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The Role of Artificial Intelligence in Library and Information Science

Pratik Dhepe
Librarian,
Rajeev Gandhi College of Management Studies, Ghansoli, Navi Mumbai

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Abstract

The paper examines the various applications of AI in libraries, as well as the advantages, operational and ethical problems, and necessary remedies to lessen these difficulties. Libraries can optimise AI's potential while guaranteeing its ethical, equitable, and efficient application by tackling these issues. Artificial Intelligence (AI) is revolutionising traditional library operations through improved accessibility, user experience, and operational efficiency through its integration with Library and Information Science (LIS). Automated cataloguing, database creation, information retrieval, digitisation, optical character recognition (OCR), and robotics are just a few of the ways artificial intelligence (AI) is being used in libraries to improve resource discovery and administration. Better information retrieval, improved metadata management, and the automation of repetitive operations are only a few advantages of these developments. But there are drawbacks to the use of AI as well, including issues with copyright, bias, data privacy, and security.

Keywords: - Artificial Intelligence (AI), Automation, Digitization, Library and Information Science (LIS), OCR, Classification, Research, Database,

1. Introduction

In terms of information management, libraries have always been at the forefront. Libraries are becoming smarter systems that can offer better services as a result of the development of artificial intelligence. The goal of artificial intelligence (AI), a branch of computational science, is to enable machines to solve complex and challenging problems in a manner similar to that of humans. Computers can comprehend and analyse human cognitive traits to produce an output or result by appropriating, modelling, and integrating them into algorithms. According to logic, artificial intelligence is a neural network, which is a system of synthetic neurones or nodes that replicates the biological functions of neurones in humans. It was created in a system to mimic how the human brain's neuronal activity is structured. As they move from one to another, the neural network as a whole produces well-informed choices. As it processes data, it models biological processes and makes educated estimates.

Definition Artificial intelligence

Artificial Intelligence (AI), a term coined by. emeritus Stanford Professor John McCarthy in 1955, was defined by him as "the science and engineering of making intelligent machines".

Artificial intelligence can be defined as. the capability of a device to perform functions that are normally associated with human intelligence, such as reasoning, learning and self-improvement (Willick, 1983).

Stuart Russell and Peter Norvig did in one of the most widely distributed books about AI called "Artificial Intelligence: A Modern Approach", define AI as "the designing and building of intelligent agents that receive percepts from the environment and take actions that affect that environment." (Russel & Norvig, 2016).

2. Objective of the Study

1. Examine the many uses of AI in libraries, such as collection administration, information retrieval, cataloguing, and user support.

2. Highlight how AI improves user experiences, expands information accessibility, and improves library operations.

3. Explain about the operational, technological, and ethical difficulties that come with integrating AI in libraries.

3. Literature Review

G. S. Chandrashekara and Mulimani, Mallikarjun (2024) The way libraries handle and make information accessible has changed significantly as a result of the incorporation of Artificial Intelligence (AI) into Library and Information Science (LIS) services. This article looks at how AI technologies affect cataloguing, information retrieval, user services, and data analysis, among other LIS-related topics. By facilitating individualised recommendations and effective information retrieval, AI-driven technologies like chatbots, recommendation systems, and natural language processing have improved user experiences. This article highlights AI's potential to improve library operations and information access for a variety of user communities by discussing its major advancements, advantages, difficulties, and future implications in LIS services.

One of the first uses of AI in libraries was the automation of cataloguing and metadata production. Machine learning algorithms simplify the cataloguing process, guaranteeing accuracy and efficiency, as shown by tools like MARC and BIBFRAME (Smith, 2020). According to studies by Breeding (2021), AI can improve metadata interoperability through linked data models, which in turn improves the discoverability of resources across digital platforms. AI-powered search engines and discovery systems have revolutionised library information retrieval. While algorithms hone search results according to user behaviour, natural language processing (NLP) enables more intuitive user interaction with search engines (Jones, 2019). The usefulness of AI in personalised recommendations, where computers examine user preferences to provide pertinent resources, is highlighted by research by Ghosh (2022). AI-powered chatbots and virtual assistants are becoming more prevalent in libraries. Research by Patel et al. (2021) emphasises their function in answering often asked questions, assisting patrons with library catalogue navigation, and offering round-the-clock customer help. While increasing user pleasure, these methods drastically lessen the strain for librarians. Predictive analytics is being used by libraries to improve collection management and development. Carter and Miller's (2021) studies examine how AI uses trends, user demographics, and circulation data to make well-informed decisions on weeding and acquisitions. This strategy guarantees that libraries continue to be sensitive to the requirements of their patrons.

4. AI Applications in Libraries

4.1 Automated Cataloging and Metadata Creation

One of AI's (artificial intelligence) most revolutionary uses in libraries is automated cataloguing and metadata generation. AI technology ensure faster, more accurate cataloguing that improves resource discoverability by streamlining the process of organizing and indexing library content.

4.1.1. Automatic Classification: The technique of automatically classifying library items into predetermined classifications or subject areas without the need for human participation is accomplished by artificial intelligence (AI) and machine learning (ML) systems. Traditional classification schemes have been revolutionised by this technology, which has made the procedure quicker, more reliable, and more scalable.

4.1.2. Subject Tagging: Subject tagging is the practice of giving library assets descriptive keywords or phrases (tags) so that users may quickly find resources based on themes, topics, or other pertinent criteria. The introduction of artificial intelligence (AI) has improved the efficiency, consistency, and scalability of subject tagging. AI systems improve resource access and discovery by automatically creating pertinent tags based on their analysis of resource

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content.

4.1.3. Linked Data Integration: By using web-based, machine-readable formats to link library materials to external datasets, linked data integration enables users to easily find and access information on several platforms. In the digital age, artificial intelligence (AI) is essential for automating the linking and contextualisation of data, which improves the interoperability, discoverability, and relevance of library collections.

4.2 Digitization and Optical Character Recognition (OCR) in Libraries

Two important technologies that have completely changed how libraries maintain and make physical holdings accessible are digitisation and optical character recognition (OCR). When combined, these technologies make it possible to transform handwritten or printed documents into digital formats, increasing their accessibility, searchability, and cross-platform shareability.

4.2.1 Benefits of Digitization and Optical Character Recognition (OCR) in Libraries

Digitization and **Optical Character Recognition (OCR)** are pivotal in modernizing library practices, offering significant advantages for both libraries and their users. These technologies facilitate the conversion of physical resources into digital formats, making materials more accessible, searchable, and easier to preserve.

Enhanced Availability

Global Access: By removing geographical restrictions, users can access library materials from any location in the world thanks to the ability to access digital resources remotely. 24/7 Availability: Users can access resources at any time with digital content, which increases user happiness and convenience overall. Support for Disabled Users: Texts that have been digitized can be transformed into a variety of accessible formats, such as text-to-speech or fonts that can be adjusted, making the materi-als more inclusive of people with impairments.

Improved Searchability

Text-Based Search OCR makes it possible to turn scanned documents into machine-readable text, which allows you to look for particular words or phrases inside of them. Information retrieval is significantly enhanced by this. Effective Data Discovery By indexing and classifying vast amounts of text, OCR enables users to locate the precise information they require more quickly without having to search through entire pages or physical stacks. Faceted Search Libraries can incorporate sophisticated search functions like subject, author, date, and keyword filtering by using OCR and metadata generation.

4.2.2 Assistance for Academic Research and Education

Aids in Data Mining and Analysis: After being digitised and OCR-processed, texts can be examined using sophisticated computational tools for studies in content mining, sentiment analysis, and textual analysis.Collaboration and Interdisciplinary study: Researchers both inside and outside the library community can more easily share and collaborate thanks to digital materials, which promotes interdisciplinary study and innovation. Global Resource Sharing: By sharing digitised texts with other libraries, archives, or educational institutions as well as across platforms, knowledge can be disseminated more widely.

4.2.3 Efficiency in Space and Cost

Decreased Need for Physical Storage: Libraries can drastically cut down on the amount of physical storage space they require by turning physical resources into digital versions. This is especially crucial for huge collections. Reduced Maintenance Costs: The logistics of overseeing physical storage facilities and the necessity for expensive physical maintenance and repairs are eliminated by digital preservation. Simplified Access and Operations: Libraries can increase the efficiency and economy of their

operations by streamlining processes for resource management, cataloguing, and tracking through the use of digital tools.

4.3 Robotics in Library Management

The integration of automated technology and robotic systems to improve and expedite a range of library operations, from resource management to user services, is known as robotics in libraries. Libraries are changing from conventional locations to highly automated, user-centric facilities as a result of the development of sophisticated robots. In addition to increasing productivity, robotics in library operations also improves accessibility, improves user experience, and lessens the physical strain on employees.

4.3.1 Material Handling Automation:

It is possible to program robots to autonomously retrieve, arrange, and shelve books. These robots carry things to and from storage places, expediting the process and lowering the need for manual labour. They are frequently utilised in Automated Storage and Retrieval Systems (ASRS). Inventory management: Camera-equipped and scanner-equipped robots may search library shelves on their own to look for lost or missing books. This guarantees that resources are appropriately categorised and current and aids in maintaining an accurate inventory.

4.3.2 Robots for Library Services:

Interactive Information Assistance: Library robots can serve as virtual assistants, giving patrons information, responding to simple questions, giving directions, and even assisting with chores like finding books or scheduling study spaces. Conversational interfaces can be included into these robots' designs to improve user experience. Robotic Delivery Systems: In huge libraries with intricate layouts, some libraries employ robots to bring books and other materials straight to users. This automated distribution system offers a creative approach to managing user requests while expediting the

book retrieval process.

4.3.3 Automation of Robotic Processes:

Self-Checkouts: Self-checkout systems are being implemented by libraries so that users can scan books and check them out without assistance from personnel. These systems automate the circulation process through the use of robotics and RFID technologies.Automated Cataloguing: Robots can help in cataloguing and updating library systems. This includes organising data, tagging items for greater searchability, and entering new resources. Accuracy and quickness in handling massive amounts of resources are guaranteed by this automation.

5. Benefits of Artificial Intelligence (AI) in Library and Information Science (LIS)

Libraries are being transformed into more effective, accessible, and user-friendly spaces through the incorporation of Artificial Intelligence (AI) in Library and Information Science (LIS). AI has become a vital tool in contemporary libraries due to its capacity to improve information retrieval, automate tasks, and customise user services. The main advantages of AI in LIS are listed below:

5.1 Improved Information Retrieval

Advanced Search Features: Artificial intelligence (AI)-powered search engines and systems are able to evaluate user searches and deliver more precise and pertinent results. Natural Language Processing (NLP) makes it easier for people to search for information by enabling them to use conversational language. Contextualised Search AI programs are able to comprehend the context of a search query and rank the results appropriately, giving users more focused and targeted information. This lessens the need to sift through pointless results, improving the user experience. Semantic Search AI makes it possible to perform semantic searches, which help determine the meaning of words and phrases and produce more accurate results. In huge databases, where specific key-

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word matches might not always produce the best results, this is very helpful.

5.2 Improved Metadata Management and Cataloguing

Automated Metadata Generation By examining text, photos, and other multimedia components, artificial intelligence (AI) technologies can produce metadata for digital information automatically. This guarantees consistent and correct metadata while minimizing the amount of manual cataloguing labor. Intelligent Classification Materials can be categorized by AI systems, especially machine learning models, according to their context, metadata, and content. This helps libraries keep accurate and current records and removes errors in manual classification. Tagging and Indexing: AI can automatically tag resources with pertinent keywords, index terms, and tags, which facilitates the classification and organization of large volumes of data. Both discoverability and search results are improved as a result.

5.3 Automating Routine Library Activities

Automated Classification and Cataloguing AI can lessen the labor of library employees by automating the classification, cataloguing, and indexing of new resources. Resources can be analyzed and categorized by machine learning algorithms using metadata and content. Effective Resource Management: AI technologies can assist with inventory management, automate check-ins and check-outs, and track library resources. As a result, less physical labor is required, and mistakes resulting from improper resource placement or classification are reduced. Document Processing: AI technologies can help with the processing and digitization of paper documents. Printed materials can be transformed into digital formats using optical character recognition (OCR) software, which AI systems can subsequently index, organize, and search.

6. Challenges and Ethical Considerations for AI in Library and Information Science

While there are many advantages to integrating artificial intelligence (AI) into library and information science (LIS), there are also some drawbacks and significant ethical issues. To guarantee that AI technologies are applied in libraries in a responsible, fair, and efficient manner, these issues must be resolved. The following are some of the main obstacles and moral dilemmas raised by AI in LIS:

6.1 Security and Privacy of Data

Libraries handle enormous volumes of private and sensitive information, such as user interactions with library systems, personal preferences, and borrowing histories. For AI systems to work well, they frequently need access to this data (e.g., for personalized suggestions, predictive analytics, or chatbots). There are serious privacy and data security issues with the usage of AI. The confidentiality of library patrons may be jeopardized by unauthorized access or exploitation of personal information. AI systems may also unintentionally gather more data than is required or infringe on users' privacy rights.

6.2 Discrimination & Bias

Biases in the training data might be inherited by AI systems, especially machine learning models. As a result, some groups or points of view may be disproportionately favoured over others in search results, content classification, or recommendations. AI bias has the potential to worsen already-existing disparities, marginalise particular populations, or perpetuate stereotypes. Biassed algorithms in libraries may lead to unequal access to information, making it more difficult for diverse or under-represented user groups to locate pertinent materials.

6.3 Effect on Library Employee Positions

The implementation of AI in libraries may result in adjustments to staff responsibilities, such as the automation of jobs that have historically been done by people. Concerns are raised on the need for reskilling, changes in workforce requirements, and job displacement.

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As AI becomes more widely used, library employees may lose their jobs or have their responsibilities changed, which could result in job insecurity or less prospects for professional growth. The topic of how libraries might support their staff in adjusting to these changes raises ethical concerns.

6.4 Copyright and Intellectual Property Concerns

AI raises questions about copyright infringement even while it can assist libraries with digitizing, classifying, and making materials more accessible. AI-powered tools may unintentionally breach intellectual property rights by using copyrighted materials. Libraries need to make sure AI systems respect copyright regulations and content producers' intellectual property. Unauthorized use or duplication of copyrighted content may give rise to legal issues and moral conundrums involving information access.

7. Conclusion

Artificial intelligence is changing the field of library and information science by offering creative ways to improve user experience, expedite operations, and improve library services. Automated cataloguing, personalized suggestions, and robotic systems are examples of AI-driven technologies that improve accessibility and resource management, enabling libraries to adapt to the changing demands of their users. But there are also significant ethical questions raised by the use of AI in libraries, including those pertaining to algorithmic bias, data privacy, and the effects on library staff positions. Libraries must overcome these obstacles by putting in place inclusive, equitable, and transparent AI systems while making sure that all legal and ethical requirements are met. AI has the potential to remain a potent instrument for updating libraries, making them more user-focused, responsive, and efficient with proper preparation and supervision.

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