Application of AI in Academic 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.

Introduction:

The world now has witnessed many technological changes, that affecting the lives of everyone and any institutions, and it is no longer confined to a specific group, but accompanied everyone and every organization. This change of technologies due to the great benefit that serves everyone. In light of this information inflation, there are many applications that appeared and facilitated the operations, applications to share in that. Applications of artificial intelligence are a major development that affected and facilitated many of the processes that humans perform and simulate their actions with the existence of systems designed for this, and it includes all processes that simulate the genius and innovation of electronic computers. Modern information and communication technologies are among the changes taking place in various fields and have a vital role in knowledge management.

Artificial intelligence already touches many of our daily computing activities, most of the computer systems and mobile phones being developed today have artificial intelligence features and we have probably used them not knowing that they are intelligent machines. Examples of Artificial intelligence in computers are speech recognition, natural language processing, self-driving or autonomous cars, machine learning, deep leaning and robotics. Artificial intelligence works based on perceptual recognition unlike human beings that operate on deep cognition. The power and advantage of Artificial intelligence lies in the fact that computers can recognise patterns efficiently at a scale and speed that human beings cannot.

The development of societies in recent times have been facilitated by the

growing demand of access to information, and libraries are the prime source in providing this access. The paradigm shift in the format and dynamics of information and knowledge as a result of the rapid advancement in computer technology and software applications especially artificial intelligence, have shifted libraries to a demand of the commensurate supply of the same technologies. Unless libraries begin to exploit the new technologies and innovate their information and services delivery, they may face obsolescence in this era.

Concepts of Artificial Intelligence (AI):

The sound of the term artificial intelligence often conjures images of robots or computers that talk. Artificial intelligence is an aspect of computer science that focuses on how computers learn (Machine Learning), interpret information, vision: character recognition, picture analysis, 3D perception, and modelling of the function of the eye; furthermore, it encapsulates speech recognition, speech production, understanding and use of natural language (Natural Language Processing), and Expert System which continues to gain more attention. Furthermore, artificial intelligence is the programming and development of computers to perform human required-intelligence task, such as speech recognition, decision-making, visual perception, language translation, talking and emotional feelings (Irizarry- Nones, Palepu & Wallace, 2017). According to Heath (2018), artificial intelligence is the technology that enables machines be to have the abilities to plan, learn, reason, solve problems, move, and be creative to some extent. Three main focus of artificial intelligence is perception, reasoning and action. Reasoning is fundamental in intelligence gathering, it involves internal processes or programming logic/algorithm, that makes computers think of the best way of action before performing the action. Similarly, McGraw-Hill

Encyclopedia of Science and Technology (2007) maintained that artificial intelligence is a subfield of computer science focused with understanding the nature of intelligence and constructing computer systems with ability to make intelligent behaviour. Moreover, it is primarily concerned with representations of knowledge and heuristic methods of reasoning using common assumptions and rules of thumb. Other definitions of artificial intelligence include: creating machines with minds (Haugeland, 1985), the study of mental faculties through the use of computational models (Charniak & McDermott, 1985), the explanation and emulation of intelligent behaviour in terms of computational processes (Schalkoff, 1990), the science and engineering of making intelligent machines and computer programs (John McCarthy). Artificial intelligence is concerned with the concepts and methods of symbolic inferences and representation of knowledge by machines. It is aimed at performing intelligent tasks such as logical thinking, learning new abilities and adopting to new situations and problems (Nilson, 1998 cited in Shohana, 2016). In a nutshell, artificial intelligence is making computers or machines intelligent just like human beings, in order to make them find solutions to complex problems in human fashion.

Components of Artificial Intelligence:

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

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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. (ALA 2019). 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. Researchers noted that text mining techniques are used in efforts to organise vast amounts of language data (i.e., converting unstructured data to structured data) and to define concepts conveyed in

textual form (e.g., sentiment and emotion analysis in speeches and comments).

Pattern Recognition:

Pattern recognition automatically recognises patterns and consistencies in data sets. Pattern recognition is an example of machine learning, as well as other AI technologies such as data mining and knowledge discovery in databases. Pattern recognition is centred on a priori knowledge or statistical information collected from the structures. Patterns to be classified are frequently clusters of observations or measurements that define points in a suitable multi-dimensional space. The usage of the Completely Automated Public Turing Test (CAPTCHA) to check if the user is a robot or a human at the front end interface is an example.

Robotics:

Library activities involve plenty of manual work, which can be partially or fully done effectively with the help of robots. Technology has advanced libraries in many ways; robots are being used instead of humans in various library operations, especially those tasks which are hazardous and time-consuming. A robot is a mechanised device that uses artificial intelligence methods to complete automated activities under direct human guidance, pre-defined instructions, or a set of generic procedures. Robots are now being programmed to answer Frequently Asked Questions (FAQs) that library patrons may have. Even though robots have artificial intelligence, they can not be as intelligent as humans as they are man-made and need a human touch to get operated.

Chatbots:

Chatbots (referred to as intelligent agents, digital assistants, or virtual agents) are software applications which can converse intelligently, whether by speech, text, or possibly by embodied expression. Through their design, they closely emulate human conversation to communicate and

interact with people. This was achieved in the artificial intelligence Turing Test. Amazon's Alexa, Google Assistant, and Siri are examples of modern chatbots that are used in everyday life.

Artificial Intelligence and Ranganathan's Principle of Librarianship:

The five principles of Ranganathan are fundamental to librarianship. These five principles are the hallmark of the provision of library information resources and services in the library. The following is how we see AI aligning with each of Ranganathan's five principles:

1. Books are for use: Any activity or process in the library promotes the use of library information resources. Artificial intelligent systems increase access to books or other information materials available to users and make the use of these materials easier. The majority of books are now available digitally and users get to use them more than before because they have become more accessible.

2. Every person his book: Libraries serve a wide community of users, irrespective of the type of library. Therefore, the library acquires information resources to meet a wide variety of needs. Every individual has that particular book or information material that meets their information needs at that point in time. It is important that library patrons get hold of the book. Intelligent systems such as the recommender system make this possible. It can recommend resources to acquire in the library to the collection development librarian as well as recommend to the user the best information material that meets the information needs of the user.

3. Every book its reader: Each book has its own audience. Books or other information resources should not be on the shelf and should not be used. No matter how little the population might choose to use such materials, they must have a proper place in the library. AI helps mediate between them and creates a function that not only brings users to the book but also brings the book to the users.

4. Do not waste the time of a user: This is the apex goal that the application of AI in libraries seeks to achieve. Users get busier and impatient. An intelligent system can quickly decipher the needs of a library patron and answers to the query are provided to the user. Also, an intelligent algorithm makes it possible to find the fastest route from the user's current location to an information resource location in the library. This smart technology can sense users' and books' locations and offer directions to connect them together.

5. Library is a growing organism: Libraries today are not what they were a decade ago. This is because a library is a dynamic institution and should never have a static outlook. Some growth occurred in the theory and practice of librarianship. The application of AI to libraries and information centres also brings growth and library patrons are better served.

Library Processes and The Application Of Artificial Intelligence:
1. AI for Cataloguing
2. AI for Circulation (OPAC)
3. AI for Reference Services
4. AI for Collection Development
5. AI for Indexing

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

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challenges include but are not limited to the following:

1. Lack of technical know-how to use and operate artificial intelligence systems among the library staff.
2. Lack of adequate funding to develop or procure artificial intelligence systems in libraries. Since the budgets for hardware and software are frequently tight, there's always constrain to the type of system the library can purchase or develop.
3. High system development and maintenance cost of artificial intelligence systems in libraries.
4. Erratic power supply to power artificial intelligence systems in libraries especially in developing countries.
5. Inherent complexities of expert/artificial intelligence systems' development.
6. Limited natural language capabilities.
7. Intelligent systems lack that common base of human knowledge, severely constraining the types of functions that they can perform.
8. Level of effort and technical expertise needed to create artificial intelligence systems in libraries. The level and nature of effort that must be invested to develop an intelligent library system is directly proportional to the power and complexity of the system. This implies that, the more intelligent the system is, the more the effort that must be invested therein. Currently, the required skilled personnel with expensive development tools or techniques, needed to develop sophisticated intelligent system in libraries are lacking or costly, hence, the lack of such systems in libraries.
9. Limited amount of artificial intelligence experts among library automation vendors. The field of artificial intelligence is complex and thus, requires a specialised knowledge in that aspect far beyond the development of conventional library automation systems. Consequently, this will require hiring new personnel in that area before any significant, widespread work can be done in the area of artificial intelligence systems in libraries.

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. IN addition, as it is with many emerged technologies, artificial intelligence is also viewed as thread to librarians and the touch of humans in libraries, the eventual acceptance and incorporation of artificial intelligence into library services will no doubt reveal the many potential promise it has in librarianship. Artificial intelligence will not diminish the human touch in libraries, nor will it erode the library's connection with their patrons any time soon.

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