
ARTIFICIAL INTELLIGENCE AND ROBOTS IN LIBRARIES: OPPORTUNITIES IN LIS CURRICULUM FOR PREPARING THE LIBRARIANS OF TOMORROW

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ABSTRACT

The study aimed to explore academic libraries' engagement with AI and their response to the growing presence of AI. Content analysis is employed to identify and assess the framing of AI, robotics and related themes in the documentation. Findings indicate only one subject mentions AI to position subject content and none mention robotics. It analyzed scholarly articles, strategic plans, and programming in top research universities in the US and Canada. The findings revealed a lack of awareness about AI trends, but a few institutions were found to be participating in or creating their own AI hubs. The study aimed to understand the librarian's role in an AI-dominant future in LIS (Library information science).

Keywords: Robots, Robotics Libraries, Artificial Intelligence, Application of Robotics.

1. INTRODUCTION

What is perhaps the library's best kept secret has been its slow uptake on automation and digital technologies. To the outside world, the library is a pioneer in the quest for innovation, from video collections to audio books and databases to maker spaces, the library is viewed as an agent of change. Those who criticize the library speak to the physical stacks and the social-economic divide, claiming that the information is online for all to seek [1]. It is not an argument that the library has failed to digitize, but rather an argument that raises the capitalistic aims of the information industry. Librarianship is quick to defend against this argument, but where the profession struggles is in admitting its faults in regards to digital progression.

Historically, the library has been reluctant to change, often waiting for a particular technology to reach market saturation before reacting to a new trend.

Once a patron has been readily exposed to a technology across multiple venues, then the library will adopt its use [2]. Dominating the technology conversation for years has been the growth of artificial Intelligence (AI) and machine learning (ML) in disciplines outside of the traditional sciences. Made popular by the works of science fiction, the capabilities of these two fields are only just beginning to unfold. This work is made more complicated by differing definitions of what AI is and what can be considered as AI. While there is an understanding that AI is a computer program designed to replicate human intelligence, the truth is that it is so much more. Everyday applications of AI are already well-integrated into society, through technology such as driverless cars, satellites, the Internet of Things, and perhaps most obviously, the Google search engine [3].

The concept of robotics is not new though it has evolved in recent times, it traces its origin dated back in ancient times. The idea of making those machines or devices that effectively does human work or substitutes human labor was old but gained popularity and acceptance with the evolution of new technologies such as artificial intelligence, machine learning, big data, etc.. In other words these technologies flourished the success of Robots. While the origin of industrial robotics can be traced back to middle of 20th century (Gasparetto & Scalera, 2019). Initially robots were used for industrial operations, but robotics is now finding applications in a wide range of sectors. Notably, the modern robotics has evolved in last two decades. It has now being used across the fields such as industrial robots which are being used in industrial environment, Medical robots which are primarily being used in the surgery, Military robots in armed forces, Space robots in space operations and the most popular Humanoid robots which resemble humans.

As robots are in wide use across the fields hence its use in modern libraries is not an exception. Libraries are using robotics technology is now no more a news. With the aid of Artificial intelligence and machine learning robots have become more effective and well equipped to in performing the different activities of libraries. Many libraries across the world are using humanoid robots to serve the different library operation. Tella emphasized the use of robots in

libraries around the world. Science Technology Engineering Mathematics (STEM) education programs are being given access by different libraries concerned to robots. Chicago Public Library, University of Rhode Island Library are examples of libraries that are hosting different robots related programs [5]. With exponential growth of literature the consumption rate has also increased and to get access to the required knowledge libraries are the major conduits. With the emergence of computer technology particularly AI enabled humanoid robots has triggered a significant revolution in the structure and dynamics of information and knowledge [6]. The potential of AI enabled robots has been increased as a result of convergence of technologies such as big data, greater computing power, deep learning etc.

2. LITERATURE SURVEY

Balleste, R. et.al [7] explores the potential of artificial intelligence (AI) in law libraries. The author emphasises the role of libraries in designing and programming AI systems to enhance public services. While acknowledging the challenges of implementing AI technology in complex transactions like legal reference interviews, Balleste highlights the possibilities offered by intelligent systems to supplement and expand library services. The article discusses the conceptualisation of AI systems, their programming through algorithms, and the use of avatars or graphical displays to facilitate interaction with library patrons. Balleste envisions AI assistants as valuable tools that can assist librarians in performing menial tasks and improve patrons' experience at library websites. The author also speculates on the future potential of AI in law libraries, suggesting its application in areas such as reference services, circulation operations, and cataloguing. Balleste's article provides a thought-provoking glimpse into the evolving role of AI in law library settings.

Alberico, R. et.al [8] predicts the impact of expert systems and artificial intelligence on libraries over the next ten years by considering five areas: knowledge media, knowledge industries, knowledge institutions, modes of discourse, and implications. The predictions are based on existing technology, but the author acknowledges that technological advances may occur in the future. The author references the publication "Libraries of the Future" as a relevant and on-target prediction for the future of libraries and artificial intelligence. The author also mentions Project Intrex, an early experiment by MIT to develop an electronic library, incorporating many technological solutions to the problems faced by libraries.

R-Moreno, M. D., Castaño, B., Barrero, D. F., & Hellín, A. M. et al.[9] discussed using RFID and wireless techniques for efficient library service management. The review highlights the application of RFID in libraries to determine the physical location of books and assist users in navigating the library. The prototype system, named SIGUEME, combines RFID sensors, AI-based planning and monitoring, and screen-based information display. The integration of RFID and Wireless Sensor Networks (WSNs) is explored, emphasising the expanded functionality and reduced costs. The review also examines the application of RFID and WSNs in healthcare, logistics, and libraries, discussing the benefits and challenges in each domain. Experimental results from the implementation of SIGUEME in Meco's Public Library are presented, showcasing the system's capabilities in tracking users, generating statistics, and providing guidance.

Wu, J., Williams, K. M., Chen, H.-H., Khabsa, M., Caragea, C., Tuarob, S., Ororbia, A. G., Jordan, D., Mitra, P., & Giles, C. L. et al. [10] presented an application of artificial intelligence (AI) technologies in CiteSeerX, a digital library search engine. The review highlights key AI techniques for document classification, de-duplication, metadata extraction, and author disambiguation. It emphasises the unique features of CiteSeerX, such as open access to full-text scholarly documents, automatic extraction of metadata and citation context, and indexing of paper entities like tables and figures. The review discusses the challenges and performance of these AI technologies and their transferability to other digital libraries. It also describes the architecture of CiteSeerX and the use of open-source software in its development. The review highlights the cost and scalability challenges of rebuilding a system like CiteSeerX from scratch.

Arlitsch, K., & Newell, B., et.al [11] explained in their article "Thriving in the Age of Accelerations: A Brief Look at the Societal Effects of Artificial Intelligence and the Opportunities for Libraries," discuss the impact of AI on society and the opportunities it presents for libraries. The authors state that increased computer processing power, big data, and machine learning techniques have accelerated the development of AI. They mention how AI has already changed many industries, including libraries. The authors also examine the potential effects of automation on employment, social and political systems and how it could impact libraries. They suggest that libraries must be prepared for the changes brought about by AI and must embrace the opportunities it presents by providing opportunities for lifelong learning to their communities. Bi, S., Wang, C., Zhang, J., Huang, W., Wu, B., Gong, Y., & Ni, W. et al. [12] reviewed Artificial Intelligence Technologies in Emerging Smart Libraries. They examine new technologies such as

IoT, RFID, WiFi, BLE, NLP, Deep Learning, Recommender Systems, and OCR. They also delve into innovative library services such as attack prevention, machine vision, and intelligent circulation services using sensors, smart authentication, identification, and encryption. They provide a comprehensive survey on AI and IoT technologies in intelligent libraries, presenting a systematic and structured overview of this growing field. A case study on smart circulation services highlights the improvements that can be made in traditional librarianship with the integration of AI and IoT. The authors also discuss the challenges and prospects in the field.

3. METHODOLOGY

The authors evaluated twenty-five universities and their libraries to determine the prevalence of collaborations surrounding artificial intelligence. The sample includes the fifteen Canadian universities part of the U15, a group of the most research-intensive universities in the country. The American universities were selected from the Times Higher Education List and highlights some of the leading universities in the United States. Although the University of Rhode Island and the University of Oklahoma were not part of the original sample, the authors decided to add them as outliers because the original sample provided very few instances of artificial intelligence and those universities offered applicable case studies for AI in academic libraries. Since the initial data collection took place in April 2019, the authors evaluated the websites again in July 2019 to ensure relevant updates would be included.

The environmental scan is not intended as an exhaustive study on the presence of artificial intelligence in libraries, but rather it attempts to show a representative picture of AI in research-focused academic libraries. Table 1 outlines the universities that are part of the sample. The authors used the searches imbedded in the university and library websites to search for the following keywords: artificial intelligence, machine learning, deep learning, AI hub. They also consulted the library's strategic plans or vision and mission statements, research and subject guides, lists of programming and events, as well as official partnerships to identify if artificial intelligence had any presence within the library. When evaluating subject guides, the authors looked for individual guides on artificial intelligence; guides that only mentioned the technology or had a short section dedicated to it were not included in the results. A similar approach was used to evaluate the university websites.

The authors searched for the same keywords and also looked for AI hubs, courses on artificial intelligence and made note of significant researchers in the field. Notable researchers were defined as faculty members who had significant experience and contributions in the field of artificial intelligence, such as award and grants winners, as well as researchers in charge of AI hubs. Sessional lecturers were not included in the sample.

The authors chose to include hubs with a focus on artificial intelligence as a whole and not specialized AI hubs that focus on specific areas such as business, medicine or law. The aim was to identify potential partners for the library and the authors decided that specialized hubs would not be as conducive to partnership as those with a more general focused.

4. CONCLUSION

The current state of artificial intelligence in academic libraries is nearly non-existent, leaving a gap in the literature for libraries to engage in the AI conversation. Some active libraries, such as Stanford, MIT, the University of Oklahoma, and the University of Rhode Island, have engaged with AI, but the uptake in librarianship is slow. The University of Oklahoma has created the Projects in Artificial Intelligence Registry (PAIR) to connect researchers and move the AI conversation more directly into libraries. The authors hope to see the profession engage in AI and work to become thought leaders in the field. The AI revolution is not on the horizon, and libraries need to make peace with this fact and begin the process of co-existence. Rather than take a responsive or reactive approach, libraries can initiate these conversations in their strategic planning. The absence of AI within the noted university libraries' planning was not a surprise. Most of these documents were built around vague references to emerging technologies or digital scholarship, if those were even mentioned at all. The authors acknowledge the intention by administration to avoid labelling specific technologies, however, artificial intelligence is not one specific technology. As researchers have already noted, clear communication and identification of these digital developments can help increase user adoption and staff acceptance. Another area where libraries could be seen to improve is in the outreach and instruction of AI-related topics at their institutions. Very few libraries offer programming or other initiatives on the topic, some of which include speaker series and workshops. The University of Toronto is in the process of launching their first ever year-long challenge to learn and have discussions on artificial intelligence as part of a joint effort with the library. It is also interesting to note that some of the university libraries that have engaged with AI are smaller in size. One could easily assume that larger academic libraries who receive more funding would be at the center of conversations surrounding new technologies and AI; however, the authors found the opposite to be true. While Stanford and MIT have engaged with AI, the University of Oklahoma and the University of Rhode Island have emerged as the leaders in involvement

with AI. This could possibly be related to a more dedicated focus among faculty and less need to spread out resources across a massive student body with widely varying research interests. Additionally, small institutions may not be as bound to the bureaucratic process, thus giving them more flexibility to pursue new initiatives. Given that AI will certainly affect the way individuals search for information, a natural fit for the library would be to position itself at the forefront of AI instruction. Libraries have always prided themselves on their involvement in information literacy, however, almost no initiatives have focused on educating patrons on AI. Whether this is voice assistants or search algorithms managed by AI, it is clear that this field will have a deep impact on the search process. There have also been no initiatives to update current library standards, such as the Framework for Information Literacy in Higher Education, in relation to concerns brought on by artificial intelligence including bias in search results and ethics considerations.

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