hybrid systems. The synergy of these two types of intelligence becomes defining for the efficiency and safety of the functioning of the hybrid system.

Currently, bionic approaches to hybrid human-machine intelligence are being developed, representing a strategy for the design and enhancement of artificial intelligence systems capable of collaborating with humans on a more natural and efficient level. Bionic approaches provide a unique opportunity to learn from nature and integrate its principles into hybrid systems. Thus, the merging of humans and machines into a harmonious unified system becomes more effective, reliable, and sustainable. Developments are aimed at creating integrated, adaptive, and advanced systems by combining the best aspects of natural and artificial intelligence [see: 2; 3]. Artificial intelligence technologies expand the boundaries of human capabilities, offering new tools and methods for solving complex tasks and advancing in various areas of human life. There is an attempt to unite the advantages of human intelligence, including creative abilities, with the capabilities and precision of artificial systems.

One of the key tasks in this process becomes the harmonization of interaction between humans and machines within ergotechnical systems, aimed at ensuring effective and safe human work in the environment. Main attention in research is devoted to the development of soft interaction models, capable of adequately responding to changing conditions and preventing undesirable consequences.

An important aspect in the development of hybrid human-machine intelligence is universality and the ability to perform a variety of tasks. This is achieved through adaptive hybrid intelligent control schemes that combine traditional logical thinking algorithms and the principles of fuzzy logic.

Among the outcomes of bionic approaches to systems with artificial intelligence, it is important to mention the creation of neurocomputing interfaces, which allow for recording and interpreting the electrical activity of the human brain to control technical systems, which can be useful for people with limited motor abilities in interacting with the world. For example, the development of prostheses and additions to the human body, which can perceive and transmit signals from the nervous system, allows for restoring lost functions or enhancing existing ones. The development of sensors and sensory systems capable of perceiving the environment as human organs do can significantly improve human perception of the surroundings. Thus, in the collective monograph «Human and Artificial Intelligence Systems,» new challenges associated with the expanding use of artificial intelligence in various fields are addressed, and the necessity of developing trustworthy artificial intelligence systems is substantiated [16].

Technologies in the field of artificial intelligence have been developed over the last decade to the extent that they are now capable of creative activities, long considered the prerogative of humans. Moreover, these technologies have reached a level that raises questions about who the true author of the produced results is, and how important the human role is in this creative activity. Does the authorship of works generated by AI belong to the programs themselves or to the person behind their creation and launch? Programs using deep learning algorithms create music for films, learning from classical examples. AI improves its algorithms through many iterations or uses neural networks for learning. Questions arise about whether AI can be considered an author if it is only «trained» on experience and the creative result is not a product of direct programming [see: 10]? Undoubtedly, questions about the boundaries of authorship and creativity in the «human-artificial intelligence» system remain relevant and require further study and discussion in the scientific community.

Contemporary research provides various viewpoints on the process of evolution. In particular, views different from Darwinism and the synthetic theory of evolution belong to scientists such as biologist and systemologist A. A. Lyubishchev [see: 8], historians of science E. B. Muzrukova [see: 11], Y. V. Chaikovsky [see: 15], and others. Among them is biologist V. I. Nazarov, who in his fundamental work «Evolution Not According to Darwin» criticizes Darwin's theory of evolution for its reductionist approach, emphasizing its lack of aesthetics, lack of empirical support, and inadequacy in explaining the formation of consciousness, social behavior, and the essence of human existence in hominid evolution [see: 12]. His book also notes the importance of considering abrupt transformations in understanding evolutionary processes, raises the issue of the need to transition to another methodology for studying phenomena of different levels of reality, and calls for considering evolution as a complex phenomenon dependent on multiple factors. V. I. Nazarov adheres to the ecosystem concept of evolution, finding support for his views in the perspectives of paleobotanist and evolutionist V. A. Krasilov [see: 4], which allows him to pay attention to destabilize processes for ecosystems as a prerequisite for the formation of new species and to consider various factors of evolution.

As we believe, evolution is a type of development in which the distant final result is hidden from the subject of evolutionary changes [see: 6]. However, there are also fundamentally different subjects: the planner of the changes being made, guiding the activities of the executing subject, and the research subject, objectively examining the past of the observed evolution and trying to «peer» into its future.

This possibility can be justified by the long-existing concept of nomogenesis, developed over a hundred years ago by the Soviet academician Lev Semyonovich Berg and presented by him in 1922. Nomogenesis embodies development conducted by firm principles and overcoming randomness. This concept is contrasted with the evolution as viewed by Charles Darwin, as a result of random environmental influences and natural selection. Lev S. Berg's approach emphasizes that the role of randomness and external influences should not be overestimated in the study of evolution. Research should primarily consider the internal laws and mechanisms that govern the development of organisms, appearing as sources of their transformation and complex harmony. The influence of the struggle for survival and natural selection is acknowledged but considered secondary compared to the laws of nomogenesis. Since Lev S. Berg's works proposed a new view of evolutionary processes, his ideas sparked discussions and debates in the scientific community [see 5; 13]. The essence of nomogenesis lies in the idea that evolution can be interpreted as the gradual unfolding and development of predispositions already present in organisms, meaning evolutionary change is based on patterns and largely an unfolding of existing predispositions. The idea of nomogenesis indicates that evolution is not always a random and disorderly process. Instead, it implies that organisms possess internal mechanisms that influence their changes over time. This view suggests that evolutionary changes can be directed and have their own internal logic. Within the concept of nomogenesis, evolution is understood as the process of unfolding an organism's potential in response to changing environmental conditions. Nomogenesis highlights the importance of internal resources and capabilities of organisms, and consequently, this approach continues to influence our understanding of the evolutionary process.

Similarly, as the general concept of evolution has transcended its meaning from biological evolution to become a universal scientific concept, the concept of nomogenesis can also be considered a universal scientific notion. Its generalizing nature is clearly indicated by the fundamental content of evolution captured in nomogenesis. «At the base of any transformations lies one or several universal principles that manifest equally in all spheres of existence: inorganic, organic world, human life activity, and thought» [9, p. 47]. Such is the main essence of the nomogenetic approach to the study of evolution.

II. Nomogenesis as planned evolution

As previously noted, nomogenesis challenges the traditional view of evolution as largely a random process, revealing it as a phenomenon much more organized than mere chaotic changes. In nomogenesis, it is emphasized that evolution is directed, following a specific path, taking into account internal mechanisms and laws that structure and guide life. It's not just random changes, but coordinated development, predetermined by internal principles. Nomogenesis appears as planned evolution, where the concept of «plan» is closely intertwined with the concept of «purpose,» creating a deep connection between development and directionality. This connection leads us to great philosophical thinkers and their ideas, which influence our understanding of the world. In this aesthetic harmony, an analogy opens up with ancient tradition. The opposition between eternity and time, fundamental to Platonism, forms a framework for understanding evolution as a process of reading information from eternity. Evolution becomes an act of turning to eternal ideas, to a plan that is traced in time and gives structure to the real world.

The concept of the «The two-faced Janus of the evolutionary essence of AI», which describes AI as an entity simultaneously facing both the past and the future, fits into the nomogenetic perspective, as it highlights the dynamics and multifaceted nature of the evolutionary process. This idea helps understand how the development of AI can be predictable within certain limits, while remaining open to a variety of possible evolutionary trajectories. Such an approach allows for an assessment of which aspects of AI development might be more preferable in terms of preserving and advancing human intellect and society as a whole [17].

Nomogenesis as planned evolution not only changes our understanding of evolutionary processes but also reveals the philosophical undercurrent in the very essence of development. This idea intertwines philosophy, aesthetics, and science, elevating our perception of life in its quest for harmony in time and eternity. Undoubtedly, regularities as stable, recurring, and essential connections of phenomena can be known, and thus, the course of further evolutionary changes and, with some degree of error and probability, their results can be predicted – more so the intermediate and less so the final outcomes. If there is a subject planning corresponding changes, not being their direct producer, then they necessarily engage in predicting the outcome. Of course, the task of planning is not easy, especially since in the evolutionary process, due to its nonlinearity, there will inevitably be jumps, i.e., breaks in continuous changes with unpredictable results.

An example of a planner is a breeder, acting purposefully in their direction of interest. At the same time, it must be said that plans and goals often emerge a posteriori, i.e., as a result of the completed stage of evolution. It's one thing to judge what has happened, when it's clear how everything ended, and another to try to mentally jump ahead and predict the outcome. In the first case, we have a view as if from outside the evolutionary process, from the perspective of the whole, while in the second case – a view as if from within it. Yet, this latter view can be productive, and the difficulties of prediction can be significantly smoothed by the fact that in the concept of nomogenesis, a sequential realization of morphogenesis is assumed, where all subsequent forms are considered derivatives of the original. Introducing the concept of a completed form and considering it as the outcome of evolution, completeness can be interpreted not only in the ontological sense as the stability of existence, and in the case of biological systems – as the ability to reproduce, but also in the aesthetic sense, adding both the quality of integrity and its perception by the observer. Such completed forms, apparently, for the evolving object can have a discrete, and moreover, countable, number, which is explained by the potentials laid in the initial state of the object.

The concept of nomogenesis reinforces the idea that evolution is not a random process, but follows a specific, albeit complex, trajectory determined by internal potentials and external observations. Thus, nomogenesis offers an alternative view of evolution as a process governed by internal developmental logic and external influences, rather than just a series of random events. Within the context of nomogenesis, the concept of a «higher form» or «ideal state» takes on new meaning. Unlike the Darwinian approach, where evolution is seen as a struggle for survival and natural selection, nomogenesis implies the existence of a certain direction or «higher goal» towards which the evolving entity strives. This goal may not be explicitly set or consciously realized, but it manifests in the sequential development and achievement of certain forms.

In the context of the nomogenetic approach to artificial intelligence, which is based on the understanding of the dynamics and multifaceted nature of evolutionary processes, the «virtual index» proposed in the works of Elkhova can serve as a criterion for measuring the degree of human integration with an artificial environment. Immersion, involvement, and interactivity, as components of the index, determine how effectively artificial intelligence can mimic or expand human perceptions and interactions, which is key to predicting its development [18].

Additionally, nomogenesis brings important considerations to the realm of ethics and responsibility in science. Recognizing that evolutionary changes are not entirely random and can be predicted with a certain degree of accuracy, raises questions about the role of humans in this process. If humans can influence the course of evolution, what are their ethical obligations towards other forms of life? This question is especially pertinent in the context of modern biotechnologies and genetic engineering. Furthermore, nomogenesis offers a new perspective on the interaction between humans and nature. Instead of perceiving humans as separate entities, standing «outside» or «above» nature, nomogenesis views humans as active participants in the evolutionary process. This interaction can be either harmonious or conflictual, depending on how human actions align with or contradict the internal logic of evolution. Thus, nomogenesis opens up new horizons for understanding life and its evolution. It proposes a holistic approach that considers both the internal dynamics of evolving systems and external factors influencing their development. This perspective emphasizes the importance of integrating scientific knowledge with philosophical and aesthetic ideas for a complete and deep understanding of the nature of life and its evolution.

III. Transfer of foresight functions to AI

Artificial intelligence possesses the ability to analyze and process vast amounts of data in a short time, enabling it to make predictions based on complex statistical analyses. Regarding the transfer of foresight functions to AI, in this context, foresight implies the ability of an algorithm or model to predict future events or outcomes based on existing data. This is especially important in areas such as finance, medicine, transportation, and many others where decision-making requires analysis of future possible outcomes. Forecasting is one of the key functions of AI. Modern AI systems are capable of analyzing huge data sets to uncover hidden patterns and trends, which can be applied to foresee future events. The use of big data enables AI to create more accurate forecasts.

Many AI systems employ machine learning for foresight. Machine learning models are formed based on past data; both supervised and unsupervised, using various techniques such as regression, classification, clustering, and deep learning. Neural networks are primary tools for foresight in AI.

They can learn from complex and unstructured data such as images or text and leverage this data to create accurate predictions. AI systems are capable of adapting to new information and changing circumstances. They can update their foresight models as new data becomes available, improving the accuracy of their predictions over time. Although AI is capable of making data-based predictions, it also accounts for uncertainty, providing not just a forecast but also a measure of uncertainty, or a confidence interval for that forecast. AI can account for the uncertainty of predictions in decision-making, using methods such as Bayesian inference or Monte Carlo methods.

Thus, Bayesian inference is a method of statistical analysis based on Bayes' theorem. This approach is a powerful tool for handling uncertainty and incorporating prior knowledge into the model. Bayes' theorem describes how to update the probabilities of events based on new data. The Monte Carlo method is a powerful tool in the arsenal of artificial intelligence. It offers a flexible and versatile approach to solving complex problems that can be applied in a wide range of contexts. The Monte Carlo method can be used to assess uncertainty in AI model forecasts, to approximate the distribution of the model's predictions, which can provide a more comprehensive understanding of the uncertainty of these forecasts. Real-time decision-making is a critical aspect of many AI applications. This is especially important in fields where a delay in decision-making can lead to negative consequences (autonomous driving, cybersecurity, medicine, finance, etc.).

Key aspects of AI real-time decision-making include: speed and efficiency; adaptability; reinforcement learning; autonomy; data-driven decision-making. In the context of transferring foresight functions to AI, these key aspects play a crucial role. The speed and efficiency of AI allow for processing large volumes of data and making predictions in real-time, which is critically important in dynamic sectors. The integration of AI into the foresight process represents a turning point in the development of many industries, not only improving the quality of decision-making but also significantly enhancing the speed and flexibility of processes, which is especially vital in rapidly changing and competitive environments. Thus, the transfer of foresight functions to AI opens up new opportunities for improving decision-making processes in various areas. It not only increases the accuracy and speed of predictions but also introduces new approaches to data analysis and interpretation, enriching the capabilities of human intelligence and expanding the boundaries of our knowledge.

CONCLUSION

In the article, a new perspective on the problem of foreseeing the development of artificial intelligence is outlined. The authors contrast their viewpoint with the opinion of the renowned futurist R. Kurzweil, who believes such predictions to be impossible after reaching the state of technological singularity. An evolutionary approach to considering AI allows us to broaden our understanding of the dynamics of system development and open new avenues of research in this field. This is of interest to researchers involved in the development and application of AI. Forecasting is rightly considered a key function of AI, based on the ability of modern electronic systems to analyze large volumes of information using machine learning to identify patterns and trends in the studied objects for potentially more accurate predictions. The authors emphasize the importance of such forecasts and pay attention to the problematic aspects of using big data and machine learning methods. The practical significance of the results lies in the fact that foreseeing the development of AI can be useful in various fields where decision-making requires consideration of future possible outcomes, which will increase the efficiency and accuracy of the decisions made and contribute to improving the quality of life. For further research, it is recommended to deepen the analysis of evolutionary regularities in the context of artificial intelligence development. Studies in the field of nomogenesis and other related topics may provide additional insights into the possibility of predicting AI development. It is also worth exploring new methods and technologies in machine learning that will enhance the accuracy of AI predictions. The development and application of neural networks and other deep learning algorithms can significantly improve the predictive capabilities of AI systems. Overall, this work represents a certain contribution to the field of AI research and its forecasting. Its results can stimulate further research and lead to new knowledge regarding the development and application of artificial intelligence in various areas of our life.

RESULTS

The conclusions are based on the results of our research and are of interest to researchers and practitioners in the field of artificial intelligence, as well as to everyone interested in the possibilities of foreseeing the development of AI and its role in the future:

– The study conducted an analysis of scientific foresight tasks in the field of artificial intelligence and considered various viewpoints regarding the possibility of predicting its development in the coming decades;

– It was found that most researchers consider the forecasts of AI development to be complex or impossible, especially after the proposed technological singularity, asserted by R. Kurzweil;

– The work presents a nomogenetic model of AI evolution, where the possibility of predicting the future development of AI is substantiated, taking into account the relative unpredictability of intermediate results, caused by the nonlinearity of the evolutionary process.

СПИСОК ЛИТЕРАТУРЫ / REFERENCES

1. Берг Л. С. Номогенез, или эволюция на основе закономерностей // Метод. 2021. № 11. С. 445-450. [[Berg L. S. "Nomogenez, ili evolyuciya na osnove zakonomernostej" // Metod. 2021. No. 11, pp. 445-450.]].
2. Глобальное будущее 2045. Конвергентные технологии (НБИКС) и трансгуманистическая эволюция / Под ред. проф. Д. И. Дубровского. М.: ООО «Издательство МБА», 2013. [[Global'noe buduschee 2045. Konvergentnye tehnologii (NBIKS) i transgumanisticheskaya evolyuciya / Pod red. prof. D. I. Dubrovskogo. Mooscw: OOO «Izdatel'stvo MBA», 2013.]].
3. Колесников А. В., Малинецкий Г. Г., Сиренко С. Н. Новые горизонты сотрудничества. Проектирование будущего // Проблемы цифровой реальности. 2022. № 1 (5). С. 6-28. [[Kolesnikov A. V., Malineckij G. G., Sirenko S. N. "Novye gorizonty sotrudnichestva Proektirovanie buduschego" // Problemy cifrovoj real'nosti. 2022. No. 1 (5), pp. 6-28.]]
4. Красилов В. А. Нерешённые проблемы теории эволюции. Владивосток: ДВНЦ АН СССР, 1986. [[Krasilov V. A. Nereshennye problemy teorii evolyucii. Vladivostok: DVNC AN SSSR, 1986.]]
5. К столетию публикации «номогенеза» Л. С. Берга (1922) // Lethaea Rossica. Российский палеоботанический журнал. 2021. Т. 23. С. 45-47. [[K stoletiyu publikacii «nomogeneza» L. S. Berga (1922) // Lethaea Rossica. Rossijskij paleobotanicheskij zhurnal. 2021. Vol. 23, pp. 45-47.]].
6. Кудряшев А. Ф. Развитие, эволюция, коэволюция: соотношение понятий // Вестник Башкирского университета. 2012. Т. 17. № 1-1. С. 640-644. EDN PEGUPT. [[Kudryashev A. F. Razvitie, evolyuciya, koevolyuciya: sootnoshenie ponyatij // Vestnik Bashkirskogo Universiteta. 2012. No. 1-1. Vol. 17, pp. 640-644.]]
7. Курцвейл Р. Эволюция разума: как развитие искусственного интеллекта изменит будущее цивилизации / Пер. с англ. М.: Эксмо, БОМБОРА, 2020. [[Kurcvejl R. Ehvolyuciya razuma: kak razvitie iskusstvennogo intellekta izmenit budushchee civilizacii. Moscow: Ehksmo, BOMBORA, 2020.]]
8. Любищев А. А. Философские проблемы эволюционного учения // Философские проблемы эволюционной теории. 2019. Т. 1. С. 43-45. [[Lyubischev A. A. Filosofskie problemy evolyucionnogo ucheniya // Filosofskie problemy evolyucionnoj teorii. Vol. 1, pp. 43-45.]]
9. Mityai I. S. Nomogenesis – the way out of the crisis for biological science // Academician Leo Berg – 145: Collection of Scientific Articles = Academician L. S. Berg is 145 years old: Collection of scientific articles / Eco-TIRAS International Association of River Keepers, Leo Berg Education Foundation, The City of Bender Museum / executive editor: I.D. Trombitsky; editorial board: I. K. Toderas [and others]. Bender: Eco-TIRAS, 2021 (Tipogr. «Arconteh»). Pp. 45-48.
10. Морхат П. М. Концепт гибридного авторства (юнит искусственного интеллекта как соавтор человека в создании результатов интеллектуальной деятельности) // Бизнес. Образование. Право. 2018. № 3 (44). С. 292-296. [[Morhat P. M. Koncept gibridnogo avtorstva (yunit iskusstvennogo intellekta kak soavtor cheloveka v sozdanii rezul'tatov intellektual'noj deyatel'nosti) // Biznes. Obrazovanie. Pravo. 2018. № 3 (44). S. 292-296.]].
11. Музрукова Е. Б. Эволюционный синтез и его «архитекторы». Размышления над книгой «Создатели современного эволюционного синтеза» (2012) // Историко-биологические исследования. 2014. Т. 6. № 4. С. 105-110. [[Muzrukova E. B. "Evolyucionnyj sintez i ego «arhitektory». Razmyshleniya nad knigoj «Sozdateli sovremennogo evolyucionnogo sinteza» (2012)" // Istoriko-biologicheskie issledovaniya. 2014. Vol. 6, No. 4, pp. 105-110.]]
12. Назаров В. И. Эволюция не по Дарвину: Смена эволюционной модели. М.: Изд-во ЛКИ, 2007. [[Nazarov V. I. Evolyuciya ne po Darvinu: Smena evolyucionnoj modeli. Moscow: LKI, 2007.]].
13. Поздняков А. А. Номогенез Л. С. Берга как попытка объединения эволюционистики и систематики // Lethaea Rossica. Российский палеоботанический журнал. 2022. Т. 24. С. 64-91. [[Pozdnyakov A. A. Nomogenez L. S. "Berga kak popytka ob'edineniya evolyucionistiki i sistematiki" // Lethaea Rossica. Rossijskij paleobotanicheskij zhurnal. 2022. Vol. 24, pp. 64-91.]].

14. Фатенков А. Н. Натурный ум в контратаке на искусственный интеллект (полемический отклик на «Эволюцию разума» Р. Курцвейла) // Философский журнал, 2022. Т. 15. № 3. С. 172-183. [[Fatenkov A. N. Naturnyj um v kontratake na iskusstvennyj intellekt (polemicheskij otklik na «Evolyuciyu razuma» R. Kurcvejla) // Filosofskij zhurnal, 2022. Vol. 15, No. 3, pp. 172-183.]].
15. Чайковский Ю. В. Активный связный мир. Опыт теории эволюции жизни. М.: Товарищество научных изданий КМК, 2008. [[Chajkovskij Yu. V. Aktivnyj svyaznyj mir. Opyt teorii evolyucii zhizni. Moscow: Tovarischestvo nauchnyh izdanij KMK, 2008.]].
16. Человек и системы искусственного интеллекта / Под ред. акад. РАН В. А. Лекторского. СПб.: Изд-во «Юридический центр», 2022. [[Chelovek i sistemy iskusstvennogo intellekta / Pod red. akad. RAN V.A. Lektorskogo / Lektorskij V. A., Vasil'ev S. N., Makarov V. L. i dr. Sankt-Peterburg: Izdatel'stvo «YUridicheskij centr», 2022.]]
[17. Kudryashev A. F., Elkhova O. I. The two-faced Janus of the evolutionary essence of artificial intelligence // Systems Engineering and Information Technologies. 2023. Vol. 5. No. 1(10). Pp. 76-83. EDN QFEPLB.
18. Elkhova O. I. Justification of the virtual index in philosophy// Systems Engineering and Information Technologies. 2022. Vol. 4. No. 2(9). Pp. 5-12. EDN EVAIPZ.

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МЕТАДАННЫЕ / METADATA

Название: Прогнозирование развития искусственного интеллекта: номогенетическая перспектива.

Аннотация: В статье анализируется задача научного предвидения в области искусственного интеллекта (ИИ) и оценивается возможность прогнозирования развития ИИ на ближайшие десятилетия. Основываясь на эволюционной модели ИИ, авторы предполагают, что ИИ вписывается в эволюционное развитие человека, а опора на идеи номогенеза, впервые представленного в 1922 г. биологом Л. С. Бергом, позволяет им утверждать, что принятие концепции устойчивых закономерностей эволюции создает принципиальную возможность предсказывать некоторый диапазон предстоящих в ее результате изменений. Рассматривается также вопрос о передаче человеком функций предвидения ИИ, особенно в тех разделах науки и техники, где принятие решений требует усложненного анализа будущих возможных исходов. Эволюционный подход к рассмотрению ИИ позволяет расширить наше понимание динамики развития систем и открыть новые пути исследования в этой области. Исследование подчеркивает значимость использования больших данных и методов машинного обучения для прогнозирования. Приводится аргументация в пользу того, что предвидение развития ИИ в принципе возможно, хотя и с некоторой степенью вероятности, что настраивает на оптимистический лад исследователей в различных областях человеческой деятельности, в которых ИИ уже нашел или еще найдет свое применение. Для дальнейших исследований рекомендуется углубить анализ эволюционных закономерностей в контексте развития искусственного интеллекта. Исследования в области номогенеза и других смежных тем могут дать дополнительные представления о возможности предсказания развития ИИ.

Ключевые слова: искусственный интеллект (ИИ); номогенез; эволюционная модель искусственного интеллекта; эволюция; система «человек – искусственный интеллект».

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