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Opportunities and Challenges of Library with Artificial Intelligence and Information Technology in Digital Era

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Abstract

The twenty-first century is a time of fast changes and new technology, so organizations need to keep up with these changes to meet what people want. Using Artificial Intelligence in libraries is a way to use different technologies that let machines sense, understand, act, and learn. These technologies help with library tasks and offer new tools for libraries. This article looks at how Artificial Intelligence is being used in Smart Libraries and what effect it could have. It covers how AI is applied in four areas: education, information, help, and social networking, along with the results of these uses. The article also talks about conversational agents like chatbots, AI-powered library services that involve users, the effect of research, finding information, and virtual reality.

Keywords: *Artificial Intelligence, Innovative Services, Smart Libraries.*

1.1 Introduction

The twenty-first century has brought about fast changes and big technological advances. Organizations need to keep up with these changes to meet what people want. Using Artificial Intelligence in libraries is a group of technologies that help machines sense, understand, act, and learn. These technologies can handle administrative tasks and offer new, advanced tools for libraries. This article looks at how Artificial Intelligence is used in Smart Libraries and its possible effects. It covers four areas: education, information, assistance, and social networking, explaining how they are applied and what they mean. It also talks about conversational agents like Chatbots, AI-based library services, research impact, information discovery, and virtual reality. In the past ten years, the new technology revolution has helped Smart Libraries become smarter in four key areas: the physical space, how information is organized, the way services are provided, and the methods of management. This has been made possible through technologies like the Internet of Things, big data, cloud computing, RFID, artificial intelligence, and virtual

reality. Smart Libraries aim to give users better and more quality services, create a more appealing environment for information connection, and offer a more varied space for sharing information. Some fully developed uses of Smart Libraries include 24/7 self-checkout systems, mobile or internet-based renewal systems, smart inventory and location systems, intelligent seat booking systems, and 3D/AR/VR navigation. As a high stage of digital libraries, Smart Libraries need modern technology to improve user experience and service. Just using the Internet of Things or RFID is not enough to meet all the technical needs of a Smart Library. Artificial Intelligence is a new force that can drive the development of Smart Libraries forward.

1.2 Artificial Intelligence

Artificial intelligence, or AI, refers to the capability of a digital computer, computer-controlled machine, or software to mimic the intellectual abilities of intelligent organisms, like humans. It can be seen as a set of technologies that allow machines to perceive, understand, act, and carry out tasks that match human intelligence. The main parts of AI include machine learning, big data, natural language processing, decision-making logic, data visualization, and data analytics. Liu described AI as intelligent machines or systems that imitate human intelligence activities and expand the study of human intelligence. AI technologies can also be used to offer new, real-time virtual reference services through mobile and social networking platforms by combining existing library resources with other external content. Other promising areas of AI in libraries include natural language processing, indexing systems, and the use of robotics in library operations.

1.3 Areas of Artificial Intelligence

a) Artificial Intelligence focuses on symbolic, non-algorithmic ways of solving problems. Intelligence is based on the ability to work with symbols. Although Artificial Intelligence is a relatively new field, it has transformed society in ways that are hard to imagine. The goal of its various subfields, such as expert systems, natural language processing, pattern recognition, and robotics, is to imitate human intelligence using computers. Some of the recent computational methods and areas that are used to improve different aspects of Artificial Intelligence are as follows:

b) Expert System:

Expert systems are computer programs that rely on specialized skills and are used as intelligent interfaces or gateways to access databases and retrieve the right information. They range from simple systems based on rules and basic data to large, complex projects that take many people and years to develop. An expert system provides expert advice, makes decisions, or suggests solutions based on specific situations. The main parts of an expert system include the knowledge base, the inference engine, and the user interface.

c) Natural Language Processing:

The most advanced form of computer language is natural language. AI researchers have made significant progress in creating natural language interfaces, even with limited vocabulary and grammar rules. Natural Language Processing helps computers understand the main idea in a question or answer. Its goal is to develop computers that can analyse, understand, and produce language that humans use naturally. Some key parts

of natural language processing include speech synthesis, speech recognition, machine translation, linguistic methods, information retrieval, and information extraction.

d) Pattern Recognition:

The process involves finding the closest match between new data and existing data patterns that have been stored before. This happens all the time throughout the lives of all living things. Studying how we identify patterns is important in many areas like psychology, anthropology, cognitive science, and computer science. Pattern recognition can be based on past knowledge or on information gathered from the patterns themselves. The data that needs to be sorted is usually made up of groups of measurements or observations, which can be thought of as points in a multi-dimensional space. The main steps in pattern recognition include collecting data, preparing it for analysis, extracting key features, choosing and training a model, and finally testing how well it works.

e) Robotics:

It is a part of Artificial Intelligence that deals with tasks related to sensing and moving. A robot is a mechanical tool that performs automated tasks, either under direct human control, following a set program, or based on standard instructions, and it uses AI capabilities to do so.

f) Machine learning:

Arthur Samuel, an American pioneer in computer gaming and artificial intelligence, introduced the term 'machine learning' in 1959 and described it as 'it gives computers the ability to learn without needing explicit programming'. Based on how the system responds or reacts to signals, machine learning applications are divided into four main types: supervised learning, unsupervised learning, reinforcement learning, and semi-supervised learning.

1.4 Advantages and Disadvantages of Artificial Intelligence (AI)

The main benefit of Artificial Intelligence is that it makes decisions based on data, not emotions. The advantages of AI are amazing, and what this field can offer us is the chance to move forward and become part of the history of artificial robots.

The advantages of Artificial Intelligence (AI) include: completing tasks faster than humans, handling multiple functions at once, having a high success rate, easily managing stressful and tough work, finishing complex assignments in a short time, reducing defects and errors, increasing efficiency quickly, taking up less space and being compact, handling long-term and complex situations, and even exploring new areas like outer space.

The disadvantages of Artificial Intelligence (AI) are: it can be misused, leading to large-scale destruction, sometimes programs act against the user's commands, human jobs are affected, unemployment rises, the quality of AI depends on the programmer, it requires a lot of time and money, it can increase technological dominance, lacks the human touch, and may make the new generation lazy.

1.5 Application of Artificial Intelligence (AI) in Smart Libraries:

Artificial intelligence plays a major role in almost every part of the Smart Library's operations. After carefully analysing many studies and real-world examples from both inside and outside the country, three main areas where AI is applied are identified: Intelligent Resource System, Intelligent Management, and Intelligent Services.

a) **Intelligent Resource System:** As big data and AI technology continue to grow, the intelligent resource procurement system can automatically gather and combine all users' personalized needs with different types of document resources using deep learning.

This makes it possible to create an intelligent system for deciding how to procure documents. Building such a system requires focusing on two important aspects.

i) It is important to scientifically and reasonably determine the factors that influence decisions. The library can develop a fair and objective decision-making model by considering various factors such as user group characteristics (like gender, age, educational background, and occupation), personalized user information (such as the number of teachers and students in different majors in universities, the subjects offered, their rankings, key construction subjects, students' interests, and course names), book recommendations and purchases (related to academic degrees, book popularity or usage, prices, etc.), expert opinions (on discipline development, book usage rates, and reproduction rates), and annual budgets. This helps in creating a book order plan and optimizing how book purchasing funds are used.

ii) It is also important to collect and analyse open resources thoroughly. By smartly gathering and examining these resources, the procurement system can give librarians valuable information to make better decisions.

b) **Intelligent Management** It consists of Intelligent warehouse management and Intelligent Security Management:

i) **Intelligent warehouse management:** Intelligent warehousing management has several distinct characteristics like

(a) Realize the self-service management of the book library with the goal of automatic book circulation and paper document management.

(b) The books can be placed anywhere on the bookshelf without needing specific labels or numbers, which simplifies the way the bookshelf is organized.

(c) A robot system can be used to manage the automatic and unmanned counting, checking, and sorting of books.There are many successful examples of this in library intelligent warehouse systems. For example, Nanjing University Library in China uses an ultrahigh-frequency RFID technology-based intelligent book inventory robot. This system combines automatic identification, RF phase technology, and machine automation to perform book counting automatically. This allows for precise and fast inventory checks, making it easier for library staff to locate and manage books, which in turn significantly reduces the time readers spend searching for books.

Similarly, BookBot at the Hunter Library of North Carolina State University is a robotic system that delivers books using high-density automated shelving technology.

It can store up to two million items and deliver any item within five minutes of clicking on the online catalog. BookBot takes up only one-ninth of the space needed by traditional bookshelves, turning the library into a more dynamic learning and collaborative environment. Books and other items are barcoded, sorted by size, and stored in over 18,000 boxes. Every time a book is borrowed or returned, it is scanned, allowing the library's online catalog to track all the data in real time.

(ii) Intelligent Security Management: The library's daily services include seat management, lending management, and identity management, among other security-related tasks. Artificial intelligence technologies such as face recognition and fingerprint recognition can further improve the library's security management. For example, face recognition technology specially developed by AI is used to collect students' facial information and link it with their personal details. After this connection is made, students no longer need to carry their student ID cards and can simply enter and exit the library by scanning their face.

c) Intelligent Services

Intelligent services are divided into three categories: Intelligent Application Service, Intelligent Consulting Service, and Intelligent Knowledge Service.

(i) Intelligent Application Service: At present, the technology used in library self-service application services is quite advanced, and the forms and content of these services are diverse.

The main examples include self-service seat management systems, self-service library ATMs, self-service print and copy management systems, and lecture and training appointment management systems. Self-service applications offer several advantages over traditional services. They break the limitations of time and space, allowing instant service access even when the library is not open. This expands the forms of library services and the range of people who can use them, thereby reducing the library's operational costs and labor expenses. It also increases users' willingness to engage with services, protects user privacy during service applications, and improves the efficient allocation of service resources, reducing the chances of errors caused by manual processes. These intelligent application services are commonly seen in general smart libraries.

(ii) Intelligent Consulting Service:

Consulting services are a key part of library services. However, traditional consulting services have some problems, like a small number of consultants, slow manual processes, and time limits. The introduction of intelligent consulting services helps solve these issues. It allows users to get better consulting support, making library services more independent, fast, convenient, and available anytime.

(iii) Intelligent Knowledge Service:

Knowledge service is the main part of library services, and intelligent knowledge service is a new way of innovating library services.

It has strong potential and a bright future. The quick development of AI technologies such as cross-media awareness, big data management, deep learning,

virtual bionic functions, and language interaction makes it possible to improve and specialize knowledge services. The key parts of intelligent knowledge service include understanding user behavior, managing information data, and operating service activities. These are done using tools like knowledge analysis, presentation methods, research models, and analysis techniques. It helps in managing user behavior, data, and service operations smartly.

1.6. Conclusion

Because of artificial intelligence, the education system is changing.

The role of libraries as centres for education, learning, knowledge, and communication will become even more important. Libraries can have more development opportunities by combining AI with their services. AI brings better tools for tasks like discovery, searching, and retrieval, making these processes more efficient. These intelligent systems can help improve human skills. Librarians can use AI for reference services, teaching information skills, monitoring, evaluation, and information searches. AI can affect many library services, from offering insights to managing collections and transferring files. This type of technology will create better partnerships between librarians and other stakeholders.

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