

The Automation Impact of Artificial Intelligence (AI) in Services Delivery to Academic Library Users and Librarians in Nigeria.

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Abstract

Technological advancement has continued to change the world and various activities taking place within it. This technological change is so fundamental that it is reshaping job performances, enhancing human development and also providing different bases for the promising future of technology penetrating into human ways of doing things. Series of studies have shown levels of technology application to library services. This paper presents some of the branches of artificial intelligence such as expert systems, natural language processing, neural network and robotics, and the impacts they have created as a result of their application in enhancing library services delivery to academic library users and librarians in Nigeria.

Keywords: Artificial intelligence, academic library, expert system, natural language processing, neural network, robotics.

Introduction

Two independent words put together produced the concept “Artificial Intelligence” which has gained dominance in the academic world of technological advancement over the years. According to the British Dictionary (2012) online edition, the word artificial was defined as something made out of imitation, something not natural, lacking spontaneity, something assumed and not sincere. The Webster’s New World Dictionary further defines artificial as something made out of human works and not natural. In other words it means something not arising from natural or necessary causes; contrived or arbitrary. Intelligence is the ability to learn or understand or to deal with new or trying situations: the skilled use of reason, the ability to apply knowledge to manipulate one’s environment or to think abstractly as measured by objective criteria (as tests)”. It is the general mental ability involved in calculating, reasoning, perceiving

relationships and analogies, learning quickly, storing and retrieving information, using language fluently, classifying, generalizing, and adjusting to new situations. The Encyclopedia Britannica, (2006), further defines intelligence as the ability to adapt effectively to the environment, either by making a change in oneself or by changing the environment or finding a new one, it is not a single mental process, but a combination of many mental processes directed towards effective adaptation to the environment. The focus of this paper therefore is to examine the automation impact of ARTIFICIAL INTELLIGENCE (AI) in services delivery to academic library users and librarians in Nigeria.

What is Artificial Intelligence?

The concept is relatively new in its application in the Nigeria academic libraries system, although it has been in use decades back among western world libraries. Various academic scholars across the globe have given diverse definitions and opinions on the relevance of artificial intelligence to library services. Frankenfield (2021) defines artificial intelligence (AI) as the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving. Kok, et al (2018) defined artificial intelligence as an area of study in the field of computer science which is concerned with the development of computers able to engage in human-like thought processes such as learning, reasoning, and self-correction. The report further stated that the concept of the machines can be improved to assume some capabilities normally thought to be like human intelligence including learning, adapting, self-correction, etc. Merriam-Webster (2019) defined artificial intelligence as

a part of computer science that deals with giving ability to the machines to look like they have natural human intelligence. Raynor (1999) indicated that artificial Intelligence is that field concerned with developing techniques to allow computers to act in a manner that seems like an intelligent organism, such as a human would. His report further argued that the aims vary from the weak end, where a program seems "a little smarter" than one would expect, to the strong end, where the attempt is to develop a fully conscious, intelligent, computer-based entity. Asemi and Asemi (2018) defined artificial intelligence as that area of computer science that focuses on creating machines that can engage on behaviors that humans consider intelligent and these areas includes: expert system, fuzzy logic, artificial neural network, evolution algorithms, case base reasoning, image processing, natural language processing, speech recognition and robotic.

The goal of Artificial Intelligence is to develop computers that can think, see, hear, walk, talk and feel, and the beauty lies in the fact that these computers can recognize patterns efficiently at a scale and speed that human beings cannot. Literally speaking, artificial intelligence can be described as a replica knowledge through the application of computer peripherals which has been programmed to become real and beneficial to mankind because of its technological application and usability. It is a technology which has given the world a face lift in the advancement of human knowledge and its' application to all disciplines.

Academic library

The academic libraries being the hub wherein teaching and research activities, are processed to enhance and meet the demands of its clientele's calls for continuous academic and knowledge upgrade. According to Chalukya, (2015) academic library is designed to support the

teaching and research needs of the institution they serve, with a view to ensuring that the use of its information resources and services are maximized to benefit its users.

Going by the technological advancement world over in the discharging and performing the general academic library routine, academic libraries in Nigeria should not be left lagging behind. The academic library has continued to metamorphose from its traditional (analog) functions it use to operate to the digital and now the artificial intelligence performances. It is important to emphasize here that as the daily library schedules are changing so also the academic library librarians' responsibilities are changing for more enhanced job performances.

Traditionally, the academic libraries are saddled with the total function of given direct service to individual on individual bases, regardless of the kind of information and the purpose to which it will be put to the library users.

With the era of digital libraries and librarianship, the academic library services was affected, as the services was moved to the virtual world of the Internet. This technology allow library users to submit queries to the library at any time and from any place in the world and by this act, patrons can access the resources from outside the physical library building, Chandwani (2018). This paradigm shift of artificial intelligence technology have place the library in a state of technological advancement and except the library begins to explore the dividends attached to artificial intelligence and apply them to her daily routine activities in service delivery, they may face obsolescence in this era. The advent of Artificial Intelligence (AI), in the academic library services has further received a boost in its services dissemination.

Services delivery through application of Artificial Intelligence (AI) in academic libraries

The application of Artificial Intelligence (AI) in library services delivery have contributed to the enhancement of the job performances of many librarians functions such as cataloging, indexing, information retrieval, reference, and other purposes. It can also be utilize in many areas such as speech recognition, machine translation and librarian robots. The concept of artificial intelligence is very broad and can be applied to every facet of the academic libraries as well, to make it a smart library. However, for the sake of this paper, artificial intelligence activities shall be narrowed to the services delivery of the academic library in reference services, cataloguing & classification services, circulation services and collection development services. Based on the essentialities of artificial intelligence, it's applicability in the academic libraries is of paramount importance. The academic library is the image maker of the institution, and the application of this technology to its services delivery will enhance and create a new driving force that will provide the library clientele with more efficient, effective and high quality services.

Expert Systems in reference services delivery unit of the academic library

An expert system is a computer system emulating the decision-making ability of a human expert, they mimic the decision-making intelligence of human. It is a knowledge-based system that employs knowledge about its application domain and uses an inference (reason) procedure to solve problems that would otherwise require human competence or expertise. They are designed to solve complex problems by reasoning through bodies of knowledge. Shrivastava, (2018), described an expert system as a computer program that attempts to mimic human experts by the system's capability to render advice, to teach and execute intelligent tasks. The application of the expert system to the reference service unit of the academic library will go long way in assuaging the efficiency of the routine reference librarian's task. However, the introduction of

artificial intelligence to reference unit will help the library users to know how to use the information resource materials in the library, it can also assist the patrons to locate information resource materials in the shelves, as well as further guide the library users on the type of information resource materials fall on. Artificial intelligence in the reference unit direct users on how to use online information resource materials. This is because expertize knowledge base of a particular domain are required in designing the software.

The key features of expert systems include extremely responsive, reliable, understandable and high execution. The beauty of expert system is that, they use a knowledge base of a particular domain and bring that knowledge to bear on the facts of the particular situation at hand. Hence, if applied to academic library reference unit, the expertise base knowledge will provide excellent and efficient outcome to all library users. When expert system is applied to the reference service unit of the library it can complete its part of the tasks much faster than a human expert. The error rate of successful systems becomes low, sometimes much lower than the human error rate for the same task. It can also facilitates making of consistent recommendations.

Natural Language Processing (NPL) in collection development unit of the academic library

Another area through which the academic library would gain prominence with the technology of artificial intelligence is on Natural Language Processing. This techniques allows a computer to understand the main linguistic concepts within a question or solution, and Its goal is to design and build computer that analyze, understand and generate language that humans use naturally (Kumar,2004). According to Zulaikha (2020), Natural Language Processing (NLP) refers to the science of drawing insights from natural human language in order to communicate with

machines and grow businesses. Poelmans (2020) further defined natural language processing as a form of artificial intelligence (AI) that gives computers the ability to read, understand and interpret human language. It helps computers measure sentiment and determine which parts of human language are important. For computers, this is an extremely difficult thing to do because of the large amount of unstructured data, the lack of formal rules and the absence of real-world context or intent.

The following are some of the tools used in natural language processing that enhance artificial intelligence when applied to the academic libraries: Spell checker, Autocomplete, Spam filters, Voice text messaging. Vijay and Sheshadri (2019), emphasized that NLP 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 it possesses. Being able to talk to computers in conversational human languages and have them understand us is a goal of artificial intelligence researchers. Omame and Alex-Nmecha (2020) stated that in libraries, NLP can be used to design intelligent expert information retrieval system, where users can interact directly with the system using natural languages. The computer takes in the natural language as input, analyses and processes it, then respond accordingly with the needed information.

The AI technology enables the collection development unit of the academic library to be very accurate in the process of responding to the users demands in the library without the interferences of humans. It is the collection development unit of the academic library that source for the exact demand of the users and make these relevant information materials readily

available, through the proper selection tools and acquisition processes, it also periodically reviews the library collections through proper weeding. Applying the natural language processing software to academic library, will, to a very high extent improve the services delivery. The main application for natural language systems at this time is as a user interface for expert and database systems.

Neural Networks in the cataloguing and classification unit of the academic library

These are computing systems modelled on the human brain's mesh-like network of interconnected processing elements, called neurons. Neural networks are much simpler than the human brain (estimated to have more than 100 billion neuron brain cells). Like the brain, however, such networks can process many pieces of information simultaneously and can learn to recognize patterns and programs themselves to solve related problems on their own. Mohaiminul, Guorong and Shangzhu (2019), opined that neural network is a type of artificial intelligence that attempts to imitate the way a human brain works. Rather than using a digital model, in which all computations manipulate zeros and ones, a neural network works by creating connections between processing elements and the computer equivalent of neurons. It is an array of interconnected processing elements, each of which can accept inputs, process them, and produce a single output with the objective of imitating the operation of the human brain. Knowledge is represented in a neural network by the pattern of connections among the processing elements and by adjusting weights of these connections. The neural network can be trained to recognize certain patterns and then apply what it learned to new cases where it can discern the patterns. This branch of artificial intelligence to the cataloguing and classification

unit of the academic library will enhance the total functions of the unit. Recall that cataloguing and classification of information resource materials in the library, though most tedious, is the heart of librarianship profession.

Cataloguing and classification provide details of author's name, titles and subject terms to describe information resources it also classifies information to a class in a classification system using cataloguing and classification tools and schedules. Considering the billions of neuron cells applied manually in achieving the set task in this unit of librarianship, the application of the neuron network to achieve this task shall be highly effective. Doszkocs (1990), stated that the integration of neural network alongside with other artificial intelligence technologies into the academic library will undoubtedly proffer massive solution to major academic library challenges, which includes ability to self-organize and automatically restructure the database, with incomplete or imprecise queries, support natural language interfaces, resolve semantic ambiguities and complexities in queries, perform closest (partial) match non-Boolean searches. The researcher went further to state that it provides ranked output of relevant items, organize the database according to user preferences, accept relevance and other feedback from the user, learn document, term and query distribution patterns, exploit implicit and explicit associations in the database, cope with the combinatorial information explosion, offer "intelligently synthesized" output (answers, summaries), discover and suggest new relationships and hypotheses.

Robotics in the readers services unit of the academic library

According to Wikipedia/robotics (2014), this is often described as the subfield of Artificial Intelligence that is concerned with perceptual and motor tasks, it is described as 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. Engineering, and physiology are the basic disciplines of robotics. This technology produces robot machines with computer intelligence, computer-controlled and human-like physical capabilities. Considering the multifaceted services delivery in the academic libraries world over, the application of robotic services into the circulation unit of the academic library have become imperative. Robots, are 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.

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. Vysakh and Rajendra (2020), stated that they have started to place robots instead of humans in various operations especially those tasks which are hazardous and time-consuming. For example, Robot at PESIST central library helps in the filing, sorting and replacing the books in the shelf and that libraries with a huge collection are now using robots for inventory purpose, (Manoj, 2016). The introduction of robots to engage in this function enhances the smooth running of the library activities. The librarian spends the time (which the robots occupy) on other meaning schedule, which otherwise would have been wasted in moving from one place in the library. Another robot from the same library named 'Bobbie'

delivers materials like newspapers, magazines, and brochures, welcomes and directs guests and students to various locations. The robot has also been programmed to answer Frequently Asked Questions (FAQs) that students may have (Tay, 2014). Talking robots can be placed in various sections of the library as a user aid and guide, while the integration robots with other artificial intelligence technologies like a drone being controlled by a robot can make sure that the library is always under surveillance.

Conclusion

Series of the success stories of the application of artificial intelligence seems to be progressing and diversifying across the globe in all areas of human endeavours and the future looks very promising and bright with the presence of this technological advancement. This technology has not only enhanced human existence with respect to service delivery, it has enabled academic libraries of higher institutions of learning to increase their scope of activities and enlarge its horizons of services dissemination with ease and accuracy. Also, the application of expert systems, natural language processing, neural network etc. has transformed the analog daily library routine services. Finally the increasing relevance of Artificial Intelligence as shown in this paper indicate that, in the near future, the lives and functions of librarians who will embrace this recommended technology will be greatly improved.

References:

- Asemi, A. & Asemi, A. (2018). Artificial intelligence (AI) application in library systems in Iran: A taxonomy study. *Library Philosophy and Practice* (e-journal). <https://digitalcommons.unl.edu/libphilprac/1840>
- Chalukya, B. V (2015). Academic libraries and user education. *E-Library Science Research Journal*. Accessed 01/01/2021. 3(5). https://www.researchgate.net/publication/279182896_ACADEMIC_LIBRARIES_AND_USER_EDUCATION

- Chandwani, A. (2018). An overview of Digital Reference Services. eprints.rclis.org. Retrieved 20 December 2020, from http://eprints.rclis.org/14295/1/DIGITAL_REFERENCE_SERVICES.pdf.
- Doszkoecs, T. E. (1990). Neural networks in libraries: The potential of a new information technology. <http://web.simmons.edu/~chen/nit/NIT%2791/027-dos.htm>
- Frankenfield, J. (2021). What is Artificial Intelligence (AI)? *Alternative Investment*. <https://www.investopedia.com/terms/a/artificial-intelligence-ai.asp>
- Kristin, W. (2016). Libraries in an Artificially Intelligent World, *Public Libraries*, 2016. [Online]. Available: <http://publiclibrariesonline.org/2016/02/libraries-in-an-artificially-intelligent-world/>
- Kok, J. N., Egbert J. W. B., Walter A. K., Peter van der P. and Mannes P. (2018). *Encyclopedia of life support system*. Artificial Intelligence: Definition, Trends, Techniques and Cases <http://www.eolss.net/sample-chapters/c15/e6-44.pdf>
- Kumar, P.S.G. (2004) Information Technology: Applications. New Delhi: BRPC. Pp 401-425
- Merriam-Webster, (2019). Definition of Artificial Intelligence. [Online]. Available: <https://www.merriam-webster.com/dictionary/artificial+intelligence>
- Mohaiminul, I., Guorong, C., Shangzhu, J. (2019). An Overview of Neural Network. *American Journal of Neural Networks and Applications*. 5(1); 2019: 7-11. doi: 10.11648/j.ajna.20190501.12
- Oname, I. & Alex-Nmecha, J. C. (2020). Artificial intelligence. *ResearchGate*. https://www.researchgate.net/publication/338337072_ARTIFICIAL_INTELLIGENCE_IN_LIBRARIES. DOI: 10.4018/978-1-7998-1116-9.ch008
- Poelmans, K. (2020). What is Natural language processing? *Textmetrics*. <https://www.textmetrics.com/what-is-natural-language-processing-nlp>
- Raynor, W. J. (1999). The international dictionary of Artificial Intelligence. <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.375.8194&rep=rep1&type=pdf>
- Shrivastava, S. (2018). Artificial intelligence and expert system: Intelligent library. *International Journal of Innovation and Research in Educational Sciences*. 5(4), 2018, pp476-478. https://www.ijres.org/administrator/components/com_jresearch/files/publications/IJRES_1299_FINAL.pdf

Vijay, K. S. & Sheshadri, S. K. N. (2019). Applications of Artificial Intelligence in Academic Libraries. *International Journal of Computer Sciences and Engineering*. 7(16), 2019. https://www.researchgate.net/publication/332876721_Applications_of_artificial_intelligence_in_academic_libraries

Vysakh, C and Rajendra, B. H. (2020). Application of artificial intelligence robot in libraries. Reshaping of Librarianship, Innovations and Transformation, Pp59-63. https://www.researchgate.net/publication/338712408_Application_of_Artificially_Intelligent_Robot_in_Libraries

Zulaikha, L. (2020). Types of artificial intelligence you should know. <https://www.edureka.co/blog/types-of-artificial-intelligence/>