
Research Article

Moral and ethical challenges of artificial intelligence in scientific research

Ma Fei^{a*}

1042238104@pfur.ru

ORCID: 0009-0002-5688-1348

Barabash Victor Vladimirovich^b

barabash_vv@pfur.ru

ORCID: 0000-0002-8909-2145

^{a b}RUDN University, Miklukho-Maklaya str., 6, Moscow, 117198,
Russia

Received: 6/11/2024 Accepted: 5/12/2024 Published: 28/04/2025

Abstract:

With the rapid iterative development of AI technology and its deeper application in the field of scientific research, its impact on scientific research has become more extensive. Artificial intelligence is becoming a powerful assistant in scientific research, and is quietly changing the face of academia. The application of artificial intelligence in scientific research can not only cross the language gap, quickly analyze massive data, help people save a lot of time and cost,

© This Is an Open Access Article Under the CC by License.
<http://creativecommons.org/licenses/by/4.0/>



* Corresponding author
E-mail address: 1042238104@pfur.ru



and improve the efficiency of scientific research. And to a certain extent, it can also help people break through the traditional thinking and cognitive limitations, propose new research directions, and expand people's cognitive horizons. However, the moral and ethical risks brought by the application of artificial intelligence in scientific research should also be emphasized. Based on a brief overview of the development and application of AI in scientific research, the article puts forward the possible moral and ethical challenges of AI in scientific research, such as authenticity and accuracy, deep comprehension, data privacy, algorithmic bias, technology dependence, and intellectual property rights. It is hoped that it can provide meaningful thinking for the healthy and safe development of AI in scientific research.

Keywords: artificial intelligence; scientific research; data privacy; algorithmic bias; technology dependence

1. Development of Artificial Intelligence in Scientific Research

Since John McCarthy and other scholars proposed the concept of “artificial intelligence” at the Dartmouth Conference in 1956, although only a few decades have passed, artificial intelligence technology has made tremendous progress and brought about radical changes to human society. Gradually, human society is being pushed in a more intelligent direction. Artificial intelligence is generally considered to be computer systems or technologies that emulate human intelligence, such as visual or audio recognition, data analysis, data-based judgment or decision-making, and machine learning technologies that allow computers to continuously improve their intelligence (Huang, G. Z., Fang, J. W., & Tu, Y. F., 2022:3). In recent years, with the iterative



development of artificial intelligence technology, modern deep learning and other intelligent technologies have been increasingly used in scientific research, providing people with a more intelligent service experience. Some scholars believe that in the next five to ten years, software powered by artificial intelligence will revolutionize the way people teach and learn (Qu, Y. K., 2024:31). Therefore, the development of trustworthy, ethical and moral artificial intelligence for scientific research has become an important direction of the times.

Some researchers have argued that changes in the field of education require the development of cognitive tools for disciplines based on AI technology. Early AI systems can help teachers and students collect data efficiently and analyze and present it in increasingly intelligent ways that promote deeper thinking and the discovery of meaning behind changes in the data (Huang, G. Z., Fang, J. W., & Tu, Y. F., 2022:3]. Such as the intelligent tutoring system for digital learning developed by Pai and others, not only improve the efficiency of students' math learning, but also increase their motivation (Pai, K. C., Kuo, B. C., & Liao, C. H. et al., 2021:137). Hwang et al. developed a mobile learning system with an interactive concept map mechanism that can provide real-time prompts or study guides to help students reorganize and refine what they have learned by assessing the concept maps they have developed (Hwang, G. J., Wu, P. H., & Ke, H. R., 2011:2272]. In recent years, generative artificial intelligence, represented by ChatGPT, has developed rapidly and helped teachers and students accomplish various complex tasks with its powerful self-learning, self-supervision and natural language processing (He, X., & Xi, J., 2024:27), and it is rapidly and widely used. Artificial intelligence is becoming a powerful assistant in scientific research, and is



quietly changing the face of academia. On the one hand, the application of AI in scientific research can help people cross the language gap, process and analyze huge amounts of text data, while generating relevant analysis reports, helping people save a lot of time costs. On the other hand, the application of generative artificial intelligence in scientific research can help people predict the results of experiments, or even propose new research directions based on existing research data, breaking through the traditional limitations of thinking and cognition. The application of artificial intelligence in scientific research is increasingly improving the efficiency of scientific research, and I believe that in the near future, the application of artificial intelligence in scientific research will be more extensive, and there will be more intelligent scientific research cognitive tools to help people better carry out scientific research. For example, generative AI can now help people quickly understand the progress of research in related fields based on key information input, providing more research ideas for further scientific research. Meanwhile, ChatGPT 4.0 has integrated multimodality for external access and for data analysis, facilitating the development of ChatGPT-based scientific cognitive tools (Qu, Y. K., 2024:31).

It is worth noting that while generative AI such as ChatGPT has been widely responded to, the moral and ethical issues such as authenticity and accuracy, deep comprehension, data privacy, algorithmic bias, and technological dependence brought about by AI in scientific research are also becoming more and more prominent. Therefore, this paper focuses on a systematic analysis of the moral and ethical challenges that may arise from AI in scientific research.



2. Moral and Ethical Risks of Artificial Intelligence in Scientific Research

In recent years, with the rapid iterative development of generative AI technology and the rapid broad-spectrum application, especially in people's interaction with generative AI represented by ChatGPT, the moral and ethical risks of AI in scientific research have become increasingly prominent. Therefore, this part focuses on the moral and ethical risks of AI in scientific research.

2.1 Issues of authenticity and accuracy

The core mechanism of generative artificial intelligence is the deep cultivation of machine learning using big data as “fuel” to continuously improve its application performance. In this process, factors such as data quality and data timeliness affect the authenticity and accuracy of AI-generated content. First, the quality of data. The performance improvement of generative AI requires massive data feeding training to make it more intelligent and humanized. And most of the training data come from open source data, external purchases, automated data collection and public data to realize massive data feeding training. To a certain extent, these training data contain both correct and incorrect information. If this wrong information is repeatedly learned and generated under the application of artificial intelligence technology, the phenomenon of “serious nonsense” is very likely to occur in human-machine dialogues. (Wang, T. E., 2023:19). At the same time, with the wide application of deep faking techniques, the large amount of false information generated further exacerbates the truthfulness and accuracy of the output content. Therefore, the authenticity and accuracy of the training data directly affect the



accuracy and authenticity of the content generated by AI in scientific research. Second, the problem of data timeliness. The data of generative AI is based on a static knowledge base that it is exposed to during training, and the database is not updated in real time. This means that when conducting scientific research, the content generated through generative AI may have a certain lag when it comes to the latest knowledge information. This can affect the accuracy in scientific research to some extent.

2.2 Deep comprehension issues

Although generative AI has improved its performance more substantially with the continuous updating of training data, it still needs to be improved in terms of deeper understanding and interpretation of texts and so on. The generative AI database represented by ChatGPT is limited by the scope of the domain and timeliness of the training data involved, making it difficult to deeply understand the complex linguistic structures and cultural connotations in ancient texts. For example, there are deficiencies in content understanding, thoughts and feelings, and deep-level analysis of ancient Chinese texts and ancient poems. Although Chinese ancient poems are short in content, they contain rich thoughts and emotions and deep meaning. When analyzing them, in addition to interpreting the surface text of ancient poems, it is also necessary to fully understand the author's emotional expression and the deep-seated ideological meaning. Therefore, AI may lack the ability to understand the complex language and artistic expression techniques in literary works or art works in conducting scientific research applications, thus affecting the in-depth interpretation of the works to a certain extent (Qu, Y. K., 2024:31).



2.3 Data privacy risks

Ian Ayres has mentioned that, “big data analytics reduces the space for effective privacy, and people live in a world where it is increasingly impossible to hide who they are, what they do and what they will do.” Data as an important element of the development of artificial intelligence and operational “fuel”, without sufficient data, artificial intelligence can not be effective learning and optimization. In the process of acquiring, collecting and processing application data, AI has data privacy risks. First, in the data acquisition and collection stage, it is manifested in excessive collection and opacity of collection (Yang, J. F., & Chu, J., 2024:21). In the era of artificial intelligence, data increasingly emphasizes its value and becomes an important factor resource. Excessive collection of sensitive and private data of users is very likely to have the risk of data privacy leakage and generate moral and ethical problems. Second, in the data processing stage is mainly manifested in the security of data transmission and processing. After data collection, it will be transmitted and processed in various systems or nodes, and in this process, it is also very easy to produce the leakage and abuse of private data, and there is a risk of data privacy security. Therefore, in the application of scientific research through artificial intelligence technology, it is necessary to be sufficiently alert to the data privacy security risk of users.

2.4 Algorithmic bias

Algorithmic fairness is seen as a core moral and ethical issue in the field of artificial intelligence (Wang, Y. M., Wang, D., Wang, H. J., & Liu, C. C., 2023:37). There is a high risk of algorithmic bias and even algorithmic discrimination in artificial



intelligence in scientific research. Algorithmic bias in generative AI generally refers to the risk of algorithmic bias, algorithmic discrimination that may be brought about by the opacity of algorithmic models and the influence of human preferences during the operational phase of AI. This algorithmic bias, algorithmic discrimination may bring impacts on social equity and personal cognition, etc. Especially in scientific research, algorithmic bias and algorithmic discrimination can either implicitly or explicitly affect the user's thought cognition, which in turn affects the cognition of growing students to a certain extent. Therefore, the moral and ethical risks posed by algorithmic bias are a cautionary issue in scientific research, and there is a need to ensure the fairness of algorithms by reducing or even eliminating bias and discrimination through data cleansing, algorithm design, and increased transparency and interpretability.

2.5 Technological overdependence

While the rapid iterative development of generative AI has brought many conveniences to the field of scientific research and increased the efficiency of content creation. However, it has also generated an over-reliance on technology and thus an overuse of AI technology to acquire knowledge and information. Over-reliance on technology may, first of all, bring about a decline in cognitive thinking skills. As we know, generative AI is a large model based on data and processed through algorithmic operation, if users rely excessively on the output of AI for analysis and decision-making, this will, to a certain extent, reduce the opportunity for users to conduct independent thinking and analysis, and thus weaken the cognitive thinking ability of users. Second, the decline of innovation ability. The decline of cognitive thinking



ability and excessive reliance and trust on technology will further bring about the decline of people's innovation ability. Critical thinking and innovativeness are at the core of scientific research, so over-reliance on technology is also a concern in scientific research.

2.6 Intellectual property protection

With the development of artificial intelligence technology, generative artificial intelligence is more and more widely used in scientific research. In the process of scientific research, generative AI is able to generate new content works by quickly recognizing and extracting data such as text, images, audio and video, etc., based on the key information input by the user, in the existing training database. As for how the intellectual property rights of new content works generated by generative AI are defined and protected, there is no specific definition as of now. Therefore, the dispute of intellectual property rights of content works generated by generative AI is another challenge that people face. It is also a problem that people need to solve urgently in scientific research.

3. Conclusion

As the application of artificial intelligence in scientific research becomes more and more extensive, the trend of human-computer interaction learning becomes more and more obvious. Although the rapid development of AI brings many conveniences to scientific research and frees people from complex and tedious thinking labor. However, it also brings moral and ethical risks such as authenticity and accuracy, deep comprehension, data privacy, algorithmic bias, technology dependence and intellectual property rights. This is an urgent need to draw people's attention and timely



prevention and standardization. Only in this way can we better promote the healthy and safe development of AI technology and better play its important role in scientific research.

References:

1. Huang, G. Z., Fang, J. W., & Tu, Y. F. (2022). The Global Picture and Trends of Artificial Intelligence Educational Application Research. *Modern Distance Education Research*, 34(3), 3-14.
2. Qu, Y. K. (2024). Research on ChatGPT Subject Teaching Knowledge and Educational Applications. *China Education Informatization*, (9), 31-41.
3. Huang, G. Z., Fang, J. W., & Tu, Y. F. (2022). The Global Picture and Trends of Artificial Intelligence Educational Application Research. *Modern Distance Education Research*, 34(3), 3-14.
4. Pai, K. C., Kuo, B. C., & Liao, C. H. et al. (2021). An Application of Chinese Dialogue-Based Intelligent Tutoring System in Remedial Instruction for Mathematics Learning. *Educational Psychology*, 41(2), 137-152.
5. Hwang, G. J., Wu, P. H., & Ke, H. R. (2011). An Interactive Concept Map Approach to Supporting Mobile Learning Activities for Natural Science Courses. *Computers & Education*, 57(4), 2272-2280.
6. He, X., & Xi, J. (2024). Research on Risk Prevention of Generative AI Model Application in Legal Discipline Education. *Journal of Changchun Normal University*, (9), 27-33.
7. Qu, Y. K. (2024). Research on ChatGPT Subject Teaching Knowledge and Educational Applications. *China Education Informatization*, (9), 31-41.
8. Wang, T. E. (2023). ChatGPT's Characteristics, Educational Significance and Its Problem Response. *Ideological Theory Education*, (4), 19-25.
9. Qu, Y. K. (2024). Research on ChatGPT Subject Teaching Knowledge and Educational Applications. *China Education Informatization*, (9), 31-41.



-
10. Yang, J. F., & Chu J. (2024). Ethical Risks and Normative Principles of Artificial Intelligence Educational Applications. *Chinese Journal of Education*, (11), 21-27.
 11. Wang, Y. M., Wang, D., Wang, H. J., & Liu, C. C. (2023). Algorithmic Fairness: The Logic and Governance of Algorithmic Bias in Educational Artificial Intelligence. *Open Education Research*, (5), 37-46.