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The Application of Artificial Intelligence (AI) in Library and Information Centre

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Abstract

Artificial intelligence has taken over many industries and is seen as a continuation of human intelligence. Artificial intelligence applications in libraries have revolutionized the information industry. Additionally, it has given modern libraries' development fresh life. It is believed that integrating artificial intelligence into library operations will open up new internet resources for libraries. Virtual reality, which engages users with libraries and improves information literacy abilities, is one of the valid innovations that librarians are constantly utilizing to engage and expand services for their patrons. It wouldn't be incorrect to argue that the development of the computer accelerated the process of digitization, much as the discovery of the wheel ushered in the mechanical age of human existence. Humans are the only animals with the innate ability to think for themselves. With the power of independent thought, humans have created a great deal of innovative technologies. One example of them is the development of the computer. The most significant development in computer technology that humans have made with the use of their intelligence is artificial intelligence. The goal of the computer science field of artificial intelligence is to build computers with human-like intelligence. Almost everywhere that computers are used, artificial intelligence is now being deployed. The need for this is growing daily, namely in the areas of science, health, automobiles, engineering, climates, business, pharmaceuticals, and academic libraries. AI must be used in libraries for both technical and library services purposes. The application of AI will expedite and improve the quality of work done in libraries, allowing them to offer a greater number of services with fewer staff members.

KEYWORDS: Artificial Intelligence, Big Data, Internet of Things, Smart Library.

1. INTRODUCTION

Over the past decade, the integration of emerging technologies such as the Internet of Things (IoT), artificial intelligence (AI), big data, cloud computing, RFID technology, and virtual reality has transformed libraries into intelligent spaces. This technological revolution has enhanced the physical space, information resource organization, service modes, and management methods in libraries. Smart libraries aim to provide better, more effective services, create an engaging environment for knowledge connection, and develop diverse areas for information exchange. Examples of smart library applications include 24/7 self-borrowing and returning systems, mobile phone self-renewal systems, intelligent inventory/positioning systems, intelligent seat reservation systems, and 3D navigation systems.

However, to further enhance reader services and experiences, smart libraries must incorporate contemporary scientific and technological advancements. While technologies like IoT and RFID have laid a foundation, they alone cannot fully meet the technical demands of smart libraries. AI is emerging as new driving forces for the development

of smart libraries. These technologies are reshaping our world and the way we think, act, and make decisions. Recently, many different attributes of machine learning and artificial intelligence have been adopted by many leading organizations such as Google, IBM, Amazon, Netflix, Expedia and so on to improve their products and services. Almost all major sectors like; health, education, weather, business, stock, agriculture, government and non-government agencies of different countries are also showing interest and using these technologies to simplify and neutralize workload, increase and speed up productivity, reduce human interaction and most importantly lead the digital-world in a smart and sophisticated way.

Libraries and information sectors, like many other fields, are increasingly incorporating advanced technologies into their operations. This shift is driven by the ever-growing volumes of data, commonly referred to as big data, and the need for real-time data processing and result generation. Additionally, the diverse needs of library patrons continuously push these sectors to innovate. Major advancements in computer processing speed and capacity, along with the popularity of networked environments for data processing, create opportunities for mining real-time data and delivering information outputs effectively.

The application of AI is particularly beneficial for enhancing the interaction among smart technologies, thereby improving the effectiveness of different libraries. This transition moves traditional library services toward intelligent library systems, focusing on users' needs and providing customizable and ubiquitous knowledge services.

Thus, it can be argued that the introduction of AI has created a new horizon in revolutionizing both technical and user services in libraries. The self-learning and self-doing capabilities of AI can help libraries achieve better interaction among machine-automated intelligent technologies, enhancing the effectiveness and co-creation of all library services. However, to adapt to this transformed scenario, librarians must change their roles and promote the transformation of library operations and services through the assistance of machine learning and artificial intelligence technologies.

With the development of these smart technologies, a wide range of research has been conducted to understand the phenomena and create innovations in this field. To trace the development and intellectual structure of a knowledge domain, it is essential to understand the current research focus and visualize the future of the domain. Therefore, this study seeks to understand the current state of the art in AI applications in libraries and to predict future research directions.

2. Literature Review

Librarians have acquired many skills to organize information and make it accessible anywhere, ensuring the application of tools for the new generation of knowledge, which surpasses Google search, especially for academic purposes (Jacknis, 2017). Libraries focus on enhancing access to content through the application of AI. We have been witnessing evidence of this transformation toward AI application, with many libraries initiating and providing Makerspace competencies (Kristin, 2016).

According to Liu (2011) in her comprehensive literature review on the utilization of intelligent agent technology in the library environment, both AI and librarians need to reinforce each other to provide the best service to patrons.

3. Artificial Intelligence

Artificial intelligence (AI) is the capability of a digital computer, computer-controlled machine, or software to replicate intellectual characteristics similar to those of intelligent organisms, such as humans, in their functionality. According to Nwakunor (2021), AI encompasses this ability to mimic human-like intelligence and behaviors.
Liu (2016) viewed AI as intelligent machines or systems that simulate human intelligence activities and extend the science of human intelligence. AI technologies can also be used to provide innovative real-time virtual reference services through mobile and social networking environments by combining existing library resources and third-party content. Additionally, promising areas of AI in libraries include natural language processing, indexing systems, and the application of robotics in library activities.

4. Libraries and Artificial Intelligence

In this age of expanding 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 offerings 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 individuals search for information has changed due to 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 depends on how well they can absorb, connect, and disseminate information. Libraries can take advantage of the practical benefits of artificial intelligence to streamline processes, increase organizational effectiveness, and create new library information services.

Libraries now play more important roles than merely serving as managers of special collections of information, thanks to the changing information environment. The abundance and ease of access to information resources online can be both a gift for the democratization of data and a risk to accurate, reliable, and qualitative information. Although many people believe they can locate information without expert assistance, their search results are often found to be deficient and fail to meet relevance or quality standards.

Librarians are expected to take the lead in ensuring users receive high-quality and pertinent information by assisting them in navigating the vast amount of information available online. By guiding users to find useful information amid a sea of data, librarians uphold the standards of relevance and quality.

Traditionally, various types of libraries—particularly academic, research, and public libraries—have been crucial in increasing accessibility to knowledge, advancing equality, and facilitating access to information within societies worldwide. With AI, libraries can now provide online access to those who require it while protecting their patrons' data and enhancing their technological capabilities.

5. Applications of AI in Library Services:

i. **AI for Cataloguing:** Rule-based, descriptive cataloguing has been the focus of AI applications for cataloguing (AACR2). Artificial intelligence techniques can be applied to cataloguing information materials in two main ways:

1. **Human-Computer Interface:** The cataloguing effort is split between the intermediary (human) and the support system (AI). This collaborative approach leverages the strengths of both human expertise and AI efficiency.
2. **Full Cataloguing Capabilities Integrated with an Electronic Publishing System:** In this method, text generated digitally can be passed through knowledge-based systems, allowing the cataloguing process to be done with little to no human intervention.

However, every attempt to convert AACR2 into the highly structured instructions necessary for coding into the system has faced formidable obstacles (Afolayan et al., 2020).

ii. **AI for Circulation (OPAC):**

Artificial intelligence can facilitate simple library material retrieval from the OPAC (Online Public Access Catalogue) at the circulation desk. Natural Language Processing (NLP) can lower language barriers and make it easier to retrieve relevant information from databases, indexes, and catalogues. During the information retrieval process, users can express their information needs in their own language, simplifying and enhancing the search and retrieval process. This capability allows users to express sophisticated retrieval languages more effectively.

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 or method. By utilizing NLP for dialogue database searches, library patrons will be able to directly search databases with minimal assistance from information experts. Customers using a library's computerized catalogue might want it to recognize a specific term or an entire sentence. Human librarians, skilled in both search/query formulation and natural language, 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 and are case-sensitive. To use these new resources at the library, patrons must learn how to use computers effectively (Afolayan et al., 2020).

iii. **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, aiming to improve both 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 governing body to be fundamental to human thought on a particular topic, those keywords are programmed into the electronic database in a way that will generate the citation for an article or piece of content on the computer screen. This system ensures that information is retrieved in the correct order.

The steps involved in indexing a journal article include determining the essential elements, converting 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. This automation enhances the indexing process, making it more efficient and accurate.

iv. AI for Collection Development

AI tools can be used to choose suppliers or book dealers for library collections. An intelligent system could be created to identify vendors or book sellers based on prior successful transactions in supplying publications of a particular kind. 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.

Research has shown that AI systems have been developed within the library profession to assist with the selection process. An innovative application of this technology for creating library information resources is the Monograph Selection Advisor. This system represents the task of item-by-item decision-making that a subject bibliographer performs while choosing monographic resources. To ensure that the library can obtain the necessary results from the AI system, the system's knowledge base must be adequate, and the interface features must be user-friendly.

v. Application of Expert System in Classification

Classification is the fundamental activity in the organization of knowledge. For this reason, it is prominent in all systems for organizing knowledge in libraries and information centers. The application of Expert Systems in the area of classifications in libraries includes tools such as:

Coal SORT: This is a conceptual browser designed to serve either as a search or an indexing tool. Coal SORT consists primarily of a frame-based semantic network and the software needed to allow users to display portions of it and to navigate the conceptual structure. The expert knowledge in the system is embodied almost entirely in the semantic network, facilitating efficient classification and retrieval of information.

vi. Applications of Natural Language Processing in Library Activities:

When we think of the term Natural Language Processing (NLP), the first thought might be of being able to speak or write in complete sentences and have a machine process the request and respond. NLP can be applied to many disciplines, including library and information science, specifically in the area of searching databases such as Online Public Access Catalogues (OPAC).Indexing is the foundation for document retrieval. The aim of indexing is to increase precision, which is the portion of the retrieved documents that are relevant, and recall, which the proportion of relevant documents that are retrieved is. NLP can significantly enhance this process by allowing users to input search queries in natural language, making the search and retrieval process more intuitive and effective.

vii. Applications of Robotics in the Library Activities:

Robots can be used to transport books from the stack room to the issue counters. A book-picking robot is a service robot designed to perform tasks such as finding, picking, and delivering books to readers. This process automates the tasks of book finding and picking. The robot is developed to move towards the designated book, with its navigation controlled through a camera system. This automation streamlines library operations, enhancing efficiency and improving user service by promptly delivering the requested books.

Robot takes stock of books at Akita public library (Japan)

In Akita Prefecture, the stocktaking of books at a municipal library has been fully automated under a trial experiment, potentially eliminating the need for human involvement altogether. A robot assigned to locate books by reading data stored in integrated circuit (IC) tags on each tome can finish the task in a matter of "several tens of minutes," compared to a full day for library staff relying on bar codes (Source: *https://www.asahi.com/ajw/articles/14585237*).

Similarly, the Central Rappahannock Regional Library has introduced a robot to assist with its operations, showcasing the increasing adoption of robotic technology in libraries to improve efficiency and service.

The Central Rappahannock Regional Library (USA) is excited to introduce the newest member of their team, Pepper, a humanoid robot. Pepper can be programmed to greet customers, answer questions, and even dance! Pepper will be stationed at IdeaSpace, CRRL's new space for making and media, which opened on December 17, 2020. (Source-**https://www.librarypoint.org/pepper**)

Conclusion

The novel trends in the application of Artificial Intelligence (AI) in academic library operations include various areas:

1. **Expert Systems in Reference Service:** AI-powered systems can assist in providing expert-level guidance and information retrieval for patrons.
2. **Cataloguing, Classification, and Indexing:** AI tools can automate and improve the efficiency of these fundamental tasks in organizing library resources.
3. **Acquisition:** AI can assist in selecting and acquiring materials by analyzing usage patterns and user preferences.
4. **Natural Language Processing (NLP) in Library Activities:** NLP enables more intuitive and effective search and retrieval processes, allowing users to interact with library systems using natural language.
5. **Pattern Recognition:** AI can recognize patterns in usage data, helping libraries optimize their services and resources based on user behavior.
6. **Robotics in Library Activities:** Robots can automate tasks such as book retrieval, inventory management, and customer service, enhancing operational efficiency.

Overall, AI applications in libraries aim to streamline complex tasks, reduce errors, improve access to research materials, and complement human expertise, while addressing challenges like the lack of human touch and potential displacement of human involvement in certain tasks.

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