The rise of artificial intelligence in libraries: the ethical and equitable methodologies, and prospects for empowering library users

Article *in* AI and Ethics · February 2024

DOI: 10.1007/s43681-024-00432-7

1 author:

Oluwaseyi Wusu
University of Malaya
6 PUBLICATIONS **44** CITATIONS

AI and Ethics
https://doi.org/10.1007/s43681-024-00432-7

REVIEW

The rise of artificial intelligence in libraries: the ethical and equitable methodologies, and prospects for empowering library users

James Oluwaseyi Hodonu-Wusu[1]

Received: 20 October 2023 / Accepted: 25 January 2024

Abstract
Libraries have always been a repository of knowledge, a place where people from all walks of life can come to learn and grow. In today's fast-paced world, libraries must keep up with the changing times in order to remain relevant. Artificial intelligence (AI) is one of the most promising technologies that can help libraries achieve this goal. AI can help libraries automate processes, provide personalized services, and improve user experiences. However, with great power comes great responsibility, and AI is no exception. Libraries have an ethical and equitable promise to their users, and AI must be deployed in a way that upholds these promises. This study explores the ethical and equitable use of AI in libraries, how it can empower users, and what librarians need to consider when implementing AI. The result of the reviewed articles showed that 1499 out of 170,262 papers have been identified as describing AI in libraries through ethical and equitable methodologies and prospect for empowering library users. The future studies can focus on other professional terms, such as Trustworthy AI, Fairness in AI, Explainable AI, and Human-in-the-loop, and how this can impact libraries, and other professionals.

Keywords Artificial intelligence · Ethical standards · Equitable methodologies · Prospects · Empowerment · Library users · Libraries

1 Introduction

Libraries have long been recognized as invaluable community resources, providing access to knowledge, information, and cultural enrichment [1]. But in today's digital age, the role of libraries goes beyond simply housing books and offering quiet study spaces. Libraries have embraced technology and are now at the forefront of empowering users through the ethical and equitable use of artificial intelligence (AI) [2].

Artificial intelligence, with its ability to analyze vast amounts of data and make intelligent predictions, has the potential to revolutionize how libraries operate and serve their communities. By harnessing the power of AI, libraries can enhance user experiences, personalize services, and ensure equitable access to information for all [3].

One key aspect of empowering library users is the enhancement of information discovery. With AI algorithms, libraries can recommend relevant resources based on users' preferences, reading history, and interests. This personalized approach not only saves users time but also exposes them to a wider range of materials they may not have otherwise discovered. By tailoring recommendations to individual needs, libraries can empower users to explore new topics, expand their knowledge, and engage with diverse perspectives [4].

Additionally, AI can assist libraries in addressing information overload and improving the efficiency of cataloging and organizing resources. With the ability to process and categorize vast amounts of information, AI algorithms can help librarians streamline their workflows, freeing up valuable time to focus on more personalized user interactions and community engagement initiatives [5, 6].

References [7, 8], however, noted that the promise of AI in libraries goes beyond efficiency and convenience. Ethical considerations play a crucial role in ensuring that AI technologies are used responsibly and in a manner that promotes equity and inclusivity [9]. Libraries have a responsibility to ensure that AI algorithms are transparent, unbiased, and do not perpetuate existing biases or discriminatory practices.

✉ James Oluwaseyi Hodonu-Wusu
hodonu-wusuoj@lasued.edu.ng

[1] Department of Library and Information Science Education, College of Information and Technology Education, Lagos State University of Education, Lagos State, Nigeria

Published online: 19 February 2024

By actively engaging in conversations around AI ethics and participating in the development of ethical guidelines, libraries can guarantee that AI technologies are used in ways that align with their core values of equal access and intellectual freedom [3].

The above studies revealed that libraries need to embrace the power of AI to empower their users in ethical and equitable ways. By leveraging AI technologies, libraries can enhance information discovery, improve resource management, and provide personalized services. However, it is crucial for libraries to approach AI implementation with a strong commitment to ethics and inclusivity, ensuring that these technologies serve as tools for empowerment and not only as gatekeepers of knowledge. The general aim of this study is to assess the rise of artificial intelligence in libraries, focusing on the ethical standards, equitable methodologies, and prospects for empowering library users.

2 Understanding artificial intelligence (AI) and its potential in libraries

AI is revolutionizing industries across the globe, and libraries are no exception. Understanding the potential of AI and how it can empower library users is crucial in harnessing its benefits and ensuring ethical and equitable implementation [2].

AI refers to the development of computer systems that can perform tasks that would typically require human intelligence. In the context of libraries, AI can enhance various aspects, from information retrieval and recommendation systems to virtual assistants and data analytics [10, 11].

One of the key advantages of AI in libraries is its ability to streamline and enhance information retrieval processes. With vast amounts of digital resources available, AI algorithms can efficiently sift through this wealth of information to provide users with tailored and relevant results. This not only saves time but also improves the user experience, enabling individuals to access the information they need quickly and efficiently [4].

Furthermore, AI-powered recommendation systems can enhance personalized services in libraries. By analyzing user preferences and behavior, these systems can suggest books, articles, or other resources that align with individual interests. This not only promotes discovery but also helps users explore new areas of knowledge they may not have considered before [11].

Virtual assistants, another application of AI, can provide immediate support to library users. Whether it's answering basic inquiries, guiding users through library databases, or providing information on library events and services, virtual assistants can offer a seamless and personalized experience. This ensures that users feel supported and empowered, even in the absence of human librarians [12, 13].

AI can contribute to data analytics in libraries. By analyzing patterns and trends within user behavior, AI algorithms can help libraries make data-driven decisions. This can range from optimizing collection development strategies to identifying areas where additional resources or services may be required. Ultimately, AI-driven data analytics can facilitate more efficient resource allocation, ensuring that libraries are meeting the diverse needs of their users [11].

While the potential of AI in libraries is vast, it is essential to approach its implementation ethically and equitably [14]. Ensuring transparency, privacy, and fairness in how AI systems operate is crucial. Libraries must tread carefully, taking into account ethical considerations and avoiding bias in algorithms to provide equal access and opportunities for all users [3].

By understanding the potential of AI and embracing it responsibly, libraries can empower their users, enhance services, and remain at the forefront of the ever-evolving digital landscape. The ethical and equitable promise of AI in libraries holds great potential, and by embracing this technology, libraries can continue to serve as vital hubs of knowledge and empowerment in our communities.

2.1 The ethical implications of AI in library services

AI is revolutionizing the way library services are provided, offering exciting possibilities to empower library users. However, along with its potential, AI also brings ethical implications that must be carefully considered and addressed [15, 16].

According to [16], one of the main ethical concerns surrounding AI in library services is privacy. As AI algorithms analyze vast amounts of user data to personalize recommendations and improve services, ensuring the protection of sensitive information becomes paramount. Libraries must prioritize data collection and data security, implementing robust protocols to safeguard user privacy and prevent unauthorized access or misuse of personal data [1, 17].

Another ethical consideration is transparency and fairness in AI algorithms [3]. Libraries need to ensure that the algorithms they employ are transparent, meaning that users understand how their data is being collected, used and the decision-making process behind AI-generated recommendations [18]. Moreover, there must be an ongoing commitment to eliminate biases in AI algorithms to ensure equitable access to library resources and services for all users, regardless of their background or demographic characteristics.

Reference [18], in their article "Thriving in the Age of Accelerations: A Brief Look at the Societal Effects of Artificial Intelligence and the Opportunities for Libraries," discuss the impact of AI on society and the opportunities it presents

for libraries. The authors state that increased computer processing power, big data, and machine learning techniques have accelerated the development of AI. They mention how AI has already changed many industries, including libraries. The authors also examine the ethical standards and potential effects of AI automation on employment, social and political systems and how it could impact libraries. They suggest that libraries must be prepared for the changes brought about by AI and must embrace the opportunities it presents by providing opportunities for lifelong learning to their communities.

Additionally, the potential impact of AI on employment within library services deserves ethical scrutiny. While AI can automate certain tasks, it is crucial to strike a balance between efficiency gains and preserving human involvement and expertise. Libraries should prioritize workforce development, ensuring that staff members are equipped with the necessary skills to leverage AI technologies and contribute meaningfully to the evolving landscape of library services [18].

Furthermore, libraries must be mindful of the potential for AI to perpetuate existing inequalities within their user communities. AI algorithms rely on historical data, which may reflect biases and discrimination present in society [14]. Libraries should actively work to address these biases and ensure that AI systems are designed and trained to promote inclusivity, diversity, and equitable access to information for all users [3].

In the study of [12], and the interview of [13] on Machine Learning and Libraries with Kate Zwaard, in (2020) report that while AI presents immense opportunities for empowering library users, its implementation must be guided by a strong ethical framework. Libraries must prioritize privacy, transparency, fairness, and inclusivity in their AI initiatives, striving to create an environment that upholds ethical standards while harnessing the transformative potential of AI to better serve their communities.

2.2 Ensuring equitable access to AI-powered library resources

Ensuring equitable access to AI-powered library resources is crucial in empowering all library users. As AI becomes increasingly integrated into library systems, it is important to consider the ethical implications and strive for inclusivity [3].

One of the main challenges in achieving equitable access is the potential for bias in AI algorithms. These algorithms are trained on vast amounts of data, which can inadvertently perpetuate existing biases and inequalities [19]. For example, if a facial recognition algorithm is primarily trained on images of a certain demographic, it may struggle to accurately identify individuals from underrepresented groups [20, 21].

To address this issue, libraries must work closely with AI developers to ensure that the data used for training algorithms is diverse and representative of all library users. This can involve collaborating with community organizations, conducting user surveys, or actively seeking out input from marginalized communities. By doing so, libraries can help to minimize biases and ensure that AI-powered resources are accessible to everyone, regardless of their background or identity [1].

Additionally, providing training and support for library staff and users is essential in promoting equitable access to AI-powered resources. Libraries should offer workshops and educational programs that teach users how to navigate and make the most of these technologies. This includes not only understanding how to use AI-powered tools but also critically evaluating their results and being aware of potential biases [9, 22, 23].

Moreover, libraries should actively seek feedback from their users and regularly evaluate the impact of AI-powered resources on different communities. This feedback loop allows libraries to identify any disparities or issues that may arise and take necessary steps to address them.

By prioritizing equitable access, libraries can harness the power of AI to enhance the user experience, expand knowledge, and bridge the digital divide. It is through thoughtful and ethical implementation of AI technologies that libraries can truly empower all users and fulfill their promise of inclusivity and accessibility [9, 24].

3 Methodology

3.1 Analysis of artificial intelligence in libraries on EBSCO database

In order to analyze the evidence of the flow of search and selection technique for AI in libraries specifically focusing on the ethical and equitable methodologies, and prospects for empowering library users, we presented a tree table of AI in library-based approach after rapidly examined 1499 articles related to artificial intelligence, and libraries in EBSCO database (search was done in August 2023), with limitation to date of publication (2018–2023). The data was collected from EBSCO database that consists of articles of standard and acceptable quality [25, 26]. The first search attempt with keyword “Artificial Intelligence” “Libraries” as the title returned 170,262 articles, 1499 articles were screened in this study while others are excluded. The citations source items indexed within EBSCO database are reflected in this following report. 232 full-text articles were reviewed but 57 articles in all were relevant to our target, and others that are not so relevant to AI, Libraries, equitable methodologies, library users, ethical standards, prospect and empowerment

were removed (Fig. 1). Many of these articles are published in WoS, SCOPUS and EBSCO databases and have passed through rigorous peer review.

3.2 Addressing bias in AI algorithms and data

Addressing bias in AI algorithms and data is crucial to ensure the ethical and equitable promise of artificial intelligence in empowering library users. Artificial intelligence is only as good as the data it is trained on, and if that data is biased or limited in representation, it can perpetuate and amplify existing inequalities and biases [9, 22, 23].

Libraries play a vital role in promoting equal access to information and knowledge for all individuals, regardless of their background or identity [3]. Therefore, it is essential for libraries to critically examine and address any biases present in the AI algorithms and data they use.

One approach to addressing bias is through diverse and inclusive data collection [27–29]. Libraries can work toward building comprehensive and representative datasets that reflect the diverse range of library users. This includes considering factors, such as race, gender, ethnicity, age, ability, and socio-economic background. By ensuring that the data used to train AI systems is inclusive and representative, libraries can minimize the risk of perpetuating biases or discrimination.

Another important step is to regularly evaluate and audit AI algorithms for bias. This involves analyzing the outcomes and decisions made by AI systems to identify any patterns of bias or discrimination. By monitoring and reviewing the performance of AI algorithms, libraries can proactively identify and address any issues related to bias [13].

Furthermore, engaging in ongoing research and collaborations with experts in the field of AI ethics can provide libraries with valuable insights and strategies for mitigating bias. By staying informed about the latest developments and best practices in addressing bias, libraries can continuously improve their AI systems and ensure that they align with ethical and equitable principles [22, 23].

Addressing bias in AI algorithms and data is crucial for libraries to fulfill their mission of empowering library users. By actively working toward diversity, inclusivity, and ongoing evaluation of AI systems, libraries can harness the potential of artificial intelligence to provide equal access, fair outcomes, and unbiased services for all library users.

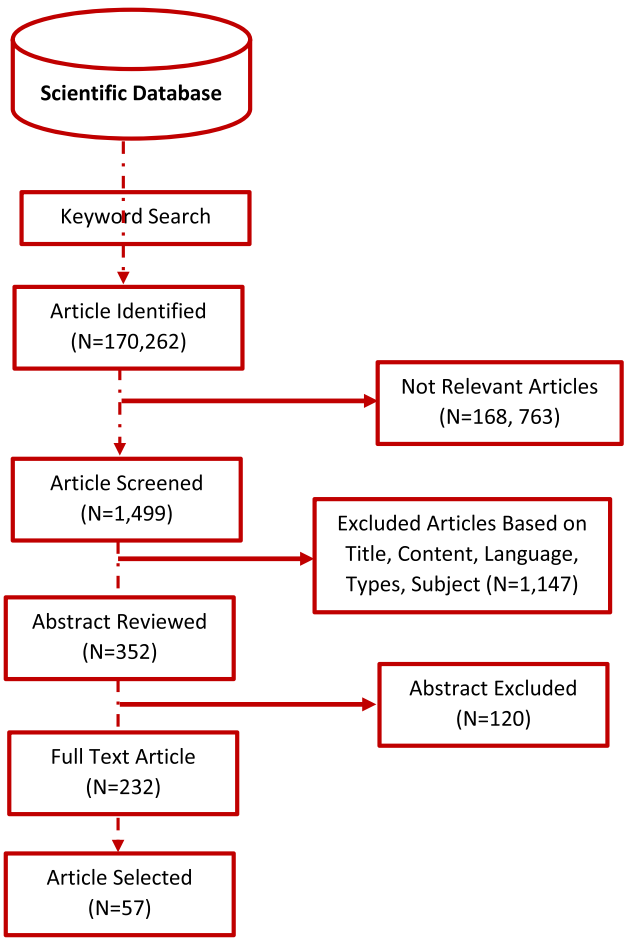

Fig. 1 Flow of search and selection technique

3.3 Empowering users with personalized recommendations and curated content

In the digital age, libraries have undergone a transformative shift in their role from being mere repositories of books to becoming dynamic hubs of knowledge and information. With the advent of artificial intelligence (AI), libraries now have the opportunity to empower their users in unprecedented ways [2].

One of the most exciting applications of AI in libraries is the ability to provide personalized recommendations and curated content. Gone are the days of browsing through endless shelves or relying solely on librarians for book suggestions. AI algorithms can now analyze user preferences, reading habits, and borrowing history to deliver tailored recommendations that match their interests and expand their literary horizons [5].

Imagine a library user who is passionate about historical fiction. With the power of AI, the library's recommendation system can analyze their reading patterns and present them with a carefully curated list of historical novels, spanning different eras and subgenres. This personalized approach not only saves time but also enhances the user's reading experience, introducing them to new authors and genres they may not have discovered otherwise [6].

Furthermore, AI can also assist librarians in curating content that reflects the diverse needs and interests of their user base. By analyzing data on borrowing trends, demographics,

and popular genres, libraries can create thematic book displays and digital collections that resonate with different communities. From highlighting works by underrepresented authors to showcasing books on timely topics, AI-powered curation ensures that library users feel seen, represented, and included [30].

However, as libraries embrace AI to empower their users, it is crucial to do so ethically and equitably (Miao, 2019). Safeguarding user privacy and data protection should be a top priority. Transparent policies should be in place to inform users about how their data is collected and used, and consent should always be sought before implementing personalized recommendations [9, 31].

Moreover, libraries must be mindful of the biases that can be embedded in AI algorithms. Efforts should be made to ensure that recommendations and curated content are diverse, inclusive, and free from discriminatory biases. Regular audits and adjustments to the algorithm can help address any unintended biases that may arise [5].

AI holds immense promise in empowering library users by providing personalized recommendations and curated content. By harnessing the potential of AI ethically and equitably, libraries and librarians can create enriching experiences for their users, opening doors to new knowledge and fostering a lifelong love for reading and learning.

3.4 AI-powered virtual assistants for enhanced user support

In today's digital age, libraries are embracing technology to better serve their users. One such innovation that holds immense promise is the use of AI-powered virtual assistants. These intelligent virtual assistants are designed to provide enhanced user support, making library services more accessible and efficient.

Imagine being able to interact with a virtual assistant that can answer your questions, provide recommendations for books, and assist with research inquiries, all in real-time. AI-powered virtual assistants have the ability to understand natural language processing, allowing users to have more conversational and personalized interactions [32].

These virtual assistants can be integrated into library websites, mobile apps, or even physical kiosks, providing users with multiple touchpoints for assistance. With advancements in machine learning and AI algorithms, these virtual assistants can continuously learn from user interactions, improving their responses and recommendations over time [5, 32].

Reference [33], reveals that the benefits of AI-powered virtual assistants in libraries are manifold. First, they offer round-the-clock support, enabling users to access assistance at any time, even outside of library operating hours. This empowers users to find the information they need and engage with library resources at their convenience. Second, these virtual assistants can cater to a wide range of user needs. Whether it's helping a student with their research project, guiding a patron through the library catalog, or providing recommendations based on a user's reading preferences, these AI-powered assistants offer personalized support tailored to individual requirements [34].

Furthermore, virtual assistants can also contribute to creating a more inclusive and equitable library environment [35]. By providing multilingual support and accommodating different learning styles, these assistants ensure that all users, regardless of their background or abilities, can access library services and resources [4, 36].

However, it is crucial to approach the implementation of AI-powered virtual assistants with ethical considerations in mind. Libraries must be transparent about the data collected and stored by these systems, ensuring user privacy and data protection. Additionally, continuous monitoring and evaluation are necessary to identify and address any biases or limitations that may arise from the algorithms and data used [5, 9].

AI-powered virtual assistants hold tremendous potential in empowering library users. By offering enhanced support, personalized interactions, and improved accessibility, these assistants can revolutionize the way libraries engage with their patrons. With a thoughtful and ethical approach, libraries can harness the power of artificial intelligence to fulfill their promise of providing equitable and inclusive services to all.

3.5 Enhancing information literacy through AI tools and technologies

Enhancing information literacy is a key goal for libraries, and the emergence of artificial intelligence (AI) presents exciting opportunities to achieve this aim. AI tools and technologies have the potential to revolutionize how users navigate and comprehend information, ultimately empowering them to become more informed and critical thinkers [4, 36].

One way AI can enhance information literacy is through personalized recommendations. By analyzing users' preferences, browsing history, and reading habits, AI algorithms can suggest relevant and diverse content tailored to individual interests. This not only saves users time but also exposes them to a wider range of perspectives and topics, fostering a more comprehensive understanding of the world [2, 4].

Reference [18], found out that AI-powered chatbots are another valuable tool for promoting information literacy. These virtual assistants can provide instant and accurate responses to user queries, helping them to find reliable sources, fact-check information, and develop research skills. By offering guidance and support in real time, AI Chabot empower users to navigate the vast sea of information with

confidence and accuracy [36]. Moreover, AI can assist in combating misinformation and fake news, a pressing issue in today's digital age. Advanced AI algorithms can analyze and evaluate the credibility of online sources, identifying potential biases, misinformation, or unreliable content. Libraries can leverage this technology to educate users on how to critically evaluate information and distinguish between trustworthy and untrustworthy sources [4, 36].

However, it is crucial to approach the integration of AI tools in information literacy initiatives with ethical considerations in mind. Libraries must ensure that AI algorithms are transparent, unbiased, and accountable [4]. Safeguarding user privacy and data protection is also paramount, as AI systems rely on vast amounts of personal information to deliver personalized recommendations and responses [5].

AI offers immense potential to enhance information literacy among library users. By leveraging AI tools and technologies, libraries can provide personalized recommendations, offer instant support through Chabot, combat misinformation, and foster critical thinking skills. While embracing these advancements, it is vital to uphold ethical standards and prioritize equitable access to information for all users.

3.6 Balancing privacy and data security concerns in AI-powered library services

As AI continues to revolutionize various industries, it also holds immense promise for empowering library users. AI-powered library services have the potential to enhance accessibility, recommend personalized resources, and streamline operations. However, as libraries embrace these technologies, it becomes crucial to strike a delicate balance between privacy and data security concerns [9, 34, 37].

Reference [31], opines that libraries are entrusted with safeguarding the privacy of their users, ensuring that their personal information remains confidential and protected. With the integration of AI, libraries can collect and analyze vast amounts of data to customize services and improve user experiences. However, this data-driven approach raises concerns about how personal information is handled and stored [9].

To address these concerns, libraries must prioritize robust data security measures. Implementing encryption protocols, secure storage systems, and regular audits can help minimize the risk of data breaches. Moreover, libraries must adhere to stringent privacy policies and obtain user consent for data collection and use. Transparent communication about the types of data collected and how it is utilized can foster trust between libraries and their users [9, 38].

Additionally, libraries should consider adopting privacy-preserving AI techniques. These approaches allow for data analysis while protecting individual privacy. Techniques, such as differential privacy and federated learning, enable libraries to extract valuable insights from user data without compromising personal information. By embracing privacy-enhancing technologies, libraries can ensure that AI-powered services respect user privacy rights [3].

Another key aspect of balancing privacy and data security concerns is the responsible use of AI algorithms [18, 39, 40]. Libraries should strive to eliminate biases and ensure fairness in the recommendations and insights generated by AI systems [32]. Regular monitoring and evaluation of these algorithms can help identify and rectify any unintentional biases that may affect the user experience. By actively promoting diversity and inclusivity in the development and training of AI models, libraries can uphold ethical standards and provide equitable services for all users [30].

While AI-powered library services offer immense potential, it is essential to navigate the ethical and equitable challenges that arise. Striking a balance between privacy and data security concerns requires robust data protection measures, privacy-preserving techniques, and responsible algorithmic practices. By prioritizing user privacy and ensuring fair and unbiased AI systems, libraries can harness the power of AI while upholding their ethical obligations to empower their users.

3.7 Understanding different types of AI-modeled library services with other real-world situations

AI multi-tasking of thinking and acquiring new abilities as well as adapting to a new challenge made it easy to be adopted by various real-world services. Although, AI is seen as a branch of science and engineering which focuses on simulating a wide range of issues and functions in the field of human intelligent [41]. But due to the changing nature and different data generation of real-world services, creating and understanding an effective AI model library service with other real-world situations could be a challenging task. However, to address these various issues, libraries must explore various types of AI that include analytical, functional, interactive, textual and visual to understand the theme of the power of AI as shown in the Figs. 2 and 3. In the following, we discuss the scope of each category in terms of library services with other real-world issues.

- *Analytical AI:* the focus of analytical AI is to discover new insights, patterns and relationship in data and assist in meaningful data-driven decision-making. As regards library services, it is pertinent to note that some of the core functions of library services include acquiring, processing, organizing, disseminating, storing and retrieving various pattern of user's information needs. Hence, analytical AI can collaborate library services by generating suggestions or recommendations to users through it analytical capability that will give meaningful data-

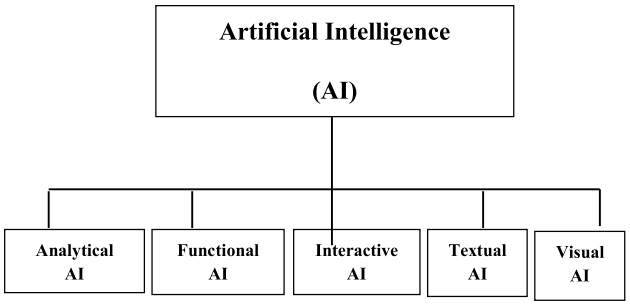

Fig. 2 Various types of artificial intelligence (AI) in the real-world situations [41]

driven decision-making when properly harnessed. Various machine learnings [42] and deep learning [43] techniques can be employed to create an analytical AI model library service that can be used to solve other real-world situations.

- *Functional AI*: functional AI works like that of analytical AI because it explores massive quantities of data patterns and dependencies. In this case, functional AI execute actions instead of making recommendations. Functional AI can be deployed to answer users' or patrons queries.
- *Interactive AI:* interactive AI usually enables effective and interactive communication automation which is well established in many aspects of our lives, especially in business world. For example, a variety of techniques, such as machine learning, frequent pattern mining, and reasoning, can be used to create chatbots and smart personal assistants. An interactive AI model could be useful in creating user's personal assistant that answers to the information needs of the library users. An AI heuristic search can be used for this interactive between the users and machine.
- *Textual AI:* textual AI involves textual analytics or natural language processing through which library patrons can enjoy text recognition, speech-to-text conversion, machine translation as well as content generation capabilities such as answering library user's queries.
- *Visual AI:* visual AI is typically capable of recognizing, classifying, and sorting items as well as converting images and videos into insights. This type of AI is often used in computer vision and augmented reality and can be deployed in the library services.

As discussed above, each of the AI types has the potential to provide solutions to various services in libraries (Fig. 3) reveals different types of library services with artificial intelligence (AI).

- *Cataloging AI:* cataloging is a process of bringing out the bibliographic information of all library materials, such as author's details, title, edition statement, imprint, pagination, series statement, ISBN, tracing, subject heading, added entries, etc. [44]. AI can be employed to provide intelligent access to the bibliographic description of the library materials. The user can use the radio frequency identifier (RFID) technology to catalog and classify the book in the library, and accurately locate the books [45].
- *Classification AI:* classification breaks down or grouping of books or documents according to their likeness. Classification is done according to classification system. The basic principle behind any classification scheme is that knowledge is divided into various classes and each class is sub-divided into divisions. With robotic AI, classification of library resources will be easier to carry out without any human errors [45].
- *Recommendation AI:* in the study of [46], Tian proposed data mining and content filtering approach for learning optimizing. With the use of this method and other AI approaches, user preferences and potential information needs of the library patrons can be more personalized, efficient, precise, recommended query services, and diversified library services contents to the users which in turns reducing the time for readers to search for required information, improves users retrieval efficiency, and other library users queries. Figure 4 shows an AI robotic recommending and answering user's query.
- *Circulating management AI*: with the application of intelligent system in libraries, multiple sub-functions of the librarians can be achieved very quickly. For instance, access control system, book borrowing and returning of books system, seat reservation for readers, such as teach-

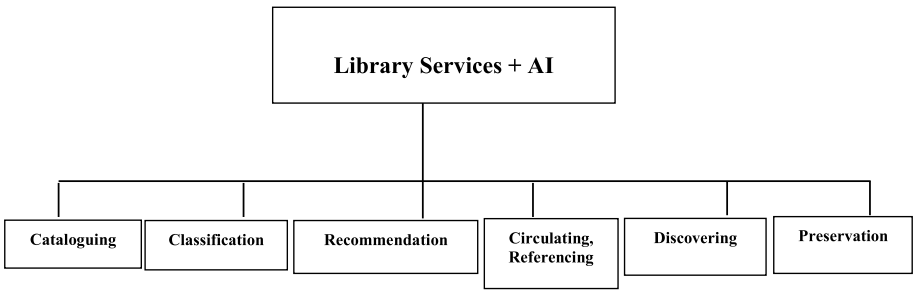

Fig. 3 Different types of library services that incorporate artificial intelligence (AI)

Fig. 4 Robot answering user's query

ers and students, and other services. In order to appreciate the intelligent system in the circulating section of the library, the library AI system needs to establish an access control subsystems. From the internal structure of the subsystem, the subsystem will be composed of network access control controller, access control card reader for the users, electric lock and computer control center. The reader needs to present his/her card when entering and exiting the library, and the access control card identifies it, reads the information contains in the card and, communicate with the card to give access control to the card holder. If the reader needs to borrow and/ returning books, he/she can enter the document name or keywords on a special retrieval device, and then the system automatically complete the intelligent screening from the collection resources and recommend relevant document resources for the users.

- *Referencing AI*: reference section of the library disseminates information to the library users. In the era of Information or reference desk where assistance from a librarian is sorted and received. Some libraries provide reference services via email to the questions raised by their clienteles, with the application of AI referencing tool, Library referencing services are made easy through the usage of virtual assistant or other AI Chabot.
- *Discovery:* Discovery AI: the intelligent discovery system will integrate information, such as user portraits, user context perception and user attributes, and provide readers with accurate knowledge recommendations by constructing a resource discovery-based system for the users [47].
- *Preservation:* Preservation AI: in the recent years, digitization has been seen as an important method for the preservation of library and information services. With the application of AI in libraries, digitization of library documents and audio–visual material like photography and analog tape recordings can be preserved for posterity and easily for referencing [48]. However, there are challenges in preserving library materials through digitization and AI. For instance, in the area of cost, resources and human resources to be deployed can be challenging for small organizations who may want to digitize their collections. Institutions collaborating with Google in their digitization process usually face the challenges of selecting few to be scanned documents with their gigapixel technology due to copyright and privacy issues [49]. The issue of biased selection also comes to play because if you cannot digitized all the documents due to the above constraints, justifying the cost while other materials are valued is less important and excluded from such form of preservation. Since the technology needed to digitize historical documents is very expensive, the process of appraisal through choosing the most valuable and most popular item to be digitized has become an established norms [50]. With the introduction of AI to enrich metadata and preservation of library resources, libraries have the opportunity to determine what should be archived as important government or institutional records and what to be discarded [51]. This is achieved through AI and Machine Language that can be deployed in libraries. This technique can be used in other areas of the library resources such as audio–visual materials using algorithms to identify and subsequently tag materials accordingly. For example, in the study of [52], using AI to help categorize digitized pictures from FARL's photo archive of art. According to the findings, what AI was doing is to place the pictures based on the taxonomy description of the materials in their different categories.

4 Discussion

The general aim of this study is to explore the ethical and equitable use of AI in libraries, focusing on how it can empower users, and what librarians need to consider when implementing AI.

From this study, the researchers found out that by understanding the potential of AI and embracing it responsibly, libraries can empower their users, enhance services, and remain at the forefront of the ever-evolving digital landscape. The ethical and equitable promise of AI in libraries holds great potential, and by embracing this technology, libraries can continue to serve as vital hubs of knowledge and empowerment in our communities [9].

Further, in the study of [9], while AI presents immense opportunities for empowering library users, its

implementation must be guided by a strong ethical framework. Libraries must prioritize privacy, transparency, fairness, and inclusivity in their AI initiatives, striving to create an environment that upholds ethical standards while harnessing the transformative potential of AI to better serve their communities.

By prioritizing equitable access, libraries can harness the power of AI to enhance the user experience, expand knowledge, and bridge the digital divide. It is through thoughtful and ethical implementation of AI technologies that libraries can truly empower all users and fulfill their promise of inclusivity and accessibility [24, 31, 38].

Addressing bias in AI algorithms and data is crucial for libraries to fulfill their mission of empowering library users. By actively working toward diversity, inclusivity, and ongoing evaluation of AI systems, libraries can harness the potential of artificial intelligence to provide equal access, fair outcomes, and unbiased services for all library users [53].

Equally, AI holds immense promise in empowering library users by providing personalized recommendations and curated content. By harnessing the potential of AI ethically and equitably, libraries can create enriching experiences for their users, opening doors to new knowledge and fostering a lifelong love for reading and learning [3].

In the study of [18], AI-powered virtual assistants hold tremendous potential in empowering library users. By offering enhanced support, personalized interactions, and improved accessibility, these assistants can revolutionize the way libraries engage with their patrons. With a thoughtful and ethical approach, libraries can harness the power of artificial intelligence to fulfill their promise of providing equitable and inclusive services to all.

Finally, AI offers immense potential to enhance information literacy among library users. By leveraging AI tools and technologies, libraries can provide personalized recommendations, offer instant support through Chabot, combat misinformation, and foster critical thinking skills [53]. While embracing these advancements, it is vital to uphold ethical standards and prioritize equitable access to information for all users.

While AI-powered library services offer immense potential, it is essential to navigate the ethical and equitable challenges that arise. Striking a balance between privacy and data security concerns requires robust data protection measures, privacy-preserving techniques, and responsible algorithmic practices. By prioritizing user privacy and ensuring fair and unbiased AI systems, libraries can harness the power of AI while upholding their ethical obligations to empower their users.

5 Embracing the ethical and equitable promise of AI in empowering library users

5.1 AI enabling library users

Embracing the ethical and equitable promise of AI in enabling library users is not just a strategic choice, but also a moral imperative [3]. As libraries continue to evolve in the digital age, it is crucial to leverage the potential of AI technologies to enhance the user experience and ensure "*equal access to information for all*" [39, 54, 55].

5.2 AI-powered applications can revolutionize library's routines

In his book titled, *The use of Library: Learning, searching and research strategy techniques for students in tertiary institutions* [44]. Wusu, reveals that library automation revolutionized current day architectures and technologies in the libraries and its operations [44]. More so, AI-powered applications have the ability to revolutionize the way libraries operate, from automating routine tasks to providing personalized recommendations and facilitating seamless information retrieval. By harnessing the power of AI, libraries can streamline its operations, freeing up valuable time for librarians to engage more directly with patrons and provide specialized assistance [38].

However, it is essential to approach the implementation of AI in libraries with a strong ethical framework. This technology should be used to augment human capabilities, not replace them. Librarians should play an active role in shaping the development and deployment of AI algorithms, ensuring that they align with the values of inclusivity, privacy, and intellectual freedom [3].

Equity is another critical aspect to consider when embracing AI in libraries [3, 56]. Efforts should be made to bridge the digital divide and ensure that all library users, regardless of their socio-economic background or technological literacy, can benefit from AI-powered services [57]. Libraries must be proactive in reaching out to marginalized communities, providing access to technology and offering training programs to empower individuals to navigate and utilize AI-driven resources effectively [38, 56].

Reference [9] further asserts that transparent policies and accountability mechanisms should be established to address concerns related to data privacy, algorithmic bias, and the potential for misuse of AI technologies. Libraries must prioritize the protection of user data and strive to mitigate any unintended consequences or discriminatory outcomes that may arise from AI systems.

By embracing the ethical and equitable promise of AI, libraries can fulfill their mission of providing free and equal access to information while adapting to the changing needs and expectations of their users. With careful consideration of ethical guidelines, active community engagement, and continuous evaluation of AI systems, libraries can harness the transformative power of AI to empower their users and foster a more inclusive and knowledgeable society [9, 24, 31].

6 Conclusion

This study has explored the ethical and equitable promise of artificial intelligence in empowering library users. The result of the reviewed articles showed that 1499 out of 170,262 papers have been identified as describing AI in libraries through ethical and equitable methodologies and prospect for empowering library users. By harnessing the power of AI, libraries have the opportunity to enhance user experiences, improve accessibility, and promote inclusivity. However, it is crucial to approach AI implementation with a strong ethical framework, ensuring transparency, privacy, and equal access for all users. As libraries continue to adapt to the digital age, embracing AI technology can truly revolutionize the way information is accessed, shared, and utilized, ultimately advancing the mission of libraries to enable and serve their communities. Together, let us harness the potential of AI to create a future where knowledge is truly accessible to all. The future studies can focus on other professional terms, such as Trustworthy AI, Fairness in AI, Explainable AI, and Human-in-the-loop, and how this can impact libraries, and other professionals.

Data availability We do not analyze or generate any datasets, because our work proceeds within a theoretical approach. One can obtain the relevant materials from the references presented below.

Declarations

Conflict of interest On behalf of all the authors, the corresponding author states that there is no conflict of interest.

References

1. Cordell, R.: Machine Learning + Libraries: A Report on the State of the Field, pp. 1-2. LC Lab Digital Strategy Directorate (2020). https://labs.loc.gov/static/labs/work/reports/Cordell-LOC-ML-report.pdf
2. Subaveerapandiyan, A.: Application of artificial intelligence (AI) in libraries and its impact on library operations review. Libr. Philos. Practice (e-journal) 7828 (2023). https://digitalcommons.unl.edu/libphilprac/7828
3. Bradley, F.: Representation of libraries in artificial intelligence regulations and implications for ethics and practice. J Austr. Libr. Inf. Assoc. **71**(3), 189–200 (2022). https://doi.org/10.1080/24750158.2022.2101911
4. Talley, N.B.: Imagining the use of intelligent agents and artificial intelligence in *Academic Law Libraries*. Law Libr. J.Libr. J. **108**, 383 (2016)
5. Bi, S., Wang, C., Zhang, J., Huang, W., Wu, B., Gong, Y., Ni, W.: A survey on artificial intelligence aided internet-of-things technologies in emerging smart libraries. Sensors **22**(8), 2991 (2022). https://doi.org/10.3390/s22082991
6. Hauptmann, A.G., Witbrock, M.J., Christel, M.G.: Artificial intelligence techniques in the interface to a digital video library. In: CHI '97 Extended Abstracts on Human Factors in Computing Systems (1997). https://doi.org/10.1145/1120212.1120214
7. Zhang, X.: On the innovative work and development of library reader service in the era of artificial intelligence. Wirel. Commun. Mobile Comput. **2022**, e3779660 (2022). https://doi.org/10.1155/2022/3779660
8. Taneja, H.: The era of 'move fast and break things' is over. Harvard Bus. Rev. (2019). Available at https://hbr.org/2019/01/the-era-of-move-fast-and-break-things-is-over
9. Miao, Z.: Investigation on human rights ethics in artificial intelligence researches with library literature analysis method. Electron. Libr.Libr. **37**(5), 914–926 (2019). https://doi.org/10.1108/EL-04-2019-0089
10. Shelton, S.D.: Robots stole my job—AI and robotics libraries. Comput. Libr.. Libr. **39**(1), 22–27 (2019)
11. Asemi, A., Asemi, A.: Artificial intelligence (AI) application in library systems in Iran: a taxonomy study. Libr. Philos. Practice (e-Journal) (2018) https://digitalcommons.unl.edu/libphilprac/1840
12. Panda, S., Chakravarty, R.: Adapting intelligent information services in libraries: a case of smart AI chatbots. Libr. Hi Tech News **39**(1), 12–15 (2022). https://doi.org/10.1108/LHTN-11-2021-0081
13. Cordell, R.: Machine Learning and Libraries Interview with Kate Zwaard, pp. 1–5. LC Lab Digital Strategy Directorate (2020). https://labs.loc.gov/work/experiments/
14. Ylipulli, J., Luusua, A.: Without libraries what have we? Public libraries as nodes for technological empowerment in the era of smart cities, AI and big data. In: Proceedings of the 9th International Conference on Communities & Technologies—Transforming Communities. ACM Press, New York, pp. 92–101 (2019)
15. Linder, C.: The libraries of the future will be AI Archivists. Popular Mechanics (2020). https://www.popularmechanics.com/technology/a32436235/library-of-congress-machine-learning-newspaper-images/
16. O'Neil, C.: Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy, 1st edn., p. 21. Crown, New York (2016)
17. Smith, L.C.: Artificial intelligence in information retrieval systems. Inf. Process. Manage. **12**(3), 189–222 (1976). https://doi.org/10.1016/0306-4573(76)90005-4,pp.194-215
18. Arlitsch, K., Newell, B.: Thriving in the age of accelerations: a brief look at the societal effects of artificial intelligence and the opportunities for libraries. J. Libr. Adm.Libr. Adm. **57**(7), 789–798 (2017). https://doi.org/10.1080/01930826.2017.1362912
19. Kim, Y., Yoo, J.H., Choi, K.: A motion and similarity-based fake detention method for biometric face recognition systems. IEEE Int. Conf. Consum. Electron.Consum. Electron. **57**(2), 756–762 (2011)
20. Martonik, A.: Android Fingerprint Sensors, Ranked. Available at http://android-central.com/android-fingerprint-sensors-ranked. Retrieved on 18 March 2023 (2015)

21. Dave, G., Chao, X., Sriadibhatla.: Face Recognition in Mobile Phones. Department of Electrical Engineering Stanford University, Stanford, California (2010)
22. Byrum, J.: Build a Diverse Team to Solve the AI Riddle. MIT Sloan Management Review (2020). https://sloanreview.mit.edu/article/build-a-diverse-team-to-solve-the-ai-riddle/
23. Seo Jo, E., Gebru, T.: Lessons from Archives: Strategies for Collecting Socio-Cultural Data in Machine Learning, p. 2. https://doi.org/10.1145/3351095.3372829 (2019)
24. Balleste, R.: The future of artificial intelligence in your virtual libraries. Comput. Libr.. Libr. **22**(9), 10–15 (2002)
25. Zhu, C., Jiang, T., Cao, H., Sun, W., Chen, Z., Liu, J.: Longitudinal analysis of meta-analysis literature in the database of ISI Web of Science. Int. J. Clin. Exp. Med. **8**(3), 3559–3565 (2015)
26. Mukhlif, F., Hodonu-Wusu, O.J., Noordin, A.K., Kasirun, M.Z.: Major trends in device to device communications research: a bibliometric analysis. In: 2018 IEEE 16th Student Conference on Research and Development (SCOReD), Babgi, Malaysia, 26–28 Nov 2018
27. Showers, B.: The evolution of library metrics. In: Tattersall, A. (ed.) Altmetrics: A Practical Guide for Librarians Researchers and Academics, pp. 49–63. Facet, London (2016)
28. Showers, B.: Library Analytics and Metrics: Using Data to Drive Decisions and Services. Facet Publishing, London (2015)
29. Sin, S.C.J., Kim, K.S.: Use and non-use of public libraries in the information age: a logistic regression analysis of household characteristics and library services variables. Libr. Inf. Sci. Res.. Inf. Sci. Res. **30**(3), 207–215 (2008)
30. Haffenden, C., Fano, E., Malmsten, M., Börjeson, L.: Making and using AI in the library: creating a BERT model at the national library of Sweden. Coll. Res. Libr.Libr. **84**(1), 30–48 (2023). https://doi.org/10.5860/crl.84.1.30
31. Balleste, R.: A hypothetical case study: creating AI assistants in the law library. Leg. Ref. Serv. Q. **26**(1–2), 47–56 (2007). https://doi.org/10.1300/J113v26n01_04
32. Yordy, L.: The library of Babel for prior art: using artificial intelligence to mass produce prior art in patent law. Vanderbilt Law Rev. **74**(2), 521 (2021)
33. Williams, R.: Artificial Intelligence Assistants in the Library: Siri, Alexa, and Beyond. Information Today (2019). https://www.infotoday.com/OnlineSearcher/Articles/Features/Artificial-IntelligenceAssistants-in-the-Library-Siri-Alexa-and-Beyond-131529.shtml
34. Johnson, B. Libraries in the Age of Artificial Intelligence. Computers in Libraries (2018). https://www.infotoday.com/cilmag/jan18/Johnson--Libraries-in-the-Age-ofArtificial-Intelligence.shtml
35. Wei, Q.: Application of virtual reality technology in medical university libraries in the era of artificial intelligence. Agric. Libr. Inf. **31**(8), 63–70 (2019). https://doi.org/10.13998/j.cnki.issn1002-1248.2019.08.19-0261
36. Oyelude, A.A.: What's trending in libraries from the internet cybersphere–artificial intelligence and other emerging technologies. Libr. Hi Tech News **34**(2), 11–12 (2017). https://doi.org/10.1108/LHTN-02-2017-0008
37. Hodonu-Wusu, J.O., Lazarus, N.G., Otun, M.O., Arekemase, O.B., Olayiwola, T.T.: Big data and openness: a big issue with librarians. Libr. Philos. Practice (e-journal). 4279 (2020). https://digitalcommons.unl.edu/libphilprac/4279
38. Li, J., & Wang, H.: Application of artificial intelligence in libraries. In: 3rd International Conference on Artificial Intelligence and Advanced Manufacture (AIAM), pp. 323–329 (2021). https://doi.org/10.1109/AIAM54119.2021.00072.
39. Hodonu-Wusu, J.O., Noorhidawati, A., Abrizah, A.: Malaysian researchers on open data: the first national survey on awareness, practices and attitudes. Malays. J. Libr. Inf. Sci.Libr. Inf. Sci. **25**(2), 1–20 (2020)
40 Wu, J., Williams, K.M., Chen, H.-H., Khabsa, M., Caragea, C., Tuarob, S., Ororbia, A.G., Jordan, D., Mitra, P., Giles, C.L.: CiteSeerX: AI in a digital library search engine. AI Mag. **36**(3), 35–48 (2015). https://doi.org/10.1609/aimag.v36i3.2601
41. Sarker, I.H.: AI-based modeling: techniques, applications and research issues towards automation, intelligent and smart systems. SN Comput. Sci. **3**, 158 (2022)
42. Sarker, I.H.: Machine learning: algorithms, real-world applications and research directions. SN Comput. Sci. **20**, 21 (2021)
43. Sarker, I.H.: Deep learning: a comprehensive overview on techniques, taxonomy, applications and research directions. SN Comput. Sci. **2**(6), 1–20 (2021)
44. Wusu, H.O.: The Use on Library: Learning, Searching and Research Strategies Techniques for Students in Tertiary Institutions in Nigeria, pp. 83–86. Afolabi Press, London (2015)
45. Pang, N., Dou, C.: Artificial intelligence inspired computer aided design of library service system. Comput. Aided Des. Appl. **20**(55), 53–63 (2023)
46. Tian, Z.: Application of artificial intelligence system in libraries through data mining and content filtering methods. J. Phys. Conf. Ser. **1952**, 042091 (2021). https://doi.org/10.1088/1742-6596/1952/4/042091
47. Xu, B., Zhao, Y., Feng, H., Zhu, S., Yu, J., Zhang, M., Kuzminykh, V.: ACM International Conference Proceeding Series, pp. 170–174 (2020). https://doi.org/10.1145/3438872.3439076
48. Barlindhaug, G.: Artificial intelligence and the preservation of historic documents. Proc. Document Acad. **9**(2), 999 (2022). https://doi.org/10.35492/docam/9/2/9/
49. Hylland, O.M.: "Even better than real thing? Digital copies and digital museums in a digital cultural policy. Cult. Unbound. **9**(1), 62–84 (2017)
50. Hughes, L.M.: Digitizing Collections: Strategic Issues for the Information Manager, vol. 2. Facet Publishing, New York (2004)
51. Rolan, G., Humphries, G., Jeffrey, L., Samaras, E., Antsoupova, T., Stuart, K.: More human than human artificial intelligence in the archive. Archiv. Manuscr. **47**(2), 179–203 (2019)
52 Han, X., Papyan, V., Prokop, E., Donoho, D.L., Johnson, C.R.: Artificial intelligence and discovering the digitized photo-archive. In: Jaillant, L. (ed.) Archives, Access and Artificial intelligence: Working with Born-Digital and Digitized Archival Collections, pp. 29–61. Bielefeld University Press, USA (2022)
53. Chen, J., Zhuo, Z., Lin, J.: Does ChatGPT play a double-edged sword role in the field of higher education? An in-depth exploration of the factors affecting student performance. Sustainability **15**(24), 16928 (2023)
54. Hodonu-Wusu, J.O.: Open science: a review on open peer review literature. Libr. Philos. Practice **1**, 31 (2018)
55. Hodonu-Wusu, J.O., Noorhidawati, A., Abrizah, A.: The cautious faculty: Malaysian university researchers' awareness, experiences, and attitudes towards open peer review. Malays. J. Libr. Inf. Sci. Libr. Inf. Sci. **26**(3), 57–76 (2021)
56. Weijia, G.U.O.: Research on influencing factors of libraries' artificial intelligence readiness. J. Agric. Libr. Inf. Sci. **34**(5), 47–56 (2022). https://doi.org/10.13998/j.cnki.issn1002-1248.22-0016
57. Safiya, N.U.: Safiya Umoja noble PhD on Twitter (2020). Available at https://twitter.com/safiyanoble/status/1267978038072889344