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ARTIFICIAL INTELLIGENCE AS AN INNOVATIVE TECHNOLOGY IN THE ACTIVITIES OF UNIVERSITY LIBRARIES

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Abstract: The university library is an important component of the educational process, so all changes occurring in society and the education system, new technologies, and Internet applications find their application in the library as well. As society changes, libraries change as well. They cease to be merely collections of various publications and become platforms for individual and collective work, known as intellectual and creative hubs.
Technologies of Artificial Intelligence (AI), with their great potential, are capable of modernizing the internal structure of libraries and changing the approach to the very process of library activities. For most libraries worldwide, the use of this technology is still in its early stages. Artificial intelligence in libraries could be used to structure information and link materials together to automatically generate curated collections of educational materials on specific topics for students and teachers. However, implementing this technology would require significant time and financial investment for training the artificial intelligence system, resources that libraries often do not have.
AI can be used for semantic analysis of digital archives and collections of cultural heritage. The efficiency of discovering new literature through automated indexing will help users conduct searches more quickly and visualize their navigation across various subject headings. AI services enable active utilization of new capabilities for informing, educating, and clearly structuring information, which is beneficial for various user groups both individually and at the institutional level.

Keywords: Artificial Intelligence, university libraries, new technologies, information user, library services

JEL Classification: D83; I23; L86

1 Introduction

The university library is an important component of the educational process, so all changes occurring in society and the education system, new technologies, and internet applications find their application in the library as well.

As society changes, libraries change as well. They cease to be merely collections of various publications and become platforms for individual and collective work, known as intellectual and creative hubs (Lund, Brady, 2021).

Technologies of Artificial Intelligence (AI), with their great potential, are capable of modernizing the internal structure of libraries and changing the approach to the very process of library activities.

2 Methodology and results of the study

On the basis of desk research, were investigated the phenomenon of Artificial Intelligence and its most popular products used in the libraries.

The concept of artificial intelligence was first discussed following Alan Turing's 1950 work, "Computing Machinery and Intelligence". In this article, Turing posed the question, "Can machines think"? Six years later, in 1956, John McCarthy introduced the term "artificial intelligence" at the first-ever AI conference at Dartmouth College (Боженко, Ярослав, 2024).

The technology named Artificial Intelligence, as proposed by American computer scientist John McCarthy, refers to a set of technological solutions that enable the imitation of human cognitive functions (including self-learning and problem-solving without a predefined algorithm) and achieve results in specific tasks that are comparable to those of human intellectual activity (Stolyarov, Yu. N., 2022).

In addition to supporting the educational process, the modern university library performs informational, educational, and training functions. Libraries also help to engage the general population in using information technologies in everyday life, including accessing government and municipal services online, among other things. Thus, through the use of marketing, libraries harmonize the relationship between government authorities and society.

Architects and designers can modernize the external appearance of a library, while the internal processes of the library can be transformed by artificial intelligence (Искусственный интеллект в библиотеке, 2023).

Artificial intelligence is characterized by fundamental properties (Figure 1).

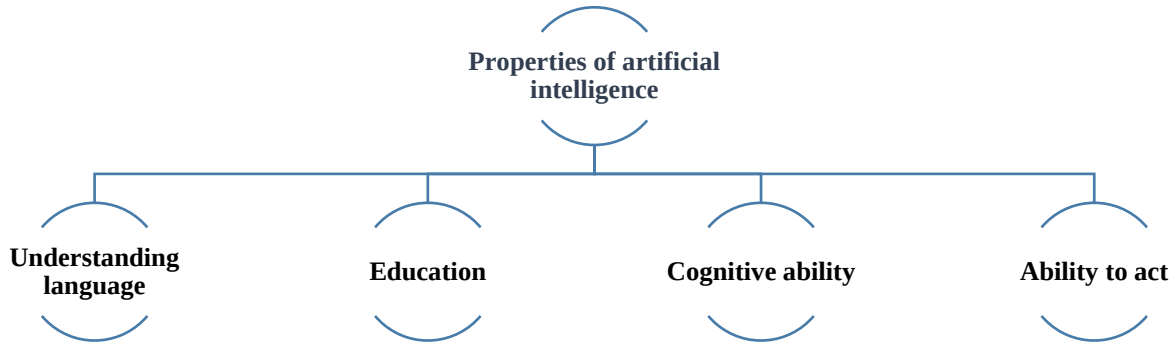

Figure 1 Key properties of artificial intelligence

Source: elaborated by authors

Artificial intelligence technologies find successful applications in fields with large volumes of information, statistical and scientific data.

AI is widely used in legal practice (DoNotPay) for drafting legal documents, in banking activities (Contract Intelligence), in education, and other domains (Степанов, Вадим, 2018).

The use of these technologies in medical purposes, construction, military affairs, and other fields should be approached with a high degree of caution and deliberation. The human, as an expert and

mediator between technology and its outcomes, becomes the essential controlling element that ultimately ensures the successful execution of AI-driven tasks.

3 Artificial Intelligence in Libraries

Artificial intelligence is one of the fastest-developing technologies globally, yet its application in many fields is currently limited to utilizing certain elements of it. For most libraries worldwide, the use of this technology is still in its early stages.

Thus, specialists at the Library of Congress in America developed an artificial intelligence-based tool called the **"Newspaper Navigator"** as part of a project (Lee, Benjamin Charles Germain et al, 2020). The innovative "Newspaper Navigator" system is based on optical character recognition (OCR), which enables the identification of printed and handwritten characters, including scanned documents. This technology was also utilized in the creation of **"Google Books"**.

The "Newspaper Navigator" system simplifies information retrieval based on correctly formulated queries using keywords or sentences. It recognizes and retrieves all relevant documents. This advanced technology also allows for object detection and classification into various types, such as headlines, photographs, maps, advertisements, and more.

To implement the project, the library initially engaged volunteers who uploaded initial data into the system and described them, enabling artificial intelligence to understand the essence of the task. The results of the "Newspaper Navigator" project are quite impressive: within 19 days, the system processed and classified all newspaper pages available to the library, totaling over 16 million pages. Moreover, the proportion of problematic pages was minimal, with only 383 identified as such (Искусственный интеллект в библиотеке, 2023).

Additionally, in libraries, there has been the application of an artificial intelligence development called **Chronicling America**. However, unlike the "Newspaper Navigator", this application lacks self-learning capabilities and the ability to accumulate data volumes to enhance its operational quality.

The experience of the Hillsboro Public Library in Oregon is noteworthy. It was the first library in the Pacific Northwest region of the USA to adopt the **Book-O-Mat** technology, a self-service kiosk installed in the city center and operated from the main library. This book vending machine allows patrons to borrow and return publications, assists library staff in tracking demand trends, and can provide users with personalized book recommendations (Параскив, Петра, 2023).

According to the American Library Association, **IoT technology** offers a wide range of "possibilities for library applications, from tracking room usage and event attendance to monitoring humidity levels for special collections and much more". Thus, libraries in the future will be able to significantly enhance the user experience by expanding their services and collections (Whitehair, Kristin, 2016).

Libraries can utilize analogs of virtual assistants like **Alexa and Siri**, developed by Apple Computer and Amazon, which handle natural language processing, speech synthesis, and create algorithms that provide users with new capabilities. Today, Siri and Alexa are accessible to anyone on their devices. Artificial intelligence, once a technology of the future, is gaining popularity in the present. Voice-activated systems can be used for providing information about library services and products, reserving publications, and more.

Artificial intelligence in libraries could be used to structure information and link materials together to automatically generate curated collections of educational materials on specific topics for students

and teachers. However, implementing this technology would require significant time and financial investment for training the artificial intelligence system, resources that libraries often do not have.

In museum and exhibition activities, there are already intellectual developments that could find application in libraries as well. For instance, multimedia equipment is used to attract visitors' attention during exhibitions. By interacting with interactive screens, visitors can obtain comprehensive information about exhibits and the history behind them. AI is employed here for organizing and structuring large volumes of data, identifying relationships between them, and optimizing search queries based on previous retrospective searches.

Additionally, AI can be used for semantic analysis of digital archives and collections of cultural heritage (Степанов, Вадим, 2018).

The efficiency of discovering new literature through automated indexing will help users conduct searches more quickly and visualize their navigation across various subject headings, which is not feasible with manual indexing. This type of AI tool will surpass the capabilities of library specialists by providing readers with more specific and accurate materials. Indexing is based on the factual content of documents rather than the subjective assessment of a classifier, enabling comparison of large document sets relevant to the query topic (Каптерев. А. И., 2023).

The application of AI algorithms to optimize information retrieval in libraries will help to quickly and accurately identify user queries and provide more relevant results. AI can also analyze the history of queries or views and offer readers personalized data on monographs, articles, films, and other sources of information.

AI services enable active utilization of new capabilities for informing, educating, and clearly structuring information, which is beneficial for various user groups both individually and at the institutional level.

4 Leading Tools and Uses

In universities and colleges, to optimize the educational and scientific processes, educators, researchers, and students are recommended to use the following AI services:

- *ChatGPT* – allows obtaining factual information, hypotheses, ideas, recommendations, and structured texts;
- *Deepl* – best translator;
- *Bearly* – text summarizer on the website (theses and antitheses);
- *Elghtlfy* – YouTube summarizer;
- *ChatGPT Plugins* – these are commonly referred to as optional add-ons or extensions that users can integrate with their AI chatbot to enhance the capabilities of the GPT-4 model;
- *MldJourney, DALLE* – image generation;
- *Perplexity* – answers to questions with links;
- *Consensus, Elcit, Research Rabbit* – working with scientific articles (Кунев, Вячеслав, 2024).

The proposed services are capable of providing prompt assistance, answering questions, clarifying queries, suggesting concepts, finding relevant information, and developing individual plans based on users' capabilities and skills 24/7.

Studying AI tools should be integrated into the University Curriculum under the discipline of "Information Literacy". Librarians can educate users on using these tools in academic and scientific activities. It is particularly important to teach users how to formulate prompts correctly. It's essential

to understand that the AI toolkit requires both theoretical understanding and practical skills in the field of study. Without sufficient subject-specific theoretical knowledge, it is impossible to formulate prompts correctly and consequently obtain complete and accurate results.
In the near future, AI will be widely used in the analytical and predictive activities of libraries, which will contribute to optimizing library operations, better allocation of human and financial resources, and improving the quality of library services provided.

5 Prospects and Challenges of AI Implementation in Libraries

Today, many universities are increasingly in need of specialists – analysts who collect and summarize the results of scientific achievements of institutions using various methods of data processing. Scientific libraries, equipped with specific knowledge and skills in handling large volumes of information, are poised to lead communities of data scientists in the near future, leveraging AI tools. Therefore, it can be argued that the use of AI offers libraries new opportunities, yet there are also several challenges that libraries may face (Table 1).

Table 1 Opportunities and Threats of AI Usage in Libraries

№	Opportunities	Threats
1.	Time-saving in query implementation	Funding. Costs associated with implementing AI tools
2.	Improvement of control over library plans implementation	Concerns regarding the accuracy and reliability of AI algorithms
3.	Improving the quality of library services	Reduction of library staff
4.	Increasing importance of the scientific library	Privacy and security
5.	Enhancing the intellectualization of library services	Readiness for digital changes. Lack of relevant skills among library staff
6.	Strengthening engagement within the serviced community	Generation of fakes
7.	The ability to better study the information behaviour of serviced segments	Integration with existing systems

Source: Authors development based on (Каптерев. А. И., 2023).

In her article, Kristin Whitehair notes: "Since many AI applications are oriented towards providing information to the user, it may seem that AI technologies pose a challenge to libraries". However, "this intelligence is still artificial, not human. Libraries can connect people with information and, more importantly, with other people, which AI cannot do". Adding an intelligent component to all applications available in the library is a real opportunity to better understand user behaviour patterns and adapt to their needs (Whitehair, Kristin, 2016).
Today, scientists, teachers, students, and postgraduates already use some AI tools. However, due to limited time resources and insufficient skills in using these tools, serviced segments increasingly seek help from the library.

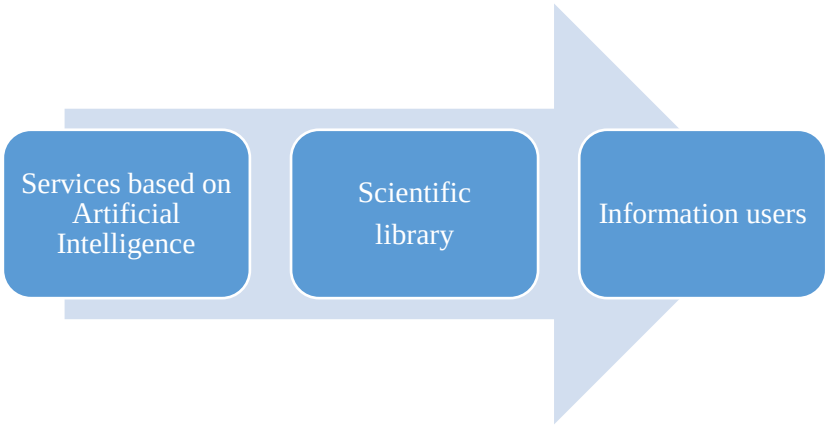

Figure 2 The library as an intermediary between the challenges of the digital society and library users

Source: elaborated by authors

The new roles of modern libraries only strengthen their classical intermediary function between governmental, educational, scientific organizations, and end-users. Thus, it can be noted that the communicative function of university libraries is increasingly reinforced.

6 Conclusions

Thus, the task of modern libraries becomes the adaptation of all segments of society to rapidly changing demands of the digital lifestyle: from developing educational skills in children and the elderly to servicing professionals using AI tools.

The gradual shift from textual to audio-visual ways of understanding the world is changing communication and information exchange methods. The model of the classical library is becoming less in demand, making way for the modern library, transforming from a place of information storage into a laboratory for creating new knowledge based on AI.

Today, scientific libraries are transforming into hubs for various forms of intellectual interaction, laboratories that facilitate scholarly activities for their serviced segments based on digital technologies.

The task of libraries to adapt citizens to the requirements of the digital lifestyle will be solved through extensive retraining of library personnel, supported by the government and the entire scientific and educational system of the country.

References

1. Lee, Benjamin Charles Germain, Mears, Jaime, Jakeway, Eileen, Ferriter, Meghan, Adams, Chris, Yarasavage, Nathan, Deborah, Thomas, Zwaard, Kate and Weld, Daniel S., 2020. The Newspaper Navigator Dataset: Extracting Headlines and Visual Content from 16 Million Historic Newspaper Pages in Chronicling America. In *Proceedings of the 29th ACM International Conference on Information & Knowledge Management (CIKM '20)*. Association for Computing Machinery, New York, NY, USA, pp. 3055–3062 [online] Available at: https://doi.org/10.1145/3340531.3412767 [Accessed 14 September 2024].
2. Lund, Brady, 2021. The Fourth Industrial Revolution: Does It Pose an Existential Threat to Libraries?. *Information Technology and Libraries*, 40(1) [online] Available at: https://doi.org/10.6017/ital.v40i1.13193 [Accessed 2 September 2024].
3. Stolyarov, Yu. N., 2022. Artificial intellect and the book library industry: Vectors for problem development. *Scientific and technical libraries*, No.1, pp. 17-34.

4. Whitehair, Kristin, 2016. Libraries in an Artificially Intelligent World. In: *Public Libraries Online*. [online] Available at: https://publiclibrariesonline.org/2016/02/libraries-in-an-artificially-intelligent-world/ [Accessed 27 September 2024].
5. Боженко, Ярослав, 2024. Искусственный интеллект уже здесь: 5 сфер, которыми завладели нейросети. In: *NUR.KZ* [online] Available at: https://www.nur.kz/family/school/1817736-iskusstvennyj-intellekt-sovremennye-vozmoznosti-i-perspektivy/ [Accessed 12 September 2024].
6. Искусственный интеллект в библиотеке, 2023. In: *Электронно-библиотечная система. Лань* [online] Available at: https://lala.lanbook.com/iskusstvennyj-intellekt-v-biblioteke [Accessed 12 September 2024].
7. Каптерев. А. И., 2023. Когнитивный менеджмент и искусственный интеллект в библиотеках: возможности и особенности. *Научные и технические библиотеки*, № 6, pp.113-137.
8. Кунев, Вячеслав, 2024. *Искусственный Интеллект как способ резкого повышения личной и бизнес эффективности* [online] Available at: https://kunev.md/AI#rec583260431 [Accessed 27 September 2024].
9. Параскив, Петра, 2023. 10 инновационных технологий для библиотеки будущего. In: *Территория L*. [online] Available at: https://gazetargub.ru/?p=18723 [Accessed 10 September 2024].
10. Применение искусственного интеллекта в библиотечно-информационной сфере, 2024. In: *Образовательный портал «Справочник»* [online] Available at: https://spravochnick.ru/bibliotechno-informacionnaya_deyatelnost/primenenie_iskusstvennogo_intellekta_v_bibliotechno-informacionnoy_sfere/ [Accessed 14 September 2024].
11. Степанов, Вадим, 2018. *Библиотека и библиотекари в эпоху искусственного интеллекта и роботизации.* [online] Available at: https://www.yarsklib.ru/_doc/collegam/forum_18/Stepanov%20V.K..pdf [Accessed 10 September 2024].