

Utilisation of Artificial Intelligence And Machine Learning on The Process of Information Retrieval And User Experience In Libraries

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Abstract

This study focused on the utilisation of artificial intelligence (AI) and machine learning (ML) in information retrieval process and promoting user experience in libraries. This conducted a primary quantitative approach to gather quantitative data through a Google survey. It gathered data from 51 sample participants and selected those through a simple random sampling technique. This study found that both AI and ML technologies are quite beneficial for managing library services. Efficient data management and searching criteria assist both librarians and readers; based on previous tasks and information, ML enriches librarians with efficient data and improves their decision-making processes. However, in order to use these technologies efficiently, high-cost infrastructure and good technological knowledge are required; this requires governmental assistance.

Keywords: Artificial intelligence, Machine Learning, smart libraries, expert system, Support Vector Machines, regression, Bayes learning, and k-means clustering

Introduction

Artificial Intelligence (AI) and Machine Learning (ML) are two growing technologies that enhance organisations' business operations along with better user experiences. These technologies focus on the improvement of information management systems; hence, libraries are promoting "smart libraries" or "intelligent libraries" with efficient data retrieval and advanced user experiences. AI mimics the behaviour of librarians and tends to support decision-making processes for library management. The current information system in libraries looks into managing users' data and information on available books (Asemi and Nowkarizi, 2020). This can result in management of all four activities of resources, such as technology, users, services, and library resources.

AI and ML store necessary information in a cloud system, allowing the social network to use those systematically. This assists the expert system (ES) algorithm in using gathered data for library decision-making and management. However, there are several issues during information retrieval and user experience by AI and ML in modern libraries. This requires the expertise and knowledge of users; furthermore, librarians must also be efficient in handling modern technologies (Barsha and Munshi, 2023). The implementation costs for these two technologies are pretty high; the lack of digital privacy regulations and the digital divide increase library management issues, especially in developing countries.

Aim and objectives

This study aims to understand the use of AI and ML technologies in the information retrieval process and user experiences in libraries.

This has the following objectives:

- To assess the role of AI and ML in information retrieval in libraries
- To evaluate the role of AI and ML in promoting user experiences in libraries
- To locate the issues of using AI and ML for modern libraries
- To suggest ways to mitigate present issues of AI and ML in modern libraries

Literature review

Efficient use of AI for library management

Yu *et al.* (2019) highlighted that artificial intelligence (AI) provides libraries with broader development opportunities; this secures users' data and preserves those for further usage. This technology does not tend to replace librarians, however, enriches them with enhanced interpersonal interactions and knowledge exchange. Furthermore, it promotes library communication and advances service efficiency in libraries. Hence, libraries should embrace this technology to develop proper user services and data management. Similarly, Cox *et al.* (2019) opined that AI plays a crucial role in data retrieval, leading to efficient data retrieval. This allows users to search based on keywords and discover good resources; hence, they can easily find scholarly articles and publishing and proceed with their learning. However, this article also highlighted some issues with AI in libraries, such as high implementation costs, a requirement for skilful employees, and proper infrastructure. Unlike the formal article, this article showed the risks to employee replacement with the use of AI.

Efficient use of ML for library management

Nguyen *et al.* (2019) focused on the effective use of machine learning (ML) in libraries of modern days. ML technology promotes learning for machines from previous works; as a result, devices can improve their behaviour and increase learning from previous tasks. This technology includes decision trees, Support Vector Machines (SVM), k-means clustering, Bayes learning, neural networks, and regression. In other words, machine learning promotes efficient data handling and provides library users with a better user experience.

Maiya (2020) highlighted the necessity of low-code libraries for any augmented ML technology. This technology supports data management processes in a library through several activities for library management. Those are regression, object detection, classification, sequence tagging, object modelling, text extraction, summarisation, and link prediction. All these processes highlighted the necessity of good knowledge and high skill in handling technologies to manage any task. This requires a simple unified interface for solving critical issues; lower commands are effective in the form of "commands" or "lines of codes".

Theoretical interpretation

Nemati Lafmejani *et al.* (2021) highlighted a close connection between Bandura's social-cognitive theory and information retrieval processes. This theory focuses on the crucial role of libraries in increasing learning abilities. According to this theory, library users require reading and learning materials that libraries provide, and its atmosphere needs to be conducive to effective learning. This article mentioned that personality, behaviour and environment are most important in promoting self-belief among human beings. The behavioural dimension of this theory is beneficial to guide the use of AI and ML in data retrieval and the improvement of users' experiences.

On the other hand, Serdyukov (2021) mentioned that formalist theory or formalism promotes online learning aspects and changes in the socialisation process. This theory assessed the use of ML and AI to develop an online education system to improve students' learning and social affairs. In the time of digitalisation of education, these technologies focus on the implementation of creativity and innovation in data retrieval and improving users' experience.

Methodology

The use of AI and ML in libraries is the independent variable; effect on information retrieval and user experience in libraries is the dependent variable. These two variables are connected by a cause-and-effect relationship to analyse the effect of using AI and ML on user experience and data retrieval in libraries. This study has used a primary data collection process; this gathered primary sources of data to fetch direct and authentic information. The primary source of data involves human participants in order to pick the

most current information (Sileyew, 2019). This study used a Google survey to collect data from its sample. Hence, it can be said that the survey is a data collection tool for this study that was based on a questionnaire containing 10 questions.

This study targeted 101 library users and selected 51 sample participants through a simple random sampling method. This method provides each participant with an equal chance to participate in this research process (Rahman *et al.* 2022). Based on received answer sheets and responses, this study selected 51 samples that had complete responses; among all 51 users, 23 were readers, and 28 were librarians.

The quantitative data analysis process is used to assess gathered numeric data from the Google survey form. Quantitative analysis promotes scientific data analysis that does not allow researchers to share their opinions, making the research process bias-free (Mellinger and Hanson, 2020). Hence, this analysis process is beneficial for increasing authenticity and validity in the overall research process.

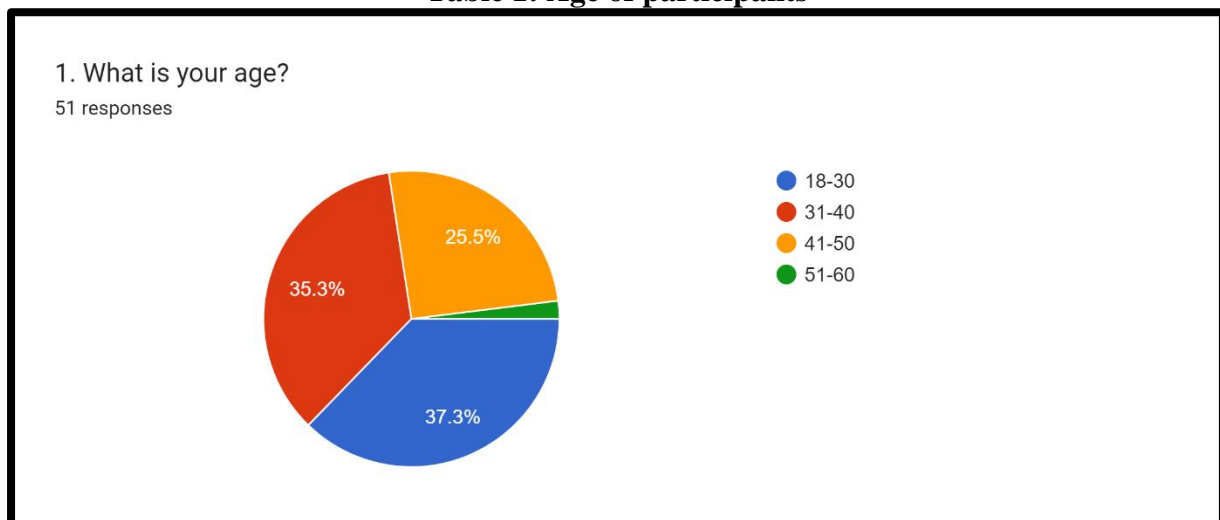
This research process maintained ethical consideration through several processes; no personal information is used for this research process. No participant was forced to participate in this research process; instead, they all willingly participated. All participants were informed of each detail, and every step of this research process. Participants' data was secured in researchers' personal devices from any unlawful use and third-party intrusion.

Result and Discussion

Findings

Responses	Respondents	Percentage	Total
18-30	19	37.3%	51
31-40	18	35.3%	51
41-50	13	25.5%	51
51-60	1	2%	51

Table 1: Age of participants

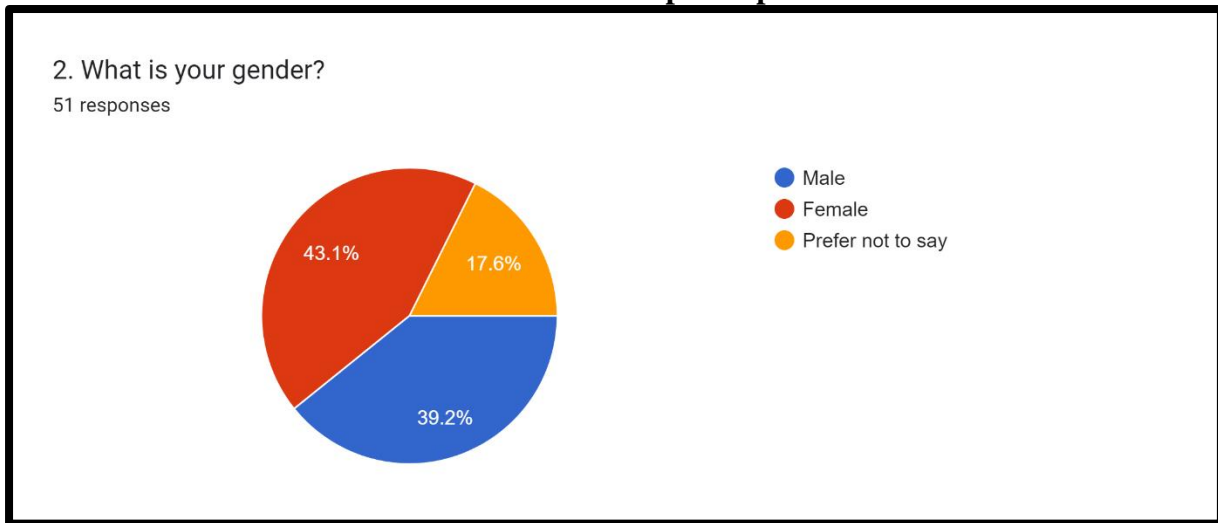


Graph 1: Age of participants

Table 1 presents the participants based on age groups; the highest number of participants are in 18-30 age group.

Responses	Respondents	Percentage	Total
Male	20	39.2%	51
Female	22	43.1%	51
Prefer not to say	9	17.6%	51

Table 2: Gender of participants

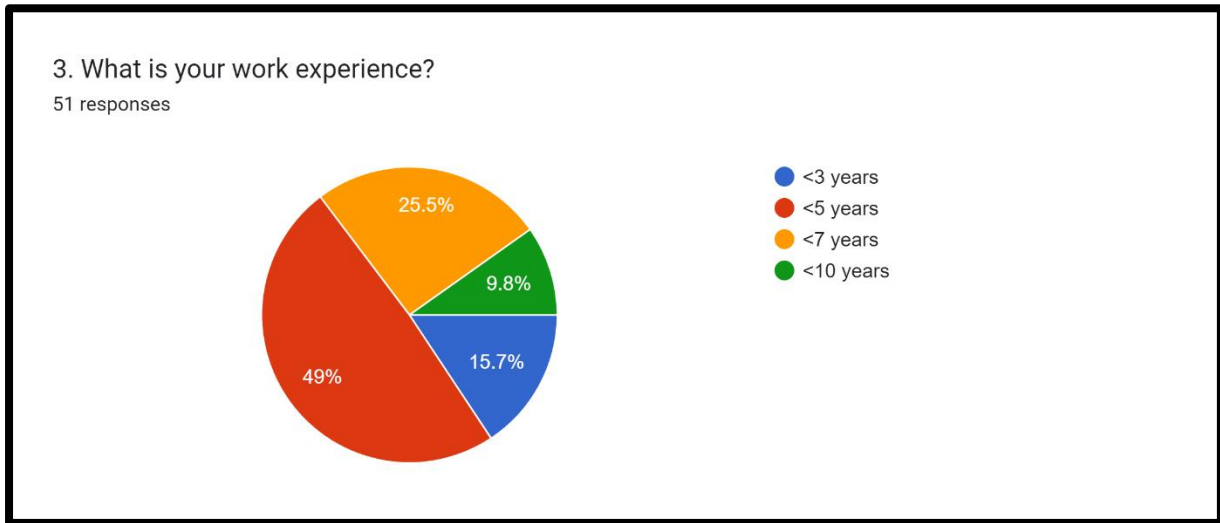


Graph 2: Gender of participants

Table 2 highlighted that female participants were highest in number; again, some participants did not reveal their gender identity.

Responses	Respondents	Percentage	Total
<3 Years	8	15.7%	51
<5 Years	25	49%	51
<7 Years	13	25.5%	51
<10 Years	5	9.8%	51

Table 3: User experience of participants

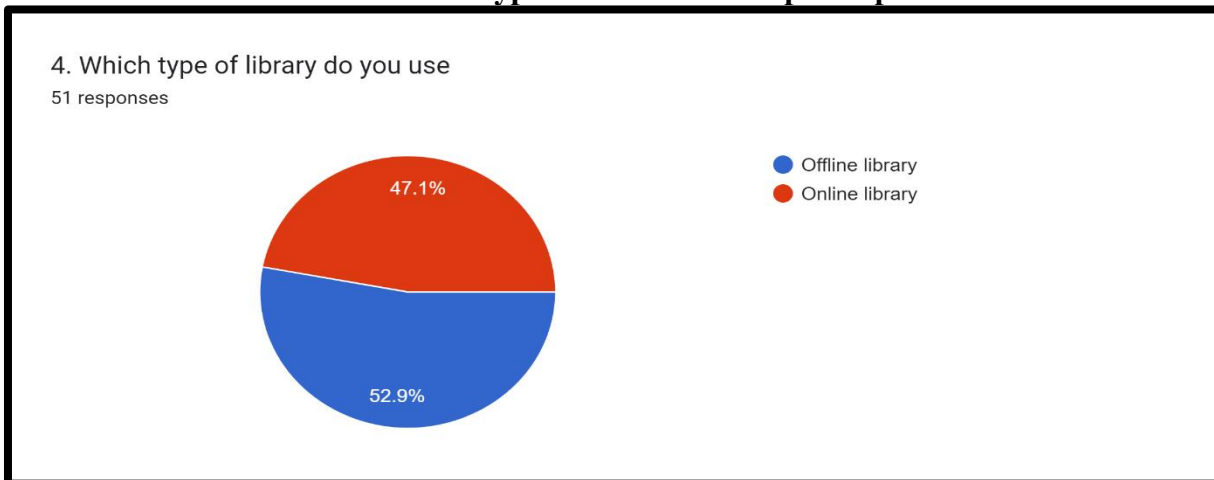


Graph 3: User experience of participants

Most participants had less than 5 years of experience, according to Table 3; they were 49% in number.

Responses	Respondents	Percentage	Total
Offline Library	27	52.9%	51
Online Library	24	47.1%	51

Table 4: Types of libraries that participants use

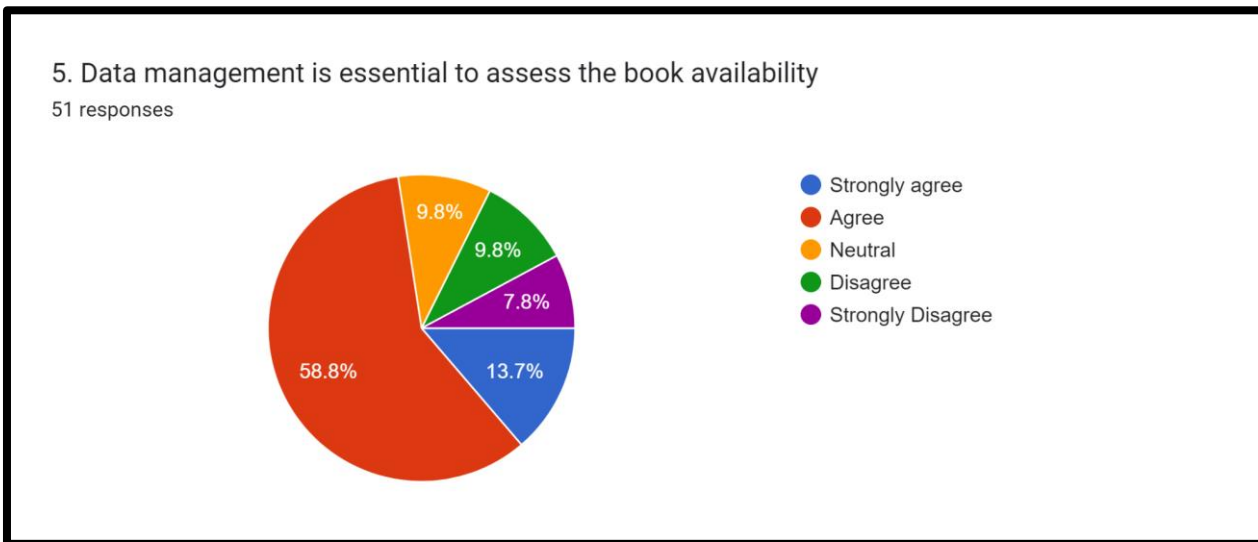


Graph 4: Types of libraries that participants use

Table 4 highlights that 52.9% of participants uses offline library, while the rest follows online libraries.

Responses	Respondents	Percentage	Total
Strongly agree	7	13.7%	51
Agree	30	58.8%	51
Neutral	5	9.8%	51
Disagree	5	9.8%	51
Strongly disagree	7	13.7%	51

Table 5: Essentiality of data management for assessing book availability

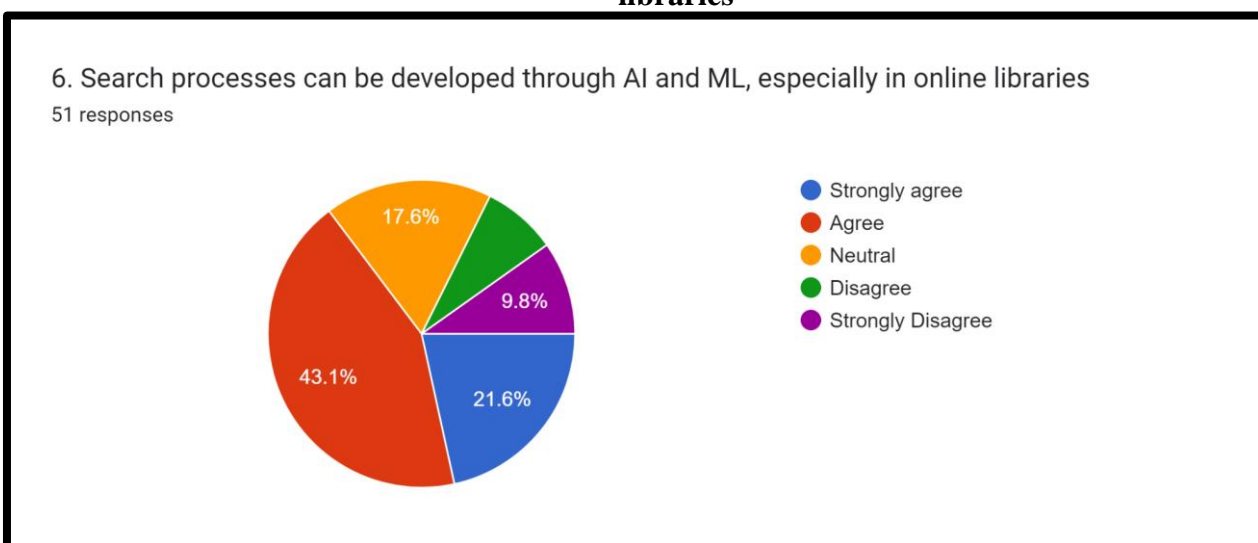


Graph 5: Essentiality of data management for assessing book availability

Graph 5 highlighted that to assess the availability of books, data management is vital; hence, this question fetched 58.8% of agreement and 9.8% of strong agreement.

Responses	Respondents	Percentage	Total
Strongly agree	11	21.6%	51
Agree	22	43.1%	51
Neutral	9	17.6%	51
Disagree	4	7.8%	51
Strongly disagree	5	9.8%	51

Table 6: Necessity of developing searching processes through AI and ML, especially for online libraries

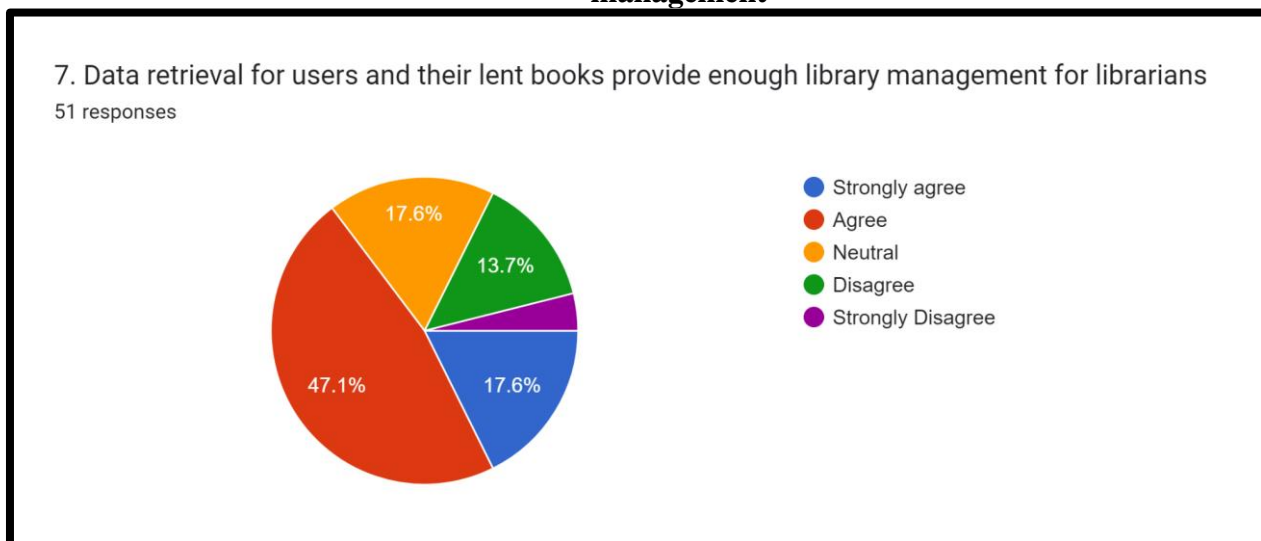


Graph 6: Necessity of developing searching processes through AI and ML, especially for online libraries

The sixth question also fetched strong support for developing search processes through artificial intelligence and machine learning. Above 64% of participants opined their support for this purpose.

Responses	Respondents	Percentage	Total
Strongly agree	9	17.6%	51
Agree	24	47.1%	51
Neutral	9	17.6%	51
Disagree	7	13.7%	51
Strongly disagree	2	3.9%	51

Table 7: Necessity of data retrieval to manage readers and their lending books for library management

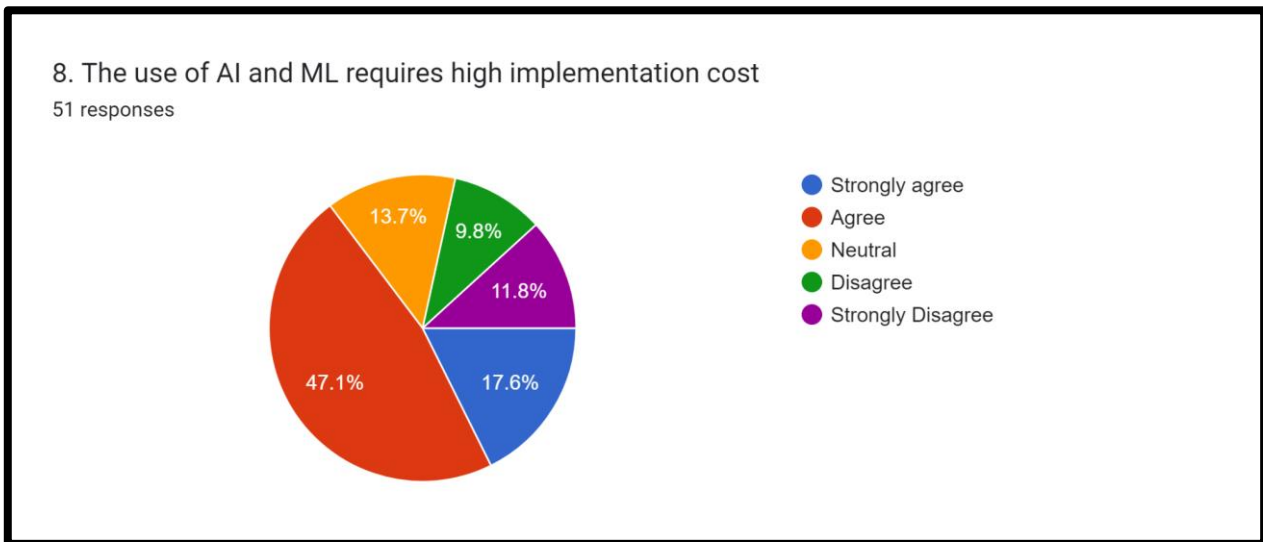


Graph 7: Necessity of data retrieval to manage readers and their lending books for library management

The seventh question also fetched strong support for an effective data retrieval system to manage readers and their lending books. 33 of the total participants supported this necessity, while only 9 showed their disagreement in this matter.

Responses	Respondents	Percentage	Total
Strongly agree	9	17.6%	51
Agree	24	47.1%	51
Neutral	7	13.7%	51
Disagree	5	9.8%	51
Strongly disagree	6	11.8%	51

Table 8: Opinion on the requirement of high implementation cost for using AI and ML

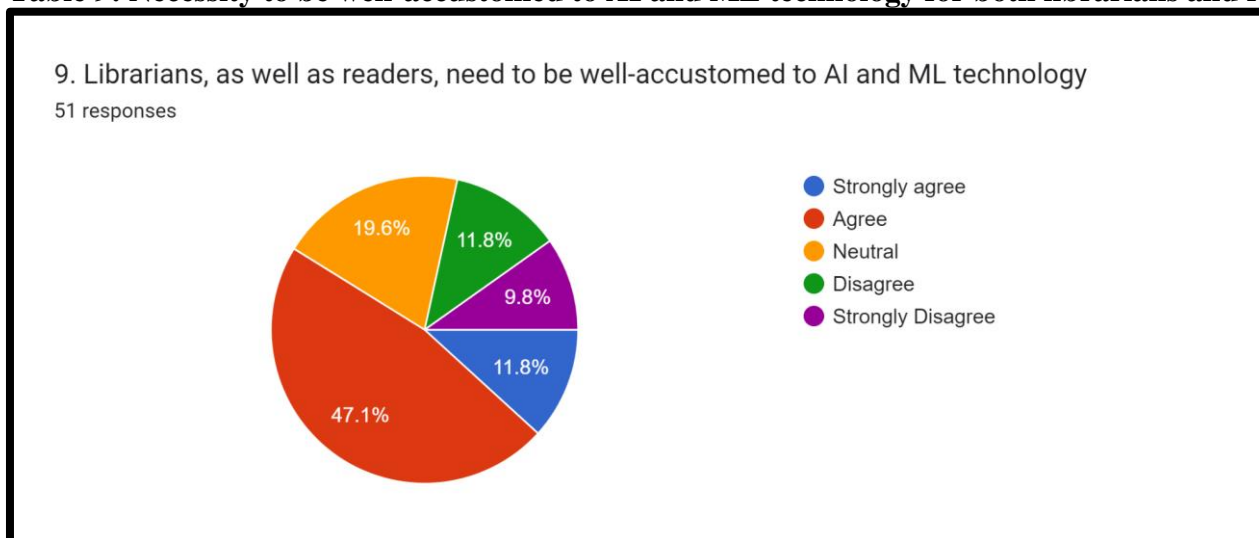


Graph 8: Opinion on the requirement of high implementation cost for using AI and ML

Most participants, that is 33 of the total participants, agreed that the implementation cost of AI and ML requires high cost for libraries. In this case, enough resources are required for successful implementation.

Responses	Respondents	Percentage	Total
Strongly agree	6	11.8%	51
Agree	24	47.1%	51
Neutral	10	19.6%	51
Disagree	6	11.8%	51
Strongly disagree	5	9.8%	51

Table 9: Necessity to be well-accustomed to AI and ML technology for both librarians and readers

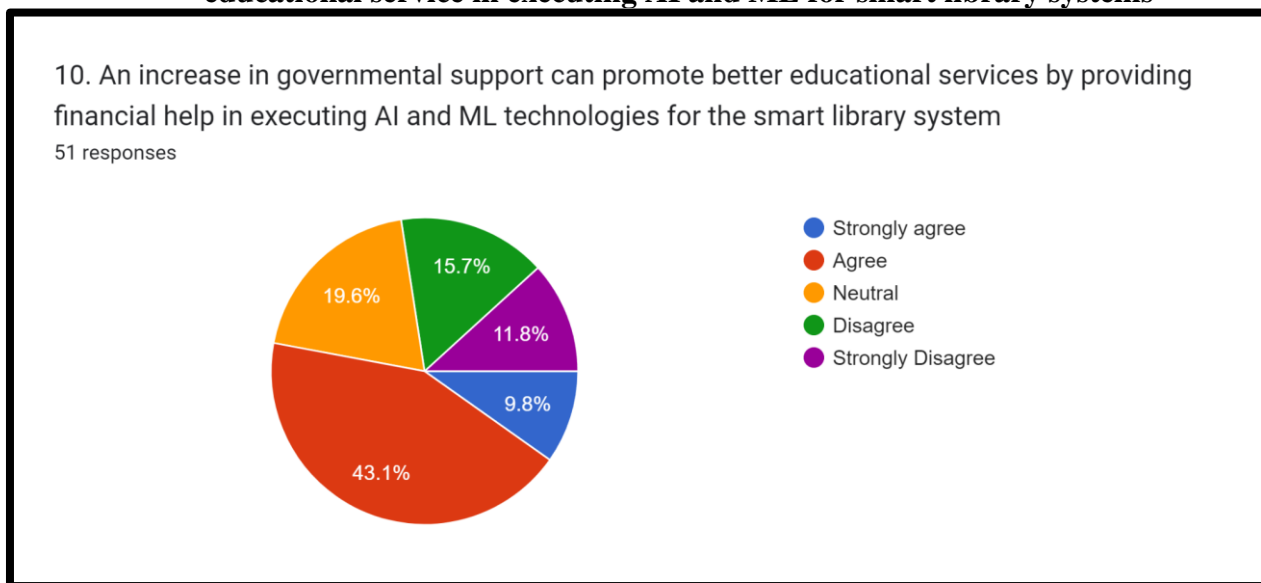


Graph 9: Necessity to be well-accustomed to AI and ML technology for both librarians and readers

The ninth question also fetched the highest number of supports that both librarians and readers need to be skilful and well-accustomed to AI and ML technologies. Almost 59% of total supported this necessity; hence, it can be said that AI and ML-based smart libraries require high technological skills from users.

Responses	Respondents	Percentage	Total
Strongly agree	5	9.8%	51
Agree	22	43.1%	51
Neutral	10	19.6%	51
Disagree	8	15.7%	51
Strongly disagree	6	11.8%	51

Table 10: Need for increasing governmental support by financial assistance to promote a better educational service in executing AI and ML for smart library systems



Graph 10: Need for increasing governmental support by financial assistance to promote a better educational service in executing AI and ML for smart library systems

Above figure highlighted that almost 63% of users preferred financial aid from the government for implementing AI and ML in libraries. This will develop an innovative library system and improve educational services in any country.

Discussion

Artificial intelligence and machine learning technologies make library services efficient through their data management processes. This is necessary for managing libraries' internal data; technologies record the way readers are being present in the library, as well as have membership. In addition, the number of lent books and available books can be maintained through proper data management. In other words, this promotes libraries' working capacity to bridge the gap between the rapidly changing and increasing needs of readers and the library-offered services (Gul and Bano, 2019). Thereafter, library management information systems also enhance libraries' service qualities for their readers and librarians. Efficient data management allows librarians to manage readers' data and library administration services and make proper decisions based on needs and requirements (Andharini *et al.* 2019). Again, online libraries can provide efficient search processes for their readers to improve their experience. However, implementation costs for these technologies are costly as this requires expensive infrastructure and costly technological management. In this concern, Mersand *et al.* (2019) opined for governmental and community support to increase financial aid for cost management to implement AI and ML in libraries.

Conclusion

This study mentioned the way AI and ML are effective for the library users, both the librarians and readers. These technologies develop information management systems for both online and offline libraries. A number of readers, membership services, and leading activities can be managed by AI and ML technologies as these technologies secure all data in cloud-based services. Furthermore, keyword-based research and finding online published journals and scholarly articles improve user experience for readers. In this concern, from previous tasks, such as searching subject matter, ML provides more similar and same subject-based publishing for the readers. This improves readers' experiences; furthermore, both online and offline librarians can record data efficiently, which increases their positive user experience. However, this study found out that AI and ML implementation costs are very high and it requires costly infrastructure, along with skilful users.

Hence, this study recommended that local government, non-government bodies, and local community need support through financial aid for the development of smart libraries (Madumere *et al.* 2020). Training and education are required for librarians primarily so that they can assist readers of all ages in using such AI and ML-based libraries.

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