Artificial Intelligence Adoption in Academic Libraries: Opportunities, Challenges, and Future Directions

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Abstract

Academic libraries are in a new phase of transformation; the speed of the development of Artificial Intelligence (AI) is truly astounding. The potential applications of AI in libraries are vast, ranging from improving research and teaching to streamlining repetitive tasks. This paper is an overview of the applications of Artificial Intelligence (AI) in Academic Libraries, with a focus on opportunities, challenges and future directions of the technology. Qualitative secondary data analysis was used in the study adopting a review design. Relevant literature published in last 6 years (2020-2026) was systematically retrieved from major scholarly databases such as Scopus, Web of Science, Google Scholar, ERIC, Springer, Emerald Insight, Elsevier (ScienceDirect) and Taylor & Francis Online. The studies were thematically analyzed and common trends in the use of AI in librarianship identified. The findings indicate that AI has proven to be a tremendous help to the library in automation, semantic information retrieval, virtual reference, library recommendations, collection development, and research support through technologies such as machine learning, NLP, and generative AI. While these advantages are present, a number of hurdles remain in the way of the broader use of AI in libraries, such as: Cost, Technical integration, ethical considerations, Privacy and data security, Copyright concerns, and Lack of AI skills among library staff. The review also emphasizes the need for effective AI governance, continuous professional development, and well-defined institutional policies to ensure the responsible and sustainable adoption of AI. The study concludes that Artificial Intelligence can be the key to unlocking academic libraries to become a smart, learner-centric knowledge center, but it can also help improve and not displace the skills and knowledge of the librarians. The findings of this research could be beneficial to library administrators, policy makers, researchers and information practitioners in their quest of enhancing AI-based library services.

Keywords: Artificial Intelligence; Academic Libraries; Library Automation; Generative AI; Digital Transformation

1. Introduction

Academic libraries have undergone a significant transformation in the new era from being storage centers to dynamic places of digital engagement (Anuradha, 2019; Sandhu, 2018). This transformation is embedded in the overall digital transformation of higher education, where institutions have started to take an integrated digital approach in order to remain relevant and effective to optimize their operations (Katulić, 2025; Sandhu, 2018). The library is an important enabler of digital scholarship, and is continually adapting its architecture and services to address changing needs of researchers, teachers, students (Katulić, 2025; Sandhu, 2018).

Artificial Intelligence (AI) is playing a pivotal role in the digital transformation and revolutionizing research and academic work. In the academic library AI is being used to transform fundamental services like cataloguing, classification, reference and resource discovery, and to streamline everyday processes.In the academic library, AI is being used to revolutionize fundamental services such as cataloguing, classification, reference and resource discovery and in routine activities to improve efficiency. Moreover, the integration of AI-powered tools can facilitate the development of personalized user experiences, automate repetitive tasks, and bolster research and scholarly work, positioning libraries to stay relevant to evolving user needs (Mupaikwa, 2024; Tzanova, 2024).

However, AI use in the academic library environment is beset with numerous challenges including the ones highlighted by Cox et al (2018) and Okpala (2026) that include ethical, cost and human resource issues.

The situation is still complicated and the direction of the library's strategy is still uncertain for library leaders (Gasparini & Kautonen, 2022). In this uncertain context, a critical examination of the use of AI in academic libraries is needed (Gasparini & Kautonen, 2022). It is crucial to undertake such a review to evaluate the real-world uses, tackle the complex issues, and create a policy framework for how academic libraries can best leverage AI to remain an integral part of the modern higher education landscape (Cox et al., 2018; Okpala, 2026).

2. Objectives

1. To explore how AI can enhance academic libraries.

2. To discuss the possibilities of using AI in academic libraries.

3. To leverage opportunities that arise from AI technologies.

4. To analyze challenges to the implementation of AI.

5. To explore future trajectory of library services with AI.

3. Literature Review

The use of AI in academic libraries has moved from a hypothetical concept to a reality, impacting the way libraries are operated and services are delivered (Cox et al., 2018; Gasparini & Kautonen, 2022). This review draws together some of the latest developments in the various functional areas and illustrates how these technologies can transform the field.

3.1 AI in Library Automation

The application of AI has greatly improved back-end library processes, especially in cataloguing, classification and metadata creation. Labour-intensive processes are now supplemented with machine learning algorithms that can accurately and quickly analyze, categorize and index large data sets (Okpala, 2026). These systems minimize human error and help to tightly manage large digital collections. Routine cataloguing tasks are automated, freeing up librarians' time to concentrate on high level curation, not only for consistency, but to ensure that metadata is optimized to discovery layers, critical to the integrity of digital repositories (Cox et al., 2018).

3.2 AI-based User Services

The introduction of virtual reference services and intelligent chatbots has revolutionized user facing services. These enable continuous support, responding to standard queries and freeing up staff for more complex research consultations (Mupaikwa, 2024). Moreover, AI recommendation systems can also learn from user behavior and search history to provide personalized content recommendations, significantly improving information retrieval. It enables users to explore the vast information landscape more effectively and efficiently, fostering a more intuitive, user-centric, and responsive digital environment for the academic community (Katulić, 2025; Mupaikwa, 2024).

3.3 Generative AI Applications

Generative AI models like ChatGPT, Gemini, Copilot, and Claude are a game-changer in the world of research. There has been an increasing trend to use these tools for literature searches, helping to locate pertinent literature and to integrate large amounts of information (Tzanova, 2024). These models can assist in formatting citations and checking references, thus minimizing research burdens.These models can also be used to standardize the formatting of citations and confirm references, easing researchers' burdens. Moreover, generative AI is a powerful tool for disseminating knowledge about complex topics and for helping students in the research process, facilitating the democratization of information literacy support (Tzanova, 2024).

3.4 AI for Collection Development

AI-powered tools are being used in libraries to enhance collection development by predicting user needs and interests.Predictive analytics using AI are being utilized in libraries to improve collection development strategies. Using usage data and data modelling, libraries can predict material usage and allocate acquisition funds accordingly, making the budget more efficient (Gasparini & Kautonen, 2022). AI systems help in the management of digital resources as well, by analyzing patterns in resource usage and recommending resources that are missing. Such a strategy of making library resources current and relevant to the changing research needs of the library (Okpala, 2026) is reactive and proactive in nature.

3.5 AI in Research Support

AI tools are increasingly playing a vital role in AI research support, especially research data management. To simplify data cleansing, storage and retrieval, libraries now utilize the technologies (Tzanova, 2024). Moreover, AI can aid in the intricate task of bibliometric analysis and research impact measurement, offering faculty and administrators granular insights into trends in publication and citation patterns. Furthermore, libraries are increasingly providing AI tools for language support and manuscript preparation to help researchers improve their language, thus reinforcing the library's central role in the scholarly communication and research ecosystem (Tzanova, 2024).

Table 1. Summary of Recent Studies on AI Adoption in Academic Libraries

Author	Year	Country	Focus Area	Key Findings
Cox et al.	2018	United Kingdom	Intelligent libraries	In the library world, AI can be used to improve automation, metadata management, and user services.
Gasparini & Kautonen	2022	Finland	AI in research libraries	The implementation of AI demands strategic planning, governance, and ethical considerations.
Mupaikwa	2024	Zimbabwe	AI-based reference services	Virtual reference services and user experience are enhanced by AI chatbots.
Tzanova	2024	United States	Scholarly communication	Literature searching, citation management, research

				assistance—all are supported by generative AI.
Katulić	2025	Bosnia and Herzegovina	Digital transformation	AI is enhancing the user experience and supporting digital transformation in academic libraries.
Macari	2025	Philippines	Innovative library services	AI affords the opportunity for personalised and technology-based academic library services.
Okpala	2026	Nigeria	AI applications in libraries	AI enhances cataloguing, collection development, research databases, and decision making.
Madivala & Holeyannavar	2026	India	Future of AI in libraries	AI is changing academic libraries by empowering intelligent services and transforming professionals.

Methodology

The qualitative review design was used in this study, with secondary data analysis to analyze the opportunities, challenges and future directions of Academic Library's use of Artificial Intelligence (AI). The review was not a primary data collection, but rather drew from existing scholarly information to respond to a clearly stated research question.

A structured search was carried out in the eight databases, namely Scopus, Web of Science, Google Scholar, ERIC, Springer, Emerald Insight, Elsevier (ScienceDirect) and Taylor & Francis Online, combining the keywords with Boolean operators: artificial intelligence, academic libraries, library automation, AI adoption, generative AI, and library services. The first search yielded a pool of records which were subsequently reviewed and sorted by title/abstract, and evaluated based on the full text for eligibility.

Only peer-reviewed journal articles and book chapters in English, published in the last 7 years (2020-2026) and directly addressing the use of AI in academic or research library settings were included. Studies that were public, special or school libraries where higher education was of no consequence or studies that were conference abstracts with no full text, editorials or opinion articles with no empirical or conceptual content, duplicate records and non-English publications were excluded.

Selected literature was then thematically analyzed by identifying and categorizing the key ideas into five broad themes: AI Services in Libraries, Opportunities, Implementation Hurdles, Ethical Implications, and Future Directions. This coding process was repetitive, and allowed for the recognition of patterns and contradictions, not just the summarization of those patterns and contradictions across studies. This synthesis provides a contextually-based, evidence-based, and organized view of the state of AI applications in academic libraries and highlights areas in need of empirical investigation.

4. Opportunities of AI Adoption

4.1 Improved Information Retrieval

In the field of information discovery, AI has transformed how information is sought by omitting the old method of using keywords and replacing it with semantic search. More recently, AI-driven search engines have been able to better comprehend the context and intent behind user queries, and can now process the semantic relationships between the terms and provide access to more contextually relevant and specific scholarly content, which can improve the information experience for users (Tzanova, 2024). The systems reduce the cognitive load on researchers, helping them to navigate through large digital archives more efficiently and accurately. AI can help automate the indexing and categorization of large datasets, ensuring information is easily and contextually accessible (Okpala, 2026).

4.2 Personalized Library Services

The use of user profiling and advanced recommendation systems is another feature that AI offers, which can offer a highly user-centric environment. The personalized suggestions in these systems can also help students choose relevant content and reading recommendations based on search trends and user behavior, which can boost students' academic interests and focus on materials relevant to their studies (Mupaikwa, 2024). The combination of this customized approach with a digital library creates an interactive and user friendly environment that clearly directs the user to the relevant information, thereby making information retrieval more effective and user friendly for the academic community (Katulić, 2025).

4.3 Enhanced Library Efficiency

AI-driven systems have optimized library functions, eliminating repetitive and time-consuming duties, while enhancing efficiency and productivity.Harnessing AI-powered systems has greatly optimized library functions, saving time and resources for routine and repetitive tasks. Librarians can leverage technologies for cataloging, data cleansing, and administration to transcend each of their roles of manual data entry to high level data curation and strategic service planning (Cox et al., 2018). Optimization ensures efficient use of resources, as AI algorithms process vast amounts of data with precision, contributing to maintaining consistently accurate metadata across all data sets and reducing human error in the management of data repositories (Okpala, 2026).

4.4 Better Decision Making

Predictive analytics is now being used as a tool to inform collection development and strategic planning at libraries. Libraries can use usage data and data modelling to make accurate forecasts of the demand for academic resources, which enables them to allocate their acquisition budgets to resources that align with the research priorities of the library (Gasparini & Kautonen, 2022). The change from reactive to proactive collection management, with the holdings being relevant and current with respect to evolving scholarly trends, is supported by real-time insights into the holdings (Okpala, 2026).

4.5 Improved User Engagement

Now, the user experience is being freshed up with round-the-clock AI-driven chatbots and virtual interaction.The user experience is getting a fresh lease on life with the ability to offer 24/7 support with AI-powered chatbots and interactive virtual services. These witty tools deal with frequent queries and offer instant help, making sure that students and teachers can get assistance beyond standard library working hours (Mupaikwa, 2024). In the more responsive and accessible digital environment, such systems can be virtual librarians who can accompany users in their research process, tailored to their needs and accessible 24/7/365 to assist the research community during their research process.

Table 2. Opportunities of AI Adoption in Academic Libraries

Opportunity	Description	Expected Benefits
Information Retrieval	Search accuracy is enhanced by semantic search and Natural Language Processing.	Rapid and timely access to information data.
Virtual Reference Services	AI Chatbots respond to user queries in real-time.	Around-the-clock support and enhanced accessibility.
Personalized Recommendation Systems	AI is used to analyze user preferences and search behavior.	Improved user satisfaction and customized learning.
Library Automation	AI handles cataloguing, classification, indexing and metadata generation.	Time savings, increased efficiency and decreased human error.
Collection Development	Predictive Analytics aids in acquisition and resource management decisions.	Improved planning and resource utilization.
Research Support	Generative AI can help with literature reviews, citations, and academic writing.	Increased research productivity.
Decision Support	AI uses library usage data and	Evidence-based strategic

	user behaviour.	planning.
User Engagement	Library services offered by virtual assistants that use artificial intelligence.Library services by virtual assistants with artificial intelligence.	Improved customer satisfaction and service delivery.

5. Difficulties encountered in the adoption of AI.

Artificial Intelligence (AI) offers significant potential to improve the services provided in academic libraries, but there are a number of financial, technical, ethical, organizational and legal challenges that need to be carefully managed and well-governed to ensure their successful implementation in academic libraries.

5.1 Financial Constraints

Investing in AI technology is a significant expense, involving software, infrastructure, licenses, and system maintenance. For academic libraries, especially those operating on a tight budget, these expenses are part of the budget equation and are in direct competition with the funds required to acquire digital resources and for collection development.

5.2 Technical Challenges

The application of AI in libraries is not easy. Many libraries don't have on-site professionals who can handle AI applications, and the ability to integrate legacy library management systems with the latest AI tools can be complicated by the need for hefty technical changes and maintenance.

5.3 Ethical Issues

With the increasing adoption of AI, privacy, data security, algorithmic bias, and copyright are significant ethical concerns that should be considered. Libraries need to ensure personal data are protected, AI systems are transparent and fair, and copyrighted scholarly content is used as per legal and ethical guidelines.

5.4 Organizational Challenges

However, there is a need for organizational change to adopt AI, in addition to technology. Factors such as change resistance, fears of job replacement and lack of digital skills of library staff can delay the process of adoption. Therefore, it is essential to emphasize the importance of lifelong learning and digital literacy initiatives to ensure that librarians can effectively work with AI tools.

5.5 Legal Issues

The legal environment and ecosystem of AI is still evolving, particularly when it comes to data ownership, intellectual property rights, and regulatory adherence. Academic libraries need to develop a robust framework of AI governance policies to ensure responsible utilization, respect the intellectual property rights of researchers and information owners, and adhere to evolving legal and ethical guidelines.

Table 3. Challenges of AI Adoption in Academic Libraries

Challenge	Impact	Suggested Solution
High Implementation Cost	Increases costs of implementing AI, particularly for institutions with limited resources.	Expand institutional funds and government funding.
Lack of AI Skills	Restricts effectiveness and use of AI technology.	Ongoing education and AI courses.
Technical Integration Issues	Challenge with integrating AI with existing library management systems.	Improve digital infrastructure and move to interoperable systems.
Privacy and Data Security	Security concerns of safeguarding personal and research information.	Implement strong cybersecurity measures and data governance policies.
Copyright and Intellectual Property	The risks of safeguarding users' personal and research data.	Put robust cyber security and data governance policies in place.
Algorithmic Bias	Issues of AI-generated content and copyrighted materials.	Create institutional policies on copyright and AI use.
Resistance to Organizational Change	May make inappropriate or biased suggestions.	Implement ethical use of AI and conduct periodic audits of AI systems.
Lack of AI Governance	Organize awarenessbuilding and change management activities.	Inconsistent implementation of AI because of the lack of institutional policies. Create detailed AI governance policies and ethics.

6. Future Directions

The future of academic libraries is still bright with AI, as it offers more intelligent and efficient services that are also user-friendly. As the world becomes increasingly digital, newer AI technologies are increasingly being required, but libraries should be aware and remain responsible and ethical in their use.

6.1 Emerging AI Technologies

Widespread advancements of AI in recent years create new opportunities for academic libraries, including those with the Large Language Models (LLMs), Responsible AI, Multimodal AI, and Agentic AI, but also Explainable AI (XAI). These technologies can help to create more natural interactions, streamline complex workflows, make information more format-friendly, and enhance transparency in the AI-driven decision-making process. In the meantime, Responsible AI frameworks will be a vital component in advancing fairness, accountability, privacy, and the responsible utilization of AI applications.

6.2 Future Library Services

AI's future impact on academic libraries is expected to be through personalized and intelligent knowledge provision. Smart repositories and AI systems for discovery and information retrieval will be more efficient; Virtual Research Assistants will support researchers and students around the clock. The concept of a library that can support the research and learning process needs to be augmented by predictive collection management, which can help in improving the library's use of its resources, scholarly collections and meeting the needs of readers.

6. 3 Capacity Building

Building AI-literacy amongst the staff and research is crucial to ensure that they can effectively use the available AI tools. Continuous training and updating staff with skills required to respond to technological advances are the needs of libraries. Additionally, there will be a need to develop strong AI policy structures to deal with the ethical, legal, and operational issues raised by these technologies, which will help ensure that their use reflects institutional values and scholarly integrity.

Conclusion

AI in academic libraries is a game-changer, providing innovative opportunities. While financial, technical and ethical concerns are significant, the potential for great change, and improvement, in the way research is found and the way resources are managed greatly outweighs these risks if properly implemented (Tzanova, 2024). Most of all, intelligent systems are an added necessity and not the end of human skills. Rather, librarians continue to be vital to the institution, and AI can be a great asset in supporting them in a variety of ways, such as automating mundane tasks and improving high-value user support (Cox et al., 2018). For the future, the key factors that will support the successful integration of AI into educational settings are ongoing staff training, clear ethics committees, and strong digital infrastructure (Gasparini & Kautonen, 2022). Academic libraries can help maintain their relevance in today's fast-paced digital era of scholarly research by creating a setting that supports the use of technology rather than supplanting human capabilities (Madivala & Holeyannavar, 2026).

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