

Artificial Intelligence Application in Metadata Management and Databases in Library: Prospects and Challenges

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ABSTRACT

The study examines the ramifications of metadata management in the era of artificial intelligence (AI) for libraries and librarians. Considering the progress and pervasive presence of AI, together with initiatives to integrate it into library functions, it is probable that forthcoming trends will involve enhanced utilisation of linked data and predictive analytics, influencing the management and organisation of metadata in libraries. As technologies and user expectations advanced, libraries evolved into multifaceted hubs, impacting the responsibilities of librarians. It is essential to develop multitasking skills, acquire new knowledge, and broaden experience across several professional domains aimed at improving metadata management by library professionals utilising artificial intelligence (AI) techniques. Despite the significant advantages of AI, human oversight is crucial; libraries must prioritise staff training and policy updates to facilitate efficient AI integration. Librarians ought to be positive and driven by productivity in their professional endeavours.

Keywords: *Metadata Management, Artificial Intelligence, Digital Librarians, Modern Libraries, Skills Development*

Introduction

The surge in data generation and management underscores the necessity for a reliable, cohesive view of an organization's data assets and creates a substantial demand for skilled professionals, libraries inclusive. Numerous libraries adopt automation to mitigate talent shortages, regulatory unpredictability, and the exponentially increasing volume of data via artificial intelligence (Diseiye et al., 2024). However, AI offers prospects including the automation of metadata generation, enhancement of resource discoverability, and effective management of extensive digital collections (Adeleke, & Okoye, 2021). The issue is that the continuous influx of AI-driven technologies exacerbates individuals' fear of missing out, but it should rather encourage and compel librarians to develop themselves

and become more professional (Abdulsalami et al., 2024).

Metadata is organized information that enables the identification, location, and retrieval of a resource or resources in the libraries (Cox, 2023). Individuals engaged with library metadata are referred to as metadata librarians or cataloguers. Metadata librarians and cataloguers facilitate research by generating, archiving, augmenting, rectifying, and sustaining the data that characterizes various library resources. Patrons seldom encounter metadata librarians and cataloguers; yet, their efforts enable users to enter a library or search the online catalogue to locate necessary resources with the use of artificial intelligence tools, thus metadata serves as the driving force behind the library catalogue (Priya, & Ramya, 2024).

Artificial intelligence methodologies, such as natural language processing tools like Aria,

GPT, Bard, and Anthropic, can autonomously extract critical information from documents and generate metadata entries (Chowdhury, & Gibb, 2019). Machine learning algorithms can utilize pre-existing metadata for training, enabling predictions based on factors such as title, originator, and subject. Libraries are employing these technologies to enhance workflow efficiency; yet, the quality monitoring and validation of auto-generated information still necessitate human discernment (Adeyinka et al., 2023). The introduction of AI can diminish the time allocated to routine metadata activities, enabling library staff to concentrate on more substantial responsibilities.

Nigerian and African university libraries encounter difficulties in providing efficient access to their collections owing to insufficient metadata and antiquated systems (Adeyemo, 2021). The rapid proliferation of resources renders manual cataloguing of new print and electronic materials impractical, while catalogue backlogs and inconsistent metadata quality hinder resource discovery and accessibility. Furthermore, the majority of African university libraries continue to depend on antiquated methods that were not initially intended for large digital collections or distant accessibility (Ajakaye, 2021). Libraries encounter difficulties in efficiently categorizing electronic materials, providing virtual reference services, and guaranteeing discoverability on online platforms, which may hinder their ability to meet the educational demands of 21st-century learners (Babatunde, 2024). These challenges could be enhanced via the integration of intelligence in the library operation by professional librarians who know intricacies and how to operate and use artificial intelligence tools. It is on this premise that this paper tries to address the place of libraries and librarians in managing metadata in the AI environment or era.

Artificial Intelligence in Management of Databases

Artificial intelligence, in essence, is the replication of human intellectuals in computers, which are programmed to exhibit human-like thinking and learning capabilities. It includes a range of methods such as machine learning, natural language processing, and neural networks. Artificial Intelligence is an interdisciplinary domain that aims to bestow machines and computers with intelligence resembling that of humans (Martin, 2020). It includes a variety of technologies such as machine learning, natural language processing, and computer vision. AI enables robots to replicate human cognition, carry out intricate tasks, and enhance their performance by utilizing acquired data. The applications of ES, Natural Language Processing (NLP), robots, and chatbots have enhanced efficiency and enhanced library services especially in databases (Hu, & Wang, 2019). Prior scholars have asserted that the future capacity of artificial intelligence (AI) to further alleviate library operations is vast. Artificial Intelligence (AI) has made substantial progress in numerous domains, including database administration (Ogunleye, & Adegbilero-Iwari, 2019). Due to the increasing need for effective data handling, traditional database management systems have proven insufficient for enterprises. AI plays a crucial role by offering sophisticated functionalities that completely transform the way we handle and examine data. Artificial intelligence approaches are revolutionizing the field of database management (Fernández-Molina, et al. 2021). This blog post will examine the role of artificial intelligence (AI) in advanced database administration. It will discuss the advantages, difficulties, and restrictions of AI in order to provide you with a clear understanding of how your business can profit from these technologies.

As a result, it (AI) alleviates the workload of library workers and improves accessibility for users who are not physically

present. Adebayo (2022). AI not only enhances user-facing services but also provides library managers and decision-makers with vital insights obtained through data analytics and predictive modeling. AI technologies empower libraries to make well-informed decisions about collection creation, space utilization, and service optimization by studying usage patterns, resource allocation trends, and user demographics. Although university libraries have great potential, the incorporation of AI is not without difficulties. The adoption and execution of AI-driven solutions face considerable obstacles due to limited technological infrastructure, insufficient finance, and a scarcity of experienced staff. Furthermore, the importance of strong governance frameworks and ethical norms in the use of AI technology is emphasized by concerns related to data privacy, algorithmic bias, and ethical consequences. Adeleke, (2021).

AI comprises a wide range of technologies and applications that try to imitate human cognitive processes, including learning, reasoning, and problem-solving, in machines. AI-driven solutions in library services provide disruptive capabilities in multiple domains, such as information retrieval, recommendation systems, virtual aid, and data analytics. Smith (2020) posits that AI technologies possess the capacity to transform library services by automating mundane chores, augmenting search capabilities, and customizing user interactions. Through the utilization of machine learning algorithms and natural language processing techniques, libraries can enhance the ability to find materials, expedite operational processes, and offer more prompt and user-focused services.

A library database is essentially a digital compilation of published materials. Library databases often catalogue articles from many sources such as journals, periodicals, and newspapers. Some databases are specialized in specific fields, while others cover a wide range of topics (Olayinka,

2010). The library resources are made accessible to library users through the library catalogue, which is a collection of catalogue cards carrying information on the reading material in typed or printed form. Data is structured into discrete units called 'data fields'. A 'data field' is a constituent of a record that corresponds to an attribute. A single record can include multiple data fields. For instance, a book record consists of many fields such as 'Author Field', 'Title Field', 'Edition Statement Field', 'Publisher Field', 'Place of Publication Field', 'Year of Publication Field', and so on. When these fields are combined, they create a record. A data file is formed by a collection of connected entries that all adhere to the same type and format.

A database is a collection of interconnected records that have a certain structure for accepting, storing, retrieving, and sharing data (Taylor, 2020). It is designed to meet the needs of various users and can be used for one or more applications. Since their inception, libraries have been manually handling data management in their current format. The library resources are made available to library users through the library catalogue, which is a collection of catalogue cards holding information on the reading materials in typed or printed form (Onwudinjo, Ogbonna, & Nwadiogwa, 2015). Contemporary libraries have incorporated computational capabilities to handle the management of these records. Database Management Systems have undergone significant advancements during the past four decades, transitioning from manual to computerized systems (Umar, & Sokari, 2020).

Advantages of Application of Artificial Intelligence in Management of Library Databases

Human beings, burdened with a highly productive intellect, are constantly seeking superior options. If the new option is determined to be more cost-effective and productive than the current one, he would transition to the former. In the quest to

navigate various strategies for managing library databases via application of artificial intelligence, some advantages were propounded by Taylor, (2020). as follows:

- AI technologies are essential for enabling open access programmes, digital scholarship, and collaborative research efforts. They provide tools for text and data mining, content analysis, and scholarly communication.
- Libraries are using a user-centric design approach to create AI-powered services and interfaces that are accessible, inclusive, and sensitive to the different requirements of users, including individuals with disabilities and marginalized communities.
- With AI, collaborative initiatives and consortia agreements will promote the exchange of knowledge, pooling of resources, and joint investment in AI infrastructure and skills. This allows smaller universities to take advantage of economies of scale and shared resources.
- The advent of voice-enabled interfaces and chatbots, supported by natural language processing technologies, facilitates more intuitive and conversational interactions between users and library systems.
- AI technologies are essential in achieving inclusive and accessible library services by eliminating obstacles to information access and catering to the different requirements and preferences of users.
- Artificial intelligence (AI) powered solutions, such as speech recognition, text-to-speech conversion, and image identification, allow libraries to offer several formats and adaptable interfaces for patrons with disabilities, including visual impairments, dyslexia, and mobility constraints.

- AI-driven translation services and multilingual interfaces improve the accessibility of library materials for individuals who are not native speakers and international students, fostering linguistic variety and cultural inclusiveness within the academic community.

Ethical and Societal Implications

AI systems may occasionally mirror the biases present in the data they are trained on, resulting in discriminating results. AI systems pose a potential threat of exhibiting prejudice, whether it is deliberate or unintentional, which could result in adverse consequences for specific demographic groups. University libraries are adopting AI technology to improve their service delivery and engage users. However, they must also address ethical and societal concerns including data privacy, algorithmic bias, and digital literacy. Taylor (2020) highlights that the integration of AI in library services gives rise to apprehensions surrounding data security, confidentiality, and user consent. These worries mostly revolve around the gathering, retention, and examination of patron data for personalized suggestions and focused marketing.

Moreover, algorithmic prejudice and discrimination provide substantial obstacles to the fair and impartial delivery of library services, since AI systems might unintentionally mirror and sustain existing biases, preconceptions, and inequities. Libraries should have transparent, accountable, and inclusive procedures when developing, implementing, and assessing AI technology in order to minimize the potential for bias, discrimination, and unanticipated negative outcomes.

The integration of AI presents several prospects for university libraries databases, according to (Adebayo, & Ibrahim, 2022):

- **Operational Efficiency:** Artificial intelligence (AI) can assist librarians in automating the process of creating and extracting metadata, improving the quality and uniformity of

bibliographic entries, and detecting and rectifying errors and discrepancies.

- **User Experiences:** Artificial intelligence (AI) can assist librarians in identifying novel and developing subjects, trends, and patterns in the realm of information by utilizing techniques like as data mining and machine learning.
- **Easy Information Retrieval:** Artificial intelligence (AI) search algorithms and recommendation systems enhance users' capacity to efficiently explore extensive digital collections, resulting in enhanced discoverability and access to pertinent information.
- **Data-driven Decision Making:** AI-powered analytics offer useful insights into user behaviour, patterns of resource usage, and trends in collection, empowering libraries to make well-informed decisions regarding the allocation of resources, development of collections, and enhancements in services.

Challenges

Although there are potential advantages, the application of AI in the management of university libraries databases is not devoid of difficulties and factors to be taken into account:

Infrastructural issue: Numerous university libraries suffer from inadequate technology infrastructure and resources to facilitate the execution of AI-driven solutions, such as high-speed internet access, hardware capabilities, and software compatibility.

Financial constraints: These constraints include difficulties in acquiring software licences, training programmes, and technical support services.

Skills and capacity building: The university libraries industry lacks a sufficient number of trained professionals who has knowledge in AI technology and data science. To tackle this skills gap, it is necessary to implement focused training

programmes, professional development efforts, and establish partnerships and seek expertise from external sources.

Ethical and legal implications: The utilization of AI in databases management gives rise to ethical and legal considerations pertaining to the protection of data privacy, algorithmic bias, intellectual property rights, and user permission. Libraries should develop strong governance structures and ethical norms to guarantee the responsible and transparent utilization of AI technologies.

Conclusion

AI is transforming the way businesses handle their databases by offering sophisticated features including real-time insights and decision-making, higher data accuracy, improved analysis capabilities, and increased efficiency. AI has become an essential tool for firms aiming to maintain competitiveness in the current digital environment due to its capacity to automate workflows and enhance process efficiency. In order to succeed in our fast-changing digital landscape, businesses must fully adopt and integrate AI into their modern database management systems. If you aspire to attain expertise in computer applications, specifically advanced database management. It can improve the effectiveness, precision, and user satisfaction in library cataloguing, management, and operations. AI technology can assist in providing support for reference services, information retrieval, cataloguing and classification, as well as collection management.

Recommendations

Following the above challenges encountered in the application of AI in the management of library databases in university libraries, these recommendations have been put in place as the way forward:

- **Provision of technological infrastructure:** University libraries should give priority to investing in technology infrastructure to facilitate the implementation and deployment of AI-driven solutions. This involves

enhancing the hardware, software, and network capabilities to guarantee that AI systems are compatible, scalable, and reliable.

- **Self-development:** Library administrators ought to establish extensive capacity building and training initiatives to provide library personnel with the essential skills and competencies required to properly utilize AI technologies.
- **Collaboration:** Libraries ought to consider engaging in collaborative partnerships and consortia agreements with other institutions, industry partners, and technology suppliers in order to exchange resources, expertise, and best practices in the deployment of artificial intelligence.
- **Digital Literacy:** Libraries should give priority to user education and digital literacy programmes in order to foster knowledge, comprehension, and responsible utilization of AI technologies among library users. This encompasses providing workshops, tutorials, and online resources that cover the fundamental principles of artificial intelligence, ethical considerations, and practical applications.
- **Ethical Governance and Policy Development:** Library administrators and policymakers should establish comprehensive governance frameworks, ethical guidelines, and regulatory frameworks to guarantee the accountable and transparent use of AI technologies in library services.

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