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The Application of Artificial Intelligence in Libraries: An Overview

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ABSTRACT

The Artificial Intelligence is viewed an extension of human intelligence and has taken over various sectors. Application of Artificial Intelligence in libraries has been providing a breakthrough for the information sector. It has also injected new vitality into the development of modern libraries. The adoption of Artificial Intelligence in library activities is considered to provide a new online service for libraries. Librarians are always on the cutting edge of technologies to engage and enhance services for their users, some of the valid additions include virtual realities that engages users with libraries and enhance information literacy skills.

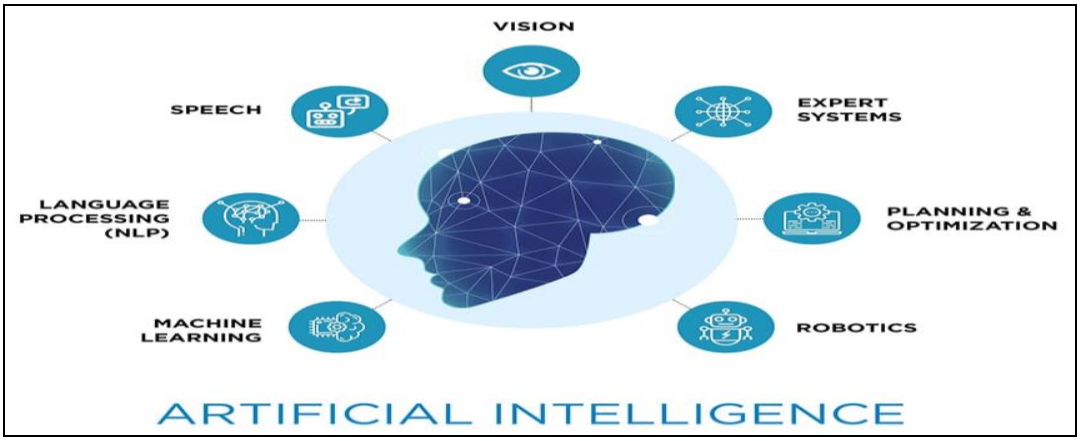
KEYWORDS: Artificial Intelligence, Big Data, Internet of Things, Smart Library.

1. INTRODUCTION

In the past ten years, under the influence of the new technology revolution, library has realized the physical space intelligence, information resource organization intelligence, service mode intelligence and management method intelligence of library with the help of the Internet of things, artificial intelligence, big data, cloud computing, RFID technology, virtual reality and other emerged technologies. Smart library strives to provide users with more efficient and high-quality services, build a more attractive information interconnection environment and create a more diversified information sharing space. The application scenarios of smart library include round the clock self-borrowing and returning system, mobile phone self-renewal system, intelligent inventory/positioning system, intelligent seat reservation system, 3D navigation system, etc. However, as a high-level development stage of digital libraries, smart libraries need to introduce modern scientific and technological means to increase readers' experience and enhance readers' services. Only relying on the Internet of things, RFID and other technologies has been unable to fully meet the technical requirements of smart library, artificial intelligence will be a new driving force for the development of smart library.

2. ARTIFICIAL INTELLIGENCE

Artificial Intelligence has come a long way from its early roots, driven by dedicated researchers. The expression of Artificial Intelligence was introduced as a 'digital' replacement for the analog 'Cybernetics'. Artificial Intelligence began as an experimental field with pioneers like George Boole (1815-1864), Allen Newell and Herbert Simon, who founded the first Artificial Intelligence laboratory (Kumar,2004). The emergence of a new field called 'Cybernetics' which has been coined and founded by Norbert Wisner brought together many parallels between human beings and machine. Cybernetics is the study of communication between human being and machine. In general Artificial Intelligence is the subfield of Computer Science concerned with understanding the nature of intelligence and constructing computer systems capable of intelligence action (Winston, 1999). It embodies the dual motives of furthering basic scientific understanding and making computers more sophisticated in the services of humanity. Artificial Intelligence mainly focuses on understanding and performing intelligent tasks such as reasoning, learning new skills and adopting to new situations and problems. Artificial Intelligence for short is a combination of computer science, psychology, and philosophy. It is concerned with the concept and methods of symbolic inferences by computer and the symbolic representation of knowledge to be used in making inferences (Nilson, 1998).The most popular Artificial Intelligence programs are the Expert systems, which are computer programs that embody human mention of Artificial Intelligence which creates vision of electro-mechanical devices replacing human beings. Large number of rules and facts make up Artificial Intelligence programmes and these programmes process ideas and knowledge, not members, in several different ways.



Some of the recent computational techniques and areas that are utilized in developing fields of Artificial Intelligence are discussed below:

- **Expert System:** Expert System are the knowledge based computerized systems which play a role of intelligence interface or gateway for providing access to database and to obtain relevant information. They range in scale from simple rule-based systems with flat data to very large scale, integrated developments taking many person, years to develop. An expert system is a computer program that provides expert advice, decisions or recommended solutions for a given situation. The different components of expert systems are Knowledge base, Inference Engine, and User Interface.

- **Natural Language Processing:** 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.

- **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, ethnology, 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. The components of pattern recognition are data acquisition, pre-processing, feature extraction, model selection and training, and evaluation.

- **Robotics:** The field robotics is often described as the subfield of Artificial Intelligence 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.

3. ARTIFICIAL INTELLIGENCE AND ITS APPLICATIONS IN LIBRARIES

Libraries are creating new operating models. It is important for any library to adapt new tools and techniques to serve their users better for their sustainability. The sources and services, being the major focus of a library, need to have great attention towards innovations to provide users what they have not expected and surprise them. The field of Artificial Intelligence in the area of library and information can't remain untouched. Following are some areas where the Artificial Intelligence can be used potentially are:

3.1 Acquisition Services

- **Decision Making Tool:** The Artificial Intelligence system will process the circulation data of the library which will help in analyzing the prominent authors and publishers to the librarians which can be decision making tool for the library authorities. The Artificial Intelligence will not only suggest readers for books authored by same author but also will help librarian to identify the books of same author for further procurement at his end.

- **Technical Services:** When the books are procured in the library, the Artificial Intelligence system will help in automatically floating the data and details like vendor, purchase history, etc. about the books.

Classification and Cataloguing of the book will also be done by the Artificial Intelligence system and details will be updated in the OPAC.

- **Circulation Services / Help Desk:** The Artificial Intelligence system can understand the users' need and behavior and help in decision making in providing relevant and timely services. For example, if a user has been issued number of books, the Artificial Intelligence system can suggest regarding sending reminders, calculation of fine, alert librarian regarding no further issuing, and if the books are lost, the system can also suggest the possible places from where purchase can be made.

3.2 Information Services

- **Recommendations as per Reading Habits:** Library can develop Artificial Intelligence system which can understand the reading habits of users and recommend relevant books and other documents such as journal articles, patents, standards, etc.

- **Recommendation Regarding Highly Read Books:** The Artificial Intelligence can also analyze the highly read books in a subject through data mining in the library and can recommend to the readers interested in that subject.

- **Conversational Artificial Intelligence:** Conversational Artificial Intelligence refers to the use of messaging apps, speech-based assistants and chat bots (computer programs which conduct a conversation via auditory or textual methods) to automate communication and create personalized customer experiences at scale. A library can answer query through chatbots and serve its users better. This will be highly useful in reference services of the library. Microsoft has created technology that uses Artificial Intelligence to read a document and answers questions just like human. Stanford Question Answering Dataset (SQuAD) is such a machine reading comprehension dataset that is made up of questions about a set of Wikipedia articles.

- **Image Recognition:** Image recognition system may find its importance in libraries also. For example, in a library dealing with defense science and technology, a scientist brings an image of a weapon and requires details such as specifications, reports, applications, etc. In such scenario image recognition Artificial Intelligence can help to identify and understand the weapon, and produce the results such as its make, evolvement, specifications, etc.

- **Text Detection:** There are Artificial Intelligence system where on feeding an image or document, all the text can be read out which can be of any length.

- **Location Detection**: There are Artificial Intelligence system which helps to track the exact location of print resources in the library. It also links to other electronic/ online resources to print materials.

- **Enhanced Understanding**: Human can't read very fast and can't mentally mine and structure the large quantity of data available in the text form in the libraries. But new with advanced artificial intelligent system that reads and understands large no. of articles can help scientists to recommend highly relevant

information for new inventions. For example, a scientist working in defense science can develop new weapons systems using recommendations provided by such Artificial Intelligence system.

- **Summarizing Text:** For text document, Artificial Intelligence not only can understand the text but can also summarize, which is a prime job of librarians. So it will be helpful for librarians who can give summaries of large text in advance and if user is interested, he can provide the full text.

- **Service for Visually Challenged People:** The 'Seeing Artificial Intelligence' app of Microsoft, is a useful app for people who are vision impaired. It's a Smartphone-based narrator that can be used anywhere: people can point their Smartphone at the pantry to find the vegemite, or use it to narrate a child's homework questions. "It does a whole set of Artificial Intelligence capabilities around facial recognition. In library scenario, visual impaired can point their mobile, and can get information regarding signage displayed in the libraries such as enter-exit, books, periodicals, reference books, circulation counter, washrooms, silence zones, cafeteria, etc.

4. BARRIERS IN IMPLEMENTING ARTIFICIAL INTELLIGENCE IN LIBRARIES

Libraries are working towards adopting Artificial Intelligence in libraries. But they have to face certain challenges in creating and deploying them. Some of the challenges the libraries are facing are:

- Management of the organization has to first understand the need of Artificial Intelligence in libraries and be willing to develop and use it.

- Planning about what is to be done for adopting Artificial Intelligence, who will do the work, who will be potential stakeholders, what will be the work flows, proper scheduling, how and when to implement, etc., is to be done with finer details.

- High end technology, coding, large data, servers, databases, communication system, networking, etc., will be required

- The implementation of Artificial Intelligence system can be very expensive so sufficient budget is required. In low-budget the Artificial Intelligence system may lack advanced features

- As the field of Artificial Intelligence is still an emerging area for library and information professionals, they have to clearly define their requirements to the developers and have to be participative in the designing of the Artificial Intelligence systems

- As the technology keeps on changing with fast speed and new version keep arriving, there will be requirement of up-gradation to complete switch over from obsolete technology

- There is requirement of training and upgrading the skills of staff regarding the use of Artificial Intelligence system.

CONCLUSION

The Artificial Intelligence applications in the libraries are at nascent stage. Artificial Intelligence has vast applications which will help the users in their information needs. Preparation of robust systems need technologies like Artificial Intelligence software, large amount of data, databases, their integration interface, storage, communication and network technologies. Under the impact of Artificial Intelligence, the education system will change. The status of the library as a social education, learning center, knowledge center and communication center will be more important, and the library can obtain a broader development space. The introduction of Artificial Intelligence technology in libraries is not intended to replace librarians, but to enrich and enhance knowledge exchange and interpersonal interactions. Therefore, libraries should also change their minds in the application of Artificial Intelligence. They should embrace Artificial Intelligence in a more positive attitude and contribute to the activation of library communication functions and efficiency of library services.

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