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Abstract

Application of Artificial Intelligence is now evidence in all spheres of life, in the educational, medical, economy sectors likewise in the library to ensure prudence of available resources for better output. This research focused on the application of Artificial intelligence in Academic libraries in Nigeria. The research design adopted was qualitative research method, using expository approach for this study. The research objective set to guide this study is how the application of Artificial Intelligence could be used in Nigerian Academic Libraries. Literatures were reviewed in relation to AI study. Findings from the present study showed that AI could be applied in Academic library services in Nigeria like Expert Systems in Reference Services, Technical, Indexing, Acquisition and its application in Natural Language Processing, Pattern Recognition and Robotics in library activities. It is recommended amongst others that academic libraries in Nigeria should embrace the use of Artificial Intelligence in the library operations, library's staff be trained on its use in the library service delivery in addition to its institution in all library units. Expenditure on Artificial Intelligence be included in the institutions' budgetary allocations. The use of Artificial Intelligence in Academic libraries in Nigerian library system could foster easy access to information

Keywords: Artificial Intelligence, Academic Libraries, Library services, Nigeria

Introduction

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.

In the educational sector, AI is used to teach the little children who are at the play group, preparatory and kindergarten classes to impart knowledge on them using robots as teaching aids to be used in the classrooms.

In the medical sphere, during the early stage and trial moments of Covid-19 pandemic, AI was used as one of the most important and effective technology that screened the virus and symptoms and it helped to manage the crisis at the time that the virus was ravaging.

In the economy and commerce, experts in Integrated Marketing Communications (IMC) are of the view that the AI technology is assisting the customers' daily lives thereby making every task and chores easier. The area of business economy is therefore leveraging solely on AI to develop brand management strategies as a fundamental part of their vision and mission. Companies in the business world have been encouraged to key into the use of artificial intelligence in the running of the affairs of their various organizations. Artificial Intelligence will help companies in getting better results in their operations. It is therefore suggested that brand managers and marketers should use artificial intelligence as a game changer so as to optimize value in increasing competitive market. The use of Artificial Intelligence in all facets of life will help to cut wastage and cost of production and delivery of goods and services thereby helping to get a better result in their operations.

The intensive pressure on librarians to provide high quality services to library users due to information explosion in our present society have led to incorporation of modern technologies.

Artificial Intelligent have found its way into the library as a chat box that handle directional

questions on library website, overdue alert, response to simple informational requests and direct users to relevant resources in the library. Artificial Intelligent is a collaborative robots used to interact with human on the library floor and perform complex or repetitive tasks. 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).

In Nigeria, the academic librarians have seen Artificial intelligence as a new driving force for the development of intelligent library. In order to meet up with the current global trends in librarianship, Librarians have begun to incorporate artificial technologies in the library system so as to meet up with the current trends in the country. Despite their efforts to meet with the current trends, there is few or no documentation on the incorporation of Artificial Intelligent in academic libraries in Nigerian educational institutions. Moreover, most available literatures on Artificial Intelligent in libraries were mostly carried out in western world and developed countries. Little or no documents were available on the application of artificial Intelligent in Libraries in developing countries. There is need to have a document that will expose the application of Artificial Intelligent in Nigeria academic libraries. This necessitated the embarking of this study. Therefore, in order to achieve the aim of this study. The following research objective has been set to guide this study:

- ✓ To reveal the application of Artificial Intelligent in Academic Libraries in Nigeria.

As stated above, this research is to intimate the audience on the use of Artificial Intelligent in academic libraries in Nigeria. The qualitative research method was adopted as well as expository approach was used for this study. Information was sourced from online search engines which are solely articles, journals and international publications.

Literature Review

Librarians have acquired many skills to organize the information and making it accessible anywhere, libraries can ensure the application of the tools for the new generation of knowledge, which surpasses Google search that has been developed for academic purposes (Jacknis, 2017). Libraries focus attention on enhancing the access to content with the application of AI. We have been watching the evidence of this transformation toward AI application with many libraries initiating and providing Makerspace competences (Kristin, 2016). According to Liu (2011) in her articles, provided a comprehensive literature review on the utilization of intelligent agent technology in the library environment. The researcher here expressed that both AI and librarians needed to reinforce each other in the interest of providing the best service to patrons.

Artificial Intelligent

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 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. Similarly, Omame & Alex-Nmecha, (2020) were of the opinion that 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, modeling of the function of the eye. It also encapsulates speech recognition; speech production, understanding and use of natural language (Natural Language Processing) and Expert System which continues to gain more attention. Artificial Intelligence focuses on non-algorithmic methods for solving problems and symbols. AI depends on the skill of mapping the symbols. New applications have created great opportunities for informational researchers, such as multimedia systems, digital libraries, GISs and e-commerce. As the application becomes increasingly powerful, diversified, pressing, several known problems in finding information became even more important in this technological era (Vijayakumar & Sheshadri, 2019). Artificial intelligence can be divided into three types: symbolism, connectionism, and behaviorism. Symbolism is an intelligent simulation method based on logical reasoning to simulate human intelligent behavior. The main principle of connectionism is the connection mechanism and learning algorithm between neural network and neurons network. The theory of behaviorism is cybernetic and perceptual-action control system. Presently, the popular technical fields involved in artificial intelligence research are: problem solving, natural language processing, artificial neural networks, genetic algorithms, expert systems, knowledge engineering, artificial life, deep learning, intelligent control etc (Liu, 2016)

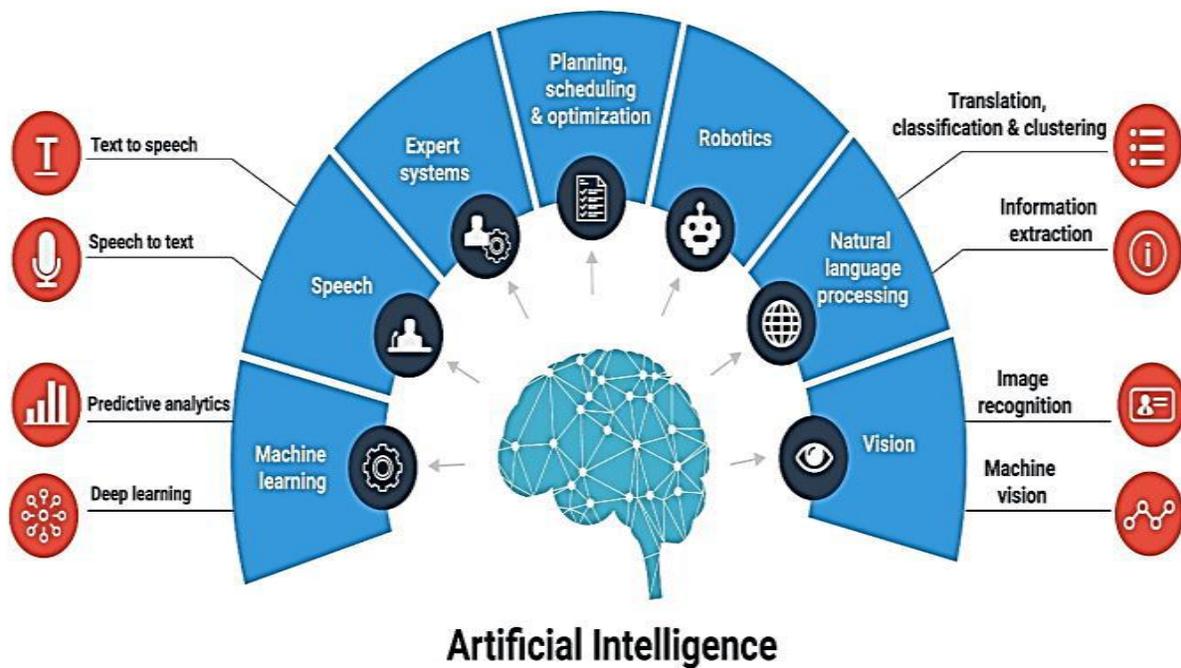


Figure 1: Artificial Intelligent Component Diagram (Source: Vijayakumar & Sheshadri, 2019).

The above figure 1 AI component diagram had shown the artificial intelligent sub areas such as expert systems, natural language processing, pattern recognition and robotics. They aim to simulate human intelligence with computers.

- ✓ **Expert System:** The Expert System is a computerized knowledge system that serves as an interface or gateway for providing access to the database and obtaining relevant information. It ranges from simple regulatory systems with flat data to very large-scale, integrated development that takes many years to develop. An expert system is a computer program that offers expert advice, decisions or solutions to a particular situation. Knowledge base, inference engine and user interface are the various components of the expert systems.

- ✓ ***NATURAL Language Processing:*** One of the long-standing goals of computer science (CS) is to teach computers to understand the language we are talking about today. The ultimate generation of computer language is Natural Language. Artificial intelligence scientists have been able to build a natural language interface using a limited vocabulary and syntax. The computer can understand the key language concepts within a question and solution through the natural language process. It aims to design and create a computer that analyzes the language that a person uses, understands and generates. Speech synthesis, machine translation, linguistic approaches, information recovery, information extraction and speech recognition are the various elements of natural language processing.
- ✓ ***Pattern Recognition:*** The new stimulus and the pre-stored stimulus coincide closely by this process. This process takes place continuously through the lives of all living beings. Pattern recognition is being studied in many areas including psychology, ethology, cognitive science and informatics. Pattern recognition based on prior knowledge or on data from the patterns. Classified patterns typically consist of groups of dimensions or observations that define points in a multi-dimensional space. Components for pattern recognition are data collection, pre-processing, selection of characters, selection of models, training and evaluation.
- ✓ ***Robotics:*** The field of robotics is frequently described as an AI subfield, which deals with motor and perceptive tasks. Robot is a mechanical device which carries out automation tasks using artificial intelligence techniques, either directly human control or a predetermined program.

- ✓ **Machine learning:** Arthur Samuel, an American pioneer in computer gaming and artificial intelligence, invented the term 'machine learning' in 1959 and defined it as “it gives computer the ability to learn without explicit programming”. Depending on the nature of the "signal" or "responses" to the learning system, machine-learning applications which are divided into four primary categories, i.e., (a) Supervised learning (b) Unsupervised learning (c) Reinforcement learning (d) Semi-supervised learning.
- ✓ **HAMLET:** The system is HAMLET (*How about Machine Learning Enhanced Theses*) currently a developer at the Berkman Klein Center for Internet and Society at Harvard. HAMLET uses the doc2vec algorithm. This is an algorithm for estimating the similarity in meaning between different documents, based on a widely used algorithm word2vec, which estimates the similarity between words. It explores the results online at the URL in the gray box. HAMLET has three prototype interfaces: a recommendation engine, an uploaded file oracle, and a literature review buddy (Asemi & Asemi, 2018 & Mogali, 2015).

Moreover, Kristin (2016) reveals that

AI applications give libraries the opportunity to change the emphasis and attention. The way we navigate the information is kept altering. AI gives a very useful shortcut to apply this knowledge and produce better outcomes. The libraries are positioning themselves to take advantage of the application of cognitive computing in general and artificial intelligence in particular for their potential utility as a tool for refining the quality of library services. Below are the means in which Artificial Intelligent could be applied in Academic library services in Nigeria.

1. Applications of Expert Systems in Reference Services

Reference service is one of vital services rendered in any library and the Expert System has to be used so as to substitute the reference librarian in the following ways:

- ✓ **Research:** It is a designed system that supplies clients with recommended sources to lookup for certain question. This is a system that teaches reference skills or computerized aid for practicing reference librarians and information specialists.
- ✓ **Pointer:** It is also known as knowledge based system but acting as computer assisted reference program. It directs patrons to reference sources
- ✓ **Online Reference Assistance (ORA):** This system intended to stimulate the services of an academic reference Librarian for questions of low and medium level by using several technologies: Examples
are videotext like database, computer assisted instruction modules and knowledge based system. ORA consist of directional transactions like library locations, services and policies.
- ✓ **Answerman:** It is a Knowledge based system that aid users for reference questions on topics of agriculture. It has series of menus that narrow down the subject of the questions and the type of tool needed. It can function as either a consultation system or as a front end to external databases and CD-ROM reference tools.
- ✓ **PLEXUS:** This is a referral tool used in Public Libraries. It includes knowledge about the reference process, information retrieval about certain subject areas, reference sources, and library users. All the above systems are advisory systems for locating reference source books and factual data.

2. Application of Expert System in Cataloguing

Cataloguing is known as the oldest library crafts. Recent attempts to automate cataloguing through Expert Systems have focused on descriptive cataloguing because it is considered as rule-based (AACR2). There are two approaches for applying artificial intelligence techniques to cataloguing

- ✓ A human-machine interface, where the intellect effort is divided between the intermediary and the support system;
- ✓ An Expert System with full cataloguing capability linked into electronic publishing system so that as a text is generated on-line, it can be passed through knowledge based systems and cataloguing process done without any intellectual input from an intermediary.

3. 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 centres. Application of Expert System in the area of classifications in libraries includes the following:

- ✓ Coal SORT: It 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 move around in the conceptual structure. The expert knowledge in the system is embodied almost entirely in the semantic network.
- ✓ EP-X: The Environmental Pollution Expert (EP-X) has certain things in common with coal SORT in that both are concentrating on enhancing interface using a knowledge

based approach. The knowledge base of EP-X consists of hierarchical frame-based semantic network of concepts and a set of template that expresses the patterns called the pragmatic relationship among concepts. These patterns are referred to as conceptual information.

- ✓ BIOSIS: BIOSIS uses knowledge based devices including a significant amount of procedural knowledge that automatically assigns documents to various categories. It is designed as an indexer aid. BIOSIS uses the information in the titles of biological documents to assign as many categories as possible of those that would be assigned by human indexers. The indexing languages are structured and practical representation of information that can be used to very good advantage of AI applications.

4. Application of Expert System in Indexing

Indexing of periodicals is another area where expert systems are being developed. Indexing a periodical article involves identification of concepts to translate these concepts into verbal descriptions by selecting and assigning controlled vocabulary terms that are conceptually equivalent to verbal descriptions. The reason for automating the intellectual aspects of indexing is to improve the indexing consistency and quality. Based on the information provided by the indexer, the systems can arrive at appropriate preferred terms to automatically assign relevant subdivisions. The system can make inferences and based on those inferences, it can take appropriate action. 'Med Index' is the best example of indexing system used in the library Indexing activity. Very few library users have interacted with knowledge based systems. Generally, users have had very little contact with these systems due to the fact that most of them are not perfect enough to be used by the everyday library patron.

5. Application of Expert System in Acquisition

The collection development area is another integral unit of the library. The librarian or the information officer is the key person in this activity. Library users have a significant role to play in building electronic collections and that their help and advice should be solicited in the process. Several systems have been incorporated. Monograph Selection Advisor, a pioneering effort in applying this emerging technology in another area of library science i.e. building library collection. Specifically, the task modeled is the item-by-item decision that a subject bibliographer makes in selecting monographic details. The knowledge base has to be broad enough and the interfacing aspect must be easy enough for the library to get the desired information from the machine.

6. Applications of Natural Language Processing in Library Activities: When we think of the term NLPL, the first thought one might have is of being able to speak or write in a complete sentence and have a machine to process the request and speak. NLPL can be applied to many disciplines. This could be applied to the field of library and information science and more specifically in the area of searching database such as Online Public Access Catalogues (OPAC). Indexing is the basis for document retrieval. “The aim of indexing is to increase precision, the portion of the retrieved documents that are relevant; and recall, the proportion of relevant documents that are retrieved”

7. Application of Pattern Recognition in Library Activities: In this era of the Internet and distribution of information, multimedia computing, new and emerging classes of information systems’ applications have swept into the lives of office workers.

New applications ranging from digital libraries, multimedia systems, geographic information system and collaborative computing to electronic commerce have created tremendous opportunities for information researchers and practitioners

8. **Applications of Robotics in the Library Activities:** Robot is “an automatically controlled, reprogrammable, multi-purpose manipulator programmable in three or more axes which may be either fixed in place or mobile for use in automation applications.” The robots are on scrambling, rolling, flying and climbing. They are figuring out how to get here on their own. As libraries provide a growing array of digital library services and resources, they continue to acquire large quantities of printed materials. This combined pressure of providing electronic and print-based resources and services has led to severe space constraints for many libraries especially academic research libraries. The goal of the Comprehensive Access to Printed Material (CAPM) is to build a robotic on demand and batch scanning system that will allow for real-time browsing of printed material through a web interface. The user will engage the CAPM system that, in turn, will initiate a robot that will retrieve the requested item. The robot will deliver this item to another robotic system that will open the item and will automatically turn the pages. By using existing scanners, optical character recognition (OCR) software and indexing software developed by the Digital Knowledge Centre, the CAPM system will not only allow for browsing of images of text, but also for searching and analyzing of full-text generated from the images.

Conclusion

Conclusively, the application of Artificial intelligence in Academic libraries in Nigeria has been seen as a new driving force for intelligent library development. Librarians have begun to adopt

artificial technology in some specific areas of their respective libraries to meet with current global trends. The novel trends of application of Artificial Intelligence in the library operations in academic libraries are the following: Expert Systems in Reference Service, Cataloguing, Classification, Indexing, Acquisition as well as artificial intelligence on Natural Language Processing in Library Activities, Pattern Recognition in Library Activities and Robotics in the Library Activities. Therefore, AI application to library services takes off complex and stressful work that humans may encounter lesser error and defect, aids to access research works, lack of human touch and replacing human involvement.

Recommendations

Based on the enumerated findings, it is recommended that all the academic libraries in the country should key into the application or adoption of Artificial Intelligence in their library operational system.

- i. Artificial Intelligence should be introduced in all the sections of academic libraries so as to ease efficient and faster library operation and service delivery in the contemporary Information and Communication (ICT) Technology era.
- ii. All academic libraries are enjoined to train and retrain all their members of staff on the use of artificial intelligence in the library system.
- iii. Annual budgetary allocation on training should be included in tertiary institutions' budget so that staff in all other departments could be trained on the use of artificial intelligence in their departments as this would encourage prompt service delivery.

- iv. Artificial Intelligence should be introduced into the national education curricula at all levels so that the products of such institutions could be engaged in all sectors of the economy and use their expertise of Artificial Intelligence for national development.

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