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Enhancing Academic Library Service Delivery Using Artificial Intelligence (AI)

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Abstract

Academic libraries are crucial parts of educational establishments because they give lecturers and students access to a wealth of knowledge resources. This article examines how artificial intelligence (AI) can change academic libraries and raise the calibre and effectiveness of service delivery in reference, circulation, cataloguing and classification to meet the changing needs of library users. Examples of AI applications in academic libraries are given in the study. The study explores the possible benefits of AI in academic library and impediments to its integration. The study concludes that the use of AI in academic libraries is a big step toward better satisfying users' changing needs and offering helpful assistance for teaching, learning, and research. It is recommended that academic libraries embrace artificial intelligence (AI) as a vital tool in their service delivery as technology develops, ultimately improving the academic experience in general. Additionally, the management of the library should work to educate and train staff members to use AI effectively for library services.

Key Words: Academic Library, Library Service Delivery, Artificial Intelligence (AI)

Introduction

In academic settings worldwide, academic libraries are essential to research and teaching processes. They act as midpoints of learning and knowledge, offering researchers, teachers, and students vital services. These services, which include cataloguing and classification, circulation, and reference, have historically been provided by people. In general, libraries have always been at the forefront of facilitating access to information and knowledge. In the digital age, libraries are adjusting to new technologies to provide better user service. The use of artificial intelligence (AI) in libraries is one of the most revolutionary technological developments that libraries can adopt. The adoption of AI in the library setting can enhance services and give patrons access to reliable information, which can spur growth and development in this era of information. One of AI's benefits for library operations, according to Divayana et al. (2015), is its capacity to carry out tasks more effectively. When libraries use AI, they can complete tasks far more quickly than when they are completed by humans. Apparently, in this new age, AI and librarians are supporting one another to give users the best possible service. Therefore, using AI can never be a threat to librarians; rather, it can be helpful.

Artificial intelligence (AI) integration has resulted in revolutionary changes that have improved the efficacy and efficiency of academic library services. AI is changing academic libraries' information delivery, organization, and search processes to make their services more effective and user-friendly. According to Kristin Whitehair (2016), the way we access information is constantly changing and with the help of numerous AI applications, libraries can shift focus and attention. AI provides a very helpful expedient to apply this knowledge and generate superior results. Libraries concentrate on applying AI to improve content access. The

nature of libraries in the future will be greatly impacted by artificial intelligence and advanced computer technology, and the quality differences will differ from what our current work anticipates. Tella (2020), discovered that libraries in developed nations have embraced and practically integrated AI technologies into every aspect of their operations, while libraries in developing nations are still getting started. This is confirmed by Grant and Camp (2018), that a lot of academic libraries, especially those in developed nations, have incorporated AI into their operations for things like circulation and reference services. The integration and eventual acceptance of AI could have a positive impact on library services, which are presently merely being studied and contemplated (Massis (2018). This article investigates how AI is changing the way academic libraries provide their services with a focus on reference services, circulation services, and cataloguing and classification services in particular.

A). Reference Services

Since the beginning, reference services have been a crucial part of academic libraries. Academic libraries' core function is to provide reference services, which act as a conduit between patrons and the enormous amount of data stored in library collections. In academic libraries, reference services include assisting patrons in locating information and research materials, responding to their inquiries, and directing them through the collection of materials available. Reference librarian helps students learn by assisting them in locating course-related materials, suggesting resources for further reading, responding to inquiries about research, and offering advice on how to conduct research. According to Tredinnick (2017), AI can also be used in libraries to create applications for efficient reference services, high-quality textbook scanning, and subject category identification. However, by integrating AI, library reference services can be improved and the process of giving patrons information and research support streamlined.

The AI listed below can be used to enhance library reference services:

Chatbots and Virtual Assistants: In the past, reference librarians were able to respond to users' questions with human labour which sometimes takes a longer period. AI-powered chatbots can be used in library management systems or on library websites to instantly respond to frequently asked user questions, relieving the burden on librarians. To free up library staff time for more complex inquiries, these chatbots can assist with general information, library policies, and simple research questions. According to Adetayo (2023), artificial intelligence (AI) chatbots, like ChatGPT, are becoming useful resources for academic libraries. They offer users convenient and accessible services outside of regular library hours, responding to their inquiries in a timely and accurate manner. Chatbots and virtual assistants with AI capabilities can also point users in the direction of pertinent resources and even help with research citations. These chatbots are always on hand to assist whenever needed. The results of Panda and Chakravarty's (2022) study on integrating intelligent AI chatbots with information services in libraries show that these chatbots can be a dependable means of launching virtual help, enhancing reference services, and advancing the idea of a "library without walls." To satisfy user information needs, libraries should think about deploying AI-enabled chatbots as virtual assistants. The study highlights the integration of AI with other technologies and its impact on intelligent information services.

Search Optimization: For users working on intricate or specialized research projects, reference librarians may provide in-depth research consultations. Personalized advice and assistance are given during these consultations to help with the research process. Artificial intelligence (AI) has the potential to improve search results, make it easier for users to locate

the resources they need, and improve search functionality in databases and library catalogues. AI tools can also help extract useful information from large textual datasets in text and data mining, which makes it simpler for researchers to locate and examine particular content in a library's collection.

Natural Language Processing (NLP): NLP technology can comprehend and analyse user queries' text. It can contribute to more precise and contextually aware responses, increasing the effectiveness of the reference service. NLP algorithms, according to Johnson & Brown (2019), enable users to search more conversationally, comprehend context, and provide more accurate results.

Content Abstraction and Summarization: Subject guides, also known as pathfinders, are hand-picked compilations of suggested readings about particular subjects or topics that librarians frequently create. For those pursuing a specific area of interest, these guides are invaluable resources. However, artificial intelligence (AI) can be used to condense long documents or articles so that readers can more easily understand the essential ideas. It is especially helpful for students or researchers who are very busy.

Recommendation Systems: Recommendation systems for library patrons can be developed using AI algorithms. Based on a user's previous borrowing or reading history, these systems can recommend pertinent books, articles, or other resources. This aids users in finding resources related to their areas of research interest. This personalization helps users find materials they might not have otherwise noticed, which also improves the user experience. Asemi and Asemi (2018), explore the "potential for library systems to use AI techniques" and the application of artificial intelligence (AI) in Iran's library systems." According to the findings, natural language processing is the least developed, while recommender systems are the most advanced.

Data analytics: Artificial intelligence (AI) can help analyse library usage data to spot patterns, like the most popular resources, the subjects that are most in demand, or the times when usage is at its highest. Decisions about resource allocation and collection development can be influenced by this information. According to Sivarajah et al. (2017), the use of AI in academic libraries enables improved dataset analysis, particularly for large datasets that are analyzed across multiple datasets. Eliminating tedious and repetitive tasks is another benefit.

Virtual Reference: Artificial Intelligence (AI)-powered systems can also provide 24/7 assistance for library users. They can provide around-the-clock reference services, allowing users to get help even when the library is closed. This reduces the workload on librarians and offers 24/7 support, making libraries even more accessible (Harris & Turner, 2021). Virtual Reference: Many libraries offer virtual or online reference services, allowing users to seek assistance through email, chat, or instant messaging.

Language Translation: A wider range of users will be able to access library resources with the AI's ability to translate content into various languages.

Digital Preservation: AI can help with digital preservation, which helps to guarantee the long-term availability of digital resources. AI can also help with the curation and preservation of digital collections.

User Behaviour Analysis: AI can be used to analyse users' behaviour and preferences allowing libraries to better customize their offerings to the unique requirements and interests of their customers. Williams (2019) talked about how artificial intelligence (AI) personal assistants, such as Siri, Alexa, Cortana, and Google Assistant, have altered how users anticipate receiving

answers to their queries. Students now expect databases to understand and know what they are searching for, which has altered their expectations for database search functions.

B). Cataloguing and Classification

Cataloguing and classification are the academic library's primary duties. Services related to cataloguing and classification involve organizing and describing library materials to make them easier to find and retrieve. To improve the accessibility of library resources through catalogues and databases, librarians create metadata, such as subject headings, classifications, and keywords, and apply standard cataloguing rules. In the past, librarians manually catalogued books and other materials based on subject, author, and other factors. This was a labour-intensive, and human error-prone process. By integrating AI into a large portion of this work, it can completely transform these services by automating the following tools. Asefeh and Asemi (2018) enumerate several ways that AI technologies can be applied to enhance library services, including circulation services, book shelving, the cataloguing of library materials, and more. Some of the artificial intelligence (AI) in cataloguing and classification are as follows:

Natural language processing: Cataloguing can be accelerated by using natural language processing to help with the automatic creation of metadata for digital resources. Content-based classification can be achieved by using machine learning models, which minimize human error and guarantee consistent categorization. By analysing the content of books, articles, and other materials, machine learning algorithms can identify the subjects of those materials and increase the discoverability of those materials for readers (Smith et al., 2021). Because of their efficiency, libraries can more wisely devote their resources to other vital services like community outreach and educational initiatives. Natural language processing (NLP) applies to a wide range of fields, including library and information science. In the context of the latter, indexing serves as the foundation for document retrieval when applied to search databases like the Online Public Access Catalogue (OPAC).

Automated Cataloguing: By making it simpler for users to find library resources, AI can help with the automatic generation of metadata for library materials and the tagging of new library materials, improving the efficiency of the cataloguing process. This speed up the time it takes for users to receive new materials and lessens the workload for librarians.

Improved Search and Discovery: Library catalogue search performance can be improved with the aid of sophisticated AI algorithms. Even with typos or synonyms in their queries, users can locate materials more readily. Fernandez (2016) pointed out that utilizing AI in academic libraries will aid in the analysis of big data, the creation of metadata, and enhanced search translation. In other words, utilizing AI in academic libraries will increase the availability and accessibility of library materials and enable staff members to respond to users' inquiries regarding AI use.

Digital Content Management: Another cataloguing and classification service that was performed manually by librarians is Digital material categorization. Digital materials like e-books, audio, and video content can be categorized and managed with the help of artificial intelligence (AI) integrated into cataloguing and classification. For simpler access and discovery, machine learning models can identify and tag content.

Content Recommendation: AI can also help with content recommendation, guiding users to relevant resources based on their perceptions and interests. Artificial intelligence (AI) can generate tailored recommendations by examining past search trends and user behaviour, which can improve the discoverability of library materials.

C). Circulation services

A well-functioning library's circulation service is essential to the smooth exchange of materials between the library and its patrons. The management of library resources that are checked out to users is a part of circulation services. Circulation services include managing holds and reserves, renewing loans, checking out and in materials, issuing library cards, and enforcing loan policies, among others. However, Integrating AI in circulation can streamline these services by automating repetitive tasks like check-in and check-out as well as overdue notifications. Ways by which artificial intelligence (AI) can enhance circulation service are as follows:

AI recommendation systems: The process of loaning and returning library materials to patrons is the core of the circulation service, which makes books, journals, multimedia, and other resources more accessible to users. When users want to check out materials, they go to the circulation desk, where the circulation personnel take care of the paperwork. The personnel scans records, library cards, and user IDs to verify that the requested items are available. Artificial Intelligence (AI) has the potential to forecast material demand and aid in inventory control, guaranteeing the availability of popular items. By analysing borrowers' borrowing patterns and past selections, AI recommendation systems can further revolutionize library services by recommending appropriate books, improving user experience, and creating new research opportunities (Chen & Lee, 2020). These personalised suggestions improve user experiences and facilitate the process of finding new books and resources.

Accessibility Services: The efficient and seamless access to library resources is guaranteed by circulation services. To give people with disabilities equal rights to library resources, AI can help transform printed materials into formats that are accessible for people with disabilities, like text-to-speech or audio descriptions for images.

Self-Checkout and Return Kiosks: The process of loaning and returning library materials to patrons is the core of the circulation service, which makes books, journals, multimedia, and other resources more accessible to users. When users want to check out materials, they go to the circulation desk, where the library employees take care of the paperwork. The staff scans user IDs or library cards, verifies the availability of the requested items, and so forth. User-controlled self-checkout and return kiosks powered by AI let users take charge of their borrowing. These systems scan and process multiple items at once, cutting down on wait times, and using computer vision and RFID technology. Tredinnick (2017), opined that through automated library services and intelligent tutoring systems, AI technologies can help library users find materials in the library.

Automated Fine Management: The library circulation service performs many crucial tasks, including lending and returning books, keeping track of due dates, renewing loans, handling holds, and collecting fines for overdue materials. AI-powered solutions are ideal for streamlining these procedures. Artificial intelligence (AI) algorithms can be used to determine overdue materials, compute fines, and even grant fine waivers in certain situations. This automation guarantees fairness in fine management while easing the administrative load.

Predictive Maintenance: Libraries establish a favourable user experience through their effective circulation services, which in turn promote patron satisfaction and repeat business. AI analytics can be used to forecast when self-checkout machines and other library equipment will need maintenance. This proactive strategy guarantees less downtime and an improved user experience.

However, despite libraries' minimal representation in current AI initiatives, Bradley (2022) contends that the industry actively engages in consultations to ensure an ethical and transparent future for AI. The author argues that libraries can still be involved in AI legislation because it is still in its early stages.

Benefits of AI in Academic Library

The integration of AI into academic library services offers several benefits, including:

1. AI integration helps to improve the accessibility and inclusivity of library services. This is supported by Jackson et al. (2018) who believe that these developments were in line with the library's goal of granting everyone, regardless of ability or language preference, access to information. Hussain (2023), investigated the possibilities and challenges associated with integrating artificial intelligence into library services. The results demonstrated that AI is a potent technology that can enhance library services. In a similar vein, Talley (2016) stressed that to better serve researchers and other library users, university librarians must adopt AI technologies.

2. AI-driven chatbots and virtual assistants offer fast, continuous support, enhancing user satisfaction which increases user knowledge. The importance of AI capabilities in library services is examined by Al-Aamri and Osman (2022). The findings show that a lot of libraries have already incorporated AI technology into a variety of services, like technical support and reference services, to make it easier for users to access information.

3. By automating repetitive tasks, AI increases staff efficiency by allowing employees to concentrate on more intricate and valuable tasks. Han (2021) research on "Intelligent Library Management under the Background of Artificial Intelligence". He argues that AI can help with data collection and analysis so that management decisions about libraries can be made with less stress on library staff. The study claims that combining AI with human knowledge can produce a more intelligent and successful library management system. The benefits of using AI in library management are also covered in the study. These benefits include reduced working hours and fewer errors, both of which may increase customer satisfaction.

4. AI suggestions improve resource discovery by assisting users in locating pertinent content that they might have overlooked otherwise. According to Yuan (2021), the direction libraries take in the AI era will have a significant impact on research on technological innovation and library development.

5. By spotting possible security threats, AI helps to make libraries safer places AI can also improve library security. Artificial Intelligence (AI) can monitor library spaces by utilizing machine learning and surveillance technology to identify anomalous behaviour and notify staff about possible problems. This keeps the library's environment secure and safe for patrons.

6. Library network security: Li, (2021) investigates the use of artificial intelligence (AI) technology in library network security. The study assesses network security scenarios, it offers an analytical hierarchy process and an AI technology approach that enhances prediction accuracy and real-time performance. The study also focuses on an enhanced algorithm based on population cognition, data fusion, and hierarchical artificial immune

situation assessment. The efficacy of the suggested AI models in anticipating and evaluating library network security scenarios is demonstrated through experimental research. The results imply that AI can improve the security and defence of library management networks.

7. AI helps with improved inventory control and resource allocation which is known as resource management.

8. AI-powered translation tools make it easier for non-English speakers to participate, reaching a wider audience for the library. The AI study by Al-Aamri and Osman (2022) examined pertinent Arabic and international research that focused on AI applications in knowledge management within information institutions.
9. Text-to-speech and speech-to-text features offer assistance to people with hearing or vision impairments.

Impediments to the integration of artificial intelligent (AI) in Academic Library

In contrast to other fields where AI has been adopted and applied, where its use has been growing exponentially, library and information science have not experienced this.

1. **Initial Costs:** Financial inadequacy has always been the major challenge facing libraries all over the incorporation of new trends that involve money. This is confirmed by Farag et al. (2021), by stress that lack of physical equipment is the first major issue in the integration of AI in the library, followed by a shortage of local suppliers of AI technology. Comparably, Echedom and Okuonghae, (2021), investigate the advantages and disadvantages of artificial intelligence (AI) use in African academic libraries. A few issues were highlighted in the study such as inadequate infrastructure and inadequate training. The authors advise the government and library administration to work together to encourage the application of AI in African libraries and to develop appropriate policies to direct its application. However, Libraries must set aside funds for the sometimes costly process of implementing AI solutions.
2. **Inadequate protection for user privacy:** AI systems gather and examine data, which may give rise to worries about its improper use. Libraries need to implement strict data security protocols and make sure that user information is handled carefully (Williams & Davis, 2020).
3. **Lack of AI literacy:** A study on the use of artificial intelligence (AI) technology in university libraries' information retrieval was carried out by (Liu et al. in 2022). The goal of the study was to improve upon the shortcomings of the current intelligent information retrieval systems. According to a survey, the primary issues with AI information retrieval technology for university libraries were difficulty learning new information, ambiguous knowledge representation, and poor comprehension of natural language. To operate and manage AI systems efficiently, library staff may need training. According to Abayomi et al. (2021), artificial intelligence (AI) is perceived as a tool to enhance job performance and user satisfaction; however, greater awareness of AI's importance in library operations is required. The study suggests that academic librarians should obtain the competencies required to comply with AI in library operations, that librarians be informed about the advantages of AI by library management, and that librarians participate in conferences and training to get ready for the adoption of AI in library operations. Weijia (2022) also suggests training library staff members in artificial intelligence, fostering an environment that is receptive to

new ideas, and encouraging staff members to look into the potential of implementing AI.

4. **The possibility of bias in AI algorithms:** Inadequately thought-out AI systems may inadvertently reinforce preexisting biases in the content selection and recommendation process. To solve this issue, librarians and AI developers must collaborate while aiming for impartiality and fairness (Smith & Martinez, 2019).
5. **The possibility of library personnel losing jobs:** The awareness and perception of academic librarians in Nigeria about the use of artificial intelligence (AI) in university library management is investigated by (Abayomi et al. (2021). The findings demonstrated that academic librarians were knowledgeable about AI's application in library operations. Nevertheless, they were worried that its adoption would result in their jobs being lost. Therefore, Johnson (2018) contends that as AI develops, people might depend on it more and stop going to libraries or librarians for information. Correspondingly, Korinek and Stiglitz (2017), opined that employment polarization or job losses could result from advancements in AI technologies. The adoption of AI could result in a significant increase in inequality because of automation. Li (2021) also draws attention to the negative effects of AI-generated prior art, such as a decline in the incentives for scientists to share important discoveries via the patent system.
6. **Attitude of librarians:** The perceptions of librarians regarding the awareness and preparedness of academic libraries in Nigeria to incorporate artificial intelligence (AI) into their operations and services were examined by Ajani et al. (2022). The study found that while Nigerian academic libraries are aware of the use of artificial intelligence (AI) in libraries around the world, they are not yet fully equipped to integrate the technology into their regular operations.

Conclusion

Libraries all over are delivering library services more effectively and efficiently with the use of AI technology. Academic library services are undergoing an unprecedented revolution through the use of artificial intelligence, which is enhancing cataloguing and classification, circulation, and reference services. This is because the review of the literature demonstrated how quickly and widely AI is being used in academic libraries. In terms of usability, effectiveness, and accessibility, it provides a wealth of advantages. The integration of AI into academic libraries is a big step toward better satisfying users' changing needs and offering helpful assistance for teaching, learning, and research. Libraries are embracing AI to better serve their communities and fulfil their mission to provide access to knowledge and information in a rapidly changing digital landscape. Despite the obstacles that must be overcome, one exciting development that has the potential to completely change how we access and use information in the twenty-first century is the incorporation of AI into library services.

Recommendation

1. Academic libraries need to keep up with technological advancements and accept artificial intelligence (AI) as a vital tool for providing services that will ultimately improve the academic experience.
2. Libraries need to implement strict policies for protecting patron data and make sure that it is handled carefully.
3. To solve this issue, librarians and AI developers must collaborate while aiming for impartiality and fairness Lastly, to provide efficient library services, library management should work to educate and train staff members to use AI.

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