

Applications of Artificial Intelligence in Library

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Abstract

We all aware of development of latest technology in every field, and the library science is not behind. This article provides an overview of the use of artificial intelligence (AI) in library services, including applications such as Expert Systems in Reference Services, Technical, Indexing, Acquisition and its application in Natural Language Processing, Pattern Recognition and Robotics in library activities. Cataloging, user recommendation systems, and data analysis. The article also examines the potential benefits and challenges of using AI in library services, and discusses future directions for research in this area. In this research paper the benefit and demerit of artificial intelligence are given.

Keywords: Artificial Intelligence, Library services, Expert Systems, Robotics, Machine Learning

1. Introduction

Intelligence is the ability to think and observe facts and skills and use them when required. Humans are born with a natural ability to recognize, reason/think and behave, which develops and better over time because of so many causes. Introduction of AI has built a new era in revolutionizing both technical and user services in libraries. Self-learning and self-doing performing capability of AI can be used in libraries for better interaction among machine-automated intelligent technologies of all library services. Artificial intelligence (AI) has the potential to transform many aspects of library services. With the rise of big data and the increasing complexity of library collections and user needs, AI can provide valuable insights and improve the efficiency and effectiveness of library operations. This article provides an overview of the use of AI in library services, and examines the benefits and challenges of adopting AI technologies. Finally, the article discusses future directions for research in this area.

2. Artificial Intelligence

Artificial intelligence (AI) is the ability enabled by a digital computer or computer-controlled machine or software replicating intellectual characteristics like intelligent organisms (human) in their functionality. Artificial Intelligence (AI) according to Nwakunor (2021), is the computer-controlled robots that think intelligently like human beings. These robots are controlled electronically with the aid of the computer by mimicking the competences of the human mind. Artificial Intelligence keeps records and analyses every action being made by the user. As a result of innovation in science and technology, Artificial Intelligence is used in all facets of life for human development and comfort. Artificial Intelligence (AI) is a suitable attempt to replace human power with the machine. The adoption of AI in the library will influence connectivity of information technology and actively support information usage as well as easing clients' search and immediately address their needs. The impact of artificial intelligence and advanced computer technology on the nature of future libraries will be enormous and the quality difference varies from experts (Vijayakumar & Sheshadri, 2019). According to Heath (2018), artificial intelligence is the technology that enables machines to have the abilities to plan, learn, reason, solve problems, move, and to some extent be creative. Accordingly, Liu (2016) viewed AI as intelligent machines or

intelligent systems that simulate human intelligence activities and extend the science of human intelligence. AI technologies also could be used to provide innovative real-time virtual reference services through mobile and social networking environments, by combining the existing library resources and third-party contents. Additionally, some other promising areas of AI in libraries include natural language processing, indexing systems, and application of robotics in library activities.

Artificial Intelligence (AI) is a vast and rapidly evolving field with a broad range of applications. Some of the major areas of AI are:

I. Expert Systems: Expert Systems are the knowledge based computerized systems which play role of intelligence. System serves as interface for providing access to the database and relevant information. An expert system is a computer program that provides expert advice, decisions or recommended solutions for a given situation. (wikipedia/ expertsystem, 2014) The different components of expert systems are: Knowledge base, Inference Engine, and User Interface.

II. Natural Language Processing (NLP): One of the long standing goals of computer science is to teach computers to understand the language we speak. The Ultimate generation of computer language is the Natural language. Artificial Intelligence scientists have succeeded in building Natural language interface to a large extent using limited vocabulary and syntax. Natural Language Processing allows a computer to understand the main linguistic concepts within a question or solution. Its goal is to design and build computer that analyze, understand and generate language that human use naturally.(Kumar,2004) The different components of natural language processing are, speech synthesis, speech recognition, machine translation, linguistic approaches, information retrieval and information extraction.

III. Pattern Recognition: It is the process of establishing a close match between some new stimulus and previously stored stimulus patterns. This process is being performed continually through the lives of all living things. Pattern recognition is studied in many fields, including psychology, ethology, cognitive science and computer science. Pattern recognition is based on either a priori knowledge or on statistical information extracted from the patterns. The patterns to be classified are usually groups of measurements or observations, defining points in an appropriate multi-dimensional space. (Wiki,2014) The components of pattern recognition are; data acquisition, pre-processing, feature extraction, model selection and training, and evaluation.

IV. Robotics: The field robotics is often described as the subfield of AI that is concerned with perceptual and motor tasks. Robot is a mechanical device which performs automation tasks, either according to direct human supervision or a pre-defined program or a set of general guidelines, using artificial intelligence techniques. (Wikipedia/ robotics, 2014) The components of Machine Learning: It involves the development of algorithms that enable machines to learn from data and make predictions or decisions based on that learning.

V. Machine Learning: Is a subfield of AI that involves developing algorithms that can learn from data and make predictions or decisions without being explicitly programmed.

VI. Deep Learning: A subset of machine learning is called deep learning (DL). Algorithms and artificial neural networks are inspired by the human brain, and they then learn from vast volumes of data. Machines use deep learning to tackle complex problems, even with unstructured, highly

diverse, and linked data sets. Neural networks, image processing, and natural language processing are some instances of Deep Learning is used in conjunction with AI techniques.

VII. Chatbots: Software programmes that can speak intelligently through audio, text, or perhaps embodied expression are known as chatbots (also known as intelligent agents, digital assistants, or virtual agents). To converse and engage with humans, they closely mimic human speech in their design. This was accomplished in the Turing Test for artificial intelligence. Siri, Google Assistant, and Amazon's Alexa are some examples of contemporary chatbots that are utilised often.

3. Libraries and Artificial Intelligence

In this age of the expansion of knowledge, AI gives libraries a competitive edge and a method to better serve their patrons. The application of AI offers opportunities to reach and entice potential customers with high reading skills through cutting-edge service offering and user experiences. The use of AI in libraries stands out because of its quick, observable, and provable ability to provide real, immediate benefits to librarians and users. The way that individuals search has changed as a result of new breakthroughs, including the digitalization of informational resources, the Internet of Things (IoT), analysis of Big Data, and intelligent machine learning. Their ability to use the knowledge, make sense of it, and eventually make decisions based on it depend on how well they can absorb, connect, and disseminate information. Libraries can take use of the practical advantages of artificial intelligence and use them for their own objectives, such as streamlining processes, increasing organizational effectiveness, and creating new library information services.

Libraries now play more important roles than only serving as managers of special collections of information thanks to the changing information environment. A gift for the democratization of data and a risk to accurate, reliable, and qualitative information are the abundance of availability and ease of access to information resources online. Even though the majority of people and searches think they can locate information without the help of an expert who can provide research direction, their search results are frequently found to be deficient and insufficient for relevance or quality standards. By assisting users in navigating the vast amount of information available, librarians are expected to take the lead in ensuring that users receive high-quality and pertinent information. Online and assisting their consumers in finding useful information amid a sea of data. The many kinds of libraries, particularly academic, research, and public libraries, have traditionally been crucial in increasing accessibility to knowledge, advancing equality, and facilitating access to information within societies all over the world. With AI, libraries can now provide individuals who require it with online access while also protecting their patrons' data and raising their level of technological ability.

4. Applications of AI in Library Services:

a) AI for Cataloguing: it is considered to be rule-based, descriptive cataloguing has been the focus of AI applications for cataloguing (AACR2). Two methods for cataloguing information materials can be used to apply artificial intelligence techniques. A system with full cataloguing capabilities 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 to no human intervention. 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. Every attempt to convert AACR2 into the highly structured instructions necessary for coding into the system has been met with formidable obstacles by researchers (Afolayan et al., 2020). Expert systems can be used by digital libraries to catalogue and search through their digital resources. Customers will be able to browse the collection, view the materials, and download their desired information using this digital

library-based expert system. The use of data mining in cataloguing processes helps with the use of intelligent library retrieval. Data mining can also be utilized in online library systems to determine the information demands of users. They assist library patrons in selecting the proper keyword or expression for information retrieval. The user-centered design of recommender systems for library catalogues and other library divisions has been the subject of several research (Mogali, 2014).

b) AI for Circulation (OPAC): Artificial intelligence can facilitate simple library material retrieval from the OPAC at the circulation desk. Language barriers can be lowered and relevant information can be more easily retrieved from databases, indexes, and catalogues with the use of NLP. Users can express their information needs in their own language during the information retrieval process, which makes the search and retrieval process simpler and more successful. Users can express sophisticated retrieval languages as a result. The introduction of AI assistive technology in search tools can address the issue of library users who might not be aware of the fuzziness of their search and retrieval strategy/method. By utilizing NLP for Dialogue database searches, library patrons will be able to directly search Dialogue databases with little to no aid from experts in information. Customers utilizing a library's computerized catalogue could want it to recognize a specific term or an entire sentence. Because they are skilled in both search and query and natural language, human librarians have an edge over machines and can serve as a liaison between users and the computer. Some URLs or web addresses require special instructions to be followed in order to retrieve the required information resources correctly, are case sensitive, or both. To use these new resources at the library, patrons must learn how to use computers (Afolayan, et al., 2020).

c) AI for Reference Services: Intelligent systems are created to direct library users to information sources inside the library system that are most likely to respond to their reference questions. The development of digital reference resources and services in libraries has resulted in more work being done on systems for reference services than on any other service or section (Chemulwo and Sirorei, 2020). This allows users to obtain information resources and have their reference queries answered in real-time. These systems are designed to direct library users to the best reference material, especially when a librarian is not available to assist them. While some reference referral systems cover knowledge broadly, others concentrate in a specific or constrained topic area (highly specialist domain or subject area). Any library's reference service is a vital component, and artificial intelligence systems will support reference librarians in their work. Here are a few instances of how artificial intelligence tools have been used in reference services: AMSWERMAN is a knowledge-based agricultural system that responds to reference requests or inquiries regarding agricultural-related subjects. It uses a series of choices to specify the query's focus and the kind of tool that is required. It can serve as a front end to outside databases or as a system for consulting CD-ROM reference materials.

d) AI for Collection Development: AI tools can be used to choose suppliers or book dealers for libraries' collections. Based on prior successful transactions in supplying publications of a particular kind, an intelligent system to identify a vendor or book seller might be created. These methods would be especially useful when purchasing less common information materials, such as conference proceedings, publications in foreign languages or from other nations, and specific technical reports, among others. Additionally, research have shown that AI systems have been built within the library profession to help with the selecting process. An inventive application of this new technology to creating library information resources is The Monograph Selection Advisor. The system specifically represented the task of item-by-item decision making that a subject bibliographer performs while choosing monographic resources. To ensure that the library can get the necessary results from the AI system, the system's knowledge base must be adequate and the interface features must be simple enough.

e) AI for Indexing: Another area where AI technologies are being developed is the indexing of library resources, particularly periodicals. Indexing is the foundation for document retrieval. The

goal of indexing is to improve recall (the percentage of relevant items recovered) and precision (ensuring that the fraction of retrieved content is appropriate). When a searcher types in keywords that have been determined by an expert (indexer) or a body to be fundamental to human thought on a particular topic, those keywords will be programmed into the electronic database in a way that will generate the citation for an article or piece of content on the computer screen. The system in the right order. The steps involved in indexing a journal article include determining the essential elements, turning them into verbal descriptions, and selecting and assigning controlled vocabulary terms that are conceptually equivalent to the verbal descriptions. To improve consistency and indexing quality, the cognitive components of indexing are being automated. Based on the information provided by the indexer, the indexing systems can automatically choose the suitable preferred terms to assign the proper subdivisions.

5. Benefits and Challenges of AI in Library Services:

The use of AI in library services has the potential to provide many benefits

a. Improved efficiency and effectiveness of library operations: Increasing the availability of information resources and service efficacy while reducing operational costs through automation, digital asset management, and optimal research data governance, libraries can assess and improve the organizational effectiveness and efficiency of library services. The development of artificial intelligence tools in library operations and services can lead to the achievement of analysis, visualization, conservation and preservation, and a reduction in the cost of delivering library services. Using intelligent technologies to deliver library information resources and services can foster creativity or innovation, which will increase operational effectiveness and efficiency.

b. Opportunity to Engage User: Incorporating chatbots and location-based services into search engine results, the library will be able to serve a wider audience with information services. Additionally, ML algorithms can instantly process content from thousands of sources in place of the typical analysis of only a small portion of those resources.

c. Helps Library Staff in Achieving Their New Objectives: Application of AI techniques will reduce human inaccuracy and inefficiencies by reducing manual tasks like daily searches and referencing activities to a minimum. These intelligent systems can free up library staff to work on more worthwhile projects like helping patrons create reading lists, instructing patrons on how to conduct better scientific research, creating library information resources, and other activities.

d. Establish Libraries at the Centre of the New Scholarly Communication: By helping in the identification of relationships that were previously missed in huge datasets, AI technologies have promoted Trans disciplinary harmonization within scholarly research. By connecting with Open Publishing organizations and developing research tools that collaborate with other organizations, libraries may also contribute to the continuous flow of data and study across all fields and subjects. Their collections become easier to browse, explore, and analyses, eventually assisting a vast, high-quality universal resource network.

6. 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:

a. Data quality and availability: AI systems heavily rely on high-quality and well-structured data for training and decision-making. Libraries may face challenges in obtaining and maintaining large datasets that are diverse, comprehensive, and accurately labeled. Ensuring data privacy and security can also be a concern.

b. **Ethical considerations:** AI raises important ethical considerations, such as biases embedded in the algorithms and potential discrimination. Libraries must carefully select and design AI systems to ensure fairness and avoid perpetuating social biases. For instance, AI-powered recommendation systems should provide diverse and inclusive suggestions.

c. **User acceptance and trust:** Introducing AI in libraries may encounter resistance from library users who may feel uncomfortable with the use of automated systems. Building trust and user acceptance requires effective communication, transparency about how AI is used, and addressing concerns regarding privacy, data usage, and potential job displacement.

d. **Skill and knowledge gaps:** Implementing AI in libraries requires expertise in AI technologies, data analysis, and programming. Libraries may face challenges in recruiting and training staff with the necessary skills. Collaboration with external experts or partnerships with research institutions can help bridge these skill gaps.

e. **Cost and resource limitations:** Developing and maintaining AI systems can be expensive, requiring investments in infrastructure, hardware, software, and ongoing technical support. Libraries with limited budgets may find it challenging to allocate resources for AI initiatives. Collaboration with other institutions or leveraging open-source AI tools can help mitigate these challenges.

f. **Limited customization and personalization:** AI systems often operate based on statistical models and predefined algorithms. Tailoring AI applications to meet individual user preferences and information needs can be challenging. Libraries need to strike a balance between automation and maintaining a personalized and user-centric approach to services.

g. **Long-term sustainability:** AI technologies evolve rapidly, and libraries must plan for long-term sustainability of AI initiatives. This involves staying updated with advancements in AI, ensuring compatibility with future systems, and regular maintenance and updates to address changing needs and emerging challenges.

h. **Linguistic Capabilities:** Chatbots possess limited memory, and their processing capacity does not support a large vocabulary or the capability to handle a variety of conversational styles. Developers must predict the forms of interaction and build appropriate replies to them, which is a tough challenge for any multilingual nation because dialects vary by region, and programmed interactional styles may not be appropriate for all types of conversations.

i. **Understanding of Users' Emotions:** Because of AI's efficiency, human creativity and empathy would be downplayed, leading to a future when the library's connection to its community and unique human traits would be discounted and scarce. Because they have emotions and can sense those of others, humans are superior to machines. Any library staff must possess empathy since it improves the delivery of information resources and services and results in the satisfaction of users' information demands. AI should be used to accomplish things, to help, and to process functions differently rather than being allowed to take values away based on information access and sharing. These challenges, AI has the potential to revolutionize libraries by improving search capabilities, enhancing information discovery, automating routine tasks, and providing personalized services. Addressing these challenges requires careful planning, collaboration, and a focus on user needs and ethical considerations.

There are many opportunities for future research in the use of AI in library services. One area of research is the development of more sophisticated recommendation systems, which can take into account a wider range of user data and preferences. Another area of research is the integration of AI with other emerging technologies, such as augmented reality and virtual reality, to create new and innovative library experiences. Finally, research is needed to better understand the ethical and social implications of AI in library services, and to develop strategies for addressing these issues.

7. Conclusion

The use of AI in library services has the potential to transform many aspects of library operations and improve user experiences. However, there are also significant challenges associated with adopting AI technologies, and further research is needed to fully understand the benefits and risks of using AI in library services. As AI technologies continue to evolve, it is important for librarians and researchers to stay up-to-date on the latest developments and to explore new and innovative ways to leverage AI in the service of library users.

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