IOSR Journal Of Humanities and Social Science (IOSR-JHSS)
Volume 31, Issue 1, Series 1 (January, 2026) 43-47
e-ISSN: 2279-0837, p-ISSN: 2279-0845.
www.iosrjournals.org

Application of Artificial Intelligence (AI) in Libraries

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Abstract:
Artificial Intelligence (AI) has brought about new prospects for expanding research in all areas. The presence of artificial intelligence technologies in all spheres of work has made the future promising. The application of AI has contributed immensely to the provision and use of library information resources and has helped to achieve the goals and objectives of the library. Librarians need to be innovative in their thinking to stay relevant in their jobs because AI has found numerous applications in libraries ranging from book filing to book delivery. Its application brought about several new possibilities in the library such as connecting physical library information resources and electronic resources, and also associating video help with physical information materials and objects. The chapter discussed some components of AI, library services it can be applied to, the benefits of its application, as well as the challenges libraries face in the application of artificial intelligence in the library.

Keywords: *Artificial Intelligence, Libraries, Machine Learning, AI Tools*

Date of Submission: 23-12-2025 Date of Acceptance: 03-01-2026

I. Introduction

Artificial Intelligence (AI) is an aspect of computational science that is concerned with making machines provide answers to complicated and difficult issues in a way that humans do. Human cognitive characteristics are appropriated, modeled, and integrated as algorithms in a manner that computers understand and can process to give an output or result. In its logical approach, Artificial Intelligence is a neural network, which is a network of artificial neurons or nodes that mimics the human biological processes of neurons. It was developed in a system to imitate the structural organization of the neural activities of humans. The neural network collectively generates informed decisions as they pass from one to the other. It models biological processes and makes best guesses as they process data. Neural networks are hence a certain form of machine learning system, which is an AI system. Artificial intelligence started as a field in the 1950s and its application to libraries started in the 1990s.

Organizations and institutions must adapt to evolving technology to suit their end-user demands in the twenty-first century, which is an era of rapid transition and technological development. Artificial intelligence in libraries can be considered as a collection of techniques that enable machines to detect, understand, behave, learn, and execute administrative activities, providing libraries with cutting-edge technologies. Librarianship as a profession is known for incorporating cutting-edge technologies not just for information dissemination. Artificial Intelligence has become the new emerging trend for libraries. Artificial intelligence has proven to be a breakthrough for information-driven sectors such as law, health, commerce, the auto industry, etc. Artificial intelligence is an extensive, comprehensive field of study that non-specialists often find it difficult to grasp without some basic knowledge. AI has brought about new prospects for expanding research in all areas. New systems are now being developed by researchers to mimic librarians' thought processes and exhibit human behaviours which were before impossible. ICT devices, computer systems, and other gadgets are progressively becoming technologically advanced and are built to reason and function as humans do, also with the perception of Human Intelligence (HI) getting transformed into Artificial Intelligence (AI). Tacit human knowledge has to be extracted and used to build an intelligent system (that is, to build an AI device, relevant characteristics and knowledge are first extracted from human experts, and these characteristics and knowledge are often heuristic in nature). Computer-based products and services are applied and used for various library operational processes as well as to provide different library services and produce output products. The application of artificially intelligent systems will help simulate human decision making. Library intelligent systems utilise AI tools to provide patrons with knowledge-based services. Artificial intelligence is widely spread and should be adopted and applied to the library.

II. Components of Artificial Intelligence

The two major components of artificial intelligence are machine learning and its subset and deep learning.

Machine Learning

Machine Learning (ML) is an artificial intelligence (AI) technology that enables developed systems to train and gain new knowledge on their own without being specifically taught. Data is fed into a consuming machine-learning system, which controls how the system outputs or reacts. The programming can also be unique; a system for machine learning can be trained to recognise certain models in case studies by exposure to the enormous data collection of the case study. The system may also be created repeatedly when its own output is used as an input or data source, it can be tested and programmed on an ongoing basis. ML systems can even be constructed as sets or groups where there is a pair, each in collaboration or in competition, of machine learning systems. The focus is on developing computer algorithms that access and use data for training themselves. Machine learning systems can play a pivot function in the provision of library information resources and services. Examples of Machine Learning tools within AI include: Big Data, Text Data Mining (TDM), Robotics, Pattern Recognition, and Chatbots.

Deep Learning

Deep Learning (DL) is a machine learning subset. The human brain inspires the algorithms and artificial neural networks which then learn from enormous amounts of data. Even with a data set that is unstructured, very diversified and interconnected, machines solve complicated issues through deep learning. Natural Language Processing (NLP), Image Processing (IM), and Neural Networking are examples of AI tools used in the context of Deep Learning. Natural Language Processing Natural Language Processing (NLP) allows computers to comprehend the primary language impressions within a question or solution. The design of subject indexing, development of information retrieval systems, and bibliometrics are all examples of how NLP can be used as crucial components in the establishment of a digital library.

III. Libraries and Artificial Intelligence

Technology has been a part of each and every human work. The presence of artificial intelligence technologies in all spheres of work has made the future promising. The world is becoming increasingly centered on using microelectronic-based technologies for information processing, handling, collection, retrieval, and utilization. Computer systems can now model numerous human competencies, such as word recognition, estimating, comprehending, conversing, recalling, completing shapes and figures comparison, sketching, drawing conclusions, and even active learning with the users. Scholars are building hardware and software that can simulate intelligent human features in order to boost computers' capabilities and power. Artificial intelligence has revolutionized the way libraries think and operate. Libraries in the modern age are technology absorbers from time to time. AI has found numerous applications in libraries, ranging from book filing to book delivery. The effect of artificial intelligence and its components on libraries in the near future will be enormous; the distinct differences will be different from what is currently attainable in the library. The majority of the library-oriented artificial intelligence applications developed until today or currently under development are basic business aids of the runtime. Potential applications include intelligent systems that help perform different tasks for the library, such as people, budget, collection development, scheduling, etc. These applications include systems for enhancing user services, such as ready references and information storage and retrieval as well as use. AI applications give libraries the opportunity to change the emphasis and attention, especially from traditional ways of carrying out operations, to modern and more sophisticated means of achieving these operations/routines. AI gives a very useful shortcut to applying knowledge (making intelligent decisions) and producing better outcomes (user achieved satisfaction). Libraries will now have to focus attention on enhancing access to content rather than physical availability with the application of AI. AI sub-areas and their components aim to simulate human intelligence with computers. Hence, the application of AI can never be a threat to librarians, rather supplementary. AI provides a competitive advantage and an approach for libraries to provide improved service to their clienteles in this era of information explosion. Prospects to reach and entice potential users with high literacy skills are provided with the application of AI through advanced service provision and user experiences. The rapid, tangible, and demonstrable capacity to give genuine, instant benefits to library professionals and users makes the application of AI stand out in the library. Hence, librarians need to monitor the advancements in AI technologies and cautiously understand how they influence users' information needs, information-seeking patterns, learning, and teaching activities, and how typical library services and operations are currently carried out.

AI influences both library technical services and readers' services. In technical services, it enhances the management and development of library collection metadata, users' data, and the statistics of library information resources used, through the application of AI tools such as Big Data and Text Data Mining. The

gradual introduction of AI tools has been noticed in readers' services and information retrieval, such as natural language processing, pattern recognition, chatbots, and robotics.

IV. Library Processes and the application of Artificial Intelligence

AI for Cataloguing

Application of AI for cataloguing has concentrated on descriptive cataloguing because it is regarded as rule-based (AACR2). Artificial intelligence techniques can be applied through two approaches for cataloguing of information materials. First, a human-computer interface, in which the cataloguing effort is split between the intermediary (human) and the support system (AI); and second, a system with full cataloguing abilities integrated with an electronic publishing system, in which text is generated digitally, it can then be passed through knowledge-based systems, and the cataloguing process is done with little or no human intervention. Researchers have faced stern challenges in every endeavour to transform AACR2 into the highly structured guidelines required for coding into the system. Digital libraries can utilise expert systems in the process of cataloguing and going through digital collections. The use of this digital library based expert system will enable patrons to go through the collection, read through the resources, and download the preferred information through the online system. The application of data mining aids the usage of intelligent library retrieval in cataloguing processes. Also, data mining can be used in online library systems to help establish users' information needs. They help library users' choice of appropriate keyword/expression in information retrieval. Several studies focus on the user-centered structure of recommender systems for library catalogues and also in other library divisions. Also, classification is an integral process in the organisation of knowledge. The following includes the application of AI tools for classification in the library: BIOSIS was developed as an indexer aid which uses a knowledge-base. It also uses a substantial amount of procedural knowledge to ascribe information materials to subject classifications automatically. BIOSIS utilises the details in the titles of biological materials to allot as many classifications as probable just like they would be allotted by human indexers. AI applications take good advantage of the structured indexing languages and practical information representation that may be utilised. Coal SORT is a conceptual browser which has no procedural knowledge but is designed as a searching or indexing tool. Coal SORT is mostly composed of the software that users require to exhibit parts of it, and also move about the conceptual structure and a framework-based semantical network. Environmental Pollution Expert (EP-X) looks like a coal SORT. A Knowledge-Based approach is used by both systems to concentrate on improving the interface. The knowledge base of EP-X comprises of a model group that expresses the structures known as the pragmatic relationship between concepts and a hierarchical frame-based semantic network of concepts. These patterns are known as conceptual information. Different categories of techniques have been used for semantic analysis of texts and multimedia objects. Artificial neural networks, Symbolic machine learning, statistics-based multivariate analysis, graph-based clustering and classification, and evolution-based programming are among the widespread techniques used. In this information age, researchers opine that these techniques will function as good substitutes for traditional processing, analysing, and summarising large amounts of diverse and dynamic multimedia information. The result of a semantic analysis procedure could be denoted in the form of semantic networks, decisions, predicate logic or rules. Distribution of activation-based inferencing methods is often used to navigate various large-scale knowledge structures, which can help in cataloguing and classification of library information resources.

AI for Circulation (OPAC)

Artificial intelligence can help with easy retrieval of library materials in the OPAC at the circulation area. NLP can assist in retrieving relevant information from catalogues, databases, indexes and help to reduce language barriers. Users can state their information requirements during the information retrieval process in their natural language, making the search and retrieval process easier and more fruitful. This enables users to state complex retrieval languages. Library users may not recognise the indistinctness of their search and retrieval strategy/method; this can be solved by the use of AI assistive technology in search tools. The usage of NLP for Dialog database searches would facilitate library users to search Dialog databases directly, with little or no assistance from information professionals. A clientele using an electronic catalogue in a library may desire to have the catalogue understand a particular keyword or a complete sentence. Human librarians are well trained in search & query as well as natural language, which puts them at an advantage and can act as an intermediary between the machine and the library clientele. Some URLs or web addresses are also case sensitive or have specific instructions that must be followed for perfect retrieval of the needed information resources.

AI for Collection Development

AI tools can be utilised in selecting vendors or book dealers for library materials. An intelligent system to identify a vendor or book seller can be designed based on previously successful transactions in supplying publications of a specific kind. Such tools would be of particular importance in the procurement of information

materials that are less routine, such as conference proceedings, publications in foreign languages or other countries, and certain technical reports, among others. Also, studies have revealed that AI systems have also been developed within the librarianship profession to assist in the process of selection. Such systems include: The Monograph Selection Advisor, which is an innovative effort in applying this emergent technology to building library information resources. Specifically, the system modelled the item-by-item decision task that a subject bibliographer carries out in selecting monographic resources. The system's knowledge base must be sufficient and the interface features must be sufficiently simple to ensure that the library can obtain the desired results from the AI system.

AI for Indexing

Indexing of library resources, especially periodicals, is another area where AI tools are being designed. The basis for document retrieval is indexing. The purpose of indexing is to enhance precision (ensuring that the fraction of the retrieved material is appropriate); and recall (the percentage of appropriate materials retrieved). The keywords which have been determined by an expert (indexer) or a body as being fundamental to human thought on a specific topic will be programmed into the electronic database in a way that will generate the citation on the computer screen for an article or material whenever a searcher inputs these keywords in the proper sequence into the system. Indexing a periodical article entails identifying key components, translating them into verbal descriptions, and choosing and allocating controlled vocabulary terminologies that are conceptually equal to the verbal descriptions. The purpose of automating the cognitive features of indexing is to enhance consistency and indexing quality. The indexing systems can automatically select the proper favourite terms to allocate the appropriate subdivisions based on the information provided by the indexer. As the applications become more enormous, pressing and diversified, several well-known information retrieval challenges have gotten much more critical in this network-centric information age. The most essential technique in IR comprises recognising vital characteristics in material. For example, automatic indexing & natural language processing are often used to spontaneously excerpt significant words or phrases from information materials, while texture, colour, or shape-based indexing and segmentation techniques are frequently employed to identify images. Speech recognition, voice recognition, and scene separation techniques can be used to identify important descriptions in audio and video streams in audio and video applications. The intelligent system can make interpretations and, based on the inference, it can take suitable action.

V. Benefits of Artificial Intelligence application in Libraries

In order to benefit from the application of AI in libraries, library staff need to have a shift in their view of AI. Instead of perceiving AI as a disruptive tool that would displace library professionals and traditional library practices, librarians and management can learn from how AI is perceived in other professions in which it is being applied. AI should be seen as a way to tackle problems in the actual world. AI Improves Operational Effectiveness and Efficiency Libraries can determine and boost the organisational effectiveness and efficiency of library services by enhancing the provision of information resources and service efficacy while decreasing operating costs through automation, digital asset management, and optimised research data governance. Collection analysis, visualisation, conservation and preservation, and reducing the cost of providing library services can be achieved with the development of artificial intelligence tools in library processes and services. Implementing intelligent systems for the provision of library information resources and services can help develop innovation or creativity that further improve operational effectiveness and efficiency. Opportunity to Engage Larger Audiences The library will be able to provide information services to a larger audience by enhancing search engine results with chatbots and location-based services. ML algorithms can also process content from thousands of resources immediately and replace the conventional examination of merely a percentage of 86 Applications. AI applications can integrate data on user touch points, previous interactions, and behaviours to identify needs and develop high-quality and engaging experiences for library users. The aim is to produce personalised, accurate research suggestions and even harmonise search results with individual expertise to provide more effective and efficient information resources and services. Helps Library Staff Achieve Their New Goals Application of AI cut down manual routines such as daily searches and referencing activities to minimum, Application of AI techniques will minimise human inaccuracies and inefficiencies. These intelligent systems can allow library personnel to engage in more valuable tasks, like supporting library users in drawing up reading lists, educating users to improve their scientific research, building library information resources, and other tasks.

VI. Challenges of Artificial Intelligence application in Libraries

Artificial Intelligence is still hampered by several technological, social and economic issues. Despite librarians and library administrators' increased recognition of the importance of integrating new technologies, there are still significant internal reservations prohibiting artificial intelligence techniques from entering the

information management sector. These challenges include but are not limited to the following: Financial Uncertainty Globally, whenever public funds and revenue dwindle and socio-economic or political changes are happening, cultural organisations and institutions such as libraries frequently suffer reductions in their allocations. Libraries can neither show value for financing nor demonstrate cost-effective practices for library users. All these require additional funding. The absence of appropriate information and knowledge concerning the operational benefits and effective cost-savings of the application of artificial intelligence techniques can offer to libraries makes it challenging for libraries and library personnel to establish the worth of incorporating these emerging technologies into library systems. Thus, today's libraries often swim in financial constraints and are unable to show value without major funding investment. Also, the majority of AI systems are proprietary software. Research into AI-based innovations is not yet a popular trend in libraries, and broader debate and clarification among experts is still required.

VII. Conclusion

The application of Artificial Intelligence is a developing technology in the field of librarianship. Artificial Intelligence has promising potential for ease and improved provision, processing, use, as well as security of information materials in the library. Researchers in LIS should collaborate with experts in AI to solve teaching and research problems related to the application of AI in libraries. This will open up opportunities in librarianship and the provision of information resources and services to library patrons will be effective and efficient. Despite artificial intelligence being applied in various aspects of the library, most of its applications are still in the theoretical stage, which is more or less limited and can not be really implemented. This is due to the fact that library AI hardware equipment and research investment is insufficient, big data collection and data mining are facing difficulties. Librarians should not be scared of these intelligent systems taking over their jobs, but should be ready to improve their knowledge to be able to engage these systems and improve their productivity.

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