Chapter

Unlocking the Potential of Artificial Intelligence in Academic Libraries

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Abstract

The objective of this paper is to explore the utilization of Artificial Intelligence (AI) within library services to enhance efficiency, accuracy, and personalization for patrons, as well as to facilitate decision-making processes and improve overall operational performance. Using a qualitative research approach, this study reviews existing literature from sources such as Taylor and Francis Journals, Emerald Insights, Science Direct, Google Scholar, and Springer Link. The findings demonstrate that while AI has been widely applied in sectors like health, agriculture, finance, manufacturing, and education, its integration into academic libraries promises significant improvements in operations such as search and discovery, cataloging, circulation, digital preservation, and Chatbot services. Despite these positive outcomes, the study also highlights limitations, including a reliance on literature without direct input from librarians and patrons, which could provide deeper insights. The research offers practical implications for librarians in both public and private universities, showcasing the potential benefits and challenges of AI implementation. Additionally, it serves as a guideline for academic libraries and encourages stakeholders to consider AI adoption to enhance library services. The study addresses a gap in understanding the role of AI in library services and calls for future research to expand on these findings across diverse library contexts.

Keywords: artificial intelligence, AI-awareness, AI-academic libraries, developing countries, academic libraries, AI and libraries

1. Introduction

Libraries have encountered numerous challenges since their inception, continually adapting to the evolving needs of society. They have undergone remarkable transformations, progressing from the era of clay tablets and stone inscriptions to the modern age of digital information. Throughout history, the mediums through which information is stored and accessed have varied widely, from ancient scrolls and manuscripts to printed books and electronic databases. Originally, libraries served as repositories of knowledge, aiming to provide patrons with access to the latest information available.

However, in the twenty-first century, the pace of technological advancement has accelerated, leading to unprecedented changes in the way information is created, disseminated, and consumed. Today, libraries are recognized as pivotal players in the dissemination of modern technology, serving as dynamic hubs where traditional resources coalesce with cutting-edge digital tools and services [1]. In the nineteenth century, books held sway as the primary conduits of knowledge, but as society progressed, so too did the formats and mediums through which information was transmitted. Just as the book evolved, adapting to new printing technologies and cultural shifts, the nature and shape of information itself continue to undergo rapid evolution in response to technological innovations and changing societal needs.

The present era of technology has brought about many advancements and innovations in education and libraries. Some of the most prominent technologies in these fields include learning management systems (LMS), virtual and augmented reality (VR/AR), cloud computing, big data, and analytics, blockchain technologies, mobile devices and artificial intelligence (AI), etc., among the use of AI is being used in education to personalize learning, automated grading, such technology provide students with personalized feedback [2]. In libraries, AI automates tasks, improves discovery and access to resources, and enhances the user experience [3]. These technologies are transforming how we teach, learn, and access information, and they hold tremendous potential for improving educational outcomes and increasing access to information and resources [4]. The present-era technologies have affected the entire ecosystem of organizations, and with novice applications, a business can grow in the right direction and the standard of living [5]; as technology grows with rapid speed, which affects the ecosystem of entire businesses like health, finance, manufacturing, education and libraries [5]. John McCarthy (An American computer scientist), in 1956, coined the word AI. He organized a Dartmouth conference and invited a group of researchers to create a machine that thinks like a human. This conference marked the birth of AI research, and the term artificial intelligence was used in the conference proposal. John McCarthy is, however, known as the father of AI for his pioneering work in the field [5]. AI has been deployed in various businesses like healthcare, transportation, finance, agriculture, robotics, manufacturing, gaming zones, education, etc. However, the use of AI in library services has proved to be a milestone for the entire operations associated with libraries.

Interestingly, cutting-edge technology has evolved the shape of modern libraries; similarly, the role of AI has been witnessed as the most sophisticated technology of our age. As every technology has its pros and cons, definitely AI is also not free from certain challenges; however, experts in this age are endeavoring to overcome the consequences of this technology. It is said that the deployment of AI will undoubtedly bring positive changes in academic libraries. Another scholar [6] postulated that AI has paramount benefits for library operations and is known as the promising technology of the current century. Applying AI systems in libraries will reduce human costs and labor. It is believed that AI is a technology that provides 24 hours/7 days without getting tired like humans. It can be used to leverage library services effectively. Many scholars have their views that AI in libraries will bring charm to the library services, and it will enhance the experience of both library staff and patrons.

1.1 Academic libraries

Academic libraries are attached to higher education institutions, such as colleges and universities [6]. These institutions serve the information needs of

students, faculty, and staff and typically focus on providing access to a wide range of academic resources, such as scholarly journals, books, databases, and multimedia materials. The primary goal of academic libraries is to support teaching, learning, and research by providing access to high-quality, diverse, and relevant information resources [7]. In addition to traditional library services such as reference, circulation, and inter-library loans, academic libraries may also offer specialized services such as data management, digital scholarship, and instruction in research methods and information literacy.

Academic libraries play a crucial role in supporting the academic mission of their parent institutions and contribute to the advancement of knowledge by providing access to the latest research and fostering a culture of lifelong learning. The fundamental goals of libraries are to offer high resources for learning, research, and intellectual growth. Libraries are transforming the conventional way of services to modern information networking. Librarians are utilizing innovative technologies to enhance user experience and remain competitive in the twenty-first century. Digital tools such as open access efforts, mobile apps, beacon technology, and AI have transformed the way libraries serve their users. Librarians must unleash the new possibility by replacing the old traditional services with modern information technology. Libraries with conventional methods will no longer survive until they adopt cutting-edge technologies like cloud computing, the Internet of Things, VR, open access initiatives, and AI. The present paper highlights the function of emerging technologies exclusively AI and its impact on academic libraries.

1.2 Nexus of academic libraries and ICT

Academic libraries play an important role in facilitating the academic pursuits of patrons (students and faculty members). It has always been considered the integral pillar of degree-awarding institutions. Academic libraries are crucial parts of academic institutions to promote cultivating future leaders. These libraries are great hubs of vital information and sources of dissemination and retrieval of scholarly information. The integration of Information and Communication Technology (ICT) within university libraries has been a subject of ongoing discourse since the inception of the internet. ICT, encompassing a spectrum of technologies facilitating information processing, coding, storage, retrieval, dissemination, and transmission [7], is recognized as a multifaceted tool for information production, transmission, and processing [5]. The evolution of technology within library services has seen notable advancements, with automated cataloging, circulation, and acquisition systems enhancing operational efficiency in the twenty-first century. In the contemporary landscape of information technologies, academic libraries stand as pivotal hubs meeting the diverse informational needs of their patrons. The advent of the internet has heralded a paradigm shift, propelling libraries into agents of innovation and technological adaptation. The symbiotic relationship between libraries and technology underscores their joint mission to cater to patrons' information requirements. The emergence of Web 2.0 technology has instigated profound transformations in the realm of information and communication technologies. As technology evolves, so do the practices within academic libraries, necessitating continuous up-skilling among library professionals to navigate new competencies demanded by the market. Librarians in academic settings operate within an ever-evolving technological milieu, providing

access to an array of digital resources such as e-books, e-journals, and electronic articles [8]. The exponential growth of technology in library usage has engendered a reevaluation of librarians' perceptions, beliefs, and opinions regarding its implications and applications. To adapt to the dynamic landscape of technological innovation, librarians undergo continual training to acquire the requisite competencies essential for meeting the evolving information needs of their patrons. This proactive stance is vital for addressing the associated challenges and opportunities posed by the integration of technology within library workflows.

1.3 Use of AI in library services

Before going into detail, it is necessary to know about AI. A computer scientist known as John McCarthy, organized a conference in Dartmouth where he introduced the word, coined the word AI. Since that time, AI has been introduced as a field of study. Initially, it was considered as part of the computer system. It was envisioned that AI would perform different tasks like human intelligence. Slowly and gradually, AI has evolved in many shapes like expert systems, neural networks, and machine learning algorithms. It is an astounding fact that the use of AI in education and libraries is increasing exponentially. Numerous applications of AI have been found, ranging from personalized learning systems to online tutoring systems. Many scholars have ascertained that AI-based learning has brought tremendous revolutions in modern library services. A few popular examples of AI applications in advanced countries include the use of automated cataloging, search algorithms, and online reference services via Chatbots. The status of AI varies across advanced and developing countries. Advanced countries like China, the USA, and some European countries have made substantial investments in AI research services, while on the other hand, developing countries are facing numerous challenges due to its high costs, IT infrastructure, and scarcity of skilled manpower; however, still with limited resources many countries in developing nations have adopted different applications of AI like Chatbots, geographic information system (GIS), radio frequency identification (RFID), and other applications of web technologies. Interestingly, some free applications of AI like Turnitin, social media networks, Grammarly, search engines, and location of libraries have already been incorporated; however, developing nations are still working to catch up with cheap applications to satisfy the information needs of their patrons. Countries with robust AI ecosystems, tech companies, and supportive governmental policies are leading the developing nations. It is perceived that the development of AI will likely continue to be shaped by technological advancement. Still, a few issues like the impact of automation on employment, privacy, and ethical concerns are a few considerable issues that need a proper solution. AI technology has great potential to harness library operations for the benefit of humanity; librarians in both developed and developing countries should cope with the surge of technology to meet the information needs of their patrons. Libraries in advanced countries have incorporated advanced applications of AI in their library operations. The librarians in developing countries must follow in the footsteps of advanced countries to deploy various applications that can bring positive changes in the library services of academic libraries.

The present study offers a snapshot of AI in academic libraries and presents the following contents in detail literature review, research methodology and design, applications of AI in academic libraries, digital resilience of the librarians, implications of AI in academic libraries, challenges of AI in academic libraries, conclusion and recommendations of the research.

2. Research objectives

The present research addresses the following three objectives

1. To explore and evaluate how the integration of AI in academic libraries can enhance library operations effectively.

2. To examine the AI-driven tools that can be used to improve users' experience in academic libraries.

3. To analyze the ethical considerations and privacy concerns associated with the use of AI in academic libraries.

3. Significance of the study

1. The present study is useful to explore the integration of AI in academic libraries. The research will explore various features of AI and identify how AI can enhance library operations most effectively. The studies also describe the more streamlined process that reduces operational costs and improves service delivery to meet the academic environment;

2. The present study will examine the AI-driven tools that can be used to enhance users' experience in an academic environment. The study further elaborates that the use of AI in academic setup will create more personalized, accessible, and user-friendly services due to which users will engage with the library resources and will get satisfaction;

3. The present study will explore ethical and privacy concerns associated with AI in academic libraries. As each technology has its pros and cons, similarly, AI also has some concerns for the user's privacy and data privacy. Highlighting them is a vital factor in safeguarding user rights and maintaining trust. These kinds of concerns will formulate a policy guide that can foster responsible and sustainable AI implementation for future use. Hence, the study will contribute positive knowledge for policymakers and stakeholders of organizations to consider these concerns before implementing them into academic libraries.

4. The present study encompasses the deployment of AI in academic libraries; hence, the study will bridge the gap between theory and practices in academic libraries. The findings of this study will contribute a handsome knowledge that will be used for future projects. Although only university libraries have been covered, the result should be generalized to entire geographical locations of the world and is not specific to a single country.

4. Literature review

4.1 RO 1: Integration of AI in an academic library

The library community began to pay attention to the potential use of robotic technology and similar applications of AI in late 1980. In their research, Chen and

Chen [9] revealed that books in libraries are increasing at an alarming rate, so there should be an expert system that can be based on AI to process all library operations, including cataloging, classification, indexing, and abstracting systems to deal with complex problems. In his paper, Ref. [10] articulated that the use of robots in libraries could smoothly alleviate library operations. Language process technology and reduction of hardware costs, such as semantic analysis and computer processors, brought tremendous revolutions in library operations. The successful implementation of AI in other fields, particularly in higher education and libraries, will catalyst library activities more robustly. In their research, Ref. [11] postulated that the use of AI in libraries was not yet widespread; however, it is believed that the next few years will be more crucial for academic librarians to implement AI in academic setup. Another study conducted [12] explored the 25 most influential universities in the United States and Canada have responded positively to AI and its applications in academic libraries. Similarly, Ref. [13] has proposed that some university libraries have already implemented a few applications of AI in their academic environment such as 3D printing, data visualization, Chatbots, and RFID technology. The study also reveals that over the next few years, the penetration of AI in academic libraries will accelerate their library activities. The study by Ref. [14] reveals that library commentators, directors, and publishing began to hold positive attitudes and agree to incorporate AI-related technologies in libraries to foster library activities in more sophisticated ways. Ref. [7] also stated that AI and similar technology can help libraries move forward to smart libraries that can be used for resource discovery, machine-readable collection, resource discovery, and machine-readable collection. Ref. [1], in his study, has stated that libraries are changing agents of innovative technologies, and AI is a promising technology that can impart better services in academic setups. Ref. [15], in their study, discovered that AI provides better opportunities in discovering new knowledge in libraries and can be used as an information literacy tool in academic environments. In their study, Ref. [16] stated that developing countries like Pakistan are lagging behind developed countries in incorporating AI in their academic libraries for many reasons. A few reasons are lack of proper finance for IT tools, lack of professional staff, data privacy, and less attention from stakeholders. Considering this in mind, the present study is an attempt to formulate a policy document that can be used as a guiding rule for implementing AI in academic setups.

4.2 RO2: AI-driven tools for library users

AI is one of the fastest-growing technologies that can be used to leverage library operations more effectively. Their study Ref. [17] discovered that numerous applications are highly useful for users in academic libraries like *Chabot*. The AI-powered Chatbots can provide round-the-clock assistance to patrons, addressing common queries and guiding them to relevant resources [18]. According to Ref. [19], in information retrieval, the concept of *Text Mining is particularly important in the rapid growth of web applications. The scholar further highlighted that* AI-powered text mining tools can extract valuable insights from vast amounts of unstructured data present in library catalogs, databases, and digital collections. *Image Recognition*: AI-powered image recognition tools facilitate the classification and cataloging of images, enhancing accessibility for patrons [18]. In their study, Ref. [18] have defined that *Natural Language Processing (NLP) is a smart tool of AI that can be used to understand text and spoken words***.** These AI-powered NLP tools enable the users to analyze and comprehend the text in multiple languages, thereby improving search capabilities and

facilitating insights extraction from multilingual data. Ref. [20] have deduced that *Recommender Systems is yet another* AI-powered tool that offers books, journal articles, and video lectures to library users based on their past search and reading history. In their study, Ref. [17] explored that modern libraries used AI *Automated Circulation*; these AI-powered tools automate circulation tasks such as check-ins and check-outs, enabling staff to allocate more time to provide personalized assistance to patrons. In essence, the use of AI tools in academic libraries has brought tremendous revolutions. Utilizing such applications not only provides the fastest services to its end users but also reduces the labor cost of the library staff. **Figure 1** below shows the AI applications and their usage in academic libraries.

4.3 RO 3: AI ethical and privacy concerns for academic libraries

The AI is an advanced technology that revolutionizes the user's experience in academic setup. Libraries are always user-centric, and deploying AI means that how libraries operate and provide services to their users. AI has its prospects and challenges for library users, hence, academic librarians must address the ethical and practical concerns before implementation. The AI deals with data, algorithms, and user privacy. The library staff should interpret and explain the AI-generated results. AI is becoming increasingly integrated into libraries of developed countries to provide maximal services to its end users without wasting their time. Some examples of AI that have already been deployed in developed countries are for the users; these are auto-summarization tools for literature reviews. The study of Ref. [7] discovered that AI is useful for borrowing library material without the involvement of library staff. Ref. [21] have examined that AI is useful for technical services of library operations like classification and cataloging which ultimately provides quick services to its users. Similarly, in a study, Ref. [22] discovered that AI can also be used for library management processes like decision-making, reference services, and information literacy services of its users. Ref. [22] have described that without modern technology, no libraries can impart better services; AI has been deployed in different library services, which attract potential users to the library, still, it is essential to consider user privacy concerns when implementing AI into libraries. In their study, Ref. [23] indicated that tailored AI-based services must be according to the user's needs for maximum usage. Ref. [17] have defined that AI has great potential for academic libraries; however, issues like data privacy and ethical concerns should be kept in mind before deploying them into academic libraries. In their study, Ref. [24] have deduced that AI in

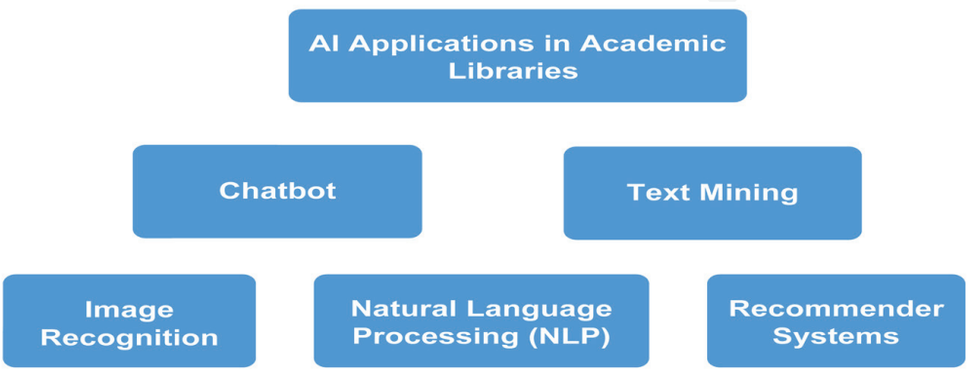

Figure 1.
Use of AI in academic libraries (self-generated).

Keyword development	• The researcher employed a comprehensive keyword strategy to identify relevant literature. Core keywords include AI and libraries, AI applications in libraries, and AI use in academic libraries. • Additional relevant keywords were identified through an initial literature scan.
Database selection	• A systematic search was conducted across the following academic databases: Taylor & Francis, Springer Link, Science Direct, Wiley Inter-science, Emerald Insight, Project Muse, Proquest, and Google Scholar.
Inclusion and exclusion criteria	• Only studies published in English were included. • Studies focusing specifically on AI applications within academic libraries were prioritized. • Literature that directly addresses the research questions was included. • Studies that do not meet the inclusion criteria, such as those focusing solely on general AI applications or those in languages other than English, were excluded.
Data collection	• Relevant articles, books, and conference proceedings identified through the database search were collected. • Full-text versions of selected articles were obtained.
Data organization	• The collected literature was organized systematically based on the research questions. • A coding framework was developed to identify key themes and patterns within the data.
Data analysis	• Content analysis was employed to systematically examine the collected data. • The range of AI applications in academic libraries. • The benefits and challenges associated with these applications. • The impact of AI on library services and users. • Emerging trends and future directions in AI for libraries.
Data interpretation	• The analyzed data was interpreted to answer the research questions. • Findings were presented clearly and concisely, supported by evidence from the literature.
Ethical considerations	• The research adhered to the ethical guidelines for academic research. • Proper citation and referencing were used to acknowledge the work of others.

Table 1.
Research methodology and design.

academic libraries has both negative and positive impacts on the user's privacy as well as on library staff. The scholars further discovered that AI can also cause a loss of job opportunities for the library staff. Similarly, the study [18] shows that, on the one hand, AI has positive potential for academic libraries, while on the other hand, AI raises concerns about data security within an academic environment. The scholars further highlighted that deploying AI and algorithm systems on digital platforms can shape information dissemination in a more sophisticated way while, on the other hand, restricting users' freedom of expression, and such expression raises concerns about privacy, consumer, and data protection [14] in their study discovered that unfair and deceptive practices can harm users' privacy in academic libraries. The library staff must address the privacy issues of users through appropriate regulations in a transparent way [25]. It postulated that AI holds great promise for academic libraries; hence, it is necessary to train library staff and users before implanting the AI applications in academic libraries (**Table 1**; **Figures 2** and **3**).

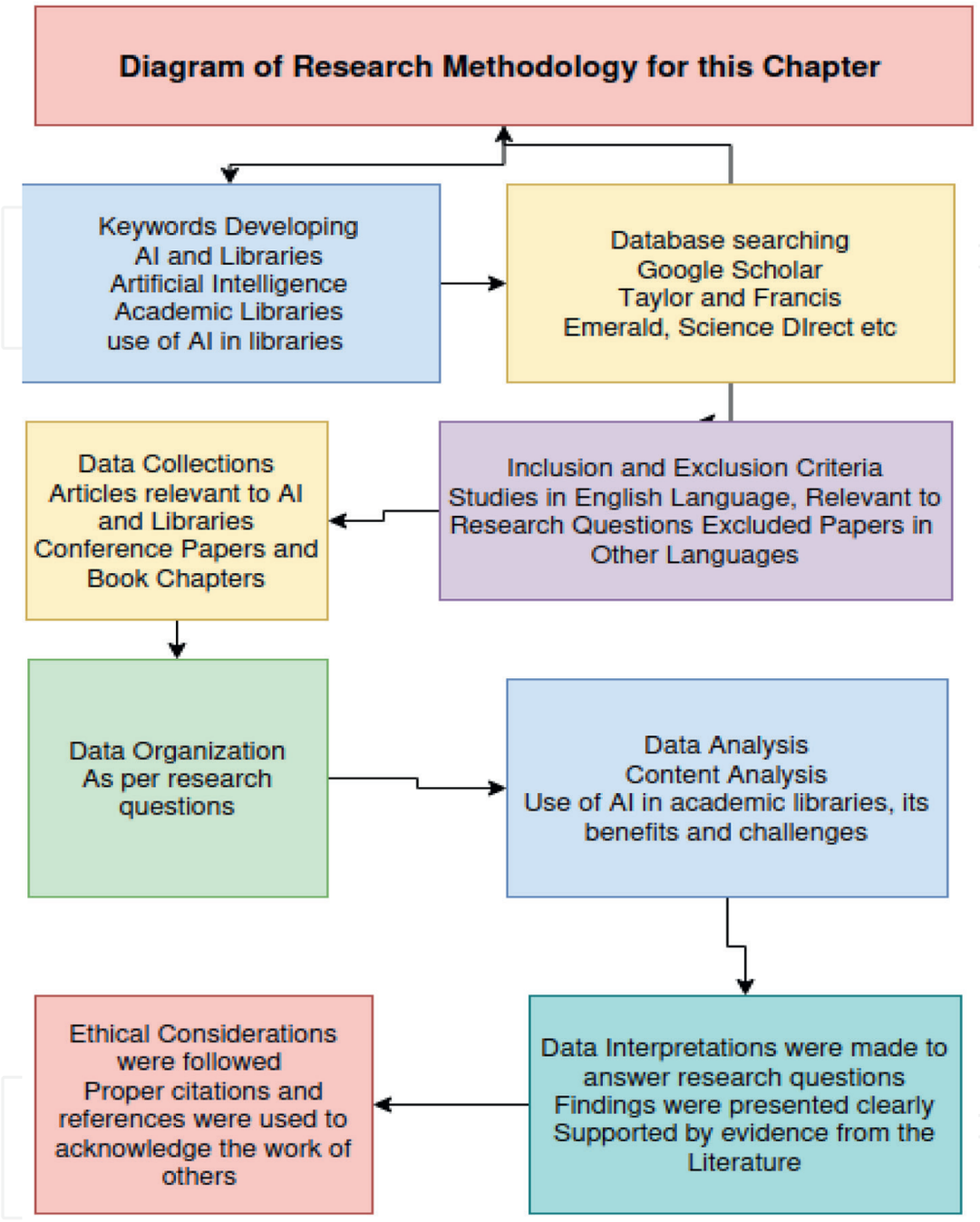

Figure 2.
Diagram of research methodology for this chapter.

Figure 3.
Applications of AI in academic libraries (self-generated).

5. Application of AI in academic libraries

5.1 Automated cataloging and classification

In their article, Ref. [14] have explained that AI is a useful tool for cataloging and classification of library material. Academic librarians work in stressful and complex environments and create errors and defects while cataloging materials and performing classification tasks in their libraries. AI can perform large amounts of library materials easily and quickly and avoid human errors.

5.2 Search and discovery

Some search engines use AI power tools. These search tools help library users/patrons to find their relevant information easily and more quickly. These search engines use and understand natural language queries and give the most pertinent results; the best example of a search engine is Ebsco-host smart search, which extracts data from numerous databases and directs patrons to other databases for retrieving them.

5.3 Personalized recommendations

AI can be used to analyze a patron's reading habits and make personalized recommendations for books and other materials.

5.4 Digital preservation

AI can be used to analyze and preserve digital collections, such as identifying and mitigating risks to digital objects, detecting, and correcting errors.

5.5 Automated circulation

The circulation tasks can easily be automated using AI Applications. All borrowing materials can easily be checked in and checked out. Using this application will free library staff from other activities, and such applications will provide personalized assistance to the customers.

5.6 DSpace

The modern library uses Dspace library software for open digital repositories. It is an open-source software with open coding. This software uses AI applications that can be used to preserve and manage library repositories. It is the admirable task of AI to provide access to digital collections.

AI applications have transformed library operations effectively; these applications not only provide better services to the patrons but also streamline the library services more effectively and free library services from human errors. AI applications are more useful for both patrons and library staff.

6. Digital resilience of librarians

Librarians of the twenty-first century are resilient to adopt the application of emerging technologies like AI in their respective libraries. These technologies not only

effectively support their library operations but also support the academic needs of the patrons. The library staff must understand the potential of AI and other technical skills associated with this technology. Furthermore, librarians also urged that AI is an advanced technology that evolves from time to time, so they should learn the technical and necessary skills. In order to empower and enhance the skills of librarians, some common ways are suggested by scholars to be noted [26].

- Librarians should participate in the professional development program and other training programs to enhance their skills.
- Staying current with the latest developments in AI through reading industry publications and attending conferences and workshops.
- Collaborating with colleagues and peers to share knowledge and best practices for using AI in libraries.
- Experiment with AI tools and technologies to gain hands-on experience and better understand their capabilities.
- Building a network of experts and resources to turn to for support and guidance as needed.

7. Implications of AI in libraries

In the library setup, the adoption of smart technologies, particularly AI is a global phenomenon. However, in developing countries, the deployment of AI in academic libraries lags due to various reasons such as financial constraints, poor IT infrastructure, lack of technical staff, knowledge of IT skills of the librarians, etc. Despite these implications, libraries are still struggling to incorporate AI in the academic realm and exhibit a spectrum of perceptions toward AI. Developed countries have recognized its potential and are endeavoring to enhance its various applications for education and research [27]. On the other side, countries in developing nations still express concerns regarding its impacts on deployment, level of awareness, privacy and security, and access to AI technology varies among stakeholders and academia. Stakeholders and academia must harness the potential benefits of AI in libraries. The authorities and stakeholders must remain informed about the latest developments and best practices offered by AI in academic setup. The authorities must examine its implications, benefits, and risks for the informed decision-making process and its effective implementation in academic libraries. Many scholars have highlighted the potential benefits of AI in academic libraries [15] and ascertained that one of the significant bottlenecks in the deployment of AI in library operations is the digital resilience of librarians. Few have underscored the benefits of AI in academic libraries that should be kept in mind before implementing them. Several open applications of AI hold promise for improving library services at minimal costs. These are:

8. Challenges of AI in the academic libraries

Albeit, before deploying AI in library operations, there might be several challenges associated with artificial intelligence; however, digital resilience of librarians will

be overcome while moving forward [28]; some challenges are mentioned below: (1) Limited technical expertise: Librarians may not have the technical skills or knowledge needed to implement and manage AI systems, and may require training and support. (2) Limited funding and resources: Implementing AI systems can be costly, and libraries may have limited funding and resources to support the development and maintenance of AI systems. They may approach the stakeholders and the Higher Education Commission for the funds in this case. (3) Limited access to data: The AI requires high-quality data. It is the job of librarians to invest more time by providing quality data. As AI relies on data, more data would mean more quality services in the library operations. (4) Internet and digital divide: The internet and digital divide is yet another challenge for libraries. In some areas, the internet speed remains quick, while in some places, the speed remains slow. It can also hamper the way the patrons demand. Internet connectivity and digital infrastructure are in high demand for running AI applications smoothly. (5) Limited awareness and understanding: To get benefits from AI applications, libraries may need to be more aware of the potential benefits offered by AI in library services. For awareness of librarians, training

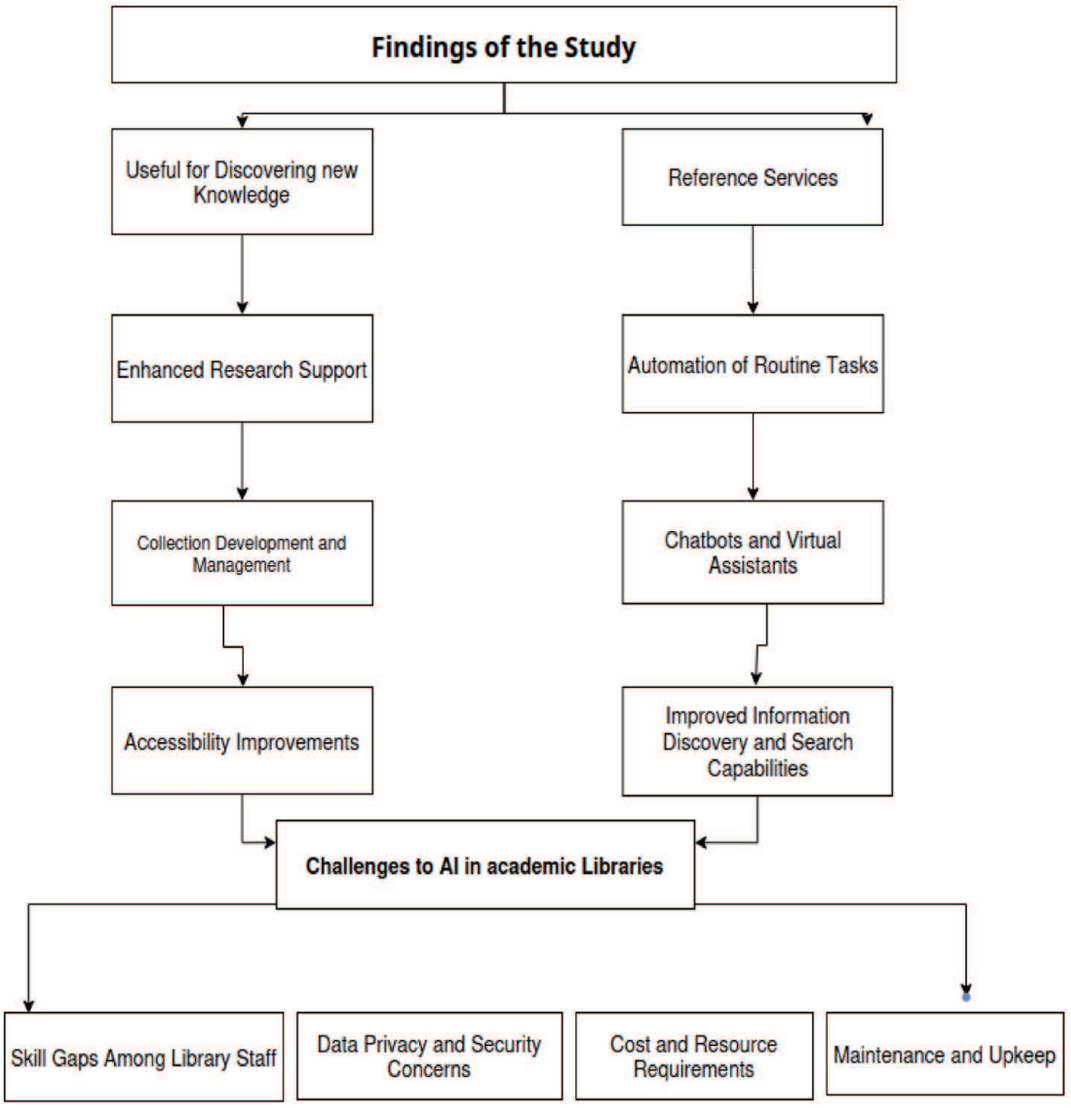

Figure 4.
Findings of the study.

programs should be organized. Because using any new system requires a complete understanding of librarians. (6) Ethical concerns: The AI mostly relies on data. As the libraries deal with huge data, such data may create concerns for the libraries regarding accountability, transparency, and bias. The librarians must know the ethical concerns of AI systems before incorporating them into library operations. Librarians may face different kinds of challenges while adopting AI in their respective libraries; however, keeping in mind the right support, resources, training, and ethical concerns, the librarians may overcome these challenges (**Figure 4**).

9. Findings and discussions

The present research has achieved three objectives of AI and its potential use in academic libraries. The findings of this study show that there is a trajectory of growing interest among librarians to adopt AI in academic libraries. The findings of this study concordance with the study of Ref. [8] who identified that AI has great potential to discover new knowledge within academic libraries context. The scholar further elaborated that AI is the perfect tool for information literacy in any academic environment. The early research identified that AI can effectively address complex library operations. The increasing use of AI-driven technologies in leading academic institutions reflects the growing confidence in AI to enhance library activities. The adoption of AI is not uniform across the globe. The developed nations are leading the way in integrating AI into their academic libraries, while the status of developing countries is a bit slow for many reasons. The study by Ref. [7] highlighted that developing countries are lagging behind developed nations because of limited resources, poor infrastructure, and lack of stakeholders interest while implementing them into academic libraries. The findings of this study also corroborate the study of Ref. [29], who illustrated the lack of librarians' training, data privacy, and finance. The study suggests that there should be tailored strategies and policies that consider the unique challenges in different regions. Over all the literature suggests a positive of the future of AI in academic libraries. The study has also explored that AI will play a critical role in the evolution of library services; however, the adoption will likely vary depending on regional, economic, and institutional factors.

The result of the second objective of the result shows that the integration of AI-driven tools in academic libraries represents significant enhancement and advancement in library operations. The study is in concordance with the study of Ref. [28], which states that numerous applications of AI have been brought into use, such as Chatbots, which provide 24/7 assistance to library users. The study also explores how Chatbots can be used to address different queries asked by patrons. Similarly, the study results also corroborate the study of Ref. [25], who discovered that Chatbot is the most significant tool of AI that streamlines the user's experience with library resources. Their study highlighted the different tools of text mining for information retrieval and discussed that text mining can extract valuable insights from large volumes of unstructured data, which is useful for digital collection and authorized users to access vast amounts of information in more effective ways. The result of this objective is also in concordance with the study of Ref. [20], who deduced that the image recognition tool of AI in academic libraries is useful for cataloging and classifications of images in the libraries. The study also found that the image recognition tool is very helpful for patrons to search and retrieve visual resources more efficiently, thereby improving the overall usability of image

collection. The result of this study also corroborates with the study of Ref. [22], who defined the NLP as an AI-driven tool and its usage in the library that enables a user to understand the text and spoken language. It can also be used to analyze and comprehend text in multiple languages; such a function is particularly valuable in academic libraries. The result of this study also meets the study of Ref. [15], who described the recommender systems as an AI-driven tool; the scholar has their views that the recommender system is an essential tool of AI that recommends the user's journal articles, books, and multimedia based on their past search. The study also concordance with the study of Ref. [11], who highlighted the use of automation circulation for library tasks. The study elaborated that automating circulation allows users to check in and check out the library resources without the involvement of library staff. In short, the adoption of AI-driven tools in academic libraries has substantial benefits, including faster service delivery, enhanced user experience, and reduced labor costs. As AI technology continues to evolve, its implementation in academic libraries will undoubtedly meet the changing needs of the libraries in the future. The integration of AI into academic libraries has brought about significant advancements in user services and operational efficiency. However, the adoption of AI technologies also raises critical ethical and privacy concerns that must be carefully considered and addressed by library professionals. The studies reviewed under this objective provide insights into the prospects and challenges of AI in academic libraries, particularly concerning ethical issues, data privacy, and the impact on users and staff.

The result of the third research objective indicates the ethical and privacy concerns of AI in academic libraries. The result of this study is closely related to the study of Ref. [5], who identified that data privacy and ethical concerns are significant issues of AI while implementing them into academic libraries. These concerns revolve around the handling of user data, potential bias in AI-generated results, and the transparency of AI algorithms. The result also corroborates with the study Ref. [28], which described that AI has undoubtedly offered positive potential for academic libraries. Still, it raises concerns about data security and the potential for AI systems to restrict users' freedom of expression; similarly, the study also related to the study of Ref. [30], who further explained that AI in academic libraries has both positive and negative impact on user privacy and the library staff. There is a great chance of data security from the user's side while for library staff it can create a tendency of low job opportunities because it will replace human work with robotic operations. The study of Ref. [12] has also discovered that AI can be used to enhance the browsing processes of libraries and allow users to borrow library material without involving the library; however, it also raises questions about the ethical implications of reducing human interactions in the libraries. In their research, Ref. [28] cautioned that in academic libraries, the unfair practices of AI could harm users' privacy, and it is essential for the library library staff to address this privacy to protect the user's data. The result of this data is also in concordance with the study of Ref. [10], who argued that tailoring AI-based services in academic libraries should ensure privacy concerns to protect user trust. Ref. [31] underlined that privacy concerns might give birth to a negative impact on user trust. Ref. [5] points out that in academic libraries, the use of AI may reduce the need for staff roles. This can pose ethical challenges for the librarians to lose job opportunities in the future. A study, suggested that [32–34] librarians should be imparted training before implementing AI in academic libraries because without proper training, librarians might face several challenges like data privacy of library

users, fairness of AI algorithms, and the protection of larger data in order to protect the users from breach and misuse of data. In essence, AI offers significant opportunities for enhancing library services; still, librarians need to safeguard the data privacy of users.

10. Implications of the study

As with other research, the present study also has some implications, such as practical implications, theoretical implications, and educational implications. The practical implication of this study will provide library administration and policymakers with an overview of AI and its usage in academic libraries. The result of this study can be utilized to decide for AI in academic libraries. It can also be used to develop user training programs and a guideline for both library staff and users.

The study adds theoretical implications to the growing body of literature on AI and its implementation in academic libraries. Particularly for university libraries that are beyond any geographical location. Furthermore, the result of this study will help the scholars to refine and extend its theoretical framework to other studies in the future. The study will provide insightful knowledge to policymakers, stakeholders, and practitioner librarians who intend to deploy AI in their respective libraries.

The study provides valuable insights for library professionals and scholars in the field. Thus, the educational implication of this study will provide handsome knowledge for library patrons, curricula devised by higher education, and students of library and information science. The study is useful for researchers, academicians, and policymakers who deal with this subject. In short, this study will help educational organizations, particularly academic libraries to use it as a policy framework.

The study also contributes handsome knowledge on the ethical and social repercussions of AI and its usage in academic libraries. Thus, the findings of this study could prompt discussion regarding the social discussion on AI. Similarly, the study describes concerns, biased issues, and power dynamics of AI in an academic environment. In short, the study provides both challenges and opportunities associated with AI use in academic libraries that could inform decision-makers in both national and international organizations.

11. Conclusion

The paper provides a comprehensive overview of the utilization of AI in academic libraries, aiming to enhance efficiency, accuracy, and personalization for patrons while improving operational performance. Through qualitative analysis of existing literature, it elucidates AI's role in various library functions such as search and discovery, cataloging, circulation, and digital preservation. Despite its potential benefits, challenges like limited technical expertise, funding constraints, and ethical concerns are acknowledged. Recommendations emphasize continuous learning, collaboration, and leveraging free AI applications. The study highlights the importance of AI adoption in academic libraries, underscoring its transformative potential amid evolving technological landscapes. Foresee in mind its function and challenges, the following

recommendations are made for the academic librarians, stakeholders, and scholars in the field:

Recommendations for AI in academic libraries

1. To make AI an integral part of their libraries, librarians must keep pace with emerging applications of AI. As AI evolves from time to time, librarians should learn these skills.

2. The librarians should experience AI and associated technologies in the age of digital transformation. Such technologies will not only bring ease to their library operations but also equip patrons with the latest technologies.

3. AI introduces numerous free applications for library operations such as Plagiarism software, Google Maps, Dspace, Chatbots, and other similar applications. Librarians should utilize these applications for smooth functioning.

4. To understand the full spectrum of AI applications in library services, librarians must bring diversity to their services to fulfill the demands of their patrons.

5. Training for new applications is highly necessary; the library staff needs to participate in professional development programs and different types of training that enhance their skills in AI.

6. To gain hands-on experience and understand the capabilities of AI applications in library operations, librarians should experiment with AI tools and technologies.

7. The latest developments in AI technologies occur from time to time. Librarians should abreast themselves with these technologies by joining conferences, workshops, and other professional development programs.

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