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Reengineering the Libraries with Artificial Intelligence

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ABSTRACT

Artificial Intelligence (AI) is transforming various sectors worldwide, and libraries are no exception. From automating cataloguing to enhancing user experience through personalised services, AI is redefining the way libraries operate. This article explores the multifaceted applications of AI in library systems, examines its benefits and challenges, and discusses its implications for the future of librarianship

Keywords: AI in libraries, AI features, Library facets

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1. Introduction

For a long time, libraries have played a crucial role in the spread of knowledge and the preservation of culture. Libraries are undergoing rapid changes in the digital age. Libraries are evolving from passive information repositories to active and intelligent knowledge centres thanks to the advent of artificial intelligence.

The replication of human intelligence processes by machines, particularly computer systems, is known as artificial intelligence. AI in library science refers to technologies such as machine learning, natural language processing (NLP), computer vision, and robotics, designed to enhance data management, operational efficiency, and user experience.

The initial work of creating artificial intelligence systems in libraries dates back to the 1990s. (Isaiah Michael Omame)[1] AI enables libraries to automate processes, provide personalised services, and improve user experiences (Hodonu-Wusu, 2025) [2], foster intelligent decisions for retrieving and sharing information (Rifqah Olufunmilayo Okunlaya, 2025) [3], and support remote access to library services (Harry E. Pence) [4]. Research and studies on the application of AI to libraries have addressed many issues and indicate its potential. Based on these premises, we reviewed the use of AI in libraries and highlighted its potential for further applications. This work reviews the various applications of AI in libraries, with a discus-

sion on both the current state and prospects.

2. Artificial Intelligence in Libraries

By automating processes, improving information retrieval, and delivering smart user services, Artificial Intelligence (AI) technology is revolutionising conventional library functions. The following is a comprehensive analysis of the most significant applications of artificial intelligence in libraries today.

2.1 Automated Metadata Management and Cataloguing

Cataloguing is a crucial library activity that has historically been done manually and is often inconsistent. Through automating this process, AI currently performs a vital function by enhancing the consistency of cataloguing, accelerating resource processing, and making retrieval more precise and efficient.

Library materials are automatically assigned subject categories using machine learning algorithms trained on classification schemes such as the Dewey Decimal Classification (DDC) and the Library of Congress Classification (LCC) (Parker, 2019) [5]. These systems reduce the likelihood of human error and increase efficiency by analysing full-text material or metadata and applying the proper categorisation codes.

3. Data Extraction

Using Natural Language Processing (NLP) methods, AI systems may get metadata from digital and scanned documents, including titles, authors, publication dates, keywords, and abstracts (Sánchez-Cuadrado & Ferrández, 2020) [6]. This feature is invaluable while working with digitised historical literature or massive digital archives.

3.1 Chatbots and Virtual Assistants

By reducing the workload for employees, AI-powered virtual assistants and chatbots provide round-the-clock customer assistance, thereby increasing user engagement. minimizes wait times at help desks and guarantees consistent support at all times.

- By responding to queries in natural language, they assist users in finding books, periodicals, or databases.
- They provide automated answers to frequently asked questions about things like library hours, borrowing policies, and membership requirements.
- Some systems even help with intricate activities like citation formatting or interlibrary loans.

Case Study: An AI chatbot has been implemented on the University of Pretoria's library website to respond to student inquiries and provide assistance with locating digital resources (Chigada & Madzinga, 2022) [7]. Similarly, MIT Libraries utilises AI-powered chat interfaces to provide academic support (MIT Libraries, 2020).

3.2 Individualised Recommendation Systems

Similar to how Amazon and Netflix operate, AI-based recommendation engines analyse user preferences,

borrowing history, and search patterns to recommend relevant resources. Additionally, it promotes a more thorough investigation of collections and supports personalised learning pathways, which is especially helpful in academic and research libraries.

- Hybrid models, content-based filtering, and collaborative filtering are all used by these systems.
- As more data becomes available, they gradually improve their recommendations.

Case Study: A prototype recommendation system was implemented at Harvard Library to suggest academic resources to scholars based on their departmental concentration and past usage (García-Marín & Calzada-Prado, 2020) [8].

3.3. Knowledge Organisation and Semantic Search

The effectiveness of conventional keyword-based search systems is often limited by users' ability to select the appropriate search terms. By making semantic search possible, which analyses the user's intent and contextual meaning rather than depending only on exact keyword matches, AI addresses this issue. It helps researchers find interdisciplinary content more easily and meets their sophisticated research requirements.

- Semantic search engines connect ideas using knowledge graphs and ontologies.
- As an illustration, a search for "climate change impact" would turn up articles addressing the subject's economic, health, and political aspects, rather than simply those that exactly match the keyword (Tan & Goh, 2020) [9].

With the use of ontology-driven systems that organise subject knowledge across disciplines, AI facilitates the creation of intelligent cross-linking of related resources (Zhitomirsky-Geffet et al. , 2018) [10].

3.4. Optical Character Recognition (OCR) and Digitalisation.

Libraries are increasingly digitising actual collections, such as rare manuscripts and archives, in order to preserve cultural heritage, enhance accessibility, and promote digital content. This is made possible by AI-enhanced OCR systems, which.

- Converting written or printed material into a machine-readable, searchable text format.
- Using deep learning models to improve OCR accuracy by fixing errors brought on by outdated fonts, damaged documents, or unusual layouts (Smith, 2019)[26].

For instance, In order to digitise and transcribe historical handwritten documents, the British Library employs AI-enhanced OCR, which makes it possible to conduct full-text searches in previously inaccessible content (British Library, 2021).

3.5 Predictive Analytics for Collection Development

Predictive models based on artificial intelligence enable librarians to make informed decisions about collection management, which in turn improves resource planning, reduces expenses, and ensures that collections

remain current and relevant.

- High and low demand materials are identified by analysing circulation data, reservation patterns, and user input.
- Zhang et al. (2021) [11] state that predictive models can help forecast future usage patterns, which can inform purchases and weeding tactics.

For instance, to improve its digital holdings and journal subscriptions, the University of Toronto Libraries employs predictive analytics (Yu & Young, 2021)[19].

3.6. Plagiarism Detection and Academic Integrity

By automating the detection of plagiarism and erroneous citations in academic publications, AI tools promote academic integrity, enhance educational standards, foster ethical research practices, and help teachers maintain fairness and transparency.

- Turnitin and Urkund are two examples of systems that use AI and machine learning to compare submissions against large databases of academic and web material.
- Traditional techniques cannot compete with AI's ability to identify paraphrasing, mosaic plagiarism, and citation manipulation (Bali et al., 2020) [12].

3.7. Library User Behaviour Analytics

The way libraries manage their space, services, and resources is changing thanks to AI-driven user behaviour analytics. Libraries can create more inclusive, responsive, and intelligent learning environments by understanding the nuances of user engagement on digital platforms as well as in physical locations. However, these advantages must be balanced by transparent procedures and strong privacy protections.

User behaviour analytics (UBA) has become a potent technique for libraries in the digital age to gain a deeper insight into how users engage with both physical and digital resources. Libraries may use the integration of artificial intelligence (AI) and machine learning techniques to analyse vast amounts of data and produce actionable insights that guide space use, resource distribution, and customised services.

3.7.1. User behaviour analytics powered by artificial intelligence

By facilitating real-time, predictive, and granular analysis of user behaviour, artificial intelligence improves conventional library analytics. AI-enabled systems are used in the following essential fields.

• 3.7.1. Monitoring Footfall in Library Areas

IoT devices, including motion sensors, video analytics, and RFID, are tracked by Internet of Things (IoT) devices and AI-powered sensors.

- The number of users accessing particular areas.
- Hours of maximum usage.

- Routes for movement within the library.

By revealing how various sections are utilised, such as whether users prefer multimedia rooms, collaborative workspaces, or quiet zones, these systems help libraries understand how different spaces are used.

For instance, To evaluate seating needs and maximise space usage, the University of Nevada, Las Vegas (UNLV) library used a sophisticated occupancy monitoring system (Clement et al., 2019)[26].

- **Time Spent on Resources or Sections.**

Libraries can figure out the following by analysing Wi-Fi log data, beacon technology, or computer use:

- The amount of time users spare in areas, such as the periodicals or reference sections.
- What are the most popular study spaces or computers?
- The amount of time spent using electronic resources through library websites.

As an example, the National Library Board (NLB) of Singapore employed AI and Wi-Fi analytics to evaluate usage patterns and repurpose underutilized areas into learning environments (Tan and; Goh, 2020) [9].

- **Search and borrow**

Using AI, a user's digital footprint is tracked across the library's resources:

- Searching the OPAC (Online Public Access Catalogue).
- Data on click-through rates.
- Previous borrowing and download history.
- Suggest helpful tools.
- Identify any gaps in the collection.
- Anticipate the requirements of users in the future.

For instance, MIT Libraries employ a knowledge graph model (Paltoo, 2021)[18] and AI-based analytics to comprehend search behaviour and customise discovery services.

3.8. Advantages of a UBA with AI

Predictive analytics in academic libraries helps anticipate student needs and allocate digital resources during exam periods, according to Chigada and Madzinga (2022)[7]. The information that was gathered and analysed can be used to:

3.8.1. Redesign Library Layouts

- It is possible to rearrange or increase the amount of space in high-traffic areas.

- Underutilised spaces may be transformed into digital or collaborative learning environments.
- Based on actual usage patterns, seats and furniture can be assigned.

3.8.2. Enhance Resource Placement and Service Delivery

- High-traffic areas or entrances may be moved closer to frequently used materials.
- Real-time data may be used to maximise staff deployment during busy periods.

3.8.3. Tailor Outreach and Communication

- Libraries may divide users according to their behaviour (such as undergraduate students or research scholars) and send tailored notifications, reading suggestions, or event invitations.
- Based on previous user interactions and preferences, chatbots may modify their responses.

4. Ethical Issues

Although AI-based user analytics have significant advantages, privacy and data security continue to be major issues:

- Libraries are responsible for adhering to data protection legislation such as the GDPR or India's Digital Personal Data Protection Act of 2023.
- User data must be anonymised to avoid identification.
- Data collection methods are more trustworthy when they are explained clearly.

4.1. Accessibility and Language Translation

Modern libraries, especially in multilingual and multicultural communities, prioritise linguistic diversity and accessibility as their core mission. By overcoming language and physical obstacles, Artificial Intelligence (AI) has revolutionised libraries' ability to deliver equitable access to information. AI is improving the inclusiveness and responsiveness of libraries to the demands of their diverse users thanks to advancements in assistive technologies, machine translation, and Natural Language Processing (NLP).

4.1.1. Language Translation in Real Time

Digital library platforms are now incorporating AI-powered machine translation systems to provide content in a variety of languages. Programs like the Google Translate API, Microsoft Translator, and Amazon Translate use deep neural networks that have been trained on massive multilingual datasets to provide almost real-time translation of documents, search results, metadata, and user interfaces. This greatly enhances the accessibility and usability of library resources in linguistically diverse nations like India.

Use Case: The National Digital Library of India (NDLI) utilises AI-based translation frameworks to facilitate searches and content distribution in more than 10 Indian languages, allowing students and researchers from

all linguistic backgrounds to access academic resources (NDLI, 2023; Chakraborty et al., 2021) [13].

4.1.2. Text-to-Speech and Voice-to-Text Services

By catering to a range of user demands and learning preferences, these technologies encourage inclusivity and promote accessibility. Libraries are employing AI-based speech recognition and synthesis tools to:

- Turn spoken words into text that can be searched (voice-to-text).
- Digitally read aloud the text (text-to-speech or TTS).

Users with reading difficulties, visual impairments, or low literacy skills can benefit from these services. Common choices include top AI products like Google's Speech-to-Text, Amazon Polly, and Microsoft Azure Cognitive Services. According to López-Nores et al. (2020) [14], integrating speech-based interfaces with library systems enhances the experience for older users and those with cognitive impairments.

Case in point: To allow blind customers to listen to texts and web content, the New York Public Library (NYPL) added text-to-speech capabilities to its e-book and website platforms (NYPL, 2021) [27].

5. User-Friendly for People with Disabilities

By making systems accessible to patrons with disabilities, libraries are using AI more and more to support the principles of universal design:

- Visual impairments (such as screen readers and TTS).
- Issues with motor function (e.g., voice command interfaces).
- Learning impairments (e.g., adaptive reading levels or simplified interfaces).

AI-based devices employ picture recognition to describe images, content summarisation to make text simpler, and predictive typing to help with communication.

AI-driven language translation and accessibility tools are empowering libraries to fulfil their democratic mission of serving all users, regardless of linguistic or physical abilities. These technologies support not only compliance with accessibility laws but also innovation in inclusive service design. As libraries continue to integrate AI, attention to quality, inclusivity, and ethics will be essential to ensuring equitable access to information.

5.1. Benefits of AI Integration in Libraries

The integration of Artificial Intelligence (AI) in libraries is revolutionising traditional practices, yielding substantial improvements in operational efficiency, user engagement, accessibility, and strategic management. Below is a detailed overview of the key benefits, supported by scholarly literature and real-world examples.

5.2. Efficiency and Time Saving

One of the most significant benefits of AI in libraries is the automation of routine and repetitive tasks, which historically required substantial human labour. Automation in cataloguing and acquisitions can reduce processing time by over 60%, freeing staff for more strategic, user-centric activities and responsibilities (Sánchez-Cuadrado & Ferrández, 2020) [6]. AI tools can:

- Automatically classify and catalogue new materials using classification schemes like DDC or LCC.
- Extract metadata from documents using Natural Language Processing (NLP).
- Answer frequently asked questions through chatbots.

Example:

The British Library and MIT Libraries use AI tools to automate metadata generation and cataloguing, resulting in reduced processing times and increased consistency (Smith, 2019; MIT Libraries, 2020)[26].

5.3. Enhanced User Experience

According to Paltoo (2021) [18], personalised recommendations and semantic search systems improve search success rates and encourage deeper exploration of digital collections.

AI enhances the user experience by providing:

- Personalised search and discovery through recommendation engines.
- Context-aware search using semantic technologies that understand user intent.
- 24/7 virtual assistance via chatbots and voice interfaces.

Case Study: The University of Pretoria deployed AI chatbots to offer round-the-clock reference services, significantly improving student satisfaction and reducing the load on human staff (Chigada & Madzinga, 2022) [7].

5.4. Cost Optimisation

While initial implementation may require investment, AI leads to long-term financial efficiency by minimising human error and reallocating staff to higher-value tasks.

AI facilitates cost savings through:

- Reduction in staff hours required for cataloguing, reference queries, and resource recommendations.
- Optimisation of subscriptions and acquisitions through predictive analytics.
- Smart energy management in library buildings using AI-integrated IoT systems.

Example:

The University of Toronto Libraries use predictive analytics to manage subscriptions and avoid redundant acquisitions, helping save significant annual costs (Yu & Young, 2021) [19].

5.5. Data-Driven Decision Making

Libraries using AI for data analysis can align resource allocation with actual user needs, improving service efficiency and relevance (Zhang et al., 2021) [11]. Libraries using AI for data analysis can align resource allocation with actual user needs, improving service efficiency and relevance empowers library managers with predictive and prescriptive analytics, enabling better decision-making in areas such as:

- Collection development (forecasting demand for materials).
- Space utilisation and layout redesign based on footfall analytics.
- Strategic planning for digital infrastructure and service expansion.

Example:

Libraries using AI-based user behaviour analytics can reallocate underutilised physical spaces into collaborative zones or digital labs (Tan and Goh, 2020) [9].

5.5. Improved Accessibility

AI significantly enhances accessibility for differently abled users, aligning libraries with global and national accessibility standards (e.g., WCAG 2.1, India's Rights of Persons with Disabilities Act, 2016). López-Nores et al. (2020) [14] emphasise that AI-enabled accessibility tools foster digital inclusion, allowing users of all abilities to participate in knowledge acquisition.

Key AI-driven tools include:

- Text-to-speech (TTS) systems for visually impaired users.
- Voice-controlled interfaces for users with mobility limitations.
- Machine translation for users with limited literacy or language barriers.

Example:

The New York Public Library (NYPL) has implemented text-to-speech and screen reader-compatible systems, improving digital access for patrons with disabilities (NYPL, 2021).

6. Challenges in Implementing AI in Libraries

While Artificial Intelligence (AI) offers transformative benefits in library environments, its integration is not without challenges. These challenges span legal, ethical, financial, and operational dimensions. Addressing them requires strategic planning, stakeholder collaboration, and ongoing evaluation. This section discusses the principal concerns involved in adopting AI in library systems.

6.1. Data Privacy Concerns

According to Kokolakis (2017) [15], privacy concerns are a significant barrier to the adoption of data-driven technologies in public institutions, including libraries. Libraries collect vast amounts of user data through online catalogues, digital repositories, access logs, and AI-driven services like recommendation engines and

chatbots. The deployment of AI tools raises significant concerns regarding the collection, storage, and use of personally identifiable information (PII)ff.

- AI systems often require detailed user behaviour data to function effectively. If mishandled, such data can be exploited or leaked.
- Compliance with laws such as the General Data Protection Regulation (GDPR) in the EU or the Digital Personal Data Protection Act, 2023 (India) is mandatory.
- Ethical librarianship mandates that users be informed about data collection and given control over their information.

Example:

Libraries using AI chatbots must ensure that the interactions are encrypted, data retention policies are transparent, and user consent is obtained.

6.2 Bias in Algorithms

AI systems learn from existing datasets. If these datasets are incomplete, unrepresentative, or skewed, the AI model may reinforce existing biases—whether linguistic, cultural, gender-based, or academic.

- Biased algorithms may underrepresent marginalised communities or favour dominant academic narratives.
- This can lead to unequal visibility of materials in recommendation systems or flawed semantic search results.

Case Study:

Koencke et al. (2020) [29]. found significant racial disparities in AI speech recognition accuracy, which could negatively affect library voice-interface systems for diverse populations.

6.3 High Implementation Costs

The initial costs of integrating AI systems can be substantial, especially for underfunded or rural libraries. Zhang et al. (2021)[11], stated that the cost of implementing AI can deter small libraries from adoption unless supported by government funding or collaborative consortia.

- Costs include infrastructure upgrades (servers, cloud platforms), software licensing, staff training, and ongoing maintenance.
- Open-source AI tools are available but often require in-house technical expertise for customisation and deployment.

Example:

Public libraries in developing countries face financial constraints in adopting AI-based services, relying instead on donor-funded pilot projects.

6.4 Skill Gaps Among Library Staff

A study by Ghosh & Singh (2020) [17] found that 72% of academic librarians in India felt inadequately pre-

pared to implement or manage AI-based systems due to a lack of training.

Effective use of AI tools requires new skills in:

- Data literacy
- Machine learning basics
- AI ethics
- System integration and evaluation

Most librarians are trained in information science rather than data science, necessitating reskilling and continuous professional development (CPD). Training programs, interdisciplinary collaborations, and inclusion of AI modules in LIS (Library and Information Science) curricula can bridge this gap.

6.5 Over-Reliance and Technological Dependence

While automation enhances efficiency, over-reliance on AI can erode traditional library values such as personalised human service, intellectual freedom, and community engagement. Buckland (2017) argues that the humanistic role of libraries—fostering critical thinking, community participation, and ethical reflection—must not be sacrificed in the pursuit of automation. AI should be adopted as an augmentation—not a replacement—of human-centred library services.

- Users may face frustration when chatbots fail to address nuanced queries.
- Reducing face-to-face librarian interactions may particularly affect senior citizens, children, or users with low digital literacy.

Implementing AI in libraries involves navigating complex challenges related to ethics, equity, cost, and workforce development. While these obstacles are significant, they are not insurmountable. Strategic planning, policy frameworks, collaborative initiatives, and sustained training efforts can enable libraries to harness the power of AI while preserving their core values and responsibilities to society.

7. Case Studies and Examples of AI Integration in Libraries

Real-world implementations of Artificial Intelligence (AI) in libraries demonstrate the technology's potential to revolutionise knowledge services. This section presents detailed case studies from three institutions: MIT Libraries (USA), the National Digital Library of India (NDLI), and the University of Pretoria (South Africa). These libraries showcase how AI is applied to enhance user engagement, streamline operations, and democratize access to information.

7.1 MIT Libraries (USA)

Institution: Massachusetts Institute of Technology (MIT), Cambridge, USA

MIT Libraries are global leaders in implementing AI technologies to support research, discovery, and digital curation.

AI Applications:

· **Research Trend Analysis:** Using machine learning algorithms, MIT Libraries analyse large volumes of academic data (e.g., citation networks, usage logs) to detect emerging fields and publication patterns. This aids researchers and library managers in identifying gaps and trends in scholarly communication (Paltoo, 2021) [18].

Automated Knowledge Mapping: AI constructs knowledge graphs connecting authors, publications, keywords, and research domains. These graphs help users discover related resources that may not be directly linked by traditional classification methods (MIT Libraries, 2020).

· **Recommendation Systems:** Personalised AI-based recommendation tools offer users reading suggestions based on explicit preferences (search queries, ratings) and implicit behaviours (clicks, downloads). These systems improve engagement and resource circulation (García-Marín & Calzada-Prado, 2020) [8].

· **Data-Driven Collection Management:** Predictive models are used to optimise journal subscriptions and acquisitions based on usage statistics, reducing costs and improving resource relevance.

· **MIT-IBM Watson AI Lab Partnership:** The library collaborates with the MIT-IBM Watson AI Lab to integrate advanced technologies such as cognitive computing and NLP into scholarly services (MIT-IBM Watson AI Lab, 2019).

7.2 National Digital Library of India (NDLI)

NDLI is India's flagship digital repository aimed at democratizing access to educational resources. It serves millions of users across linguistic and academic backgrounds. IIT Kharagpur, the Ministry of Education, and the Government of India coordinate it.

AI Applications:

· **Multilingual Search and Access:** NDLI incorporates Natural Language Processing (NLP) to support over ten Indian languages, enabling users to search, browse, and read content in their native tongues. AI-based translation tools assist in cross-linguistic content access (NDLI, 2023; Chakraborty et al., 2021) [13].

· **Metadata Enrichment:** AI models identify and fill gaps in bibliographic metadata. For example, AI can generate subject terms and summaries for resources lacking descriptive data, increasing discoverability.

· **AI-Driven Content Curation:** NDLI uses AI to recommend books, videos, and scholarly articles based on user level (school, undergraduate, researcher) and browsing behaviour. The system ensures that users receive contextually appropriate material (Sengupta & Roy, 2021) [13].

· **Smart Filtering and Clustering:** Unsupervised learning models group similar items into clusters, improving thematic browsing and keyword navigation across millions of documents.

· **User Behaviour Analytics:** NDLI tracks usage patterns to enhance interface design, personalise services, and dynamically reorder content for better user experience.

Summary Table

Institution	AI Tool/Technique	Key Impact
MIT Libraries (USA)	Predictive analytics, knowledge graphs, NLP	Enhanced research support and trend analysis
NDLI (India)	Multilingual NLP, metadata enrichment	Inclusive access, enriched metadata, improved discovery

8. Future of AI in Libraries

The integration of Artificial Intelligence (AI) into library services is poised to transform how libraries function and serve their communities. As information landscapes grow exponentially more complex and diverse, AI technologies promise to enhance operational efficiency, user engagement, and educational impact. This section explores key prospective AI applications in libraries—Robotic Process Automation (RPA), Augmented Reality (AR) and Virtual Reality (VR), and AI-curated digital exhibits—and discusses the evolving role of librarians as digital knowledge curators.

8.1 Robotic Process Automation (RPA) for Inventory and Logistics

Robotic Process Automation (RPA) involves the use of AI-powered software robots to automate routine, repetitive tasks traditionally performed by humans. In libraries, RPA can revolutionise inventory management, cataloguing, and logistics by increasing speed and accuracy while reducing human error (Willcocks et al., 2015) [20]. For example, AI-driven robots can perform shelf-reading tasks, identifying misplaced items and updating inventory records in real-time (Kumar & Kaur, 2021) [21]. Additionally, AI-powered systems can optimise book ordering and interlibrary loan processes by predicting demand patterns based on historical data and usage trends (Alma & Spink, 2019) [22].

The implementation of RPA in these contexts not only reduces operational costs but also frees up librarians' time to focus on higher-value tasks such as user engagement and program development. According to He. et al. (2020), automating back-end processes enhances overall library responsiveness and resource availability, which is crucial as libraries expand their digital and hybrid collections.

8.2 Augmented Reality (AR) and Virtual Reality (VR) for Interactive Learning

Augmented Reality (AR) and Virtual Reality (VR) technologies offer immersive and interactive learning experiences that libraries can harness to enhance user engagement and knowledge acquisition. AR overlays digital content onto physical environments, while VR creates fully immersive virtual environments, both of which can be integrated into library services for education and outreach (Radianti et al., 2020) [23].

For example, libraries can use AR applications to create interactive exhibits where users scan QR codes on physical artefacts or books to access supplementary multimedia content such as videos, 3D models, or expert

commentary (Tom Dieck & Jung, 2017) [24]. VR can transport users to virtual reconstructions of historical sites or simulate complex scientific phenomena, offering experiential learning opportunities inaccessible in traditional formats (Radianti et al., 2020) [23].

These technologies support diverse learning styles and can particularly benefit users with disabilities by providing customizable accessibility options. As noted by Johnson et al. (2019) [25], AR and VR in educational libraries encourage experiential and active learning, thus aligning with contemporary pedagogical theories.

8.3 AI-curated Digital Exhibits and Immersive Educational Experiences

AI's ability to process vast amounts of data and identify meaningful patterns enables the curation of personalised and dynamic digital exhibits. AI algorithms can analyse user preferences, previous interactions, and broader cultural trends to tailor content delivery and exhibit design (Packer & Kumar, 2020) [28]. This facilitates the creation of exhibits that are not only informative but also highly engaging and relevant to individual users or specific community groups. Such approaches transform passive consumption of information into participatory learning, supporting lifelong learning goals and community outreach missions of modern libraries.

8.4 Evolving Role of Librarians as Digital Curators

The rise of AI necessitates a fundamental shift in the professional identity and functions of librarians. Rather than being custodians of physical collections alone, librarians will increasingly assume the role of digital curators and knowledge ecosystem managers (Lankes, 2016). This expanded role involves overseeing AI tools, ensuring ethical data use, and guiding users in navigating complex digital information environments. Librarians will act as mediators between AI systems and users, interpreting AI-generated insights, maintaining metadata quality, and fostering digital literacy to empower patrons. Their expertise will be critical in curating trustworthy, contextually rich information resources and combating misinformation in AI-driven content streams (Floridi, 2019)[30].

Furthermore, librarians will contribute to the development and refinement of AI algorithms by providing domain knowledge and advocating for inclusive, equitable technologies that reflect diverse user needs and values (Crawford and Paglen, 2021)[31]. As digital curators, librarians will help create adaptive knowledge environments that support research, education, and community engagement in increasingly hybrid physical-digital library spaces.

9. Conclusion

Artificial Intelligence (AI) presents a transformative opportunity for libraries, promising to significantly enhance operational efficiency, personalisation of services, and equitable access to vast knowledge resources. By automating routine tasks such as cataloguing, inventory management, and user query handling, AI enables libraries to optimise workflows and allocate human expertise toward more complex and creative functions (He, Zhang, & Xu, 2020)[16]. Beyond efficiency gains, AI-driven systems facilitate highly personalised user experiences, tailoring recommendations and learning pathways to individual preferences, thereby fostering deeper engagement and improved information discovery (Bawden & Robinson, 2020)[32]

However, the integration of AI into library environments also raises several challenges that must be proactively

addressed. Ethical considerations surrounding data privacy, algorithmic bias, and transparency remain paramount, requiring libraries to develop rigorous governance frameworks and adopt responsible AI practices (Floridi, 2019; Crawford & Paglen, 2021).[30]

In sum, the future library will embody a hybrid space where advanced AI technologies and human expertise converge, creating a vibrant, responsive, and inclusive knowledge environment. Through careful supervision and thoughtful innovation, libraries will continue to uphold their enduring mission—facilitating access to knowledge as a public good, fostering lifelong learning, and promoting informed citizenship in a digital age (Bawden & Robinson, 2020; Lankes, 2016)[33].

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