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ADVANTAGES AND CHALLENGES OF IMPLEMENTING ARTIFICIAL INTELLIGENCE IN ACADEMIC LIBRARY SERVICES

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ABSTRACT

Artificial intelligence (AI) is a burgeoning field in computer that is being increasingly utilized in libraries. It entails the use of computer programming to perform tasks that would typically be considered to need human intelligence. The primary objective of artificial intelligence in libraries is to create computer systems or machines that possess the ability to think, behave, and effectively compete with human intellect. This undoubtedly has significant ramifications for the field of librarianship. The utilization of artificial intelligence in the library has become widespread. The technologies encompassed are expert systems designed for reference services, book reading and shelf-reading robots, as well as virtual reality for immersive learning, among other applications. While the integration of artificial intelligence in libraries may initially create a sense of detachment between librarians and users, it is likely to enhance the capabilities of libraries

rather than replacing librarians' roles. It will improve the efficiency and effectiveness of their service offering. The implementation of artificial intelligence will significantly enhance library operations and services, elevating the importance and pertinence of libraries in a dynamic digital society.

1.0 INTRODUCTION

Libraries are considered institutions that prioritize providing services, and they have been transformed by the implementation of advanced technology during the era of modern information technologies (ITs). The increasing needs of library users have necessitated librarians to adapt their methods of providing services [1]. The introduction of new technologies has significantly impacted teaching and learning approaches. Consequently, the current innovation in digital technology-driven services is promoting a new paradigm for teaching and research [2]. Librarians are actively searching for new and creative technology to uphold the user experiences of their libraries. Librarians are proactive in adopting and implementing cutting-edge technologies to enhance their services. At first, library automation and digitization were two elements that enhanced the operations and services of the library [3].

Over the past twenty years, there have been significant transformations in library services, and artificial intelligence (AI) has played a notable part in these advancements. AI is commonly characterized as the capacity of machines to perform tasks that are typically associated with human intelligence. It has become integrated as a modern technology for library operations [4]. AI has become an essential tool for improving organizational efficiency and production. It is remarkable that AI technologies have strongly altered trades in the 21st century, including libraries.

2.0 The connection between artificial intelligence and libraries

Prior studies have focused on librarians' perspectives of AI [5]. Many scholars have their ideas that AI could reasonably revolutionize library services. Customers should be taught by librarians more effectively about the use of AI in library services and how it affects information searching and browsing [6]. However, the majority of them are hopeful that AI will create new opportunities and open up new horizons for the librarians. Other studies have also shown that many librarians are concerned about the implications of AI in library services for a variety of reasons, including job security,

its usage, and technical issues [7]. According to certain research, librarians ought to get involved with professional associations that use this technology.

Engaging with these individuals will generate new skills and establish new services by applying this technology in library services. In the era of information explosion, artificial intelligence (AI) in library services will give users access to correct information and be a useful tool for the natural integration of readers and libraries. Using AI in library services will offer library practitioners and patrons momentum.

Readers will interact on the same platform and receive access to humanized services at a reduced cost. A few experts, [8] noticed that in underdeveloped nations, most librarians are still unaware of implementing it in their libraries. Perhaps this might be due of a poor awareness level or the large expenditure required for applying AI in library services. Another reason for not including AI in library services is limited research activity connecting AI to librarianship. Some libraries have partially incorporated artificial intelligence (AI), such as virtual reference chatbots that employ machine learning, a subset of AI.

These services allow a librarian to respond to patron inquiries about the library [9] Similarly, it was [10] noted that certain libraries employ its partial application, like virtual help, which can be used to answer the customer.

AI similar Alexa skills which have been introduced at The University of South California serve numerous demands of users including commonly ask question replies and events. It has also been associated with a library catalog to search for needed information [11]. According to certain academics, artificial intelligence (AI) has been linked to automation and information searching. One example of this is Yewno Discovery, a data visualization tool that was introduced in 2016 to assist users view concepts more visually than they could with standard library catalogs [12].

AI can also help patrons examine falsehoods, privacy and ethics. AI may also enable the clients to locate print books on the shelf and help them to find the right book in the right spot. Through artificial intelligence, a chatbot or conversational assistant can offer virtual reference services to better assist users. In the era of artificial intelligence, librarians are referred to as reader advisors or virtual storytellers.

To address the needs of library consumers, AI chatbots will make good changes in library services. According to study from the Massachusetts Institute of Technology, users of the global positioning system (GPS) may locate pertinent library material more easily. In recent years, a growing number of

libraries in both wealthy and developing nations have linked their websites to GPS [13].

AI is used in many contemporary social media apps, including Facebook, Instagram, Snapchat, and Twitter. Several libraries have adapted their offerings to social media platforms in an effort to draw more customers. Users can store and manage pertinent information with these apps, which employ artificial intelligence (AI) to handle and store data. Libraries should also use it to preserve a vast amount of data [14].

Libraries deal with information and withhold costly resources like computer machines, scanners, photocopiers and multimedia. Surveillance cameras are needed to protect library materials from theft when libraries are being observed from different angles. Artificial intelligence (AI) surveillance applications have enabled the development of facial recognition algorithms that can be utilized for security and surveillance tasks [15]. With cyber- attacks, AI can be employed as a security tool for securing data. For security applications, AI uses the AEG bot and AI2 platform to positively determine software bugs and cyber-attacks [16]. Among the best applications of AI are those related to radio frequency identification (RFID). RFID technologies are integrated with modern library software, which controls the library collections from theft and misplacing. Security doors and walk-through gates are put on library entrances which intimate the staff in case of theft and other security measures.

Almost every smartphone contains facial recognition capabilities that are controlled and powered by AI. Siri and Alexa are the best examples of facial and virtual voice technologies. These kinds of technology can be employed for deep learning in the academic context.

AI has been integrated with the library catalog using an expert system. A human-machine interface allows us to track the data intermediary and support system. Links between an electronic publishing system and a library catalog allow data to be passed through an online medium without the need for intellectual input from an intermediary. These are the two methods by which AI can be connected with a library catalog.

3.0 Smart services at academic libraries

According to Makori (2013), "save the reader's time" is the fourth law of library and information science. This enforces the need to incorporate technology that can enhance the quality of user services and promote user self-service.

Libraries are going toward a high-level development stage in digital libraries. To improve user experiences and services, it must therefore implement cutting-edge scientific and technological methods like

the Internet of Things (IoT), RFID, mobile and wireless access, remote assistance, data mining, artificial intelligence, and augmented reality (Schöpfel, 2018; Yu et al., 2019).

Sreekumar (2012) pointed out that the electronic resource management function is shifting and increasingly about acquiring library resources, analysis of resources and extraction of vital data to better library services. Libraries need to restructure their services based on big data, data analytics and smart technologies (Adetayo et al., 2021).

Additionally, libraries can achieve transparent user service management, capitalize on users' functional information demands, and accurately predict user trends for personalized services by fusing the strengths of scientific services, librarian decision-making, and library management (Adetayo et al., 2021).

Libraries are advancing into delivering smart services emphasizing on users focused smart services. Shorris and Tarlow (2016) highlighted that libraries are no longer merely a location to borrow information resources, as they have embraced a more active role, promoting user participation to provide high-level services. Cao et al. (2018) further pointed out that libraries are generally knowledge service hubs that mine users' needs based on information resources mining and user needs analysis. In line with this, Gul and Bano (2019) confirm that libraries are growing smarter with the rising smart technology, which boosts their functioning capacities and satisfies the users associated with them. Implementing smart technologies in libraries has bridged the gap between the services offered by the libraries and the continually changing and conflicting requirements of individuals.

Similarly, "one can visualize libraries not as places but as platforms that have redesigned the technologies, services, and the humans adhered to them," according to Gul and Bano (2019). Cao et al. (2018) also pointed out that libraries are continuously evolving in accordance with the changing user needs, changing technology and the significant growth of data. These developments result in the construction of smart services for smart users in response to the evolving practices of information access and dissemination.

International Federation of Library Associations and Institutions (2016) has pointed out that AI can boost the effectiveness of services.

Moreover, personalization of library services has been part of the libraries' history. In the past, this has been done by the librarian's ability to recall the faces and interests of each user and offer as many tailored services as possible (Kwanya et al., 2013). However, with the rising powers of technology, deeper personalization can be realized with the

increased ability of technologies to equip libraries with tools to adapt services and products to the tastes of the users. Artificial intelligence has emerged a significant driving force in advancing modern society and libraries. Through the application of artificial intelligence, a library can give a personalized intelligent service. The library can assess and investigate the professional history, personality qualities, knowledge structure, and interests of library customers utilizing the Internet, artificial intelligence, big data, and other technologies to meet their information demands. This means that library users are being supplied with more focused, intelligent services to fulfill their specific demands through system recommendations and actively promote the content that users want (Yu et al., 2019).

Deep learning mechanisms can assist in the intelligent resource procurement system to automatically collect and integrate all users' individualized demand information, as well as various forms of document resource information such as big data and artificial intelligence technology. Therefore, by combining comprehensive factors like gender, age, educational background, occupation, and so on, with personalized user information like colleges and universities, the number of teachers and students of different majors, subject setting, and subject status ranking, it is possible to build an intelligent document resource procurement decision system (Liu, 2021). Analyzing user's created data can generate substantial value and insights, allowing libraries to be smart, user-friendly and user-centered (Liu and Shen, 2018).

Furthermore, data mining techniques can positively contribute to boosting the quality of services given by the library. The necessity for applying data mining techniques in libraries is urgent due to the expanding data volume and information explosion, human analytical constraints, and the low cost of machine learning (Nguyen et al., 2019). It allows the library management to find various information hidden in the data. It can be utilized in libraries to help with decision-making (Cullen, 2005). Data mining in libraries is known as bibliomining (Siguenza- Guzman et al., 2015).

Cox and Jantti (2012) pointed out that similar strategies can also aid in establishing patterns explaining the correlation between library use and student grades. Additionally, scholars like Tsai and Chen (2008), Chen and Chen (2007), Kovacevic et al. (2010), and Renaud et al. (2015) contend that data mining can be used to suggest services based on material utilization. It can also provide tailored and individualized services for customers based on their usage behavior and system interaction, as well as establish an associative

relationship between books based on content.

Further confirmation was provided by Buckland (2017) and Yi et al. (2018) that utilizing the association rule mining algorithm to determine readers' borrowing rules based on their past and present borrowing records can assist in creating and recommending booklists for them in a tailored manner.

They stated that these strategies could boost the utilization rate of data resources in the library. Chatbot is another AI application that may give individualized user experiences based on natural language processing NLP (McNeal and Newyear, 2013). Chatbots can also reduce the effort of the library personnel, alleviating the stress of basic and routine questions so they can focus on other duties.

The applicability of data mining in libraries is twofold.

First, it promotes intelligent decision-making and second, it can provide recommendation services of the library collections to customers (Gul and Bano, 2019). In other words, data mining can be highly leveraged in offering individualized, intelligent services based on information analysis of user wants.

Recently, various applications have arisen and are being utilized in libraries to enhance users' experiences and better library collection management. For instance, radio frequency-based identification (RFID) is utilized for book management. It might give various routes for book borrowing for the readers and collection management.

RFID can be used to check collections (scan kind, enter type), locate lost collections, stop theft, and facilitate book returns and auto loans. Therefore, it aids in saving library staff time (Shahid, 2005). In line with this, Kasemsap (2017) and Rahman and Islam (2019) also affirmed that RFID technology is applied in libraries to lower operational and personnel expenses, reduce staff stress, increase efficiency, improve automation, and improve tracking and tracing of library assets.

Moreover, RFID is employed to make book circulation easier, promote self-check-in check-out activities, and drop support at any moment (Kaladhar and Rao, 2018). According to Rahman and Islam (2019), this technology may be able to meet users' needs and demands for a variety of services, such as location-based services, information literacy services, mobile application access to library resources, book reservations, QR codes, GPS navigation, registration at library gates, sensors, and mobile alerts. Furthermore, Madhusudhan (2010) and Guo et al. (2014) indicated that RFID can increase libraries' operational efficiency and precision.

Augmented Reality AR is another smart technology that can boost library service. It offers a digital medium through which librarians can share knowledge and assist clients with their studies or research. For example, libraries use AR for storytelling, where users can have real-life experiences of space exploration and other activities (Oyelude, 2017). Moreover, AR can enrich user experiences by providing them with incredibly illuminating and interactive expertise. Its applications can be put on smart devices, that is, mobile phones of library customers, to search books and also traverse different parts of the library using AR. Facial recognition is another new function integrated in AR applications where users can remotely connect into their accounts (Gul and Bano, 2019).

4.0 Artificial intelligence challenges for libraries

Technological advancement causes issues for libraries impacting their structure, physically and philosophically. Libraries have embraced new technology to benefit from their advantages and features to update their services.

Embracing smart services to satisfy and cope with users' smart needs requires clever librarians with a set of new and up-to-date abilities (Adetayo et al., 2021; Marquardt, 2017).

Librarians could regard technology as a threat that might replace them. Accordingly, they must keep their adaptability, openness to new ideas, and personal attention and caring approach to consumer needs (Padhi and Nahak, 2019).

Financial issues are also included among the main hurdles that can hamper the transformation and development of smart services to obtain all the necessary equipment needed for implementation (Padhi and Nahak, 2019). Technical challenges, such as technical failure owing to technical faults or human errors, are also a worry.

Privacy is another issue. For instance, Kshetri (2014) reiterated that the privacy and security of user data is directly tied to the gathering, storing, analysis, processing, reuse and sharing of data. And these processes are the base for smart services based on big data and data analytics.

According to Borodo et al. (2016) and Wang et al. (2016), one of the hardest things about large data is maintaining privacy.

Some librarians argue that AI in library operations has specific obstacles that need be addressed before using this technology in library services [17].

Financial challenges are crucial for integrating AI in library services. Often the library may have inadequate

infrastructure because AI demands heavy and latest technological instruments to run it successfully, therefore bad infrastructure would never enable AI in library services [18].

Resistance to change is an issue as some librarians are not interested in implementing new and innovative technologies. The negative opinion of librarians about weak skills of librarians with IT tools can create difficulties for AI as some librarians are not proficient in IT applications.

Some other obstacles include weak networking, inconsistent power supply, lack of educated workers, outdated technologies and economic issues and high cost of technological tools that need be addressed before adopting AI in library operations [19]. Despite these challenges, AI will provide good changes in library operations including information delivery services, time savings, cost- effectiveness and rapid services for the present and retrospective consumers.

5. 0 Methodology

This study followed the systematic review process provided by Kitchenham et al. (2009)[20]. Systematic review is a well-defined and controlled technique for evaluating and synthesizing the best available papers on a certain issue. It answers particular questions with evidence utilizing explicit, accountable, and rigorous research techniques (Petticrew & Roberts, 2006)[21]. The primary goal of the systematic review is to give a comprehensive, extensive, and full assessment of current information from the literature, in an unbiased and reproducible manner. It contributes to the development of evidence for practice and policy, as well as the identification of research needs (Siddaway et al., 2019)[22].

Several factors motivated this investigation. AI approaches have been used in a variety of library applications. The growing focus of AI and ML to the library sector has influenced the development of research techniques in this field. This tendency has emphasized the importance of conducting a thorough literature study to summarize the ML and AI methods utilized in libraries' many application areas. In our opinion, the rapid development of this new trend necessitates a detailed analysis that will trace the evolution of this subject while also explaining the uses of AI and ML in numerous sub-domains of libraries.

Source of Data and Search Technique

In October 2020, a thorough search of the Web of Science, Scopus, LISA, and LISTA databases was conducted. These databases were chosen since the scientific community frequently uses them for their scholarly publications. In addition, LISA and LISTA have long been

regarded as reliable sources of LIS research. To prevent search biases, individual database searches were also conducted across a variety of databases. All articles published up to this point were searched for, and they were arranged from most recent to least recent. Only peer-reviewed journals, conference papers, and proceedings were included in the search parameters.

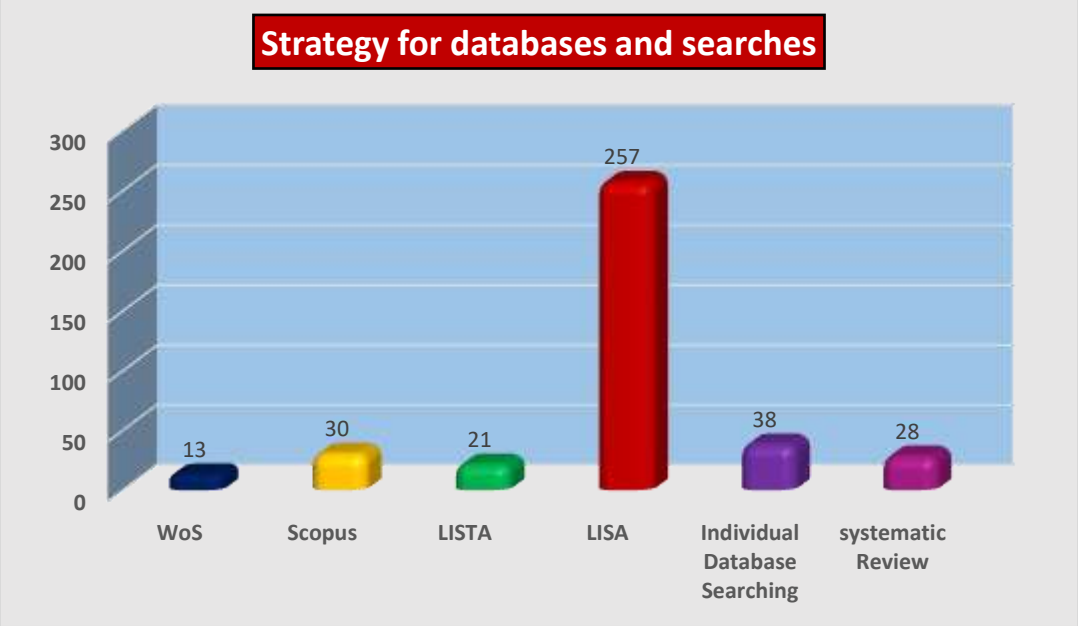


Figure 1: Strategy for databases and searches

Table 1: Strategy for databases and searches

Database	**Documents**
WoS	13
Scopus	30
LISTA	21
LISA	257
Individual Database Searching	38
systematic Review	28
Total	**387**

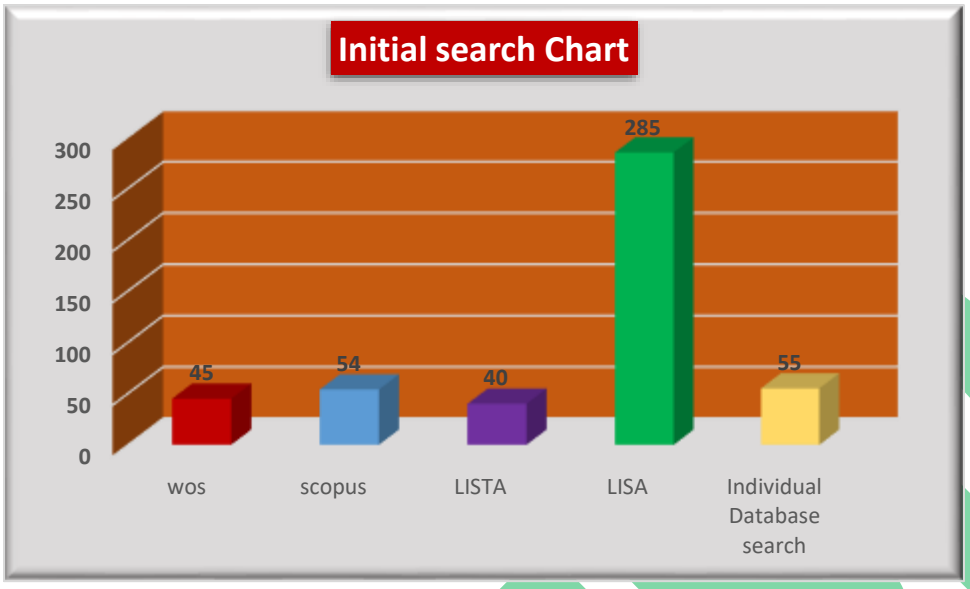
Criteria for Inclusion and Exclusion

Inclusion requirements were: (1) articles must be written in English, (2) articles must be on Smart system or AI applications, and (3) articles must belong to the sub-field of Library and Information Science. (4) The title, abstract, and keywords of the works must discuss libraries and the use of smart system or artificial intelligence. The exclusion criteria were as follows: (1) non-digital publications, (2) publications not available for complete review, (3) articles not written in English, and (4) no use of smart system or artificial intelligence in libraries.

Study Selection Researchers followed the established technique and performed an early screening of the articles based on the title and abstract. Afterward, the remaining articles were reviewed using the aforementioned inclusion and exclusion criteria. Initially, 479 articles were obtained using the established Boolean Expression (45 from Web of Science, 54 from Scopus, 40 from LISTA, 257 from LISA databases, and 55 from individual database searches). After 120 deleting duplicates (31%), the search was narrowed to 387 items. This systematic review included 28 articles after carefully filtering the remaining 387 papers using inclusion and exclusion criteria. The selection technique is summarized in Figure 1.

Table 2: Initial search Chart

wos	45
Scopus	54
LISTA	40
LISA	285
Individual Database search	55
Total	**479**



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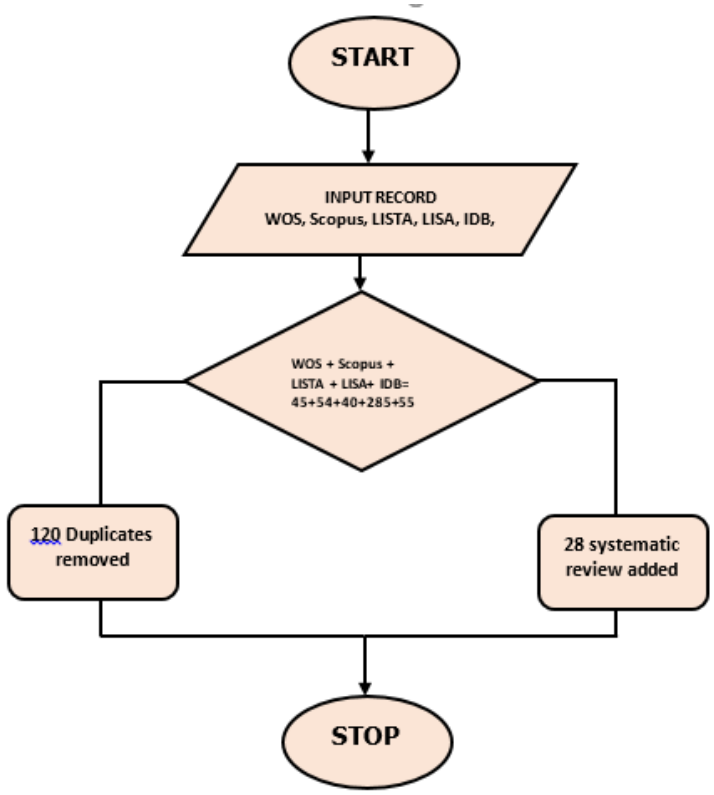

Figure 3: Method of Search for Study Selection

Conclusion

By using AI, libraries will be able to more easily assist both present and former users when they are in need. Libraries in both wealthy and developing nations are still learning how to use this technology. Although there is substantial work on AI in libraries, most cover narrow library applications. AI is certainly one of the emerging technologies that maximize library services at low cost once implemented. Libraries are crucial agents of modern technologies. Adequate budgets for incorporating AI in library operations should be kept in mind. Advocacy programs for librarians can identify numerous challenges associated with AI in library operations.

In order to equip librarians with new abilities, conferences and training on AI should be planned. It is important to develop a suitable strategy that takes into account both the advantages and disadvantages of AI in library services. By introducing librarians to discussion forums, you can influence their perspective on the use of AI in library operations. AI is still an emerging technology growing at frightening speed in different

organizations. Few well-known services, such as Chatbots, RFID, GIS technology, and virtual references, are connected to library operations in both developed and developing nations, but the majority of librarians are ignorant of their uses. Libraries in developed and developing nations cannot afford the majority of applications like big data, the Internet of Things, and augmented reality, but some low-cost ones like facial recognition, Chatbots, and Google maps can be linked to their websites.

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