Artificial Intelligence: Prospects and Challenges for Library Services

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Abstract. Librarians need complex skills and abilities to collaborate and adapt, intending to use information and communication technology to manage information and serve users effectively. This paper analyses libraries' prospects and challenges in using artificial intelligence (AI). The research design was a literature study with data analysis using descriptive analysis methods. The results show that librarians' prospects and challenges are prioritizing traditional roles by providing physical facilities and libraries that understand the value of libraries. Libraries, in addition to facing rapid technological developments, also need to be prepared to meet changes in user behaviour that also change according to the times. Another challenge is an aspect of the library's mission, which is to develop and advance research. The open access movement is also one of the challenges the library must address immediately. Then, there is the challenge of accommodating the rapid changes in teaching, which are also greatly affected by the development of information technology today.

Keywords: artificial intelligence; library; prospect; challenge; industrial revolution 4.0

1 Introduction

The phenomenon of big data and the data explosion brings euphoria to modern organizations. They are competing to exploit data through data processing and analysis applications for the benefit and convenience of the organization. One of the developments in information technology that is widely discussed today is Artificial Intelligence (AI), including in libraries. The development of technology and information helps humans facilitate their work and improve the quality of that work. AI is likely to be applied in libraries, considering libraries as a source of information that stores various types of intellectual property and data about users in large enough quantities. Nowadays, libraries process much digital content from various sources. Libraries also deal with users and social media that produce many data; library transaction data is also increasing and requires special applications to process, analyze, and then be used for decision-making, service improvement, improving the quality of resources, and others [1].

Activities in the library are also becoming increasingly complex, starting with processing content from various formats and sources, as well as the speed of content crea-

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tion, which is increasingly unpursued if only relying on manual capabilities. Information technology also has an essential role in libraries, where libraries consistently adopt it to help carry out routine library activities and decision-making.

In this decade, the use of AI in libraries has been widely discussed and researched by researchers from various fields. AI initiation has been widely seen in public, college, special, and national libraries. Yet it is college libraries that have adopted AI the most. According to the research results, many college libraries have adopted AI to support research and learning. In addition, universities also create, store, and disseminate intellectual property from the results of research and learning quickly and in large quantities. Academic libraries are also widely studied because many academics and students research in college libraries. Furthermore, the development of technology and the abilities of librarians in academic libraries are also rapidly developing [1].

AI applications in libraries are still in the early stages. It is uncertain whether AI can conduct research in law libraries smartly and replace the role of lawyers in conducting research. There are still pros and cons related to using AI in organizations. One opinion says that AI can replace human work, but on the other side, AI has not been able to replicate human uniqueness and creativity. In research, AI can help explore many data sources, create knowledge mapping, connect these concepts, analyze data, and provide predictive recommendations from these results. However, AI cannot replace some matters, namely the researcher's insight and creativity in developing research results.

In search, AI also helps to personalize the information needs in a more profound way and connect all the information which is difficult if done by humans. Utilizing machine learning algorithms and existing knowledge in the catalogue makes it possible to personalize the above information.

2 Results and Discussion

The intelligent library project, which utilizes artificial intelligence (AI), is a project that requires large funds, facilities, and human resources. Currently, AI is widely adopted by large-scale companies. Nevertheless, public, college, special, and national libraries also consider AI to support library services. Library work consists of technical services (backstage) such as information organization processes (classification, cataloging, and subject determination), collection selection processes, shelving, and loan circulation. The work is a routine activity carried out by librarians in all types of libraries. Librarians often spend their time doing repetitive work, so there is less time for professional development and the development of library innovation. Such is the case for the managerial level, which requires much help for data analysis and presenting data for decision-making and policy-making in libraries [2].

Nowadays, libraries utilize information technology not only for library automation processes such as OPAC and information retrieval but also for gate systems, circulation, and cataloging. Information technology employed in libraries for routine activities is still dependent on humans. Like classification and cataloging, where humans still manually determine the classification number and metadata of a collection, circulation is also not fully carried out by machines, so librarians still spend their time on these routine activities.

Many AI-based technologies are offered to libraries to help with routine and complex tasks, but not many libraries have partially or fully adopted AI. Several things concern libraries' adoption of AI, including related to leadership policies, budgets, human resources, and facilities.

Library leaders, librarians, observers, and IT researchers in libraries already understand AI. They define AI as a machine, robot, or computer application resembling or adopting human intelligence to help and facilitate human work. In this paper, respondents explained more about AI as a human-mimicking machine, examples of AI technology such as robots and smart machines, and the function of AI to help humans work, especially in data processing. The respondents were highly enthusiastic and hoped that AI could help the work of librarians in libraries, especially with routine tasks such as circulation, shelving, processing, and registration of new members. Respondents argued that a lot of the library's routine work consumes librarians' productive time, and with the help of this AI, librarians hope to do productive work for library development.

Respondents also see AI as useful for data analytics, such as processing library activity data that will then be used for decision-making. In this case, data analytics is related to data in the library, including borrowing data, e-resources access, service usage data, and other user activity data. Furthermore, AI is also useful for research support services and research assistants by providing information on research topics and helping search for information quickly and precisely.

Libraries are likely to apply AI, but it is inseparable from the competence of librarians, both professional competencies and soft skills. Librarians must at least have the knowledge and applications of information technology and know the development of IT in libraries. They must also be literate in AI, knowing AI, AI tools and technology, data analytics competencies, library management, user behavior, and system design. Communicating AI to non-IT programmers or computer science people is not easy. In addition to technical competencies, there are also soft skills competencies related to AI adoption. The hope is that if librarians master these skills, AI adoption in libraries will be easier. This soft skill ability is manifested in the form of adaptive attitudes toward technological advances, creativity and innovation, critical thinking, cooperation, and communication.

Respondents believe AI to be able to provide convenience. It is reflected in a survey conducted by [2], which stated, ‘Can AI help facilitate work?'. All respondents answered ‘Yes’. The survey results stated that the ease of AI could be reviewed by librarians, users, and management. Respondents believe that AI applications can help libraries with tasks, increase productivity, and allow work to be performed quickly and efficiently. Users also get convenience from AI applications in the library, such as easily accessing available services and finding sources of accurate information. Users can also get a quick response from the library, thus improving the experience of utilizing information in the library.

2.1 Prospects

Manual libraries are no longer their time. There are a series of Information Technology (IT) applications that can help the performance of librarians, even those that resemble artificial intelligence, aka Artificial Intelligence (AI).

How to manually search for books in the library seems to be about to pass. No more neck fatigue looking for the desired book title or author. Computerization has assisted the work of librarians to become much simpler and easier. Moreover, currently, there have been many developments in artificial intelligence that resembles human intelligence; thus, it can replace the role of librarians in performing performances in libraries.

Library activities such as indexing, cataloging, literature selection, archiving, and referencing can be assisted by expert systems. This system will succeed well if the scope of knowledge is deep and can be clearly defined, Engkos Koswara, Head of the Center for Informatics Research of the Indonesian Institute of Sciences (LIPI), told the press in Jakarta [3].

The expert system referred to by the man, who graduated from the University of Salford, England, in the field of Information Technology is an expert system, which is part of the Knowledge Base System (KBS), which is part of Artificial Intelligence (AI). The definition of this expert system, according to Engkos, is computer software that contains expert knowledge and experience and uses an inference engine that resembles the way experts solve problems. Hence, this software almost resembles human intelligence.

a. Variety of Applications

Expert system software widely used in libraries such as Cansearch and MenUse helps create search statements in the Medline database, the health field in cancer therapy. This system employs the help of menus on the computer screen, or the menu is driven with touch terminal techniques, not using a keyboard.

Other areas of library work, such as indexing, can be helped by Intelligent Computer Assistance (ICA), successfully practiced by the US National Library of Medicine. Popular software in this indexing field is MedIndEx, one of the prototypes of an expert system of research results for interactive knowledge-based indexing of medical literature using Medical Subject Heading (MeSH). This system can produce indexes of its knowledge base in frames, acting as a computer system to index consistently and precisely.

Another expert system is also applied for indexing purposes, namely Machine Aided Indexing (MAI). This app was created by the American Petroleum Institute. As for the field of cataloging and classification, software was developed that determines the book's classification number and the subject's title.

One example of an expert system for cataloging is the Online Catalogue Library of Congress (OCLC) Automated Title Page Project. The system was developed to produce bibliographic descriptions based on the Anglo-American Catalogue Rules (AACR2) standard. The system can correctly identify bibliographic elements in about 73 percent.

b. Library References

Another activity that expert systems help with is referencing. This activity is broad, from answering questions about directories to searching literature, explained Engkos, who has just been inaugurated as the Principal Research Expert (APU) at LIPI in the Field of Documentation, Information, and Library [3].

One expert system called Comit searches for information through bibliographic data in batches. A batch is a search that can be extended to other sources of information,

such as dictionaries and atlases. Examples of expert systems for reference consultation are Pionter, Answerman or Aquaref, Flexus, ORA, and DISTREF.

Pointer is a microcomputer program to simulate the work of librarians in government document tracing activities. The system was developed by the State University of New York, USA. It was created to instruct users about government documents in the University library. The advantage of this system lies in the questions addressed to the user to find out his needs. The computer language used is Basic, using a menu system.

The Answerman and Aquaref expert systems were developed by the National Agricultural Library, USA. This computer-based system can help library users find the right source of information, including answering their questions.

While Flexus is a development of scientists from The Central Information Service University of London, this system was created to guide users searching for information on plantations. The computer language employed is Pascal. This system can perform almost the same as a library expert or librarian in carrying out his activities by doing references.

Engkos explained that all the work of this expert system is done online. Activities include selecting databases, determining keywords, and creating search strategies. To present an expert system in the library means hosting internet access must be hosted. Building an expert system in the library must be supported by command language, output formatting, database coverage, and literature search facilities, including operations to correct errors when searching for information.

To complete the presence of expert systems in the library, databases, subject areas, indexes, thesaurus, classifications, codes, search mode reformulation techniques, and domain subjects, including semantic structure, vocabulary, and semantic relationships between terminologies, are also needed. If these can be carried out, then a librarian can be replaced by an expert system.

Indeed, it does not need to be replaced in the real sense but only has its duties lightened. It is not as easy as it is to bring artificial intelligence into the library. It requires knowledge and costs a lot of money. However, once that is done, the library becomes a center of knowledge that is not boring. Even libraries can be found online in cyberspace.

2.2 Challenge

If libraries want to apply AI, some aspects must be prepared. According to the results of a survey conducted by [2], it reveals that libraries need hardware, software, Brainware, and management devices. The availability and support of the head of the library and agencies is also an important aspect of management that can move all components in the library. In addition to their optimism about implementing AI for libraries, respondents also identified things that can hinder AI implementation, including those related to management, human resources, and facilities. Management obstacles, especially related to the budget and vision of leaders related to information technology development, are raised by librarians. They worry that management (leadership) does not have a vision of information technology development and lacks leadership support, unclear AI-related policies, and a lack of budget and leadership support. These librarians

are also highly worried about the unavailability of funds to develop information technology, especially AI. Meanwhile, from the perspective of the head of the library, the obstacles that arise are related to human resources that are not innovative, not creative, incompetent, apathetic, not experts in the IT field, and lacking in human resource will. Furthermore, the head of the library also stated the complexity of bureaucracy, the small willingness to change, and limited financial capabilities. Academics see the biggest obstacles to implementing AI in libraries as being the unwillingness and incompetence of institutions, a lack of support from parent agencies, and a lack of HR competence [2].

For reference services and research support, the use of AI is widely adopted by libraries. One library that uses AI applications in reference services is Plexus. This application answers user questions as a referral tool, where the tool helps librarians carry out the reference process. The use of AI to answer reference questions is still at the level of low-level questions such as FAQs, general information related to libraries, and mediums related to subjects in library collections or semi-structured questions. As for high-level questions that require a high level of library expertise, they still need librarians to answer.

The use of the semantic web, AI, and machine learning allows libraries to make metadata more accessible not only to libraries such as MARC but metadata that allows linked data to the semantic web, thus allowing library metadata to be widely accessed.

The classification process can also take advantage of the Coal sort application, which automatically searches and indexes, containing frame-based semantic networks. Environmental Pollution Expert (EP-X) is a knowledge-based hierarchical frame-based network. BIOSIS knowledge-based that assigns the document to categorize itself automatically. BIOSIS employs data from titles to determine categories.

A significant needs in searching for information today include making search engines personal assistants that help respond to and anticipate user information needs. Furthermore, the use of chatbots allows the use of natural language. Many libraries have built AI-based chatbots that can provide information related to FAQs and more AI services. Information professionals do not depend on controlled vocabulary when searching but rather on context-based searches.

AI search also helps to personalize information needs more deeply and connect all information, which is difficult for humans to do. Utilizing machine learning algorithms and the information in the catalog enables them to personalize the above information.

3 Conclusion

The application of Artificial Intelligence (AI) is not intended to replace librarians as a whole. Indeed, in reality, several librarianship activities have been replaced by information technology, sometimes even dominating work in libraries. The use of AI serves to help librarians carry out their activities. Sometimes librarians face a lot of work in a limited amount of time, so AI can be a tool. Hence, the presence of AI can be a solution for librarians to serve users optimally without leaving their job as information managers. Information technology systems are common, but specifically, the use of AI as an automatic guide in libraries is an interesting and unique innovation in applying. The AI librarian is a digital library concept that provides information using a system that is

integrated directly with information in the library. AI librarians will be a focused and efficient intermediary for library users.

In addition to optimism in implementing AI for libraries, respondents also identified things that could hinder AI implementation, including management, human resources, and facilities.

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