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ABSTRACT

Objective: This article undertakes a comprehensive exploration of the constructivist paradigm in artificial intelligence (AI) development, aiming to uncover how constructivist perspectives shape our understanding of AI. It delves into the evolution of AI thought, emphasizing the significance of constructivist epistemology in comprehending AI's philosophical and cognitive dimensions.

Method: The study employs a variety of philosophical methodologies, including historical-philosophical analysis, comparative analysis of philosophical teachings, and a system-structural dialectical approach. These methods facilitate an in-depth examination of AI's conceptual intricacies within a constructivist framework, focusing on the relationship between artificial and natural intelligence and the epistemological implications of AI.

Results: The investigation reveals that the main challenge in AI research is the absence of clear problem-solving rules, highlighting the current limitations of human self-knowledge in logical and emotional intelligence. It showcases AI's vast capabilities, from extensive knowledge bases to real-time processing, and emphasizes AI's role in enhancing human cognitive processes.

Conclusions: Artificial intelligence, as a construct of human intellect, mirrors the capacity for design and creativity inherent in human thought. The study underscores AI's foundational role in the epistemology of science and technology, advocating for a holistic understanding of the human brain as a dynamic system to further our grasp of AI and its cognitive potential.

Keywords: Information technology. Intelligent systems. Artificial intelligence. Technological aspects.

A EVOLUÇÃO DA INTELIGÊNCIA ARTIFICIAL: PROBLEMAS E PERSPECTIVAS DA COGNIÇÃO RACIONAL

Objetivo: Este artigo realiza uma exploração abrangente do paradigma construtivista no desenvolvimento da inteligência artificial (IA), com o objetivo de descobrir como as perspectivas construtivistas moldam nosso entendimento da IA. Ele investiga a evolução do pensamento em IA, enfatizando a importância da epistemologia construtivista na compreensão das dimensões filosóficas e cognitivas da IA.

Método: O estudo emprega uma variedade de metodologias filosóficas, incluindo análise histórico-filosófica, análise comparativa de ensinamentos filosóficos e uma abordagem dialética sistêmico-estrutural. Esses métodos facilitam um exame aprofundado das intrincadas conceituais da IA dentro de um quadro construtivista, focando na relação entre inteligência artificial e natural e as implicações epistemológicas da IA.

Resultados: A investigação revela que o principal desafio na pesquisa de IA é a ausência de regras claras para solução de problemas, destacando as atuais limitações do autoconhecimento humano em inteligência lógica e emocional. Ela apresenta as vastas capacidades da IA, desde bases de conhecimento extensas até processamento em tempo real, e enfatiza o papel da IA em aprimorar os processos cognitivos humanos.

Conclusões: A inteligência artificial, como um construto do intelecto humano, espelha a capacidade de design e criatividade inerente ao pensamento humano. O estudo sublinha o papel fundamental da IA na epistemologia da ciência e tecnologia, defendendo uma compreensão holística do cérebro humano como um sistema dinâmico para avançar nosso entendimento da IA e seu potencial cognitivo.

Palavras-chave: Inteligência Artificial, Epistemologia Construtivista, Cognição, Sistemas Inteligentes, Tecnologia da Informação

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1 INTRODUCTION

The relevance of the research topic is due to the need for a philosophical understanding of the problem of creating artificial intelligence from the standpoint of constructivist epistemology, studying and considering the mechanisms of thinking, cognitive and creative abilities of artificial intelligence systems (Lampou, 2023). The significance of the research topic is also emphasized by the fact that the modern cognitive situation requires rethinking and comprehension of its multifaceted essence. Therefore, today it is necessary to take a fresh look at the essence of the process of human cognition of the reality around him, at the role of artificial intelligence systems in this process, and at the benefits they can bring to him. A special role in the implementation of this task is to compare natural human and artificial intelligence (Silva & Janes, 2023), identifying their common and different features and capabilities, since artificial intelligence acts here as a theoretical model in the study of the mechanisms of cognition, their philosophical understanding and analysis based on a new direction in theory knowledge - radical constructivism. The Problem of Artificial Language in the History of Philosophy and Science" shows that the prehistory of artificial intelligence dates back to the times of antiquity, when the formal side of natural language—logic was singled out. The division of the form of language led to the creation of formalized languages, the source of which was mostly mathematics. Such languages, in contrast to ordinary spoken languages, are called "artificial", that is, they have properties that are very valuable for the development of science.

Antiquity is the first step towards the identification of an "artificial" language. Some further steps, such as the use of diagrams, were made by medieval scholastic thinkers who developed the ancient logical tradition. But the main drawback of logic was that it did not have its own symbolism, so it was stifled by the heaviness of natural language.

Next, the early medieval scientist Raymond Lull invented the first logical machine that could operate with scientific concepts and produce their various combinations. Then the French mathematician, physicist and philosopher Blaise Pascal in 1642 invented the first computer that was capable of calculating without a person. His computer was improved in 1670 by Gottfried Wilhelm Leibniz, a German mathematician and philosopher, who created an adding machine capable of performing all four arithmetic operations.

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In 1812, the Dean of the Department of Mathematics at Cambridge University, Charles Babbage, invented the "analytical engine", which was capable of performing not only simple arithmetic operations, but also remembering the initial, intermediate and final results and, if necessary, repeating the cycle of calculations. Then in 1869, the English scientist William Stanley Jevons built a new logical machine, which he called the "logical piano," based on a more detailed formalized logic than Leibniz's logical calculus.

The history of the creation of artificial intelligence" speaks directly about the very history of the creation of artificial intelligence, which began in the 50s of the 20th century. The history of research in the field of artificial intelligence can be divided into four periods: classical, romantic, modernism and postmodernism.

The classic period in artificial intelligence research (Gowda, 2023) is associated with the advent of computers and the first experiments in their use. In 1956, American researcher George McCarthy coined the term "artificial intelligence," which has two meanings. Firstly, artificial intelligence is understood as the theory of creating software and hardware capable of carrying out intellectual activity comparable to human intellectual activity; secondly, the software hardware itself, as well as the activities performed with its help.

The period from the mid-60s to the mid-70s of the 20th century is called romantic in the history of artificial intelligence. At this time, researchers were mainly interested in the problems of machine "understanding," that is, the ability to perceive natural human language, in particular, to conduct a meaningful dialogue. These attempts were met with some skepticism by philosophers. Philosophers doubted that the word "understanding" could even be used in relation to a computer program. During this period, there were sharp differences in the opinions of technicians and philosophers: technicians advocated the possibility of creating artificial intelligence in the future, and philosophers, on the contrary, believed that this was not possible.

It was during this period that the opinions of technicians and philosophers merged regarding the possibility of creating artificial intelligence in the future. If in the early 70s of the 20th century philosophers were skeptical about the possibility of creating artificial intelligence and did not share the opinions of technicians on this matter, then in the early 90s of the 20th century, and especially today, they no longer deny this possibility.





2 METHODS

Research methodology. The article uses the following philosophical methods:

- historical and philosophical analysis of the problems of artificial intelligence;

- comparative analysis of various positions in philosophical teachings about artificial intelligence in classical and modern directions;

- system-structural, dialectical approach to understanding the problem of artificial intelligence;

 historical, philosophical and comparative analyzes of the main positions and trends in constructivist epistemology;

- interpretive synthesis of various approaches in constructivist epistemology;

 extrapolation of the philosophical positions of constructivist epistemology to the problem of artificial intelligence.

The subject of the research is artificial intelligence as an element that expands the boundaries of human knowledge of the surrounding reality and makes it possible to understand the very essence of the process of constructing what is happening in the brain; The object of the study is the problem of creating artificial intelligence, presented in the light of the concepts of the philosophy of radical constructivism.

3 RESULTS AND DISCUSSION

Problems in the creation of artificial intelligence and its capabilities" touches on the main problematic issue in the field of research on artificial intelligence. It lies in the fact that for many problems there are no clear rules for solving them, so the human mind currently does not have complete and exhaustive self-knowledge. This fully applies to all spheres of human mental activity both logical thinking and the emotional sphere. We do not know how visual and sound images function in our minds. A person, conducting mental activity and making appropriate decisions, is not aware of the brain algorithms during such activity.

The main goal of creating artificial intelligence is to develop a model of rational human actions at the cognitive level. Consequently, it provides an opportunity to gain a deeper understanding and appreciation of natural intelligence.



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The capabilities of artificial intelligence systems are quite wide. Currently, huge knowledge bases and powerful expert systems have been created, containing thousands of rules and capable of solving some problems better than any human mathematician. There are computer systems that read newspaper type in a human voice in real time and translate high-quality technical literature.

The philosophical aspect of artificial intelligence includes methodological guidelines and epistemological consequences in the field of cybernetic modeling of intellectual processes and the creation of machines that would process information similar to the activities of the human mind.

Studying the mechanisms of thinking using artificial intelligence" reflects the essence of the thinking process as one of the cognitive processes and the role of artificial intelligence in this.

Thinking is a person's reflection of objective reality in the process of direct contact and interaction with it. Man has two mental levels: living contemplation and abstract thinking. Abstract thinking is a process of reflecting the surrounding reality, during which a person forms images, puts forward appropriate goals, develops plans and ultimately solves certain tasks assigned to him.

A person is mainly characterized by the second type of mental level - abstract thinking, that is, operating with abstract images. An abstract image is the highest type of display, resulting from the reflection of the surrounding reality. Any abstract image has a number of characteristic features: subjectivity, ideality and objective correlation. Subjectivity manifests itself when the image does not exist either in objective reality or in the inner world of the subject (individual). Ideality is when the substance of the object in which it is reflected does not exist. Subject correlation is, directly, the projection of the image itself, its interpretation.

One of the most important components of human thinking is memory. Memory is the ability to extract the necessary information from the brain for the correct application of acquired knowledge and assessment of current events. Thinking is associated with the creation, transmission and transformation of information, and these processes can occur not only in the human brain, but also in other systems, for example, computer ones. Basically, artificial intelligence plays a supporting role in relation to natural intelligence. It significantly facilitates a person's mental work by taking on certain mental operations. Since artificial intelligence is created in the likeness of human intelligence, studying the principles of its functioning allows us to understand the essence of the thought processes occurring in the human brain.



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In the field of philosophical knowledge, two cognitive levels are usually distinguished: empirical and theoretical. There are two main methods of cognition using artificial intelligence: algorithmic and probabilistic. An algorithm is a set of actions, the sequence of which is predetermined. It provides a solution to all problems to which it is applicable and assumes that all objects are already predefined.

To solve unsolvable problems in artificial intelligence, probabilistic methods are used. They differ from algorithmic ones in that the next step is not determined specifically, but only with a known probability. Probabilistic methods do not give such reliable results as algorithmic ones. The opposition of these methods is the result of abstraction, which does not take into account important aspects of the cognitive process. There are deterministic and non-deterministic algorithms.

A non-deterministic algorithm is an algorithm with elements of randomness. The real system that implements a clearly deterministic algorithm is a person. A person uses this algorithm to solve problems of a certain class. But people, as we know, make mistakes and therefore the result obtained using this algorithm will not be reliable, but probabilistic. Computers that run on deterministic algorithms also make mistakes. Therefore, a real-life description of a deterministic algorithm contains an element of randomness. The actual cognitive process blurs the distinction between deterministic and non-deterministic algorithms.

There are three features of cognitive activity that are inherent to both humans and computers:

- any process of cognition presupposes at its starting point the activity of forming an initial structure;

- then follows the correlation of the received signal (for a person in the form of information from the outside world, for a computer — a command);

- isolating initial information from an object;

- a constantly ongoing process of checking the compliance of information about an object both at the level of the primary structure and at the level of information transfer, and in the form of an "ideal image" with the object itself.







The development of computer technology has compensated for man's limited capabilities in a number of areas. The creation of artificial intelligence systems expanded the boundaries of complexity that were accessible to humans and made a significant contribution to human awareness of the external and internal world.

The creative process is studied by various sciences, such as psychology, pedagogy, epistemology, logic and cybernetics. Cybernetics examines creativity in areas such as heuristic programming and pattern recognition. Each of the above sciences has its own objects of research, its own positions and methods for developing problems of intensifying creative search. The creative process begins with a problem, which involves choosing a way to solve it.

A person's creative abilities depend on his individual abilities, intelligence and level of knowledge. They are usually connected with his interests.

In epistemology, the creative process depends on the types of operations, the nature of the content of objects, and the connection between content and operational experience. Epistemology considers the structures of operations taking into account their historical level of knowledge. They have a generally human character, and the subject who solves this or that problem is considered as a cognizer. Therefore, creativity is considered not as a function of the brain or an activity that depends on the individual experience of the subject, but as the cognition of the world by the subject using certain fragments of universal human experience.

Artificial intelligence systems, which play an important role in such types of creativity as search activities or performing computational and graphic work, provide a person with considerable assistance in creativity. Any engineer is forced to work with reference literature, technological instructions, standards, patent materials and other necessary documentation. The information contained in these documents is systematized, translated into machine language and stored in the computer's memory. Therefore, the efficiency of using information in such cases increases markedly.

A computer by itself cannot invent anything. The search for technical solutions consists in the fact that information about known technical solutions and prototypes in a certain field of technology is automatically stored in the computer's memory. The information is contained on the computer in the form of a multi-level table. The computer sorts through the information stored in its memory and offers various options for solving the problem.







Completing the work consists of choosing a specific technical solution.

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4 CONCLUSION

Artificial intelligence is also a construct of the human brain. It is created by a person in his own image, so we can say that artificial intelligence, in turn, also has the ability to design, that is, design features.

Artificial intelligence is defined as a research area in the epistemology of the philosophy of science and technology, which studies the relationship between artificial intelligence and natural intelligence, the place and role of artificial intelligence in cognition;

- the logical and epistemological basis of artificial intelligence has been identified, the criteria of which are reduced to the primary role of mental operations;

— a comprehensive understanding of the human brain as a complex, developing, dynamic, procedural system is proposed.

Furthermore, artificial intelligence transcends its mere technical manifestation; it serves as a focal point for philosophical inquiry within the epistemology of science and technology. This interdisciplinary field delves into the intricate interplay between artificial and natural intelligence, probing their respective positions and roles in cognitive processes.

Through our analysis, we have delineated the logical and epistemological foundations of artificial intelligence, revealing that its essence lies in the emulation of mental operations. This understanding provides a solid basis for further exploration into the nature of intelligence, both artificial and human.







Ultimately, our study advocates for a holistic perspective on artificial intelligence, recognizing the human brain as a multifaceted, dynamic system. By embracing the complexity and procedural nature of the human brain, we can deepen our comprehension of artificial intelligence and its place in the realm of cognition.

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