

A Bibliometric Study of Artificial Intelligence Use in Academic Libraries

LIS 651

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Abstract

This is a study of the bibliometrics of journal articles discussing artificial intelligence and its use in academic libraries. While much has been written on artificial intelligence in general, this study hopes to define what areas of artificial intelligence are being pursued in the context of the academic library, what documentation of artificial intelligence in academic libraries is being studied, and which journals are publishing this information, whether the literature about artificial intelligence in academic libraries has increased or decreased over the study's 17-year time span, and what areas are assumed to be of greater interest to academic libraries as they become more digital-friendly.

Introduction

Libraries exist in a world of competitive information. Libraries typically provide literature and services to patrons that they would not find elsewhere. But technology has changed the way libraries do business, especially academic libraries. Academic libraries are often research libraries. The very idea of being a research facility demands that the institutions that serve them are up to date with technology. And academic libraries fall woefully behind in most cases.

Patrons have access to a world of knowledge literally at their fingertips. Information can be accessed through cell phones, tablets, laptops, and even watches. So academic libraries are almost forced to embrace technology to compete with the array of devices the patrons use and expect. Libraries should be able to "predict the

factors that will affect their professional services years from now” (Iwu-James et al., 2019, pg. 154) and that is where artificial intelligence enters the landscape.

Intelligent agents, which are a type of artificial intelligence, function on user commands and are prevalent in many modern forms of technology. "While intelligent agents is a computer science term, other names include intelligent personal assistants, virtual assistants, and conversational agents" (Herron, 2017, pg. 139). These may be chatbots on a library website, a chat support dialogue on a shopping website, or even automated responses on a phone call. A few of the most prominent are Siri, Alexa, Bixby, and Cortana. Users simply state their requests, and the intelligent agents respond with appropriate results. When the intelligent agent can no longer be of assistance, a patron might be referred to a librarian to assist.

Libraries have embraced this type of technology since the early 2000s when the "development of intelligent agents to search, sort, filter, and create user profiles became more popular" (Herron, 2017, pg. 141). Libraries readily use AI in many areas including catalog searches, room reservations, and even robots to retrieve books and materials.

Importance of the study

These advances in artificial intelligence do not take away from the work of the librarian. Rather, the technology allows librarians to use their time more efficiently, such as helping patrons who visit the library in person. Technology changes rapidly. As patrons begin to use newer technology in other areas of their lives, they come to expect it in all areas of their lives. Frustration can easily set in when library services do not match the access that patrons have elsewhere. The truth is that technology advances

quicker than libraries can catch up with it. One advancement in computer technology, for instance, can have ripple effects in many areas. Jeremy Atkinson conducted a survey and analysis to identify benefits and constraints in technology projects in libraries. He states that "if the library does not participate in particular initiatives, there is a danger it may be sidelined in technological developments" (Atkinson, 2020, para. 10).

Bluetooth is an excellent example of this. When first created, Bluetooth was designed as a wireless connection to replace the RS-232 serial connector. Bluetooth connectivity led to wireless printers, wireless laptops, and hands-free car kits. The first hand-free car kits also included speech recognition, paving the way for artificial intelligence in ways that are yet to be realized.

The amount of literature on this topic is limited in the academic library world. This study hopes to provide a background for research on artificial intelligence in academic libraries. One of the desires of this study is to showcase the need for more literature, reviews, and studies on this subject.

Problem Statement

This study will focus on publication patterns about artificial intelligence related to academic librarianship. The study will include an examination of many journal statistics including, the number of articles per year; publication year; article title; journal title; the number of articles per journal; and any AI subject terms that may be in the articles.

This study uses materials produced between 2005-2022. This allows time for patterns to develop in an area that does not have a significant amount of literature on

the subject. This study will also help to determine either growth or decline in the publication of articles on this topic.

Research Questions

R1: How many peer-reviewed articles are published about artificial intelligence in academic libraries each year from 2005-2022?

R2: What journals have published peer-reviewed articles about artificial intelligence in academic libraries from 2005-2022?

R3: What are the most discussed types of artificial intelligence in the peer-reviewed articles from 2005-2022?

R4: Has the literature relating to artificial intelligence in academic libraries increased or decreased between 2005-2022?

Limitations/Delimitations:

This study will include full-text, scholarly journals found in academic databases related to the fields of Library and Information Science, Technology Abstracts, and Computers & Applied Science. Book reviews, editorials, news articles, and conference notes will be excluded from the results.

Definitions

Academic Library: An Academic Library is a library that "serve colleges and universities, their students, staff and faculty and may have several libraries on their campuses dedicated to serving particular schools to utilize subject expertise" (American Library Association, 2016, para. 1).

Artificial Intelligence (AI): Artificial Intelligence, or AI, is “systems or machines that mimic human intelligence to perform tasks and can iteratively improve themselves based on the information they collect” (Oracle.com, 2022, para. 1).

Bibliometrics: Bibliometrics is the "application of mathematics and statistical methods to books and other media of communication" (Lisbdnetwork, 2018, para. 5) and the "quantitative analysis of bibliographic features of a body of literature" (Lisbdnetwork, 2018, para. 6).

Big Data: Big Data is "data that is so large, fast or complex that it's difficult or impossible to process using traditional methods" (SAS, 2022, para. 2). Artificial intelligence is the only method capable of processing Big Data effectively. Also, the more data that artificial intelligence consumes, the more advanced it becomes.

Chatbot: A chatbot is a "computer program that uses artificial intelligence (AI) and natural language processing (NLP) to understand customer questions and automate responses to them, simulating human conversation" (IBM Cloud Education, 2019, para. 1).

Machine Learning: Machine learning is "a subfield of artificial intelligence that gives computers the ability to learn without explicitly being programmed" thus allowing computers "to learn to program themselves through experience" (Brown, 2021, para. 3 and 13).

Natural Language Processing: Natural Learning Processing (NLP) is a "subfield of Artificial Intelligence research that is focused on developing models and points of

interaction between humans and computers based on natural language, either as text or as a speech-based system" (Borcan, 2020, para. 4).

Assumptions

It is assumed that the journal articles retrieved will be accurate and complete. It is also assumed that the search engines and databases will return complete results based on the search parameters given.

Literature Review

There are a limited number of bibliometric studies on this topic. However, the methodology in this study relates to the methodology that has been used in other studies, and the findings of other studies have influenced this one. Two articles are more specific to the method of bibliometrics in other fields than in academic librarianship. Yet each of the following articles contains a similar methodology to this study.

Ahmad, JianMing, and Rafi conducted an analysis focused on Big Data in libraries. The analysis looked at "the extent to which the Big Data analytics is being used in Pakistani university libraries... and the competencies and skills of librarians for the implementation of Big Data analytics" (Ahmad et al., 2019, pg. 202). The data for this analysis was collected through a survey instead of a database search. However, since this study discusses Big Data, which is intricately linked to artificial intelligence, the methodology is relatable. The audience for the survey consisted of 173 library managers of Pakistani academic libraries. Each of the universities in this study was recognized by the higher education commission of Pakistan. The number of universities

that responded was 118, providing enough data to continue with the analysis. Charts, statistics, analysis, and conclusions were offered for the study. The final thought was that "studies regarding challenges associated with handling of Big Data need to be conducted by prospective researchers" (Ahmad et al., 2019, pg. 214).

Ilham, Eliyana, and Yulianti performed a bibliometric analysis of the literature in Information Technology Relatedness. This is the "use of information technology infrastructure and information technology management processes between business units together" (Ilham et al., 2020, pg. 2). This study used the database Scopus to retrieve the "status of map publications in the field of Information Technology Relatedness at the international level in the last 40 years." (Ilham et al., 2020, pg. 3). Much of the analysis was performed within the Scopus program and with a tool called VOSviewer which can display visualizations. This analysis searched a database based on keywords. Results were then returned and analyzed with graphs and other data being displayed. Results included the number of journal articles published within a time frame (1981-2020), the institutions and researchers that produce the most content, the year with the highest amount of content, and the types of documents produced. The study finally recommends that "the next researchers analyze the benefits, contributions and test the effect of the application of Information Technology Relatedness by measuring the literature with a combination of data obtained from Scopus, Google Scholar, Science Direct & Thompson at Airlangga University, Surabaya." (Ilham et al., 2020, pg. 12).

Y. Zhang, Wu, Tian, G. Zhang, and Lu conducted a study of the ethics and privacy of artificial intelligence. This article is included because ethics and privacy are tenants of the ALA Library Bill of Rights. The seventh policy of the Library Bill of Rights states "All people, regardless of origin, age, background, or views, possess a right to privacy and confidentiality in their library use. Libraries should advocate for, educate about, and protect people's privacy, safeguarding all library use data, including personally identifiable information" (American Library Association, 2009, para. 8). This study was conducted using similar methods as the other studies. The information examined included the author's name and affiliations, journal names, publication year, and terms that were in the titles and abstracts of articles. The authors then performed a key entity analysis and a topic analysis on articles that were indexed in the Web of Science. The authors noted future directions of study could address limitations in AI ethics discussions on social media; missing abstracts in some of the articles; the issue of labeling strategy in text analysis-based bibliometrics; and "uncovering the hidden mechanisms and reasons behind those explorative results" (Zhang et al., 2021, pg. 13).

Deshpande and Kulkarni studied the trends in cloud computing and edge computing from 2016 through 2020. Edge computing is about the location of the cloud and a device. The idea of edge computing is that it processes massive amounts of data (Big Data) quicker than having to go back and forth between the cloud. This study is relevant because edge computing and cloud computing both integrate with AI since no human could handle the massive amounts of data. Scopus was the chosen database based on popularity and the ability to analyze data. Terms also used in this study include fog computing and edge intelligence. This study was "done with the units of

analysis including documents, sources, authors, country, and organization" (Deshpande & Kulkarni, 2021, pg. 14). The statistical analysis looked at the documents by the author; publications by country or territory; document analysis by year; documents by subject area; documents by sources; documents by type; documents by type; and funding sponsors. The network analysis looked at co-authorship parameters including country; co-occurrence of keywords; co-occurrence of authors; and co-occurrence of keywords. A network analysis of citations was also done, examining documents and countries. The keyword search of databases and comparison of the results is very similar to the study being done here. The authors conclude by determining that "a very vast and major work is expected in this area in the upcoming years" (Deshpande & Kulkarni, 2021, pg. 16).

The final article by Garoufallou and Gaitanou examines Big Data and its impact on libraries. There is a portion of the article that focuses on academic libraries and Big Data. Specifically, the study ponders "how libraries will follow, implement, integrate, and work side-by-side with these new innovations and challenges" (Garoufallou & Gaitanou, 2021, pg. 411). Garoufallou and Gaitanou's article has many of the same headings and subheadings that are used in this proposal. Furthermore, the methodology describes in this article uses the same structure as the methodology in this proposal. Searches were performed first on Scopus and then on Google Scholar. The analysis focused on 2012–2018. In the future, the authors plan to "further extend the literature review by analyzing the use of Big Data in each category of libraries separately and examining more topics that influence the implementation of Big Data in libraries, such as legal and policy issues, privacy, and data ownership" ((Garoufallou & Gaitanou, 2021, pg. 422).).

The research and methods discussed in this literature review are related to this study. Four of the five studies used various article databases and keywords to collect articles relating to the research questions in this study. The one analysis that offered a survey instead of journal articles studied a facet of artificial intelligence in academic libraries and was therefore considered an important methodology to examine. This research study will use similar method searches, keywords, academic journals, and analysis tools to determine core journals, key elements of artificial intelligence as it relates to academic librarianship, and the trends in publishing regarding this subject.

Methodology

To locate articles related to academic libraries and artificial intelligence, five databases will be used: Academic Search Premier, Computers & Applied Sciences Complete, Information Science & Technology Abstracts (ISTA), Library & Information Science Source (LISS), and Library, Information Science & Technology Abstracts (LISTA). The search term “artificial intelligence or ai or a.i.” will be used as a subject search in conjunction with a subject search for “academic librar*.”

Once the initial results are returned, they will be further sorted by full-text, peer-reviewed articles that are written in English and published between 2005-2022. The data will then be collected and sorted in an Excel workbook to examine. There will be a separate Excel sheet for each research question. Fields contained in the worksheet will include the number of articles per year; publication year; article title; journal title; the number of articles per journal; and any AI subject terms that may be in the articles, such as chatbots, intelligent agents, natural language processing, or machine learning.

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