

APPLICATION OF ARTIFICIAL INTELLIGENCE (AI) FOR SUSTAINABLE LIBRARY SERVICES IN THE 21ST CENTURY

By

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Being a paper presented at the 3rd International Webinar organised by the Kwara State
University Library, Malete on 28th of May, 2024

Abstract

The rapid evolution of technology in the 21st century has significantly transformed the role of libraries from custodians of information to dynamic, interactive, and sustainable knowledge hubs. This paper explores the application of Artificial Intelligence (AI) in enhancing library services, addressing misconceptions about AI while highlighting its potential to streamline operations and improve user experiences. AI applications such as automated cataloguing, personalised recommendations, predictive analytics for collection development, chatbots for user support, and surveillance systems for security are examined alongside case studies from libraries worldwide. The paper also discusses ethical considerations including data privacy, bias, and transparency, emphasizing the need for strategic planning, staff training, and collaboration with technology partners. By integrating AI responsibly, libraries can uphold their core values of inclusivity, access, and knowledge dissemination while adapting to the demands of the digital age. Ultimately, AI offers librarians opportunities to redefine their roles, foster innovation, and ensure sustainable library services for diverse communities.

Preamble:

Good morning, the University Librarian, Kwara State University, Malete (Prof. Abdulsalam A. Salman), esteemed colleagues, distinguished ladies and gentlemen.

Please permit me to stand on the well-established protocol of the chief host. It's my pleasure to be one of the speakers on this platform today and I wish to use this medium to appreciate the organisers for having me.

To all participants on this platform, I sincerely welcome you to this enlightening session on the intersection of technology and knowledge.

Introduction

Libraries have always been the custodians of human wisdom right from time immemorial, libraries serve as the gateways to information resources, independent learning, and enlightenment. Without any iota of doubt, technological advancement has brought about a paradigm shift the role of librarians due to the challenges and opportunities brought by these emerging technologies. These roles have extended beyond the mere provision of information resources and preparation of manual card catalogues but we now find ourselves at the crossroads of tradition and innovation, where the whispers of ancient manuscripts blend seamlessly with the hum of neural networks.

Today, we embark on a journey that transcends mere algorithms and data points; we will look at how AI is reshaping the very essence of libraries, making them more dynamic, responsive, interactive and sustainable.

The topic given to me is "Application of Artificial Intelligence (AI) for Sustainable Library Services in the 21st Century which I considered timely and apt. This is because **there are many misconceptions about AI and how it will affect the job of professional librarians.**

Let's take a look at how library services were being rendered in the past and observe the pressure put on library service delivery in this era of Artificial Intelligence. There is no doubt the impact of 4th Industrial Revolution has revolutionised the way library services are now being delivered. The evolution of library services has been marked by the introduction of electronic systems of acquisition and processing of library materials (Waldstein, 1986) and the increasing use of Information Communication Technologies (ICTs) (Mayega, 2008) in the library environment. These changes have transformed the role of libraries from mere information storage to active learning institutions, with librarians providing reference and data services to support learning and career activities. However, the challenges of dealing with the complexity of information and meeting user expectations remain Mayega (2008) and that is why we librarians must study what happens around us and take the good aspect of it, to foster better service delivery to our users.

So, what is AI?

Artificial intelligence (AI), is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. (Copeland, 2024)

AI can be defined as a technology or machine's ability to perform tasks that normally require human intelligence. AI has also been defined as the ability of a machine to reason, solve problems, and adapt to the environment, similar to how a human being does. (Chen & Chen, 2022). The most important thing to note is that any good definition of artificial intelligence must contain one or two terms: technology, process, product, machines, performs tasks, and imitates or mimics human intelligence. The term AI is often used interchangeably with its subfields, which include machine learning (ML) and deep learning (DL).

Brief History of AI

AI was formally founded in 1956 during a conference held at Dartmouth College, where the term "artificial intelligence" was coined. It was reported that Alan Turing suggested the development of an imitation game popularly known as the Turing Test which served as the beginning of the Artificial Intelligence machine. Among the founding fathers of AI were John McCarthy, Marvin Minsky, Allen Newell, and Herbert A. Simon. Minsky, Nathaniel Rochester and Claude E. Shannon coined the term "artificial intelligence" John McCarthy founded the field of Artificial Intelligence. In late 2022, the advent of ChatGPT reignited conversation about the likelihood that the components of the Turing test had been met (Britannica).

What AI Is and Is Not

There are a lot of misconceptions in respect of this...

The problem is that humans confuse it with human intelligence. It is not. But what is certain is that we cannot have AI librarians /AI engineers or doctors. This is because AI does not have a wish, doesn't have emotion, doesn't want company, doesn't want money, a car or anything other than algorithms. So, AI should not be seen as a Jobs Destroyer/ Terminator because it is just an applied statistic that has come into play here and that is why the issue of bias should not come into play, we use it systematically to eliminate any form of bias and error.

What AI is good for

Narrow tasks

Repetitive tasks

Well-defined tasks

- Tasks with lots of data to learn from
- Tasks where the cost of errors is low

What AI is not Good for

- Critical thinking
- Integrating disparate information
- Creativity and Originality
- Ethical decision-making
- Replacing human interaction and empathy

Relationship between AI, Machine Learning and Deep Learning

- AI** encompasses the entire field of intelligent systems.
- ML** is a subset of AI that focuses on self-adapting algorithms. ML algorithms learn from data, recognize patterns, and make predictions or decisions.
- DL** is a subset of ML that uses deep neural networks for complex tasks.

Classifications of Artificial Intelligence

Based on cognitive capacity AI can be classified into 3, namely;

- **Weak or Narrow AI:** This performs specific tasks and lacks independent learning;
- **General/ Strong AI:** This AI aims to replicate human intelligence; and or
- **Super AI** is speculative but suggests AI surpassing human capabilities.
- **Weak or Narrow AI - Limited**

Weak or narrow AI refers to a type of AI that can only perform some specific tasks but cannot adapt to new or unfamiliar situations. This form of AI focuses on solving specific problems and cannot generalise its behaviour to other problems or environments (Chen & Chen, 2022).

Common applications of weak AI:

- Filtering Email Spam;
- Face Recognition
- Text – Speech
- Text – Image
- making suggestions on streaming platforms;
- deciding what to buy on e-commerce sites. Examples are Siri, and Alexa, the Amazon-developed hardware voice assistant that uses AI technology. Alexa is

designed to be used on smart home devices and is capable of responding to voice commands.

Artificial General Intelligence (AGI): AGI, also called General AI or Strong AI, aims to mimic human intelligence. These systems can learn, think, and perform a wide range of tasks at a level similar to humans. The goal is to create multifunctional AI that acts as lifelike, equally intelligent assistants in everyday life. While still a work in progress, AGI could be built using technologies like deep learning, neural networks, and advanced models.

Artificial Superintelligence (ASI):

ASI, often associated with science fiction, represents AI that surpasses human knowledge and capabilities. The idea is that once AI reaches the general intelligence level, it will rapidly acquire knowledge, surpassing even human abilities. ASI remains theoretical but sparks discussions about its potential impact on society.

What's Driving AI Adoption in the Library?

Factors that will drive the development of AI in Libraries.

- Technology and Infrastructure: Libraries need to assess their existing technological capabilities and infrastructure.
- Funding: Libraries must consider their budget and allocate resources accordingly.
- Staff Expertise and Training: Libraries need staff with expertise in AI, machine learning, deep learning and data science.
- Institutional Goals: AI initiatives in the library should align with the library's mission, vision, and strategic goals.
- Ethical Considerations - Libraries must address ethical concerns related to AI, including privacy, bias, and transparency.
- Data Management and Protection: AI relies on data. Libraries need robust data management practices, including data collection, storage, and security.
- User Education and Awareness: Libraries play a role in educating users about AI.

- Collaboration with Researchers and Developers: Libraries can collaborate with AI researchers and developers to create custom applications.

Potential Areas of Application of the AI for Sustainable Library Services

- Information Organisation:** AI can facilitate the classification of library materials by streamlining the categorization of books and resources, ensuring that users can search for information without wasting time.
- Information Retrieval Process:** AI-powered cataloguing can facilitate the process of information retrieval through
 - Automated metadata tagging
 - Image and text recognition for faster cataloguing
 - Improved organisation and accessibility of resources
- Search and Recall Precision:** AI can improve search capabilities through machine learning techniques. higher precision in search queries, significantly reducing the time users spend looking for information. Personalised recommendations
- Security or General Surveillance in the Library –** Artificial intelligence model can be trained for face recognition and surveillance within the library premises for security and personalised interactions.

e. AI for Collection Development:

AI can make predictive analytics for demand forecasting based on the usage pattern of library materials or compare requests from different users or vendors to avoid overlapping of titles recommended for acquisition. It can favourably curate contents based on user preferences. This lead to cost-effective acquisition process.

d. Virtual Assistants for Users' Support –

Chatbots can be used to answer users' queries 24/7. Chatbots use natural language processing (NLP) to understand users and allow them to respond to reference queries. These chatbots learn over time so they can add greater value to user interactions. It can recommend materials based on user's preferences and interests and it understands different languages (Multilingual support) for diverse communities to foster inclusion.

e. AI-Driven Data Analytics:

Artificial intelligence facilitates usage analysis for effective decision-making. The data analytics feature of the artificial intelligence, uses data to make predictions for library users based on their search history. It allows e-selective dissemination of information through stored users profile or history.

f. Inclusivity

Artificial intelligence can convert text to speech or provide real-time translations for users with visual or language barriers. This function gives librarians the opportunity to provide services to the marginalised users.

g. Shelf management and Inventory tracking:

This feature scans any material or books to detect radio frequency and identification sensors embedded in books to determine whether a book is duly checked out or removed unauthorisely. The artificial intelligence system can conduct shelf reading to locate misplaced library books for immediate action.

h. Trained artificial intelligence machine can track library materials on loan, send reminders to borrowers and ensure all library materials are returned when due.

Case Studies

Some examples of libraries implementing AI technologies include:

Abdullahi Fodiyo Library Complex, Usmanu Danfodiyo University, Sokoto has introduced the use of artificial intelligence to its collection development and information organisation such as AI Cataloguing and Classification. Today, the Collection Development and Processing Librarians are now using the artificial intelligence to facilitate their process of acquisition, classification and cataloguing library materials. The library also uses presentation and for generating synopsis for newly acquired materials. These make the daily routines of the library easy and effective. Similarly, The National Library of Sweden uses AI to automate the cataloguing of books and documents, improving efficiency and accuracy.

- ii. The University of Lagos Library that adopted and uses **Roboscholar** for face recognition and surveillance within the library premises, making interactions more personalised.
- iii. The university of Pretoria uses Libby, the cloud-based intelligent humanoid robot for some repetitive tasks at the UP's Merensky Library. Libby uses face recognition and assists with surveillance within the library premises. She engages with visitors, answers questions, and displays marketing videos.
- iv. Another library that uses chatbots and virtual assistants is University of Oklahoma and North Carolina State University. The university library deployed robot to assist in day to day operation.

Public Libraries:

- i. Shelf-Reading Robots: These robots autonomously scan print collections by detecting RFID tags embedded in books. They help locate missing or out-of-sequence books on shelves.
- ii. Telepresence Robots: Some libraries use telepresence robots for virtual interactions, allowing remote librarians to assist patrons.
- iii. Personalised Recommendations: Libraries such as the New York Public Library are leveraging AI to provide personalized book recommendations based on user preferences and reading history.

Practical Application of the AI in Library Services

We can use generative AIs to generate ideas, images, or guides about our projects, services, research or community services. For example, **Gemini, ChatGPT3.5 and Copilot** will help us simplify our tasks but not be used without caution and evaluation because the systems are still learning.



how are you?

Hide drafts ^ 🔊

Draft 1

I'm doing well, thanks for asking! As a large language model, I don't experience emotions in the same way

Draft 2

I'm doing well, thanks for asking! As a language model, I don't experience emotions in the same way

Draft 3

I'm doing well, thanks for asking! I'm always excited to learn and complete new tasks. How about yourself?



I'm doing well, thanks for asking! As a large language model, I don't experience emotions in the same way a person does, but I'm always learning and improving, which is exciting.

Is there anything you'd like to talk about today?

Enter a prompt here



Gemini may display inaccurate info, including about people, so double-check its responses. [Your privacy and Gemini Apps](#)

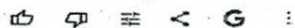


yes

Show drafts v 🔊



Great! What would you like to know? I can answer your questions about a variety of topics, or I can complete tasks like writing different kinds of creative text formats, like poems, code, scripts, musical pieces, email, letters, etc. I will try my best to fulfill all your requirements.



Gemini has just been updated. [See update](#)

Please tell me more about Prof. Abdulsalam A. Salman

Show drafts

Based on the information I found online, Prof. Abdulsalam A. Salman appears to be an expert in Library and Information Science. Here's what I could gather:

- **Affiliation:** Professor Salman is likely affiliated with the University of Ilorin, Nigeria, based on his presence on [ResearchGate](#).
- **Title:** There is some variation in titles ascribed to Prof. Salman. He is referred to as both Professor and Sub-Dean ([ResearchGate](#) and [Wikidata](#) respectively).
- **Research:** Professor Salman has publications and citations in his field. You can find some of his work on [Google Scholar](#).

Unfortunately, beyond this publicly available information, details about Prof. Salman's specific research areas or achievements are limited online.

Enter a prompt here

Gemini may display inaccurate info, including about people, so double-check its responses. [Your privacy and Gemini Apps](#)

Microsoft Bing SEARCH COPILOT NOTEBOOK

Professor Abdulsalam A. Salman

Copilot

I'm sorry, but I couldn't find any specific information on a Professor Abdulsalam A. Salman. It's possible that the details about this individual are not widely available online or may be associated with private or academic records that are not publicly accessible. If you have any additional information or context regarding Professor Abdulsalam A. Salman, such as their field of work or affiliation, it could help narrow down the search. Otherwise, you might consider reaching out directly to the institution or organization with which they are associated for more accurate information.

Learn more: 1 [imperial.ac.uk](#) 2 [bbc.com](#) 3 [britannica.com](#) 4 [en.wikipedia.org](#)

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ChatGPT

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theprime times — KWASU Librarian, Professor Abdulsalam Dissociates Self From...
theprimetimes.com.ng

Professor Abdulsalam A. Salman is a notable academic and administrator currently serving as the University Librarian at Kwara State University (KWASU) in Malete, Nigeria. He has been involved in various capacities within the university, including representing the Acting Vice-Chancellor during official events and addressing collaborative efforts with government entities to promote sectoral development, such as in the solid minerals sector (Kwara State University) (The Prime Times).

Additionally, Professor Salman has publicly distanced himself from a group known as "Concerned Kwarans," indicating his dissociation from their activities and emphasizing his focus on his professional responsibilities at KWASU (The Prime Times). His contributions to the university include overseeing library operations and supporting research initiatives that align with the institution's goals.

Is this conversation helpful so far?

"Things Fall Apart" by Chinua Achebe, formatted in a traditional library card catalogue style:

Title: Things Fall Apart
Author: Achebe, Chinua
Publisher: Penguin Books
Year: 1958
Edition: 1st
ISBN: 978-0385474542
Classification: Fiction (Historical, Cultural)
Language: English
Pages: 209

Synopsis: This novel tells the story of Okonkwo, an Igbo man and local wrestling champion in the fictional Nigerian village of Umuofia. The work is split into three parts, with the first describing his family, personal history, and the customs and society of the Igbo, and the subsequent parts chronicling the influence of British colonialism and Christian missionaries on the Igbo community.

Notes: Achebe's novel is a seminal work of African literature and is widely studied and recognized for its profound impact on world literature. It is often used as a counterpoint to the Western literary canon.

To get the dataset to train your model, you need to use either

- i. Kaggle <https://www.kaggle.com/datasets>
- ii. Google Dataset <https://datasetsearch.research.google.com/>

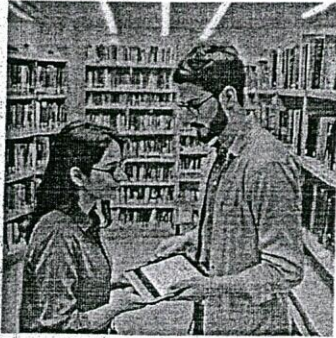
For research, you can use AI tools such as

- i. Writefull: To generate research title, abstract, paraphrase etc
<https://x.writefull.com>
- ii. Scispace: Literature review, paraphrase, generate a citation, add it as an extension to Google Chrome, or Microsoft Words <https://typeset.io>
- iii. Trink: <https://cloud.trinka.ai/dashboard/mydrive/files>
- iv. Unriddle: Summarises papers quickly.

Artificial Intelligence Detector Tools

Scribbr: is used for proofreading and editing of documents, checking for plagiarism, detecting AI writing content, paraphrasing, citation checking etc.
<https://www.scribbr.com/ai-detector/>

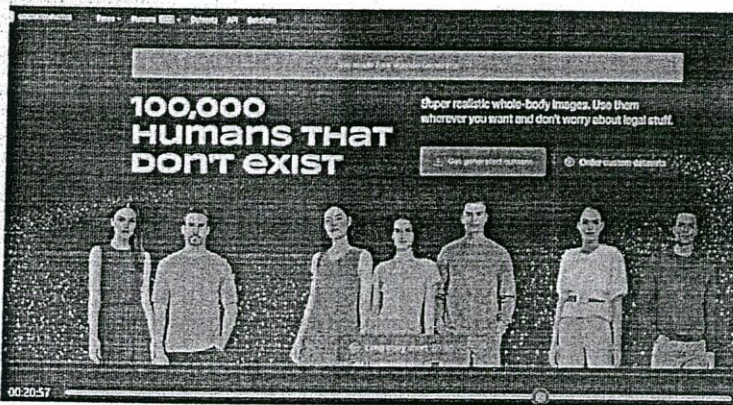
ZeroGPT, Quillbot, Image Creation, Mid journey, DALL-E



<https://www.imagine.art/dashboard/tool/realtime/text>

Human Photos -

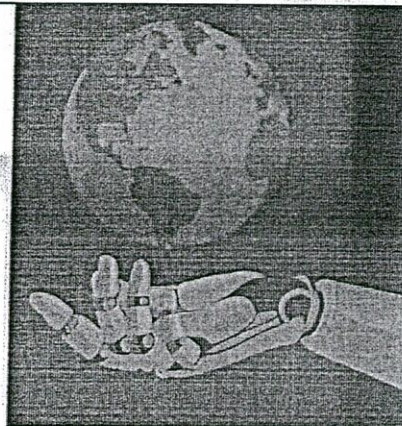
<https://generated.photos/humans>



Presentations

AI Tools for Creating Presentations

- Tome - <https://tome.app/>
- Deck Octopus: <https://app.decktopus.com/>
- Canva: - <https://www.canva.com/>



Deck Octopus: <https://app.decktopus.com>

Canva: <https://www.canva.com>

Tome: <https://tome.app>

Jenni AI for Paraphrasing.

- Steps required for libraries to adopt AI technologies

- Training staff and promoting digital literacy among users

- Steps for adopting AI in the library include:

- i. Needs assessment;
- ii. Strategic planning.
- iii. Collaboration with Natural Language Processing Experts and Data Scientists;
- iv. Selection of AI Model for training
- v. Data mining and analysis;
- vi. Training of the model and deployment
- vii. User training;
- viii. Implementation and monitoring
- ix. Usability testing
- x. Ethical Consideration;
- xi. Scalability

Challenges and Ethical Considerations

- xii. - Data privacy concerns
- xiii. - Bias in AI algorithms
- xiv. - Ensuring transparency and accountability

AI-driven Future: Strategies and Skills Development for Nigerian Librarians:

- o Librarians need training in AI basics,
- o Ethical considerations,
- o Programming, user-centered design, and project management.

New Role/ Opportunities in Libraries

The following vacancies should be advertised in our libraries:

- i. Natural Language Processing Specialists (AI Librarian)
- ii. Robotic Librarian

Before adopting an AI Solution

- Beware of the demo because it may probably look much smarter than it is
- Try it on your problem
- Try many variations – understand
- Make assumptions explicit
- Quick solution: off the shelf (first solution)
- Best solution: one of a kind of solution that is embedded

Robots improve efficiency, create engaging environments, and free up librarians for more specialized work.

Conclusion:

In conclusion, the application of Artificial Intelligence (AI) presents a promising avenue for modern libraries to enhance their sustainability and efficiency in the 21st century. Through AI-powered solutions, libraries can streamline cataloguing processes, provide personalised

patron support, optimise collection development, and leverage data analytics for informed decision-making.

Recommendations:

1. To effectively maximise the potential of AI in library services, libraries need to prioritise collaboration with technology partners and invest more in capacity building for both staff and library users to ensure effective deployment, implementation and utilisation of the AI tools.
2. Libraries and librarians should ensure proper ethical considerations such as data privacy and algorithmic bias, while also fostering transparency and accountability in AI-driven processes.
3. By embracing AI technologies while upholding core library values of access, inclusivity, and knowledge dissemination, libraries can continue to evolve and meet the diverse needs of their communities in the digital age.

References

- Britannica, T. Editors of Encyclopaedia (2024, March 8). Turing test. Encyclopedia Britannica. <https://www.britannica.com/technology/Turing-test>
- Copeland, B. (2024, May 24). Artificial intelligence. Encyclopaedia Britannica. <https://www.britannica.com/technology/artificial-intelligence>
- Chen, R., & Chen, C. (2022). Artificial intelligence. An introduction for the inquisitive reader. CRC Publisher. <https://doi.org/10.1201/9781003214892>
- R. K. Waldstein (1986). Library - An electronic ordering system. *Information Processing and Management*: 2(1),39-44.
- Mayega, S. (2008). Library information services in the digital age. <https://www.semanticscholar.org/paper/Library-information-services-in-the-digital-age-Mayega/145bca006e38949bbee88a6094f84609533ac7e4#citing-papers>