Empowering Library System with AI: A Roadmap of AI in Indian Academic Libraries System

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Abstract: **AI has extended its reach into diverse sectors, spanning education, agriculture, healthcare, economics, and library management. Its incorporation primarily aims to enhance resource allocation for more favourable results. The primary focus of this research revolved around the application of artificial intelligence within India's academic library system. The research aim for this study is to investigate the possible uses of AI within India's academic library system. The study's findings highlight the promising potential of AI in enhancing various facets of academic library services in India. These applications encompass the deployment of expert systems in technical domains, indexing, and acquisition processes, alongside its contributions in NLP, pattern recognition, and the integration of robotics to optimize library operations. Based on the findings of this study, AI is recommended that academic libraries in India should wholeheartedly embrace the incorporation of artificial intelligence into their library operations. Furthermore, it is advised that these libraries allocate resources for staff training to ensure their competency in effectively utilizing AI for delivering library services. Moreover, the integration of AI should be firmly established as a standard practice across all library units. The institutions' budgetary allocations should take AI costs into consideration. The Indian library system's academic libraries could make it simpler to find materials if AI is used.**

Keywords**: Artificial Intelligence, Robotics, Natural language processing, Academic libraries system, Library services, Expert system.**

INTRODUCTION

AI involves computer-controlled robots that possess the capacity for intelligent thinking akin to humans. These robots are electronically operated with the aid of computers, replicating human mental faculties. AI records and assesses all user activities, enhancing human convenience and progress in various life domains, a result of advancements in science and technology.

In the realm of healthcare, AI emerged as a crucial and highly effective technology for screening viruses and symptoms, playing a pivotal role in managing the crisis during the initial and experimental phases of the Covid-19 pandemic. Due to the massive strain on librarians to offer library customers with high quality services as a result of the information explosion in our current culture. AI has made its way into libraries in the form of a chat window that responds to simple informative queries, handles directed online queries at the library web-site, issues past-due warnings, and directs visitors to pertinent resources in the library. On the library floor, collaborative robots called AI work alongside people to do difficult or boring jobs. AI represents a viable endeavour to substitute human capabilities with computer-driven prowess. AI implementation in libraries will have an impact on the connection of information technology, actively encourage information utilization, and make it easier for users to search for information and quickly find what they need. AI and robust computer technology will bring substantial changes to libraries in the future, and the quality of these transformations will be influenced by the expertise of those involved.
In Indian education system, Academic librarians view artificial intelligence as a fresh source of inspiration for the creation of intelligent libraries. Librarians have begun incorporating artificial technologies into library systems to align with contemporary national and global trends in the field of librarianship. Despite their endeavours to stay current, Within Indian educational organizations, there is an obvious lack of documentation on the incorporation of intelligent technologies in academic libraries. Additionally, the majority of the research on artificial intelligence that is currently available in libraries was done in the industrialized and western world. There were few, if any, materials accessible on the use of AI in libraries in poor nations. A paper that explores the application of artificial intelligence in Indian university libraries is essential. It must be stated that a study needs to look at how AI is used in Indian educational institutions. This necessity led to the initiation of the study, with its primary focus on accomplishing its objectives.

OBJECTIVE

Framework Development: The main goal of this paper is to develop a comprehensive framework for the strategic integration of AI into the existing library systems of Indian academic institutions. This framework will provide a clear roadmap for the implementation of AI technologies to enhance library services, streamline operations, and improve user experiences.

Enhanced Resource Accessibility: The second key objective is to leverage AI to enhance the accessibility and discoverability of academic resources within Indian libraries. This includes the development of AI-driven search and recommendation systems, metadata enhancement, and automated cataloguing to make it easier for students, faculty, and researchers to find and access relevant materials efficiently.

Efficiency and Cost-Effectiveness*:* A critical goal of this paper the project's core aim is to enhance efficiency and cost-effectiveness of library operations through the application of AI. This involves automating routine tasks, optimizing resource allocation, and

implementing predictive analytics to better manage library resources. By doing so, the project aims to maximize the value libraries provide while minimizing operational costs.

ARTIFICIAL INTELLIGENCE

The design and development of computers to do tasks that need human intelligence, such as voice recognition, taking decisions, goal, converting languages, communication, and state of mind recognition, is known to be artificial intelligence. (Irizarry-Nones, Palepu, and Wallace, 2017).

The science that gives robots the ability to move, think, acquire knowledge, logical reason, resolve issues, and, to some extent, plan, exhibit creativity is referred to as AI. Therefore, AI was defined by Liu (2016) as intelligent robots or intelligent systems that imitate AI seeks to duplicate the operations of human intelligence while continuing the study of intelligence in human beings. A branch of computer science known as artificial intelligence focuses on how computers learn (ML), Through a variety of methods, such as identification of characters, assessment of images, 3D perception, and eye function modeling, artificial intelligence processes information and interprets the environment. Furthermore, it encompasses voice recognition, speech generation, the comprehension and utilization of NLP, and a growing emphasis on expert systems.

AI emphasizes non-algorithmic approaches to finding solutions and symbol interpretation heavily. AI depends on its capacity to map symbols. Informational researchers currently have a multitude of exciting opportunities afforded by new applications, such as electronic library multimedia systems, GIS, and electronic commerce. In current contemporary day, several well-known problems with finding information have become much more serious as the application became more powerful, diverse, and pressing. Three categories of artificial intelligence exist: behaviourism, connectionism, and symbolism. Symbolism is a technique for simulating intelligent human behaviour that is based on logical reasoning. The core premise of connectionism lies in the linking mechanism and learning algorithm that connects neural networks and neuronal networks. In contrast, behaviourism is characterized as a perceptual-action control system with inherent cybernetic qualities.

The most important technical areas of artificial intelligence research include finding solutions, NPL ,artificial gene algorithms, intelligence systems, information construction, digital life, learning in depth, technology control, and various other technical disciplines (Liu, 2016).

Libraries have the potential to ensure the utilization of tools that cater to the evolving knowledge needs of the new generation, extending beyond the scope of Google searches, which primarily serve academic purposes. This is achievable due to the multitude of skills that librarians have acquired to effectively organize and make information accessible across various platforms (Jacknis, 2017).

Libraries concentrate their efforts on using AI to improve content access. With many libraries starting and offering Maker space competencies, we have been able to observe the proof of this change toward AI application (Kristin, 2016).

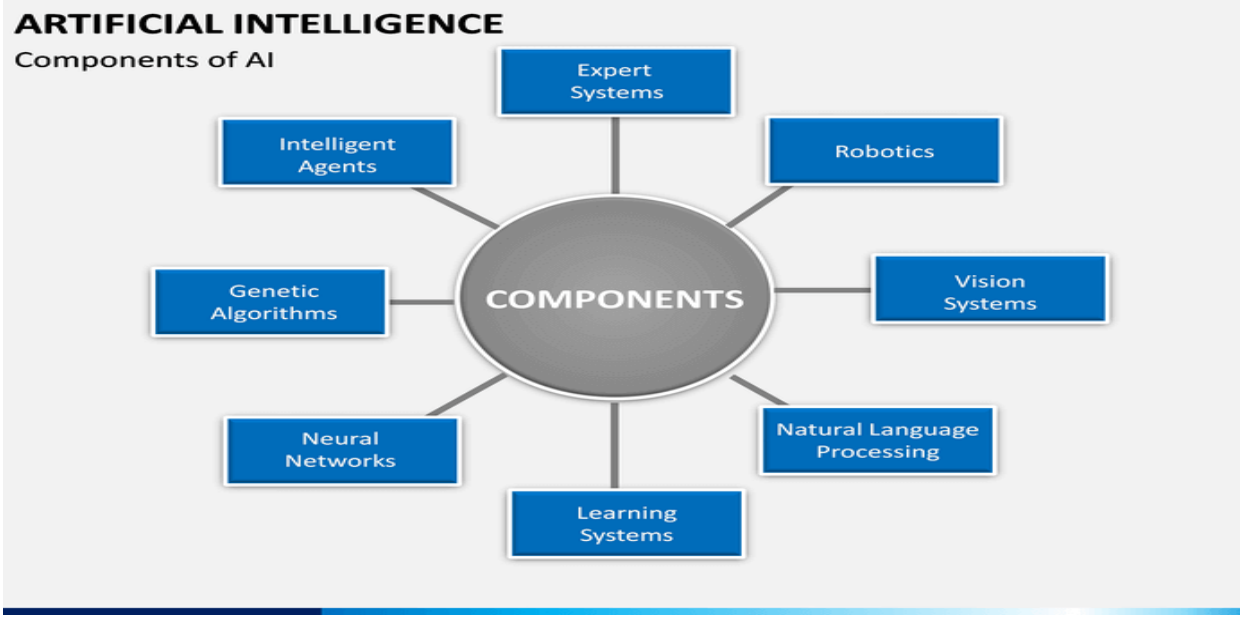

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Figure 1: Artificial Intelligent Component Diagram

The AI component diagram in figure 1 above showed the artificial intelligence subfields of intelligence systems, NPL, pattern identification, and robotic technology. They seek to imitate human intellect using machines.

NLP: Teaching computers to understand the language we use in our daily interactions has been a longstanding goal in the field of computer science. Natural Language stands as the latest advancement in the realm of programming language. A natural language client interface for artificial intelligence has been developed by researchers by implementing a restricted vocabulary and grammar. With the utilization of NLP, computers are capable of understanding the primary linguistic concepts embedded in both questions and their corresponding answers. The objective is to create a computer that can analyse and generate language in a manner that

aligns with human communication patterns. The different aspects of natural language processing include things like speech detection, artificially translated linguistic approaches, voice synthesizing, and information retrieval.

Expert System: Expert systems represent a subset of artificial intelligence that focuses on replicating human expertise and decision-making processes in a computerized format. This abstract provides an overview of expert systems, their key components, applications, and potential benefits. Expert systems are computer programs designed to emulate the decision-making abilities of human experts in specific domains. They consist of a knowledge base, a rule-based inference engine, and a user interface. The knowledge base stores a vast amount of domain-specific information and rules, which the inference engine uses to make decisions and provide recommendations. Users interact with the system through a user-friendly interface, inputting queries or problems for the expert system to solve.

The benefits of expert systems include knowledge preservation, as they store and maintain domain-specific expertise, making it accessible even when experts are unavailable. They can operate 24/7, offering consistent and reliable decision support. Additionally, they can assist in training and educating novices by providing explanations for their recommendations, thus transferring knowledge and expertise.

Pattern Recognition*:* The use of pattern recognition in surveillance, privacy invasion, and decision-making systems has raised ethical concerns related to biases, discrimination, and privacy. Pattern recognition is a crucial field in the development of intelligent systems and has far-reaching applications in diverse industries, from healthcare and finance to security and entertainment. It plays a pivotal role in the development of technology that can understand and interpret complex data, ultimately improving decision-making and automation. Pattern recognition tasks can be categorized as supervised or unsupervised. In supervised learning, the algorithm is trained on labeled data, while in unsupervised learning, the algorithm identifies patterns without labeled examples.

Robotics: Robotics is commonly recognized as a branch of artificial intelligence primarily concentrated on the development of movement and perception skills. Robots are electronic devices created for performing automated tasks, either directly under the control of a person or by using artificial intelligence and pre-programmed instructions.

Machine learning**:** Inventor of AI and computer games in America in 1959, Arthur Samuel introduced the term "machine learning," defining it as the capability for computers to acquire knowledge without the need for explicit programming. Depending on the type of "signal" or "responses" given to the learning system, ML applications are often divided into four main groups: (a) supervised education; (b) unsupervised education; (c) reinforcement education; and (d) semi-supervised education.

Libraries have the opportunity to adapt and refocus their attention with the aid of AI applications, as the methods for information retrieval are continually evolving. AI offers a valuable shortcut for harnessing this information, resulting in improved outcomes. Libraries are strategically positioning themselves to leverage cognitive computing and, more specifically, artificial intelligence applications due to their considerable potential in enhancing the quality of library services. Below are several potential methods through which artificial intelligence could be employed to enhance academic library services in India.

AI (Expert system) Application in Cataloguing:

One of the oldest and most enduring disciplines is cataloguing in the field of libraries. Recent endeavors to automate cataloguing, particularly focusing on descriptive cataloguing, have been driven by the perception that it adheres to rule-based principles such as AACR2 (Anglo-American Cataloguing Rules). AI techniques can be employed in two distinct manners for the purpose of cataloguing.

An interaction between a human and a computer in which the intermediate and the support system cooperatively exchange intellectual activities.

An expert technology connected to an digital publishing system that has extensive cataloguing capabilities, enables online-generated text to seamlessly undergo the cataloguing process using knowledge-based systems, eliminating the requirement for intermediary intellectual input.

AI (Expert system) application in classification:

The fundamental process in structuring knowledge is classification, and its importance in all knowledge management systems in information centers and libraries stems from this core role. Here are some examples of how categorization of books in libraries uses expert systems:

CoaL SORT: Theoretically, the browser Coal SORT may be used as a search and index tools. A frame-based conceptual network and the associated software make up its main components to facilitate user navigation within the conceptual structure, allowing them to explore specific areas of the network. The semantic network comprises nearly all of the expert knowledge embedded within the system.

BIOSIS: The knowledge-based system BIOSIS utilizes for the automatic categorization of documents contains a significant volume of procedural information. BIOSIS primary purpose is to aid indexers. To maximize the assignment of categories, closely mirroring the allocation made by human indexers, BIOSIS utilizes information from the titles of biological materials. The main objective of BIOSIS is to assist indexers in their work. To achieve this, it aims to assign as many categories as possible, closely aligning with the categories typically assigned by human indexers, by leveraging information derived from the titles of biological materials.

Application of Expert System in Indexing:

Another domain where expert systems are currently under development is in the indexing of periodicals. Transforming ideas into descriptions in verbal form for articles in monthly publications, it is essential to select and assign controlled vocabulary phrases that are theoretically equivalent. To improve indexing uniformity and quality, the intellectual components of indexing are being automated. The systems have the capability to autonomously select suitable preferred terms and assign relevant subdivisions by utilizing the data made available by the indexer. The system has the ability to draw conclusions and respond accordingly based on those conclusions. One of the most notable examples of an indexing system employed in libraries is "Med Index." However, based on knowledge system users who have used libraries are not very common. The majority of these systems are difficult for the typical library customer to utilize, which has resulted in limited interaction with them by the general public.

Applications of NLP in Library Activities:

The immediate mental image evoked when we encounter the term "NLPL" likely involves the ability to communicate in complete sentences, with a computer processing the request and responding verbally. NLPL has broad applications across various fields. Specifically, it can be utilized in the realm of searching databases like Online Public Access Catalogues (OPAC), with special reference to the study of libraries and information. Indexing serves as the fundamental basis for information retrieval. Indexing has two goals: to increase recalled, or the percentage of relevant information that are successfully found, and to increase accuracy, which is the percentage of documents that are actually relevant when they are retrieved.

AI(Expert System) application in Acquisition section:

Another crucial element of the library infrastructure is the space allocated for the expansion of the collection. This component of creating electronic collections is managed in large part by the librarian or information officer, active participation from library users is crucial, making it imperative to engage their support. Various systems have been incorporated to facilitate this process. The Monograph Selection Consultant is an innovative use of this cutting-edge technology in a particular field of library science, specifically in the domain of collection development. The task being modeled focuses on the detailed process of selecting monographic materials, a task typically performed by subject bibliographers. To facilitate the extraction of essential information from the system, it is essential for Both the information base and the user interface need to be thorough.

Application of (Expert system) Pattern Recognition in Library Operations:

Indeed, In the modern era marked by the Internet's widespread use, quick information exchange, multimedia computing, and the on going development of systems for information, a plethora of novel and emerging information system applications have become an integral part of the daily routines of office employees. Certainly, in the realms of information research and practice, the emergence of innovative applications a variety of prospects and bright futures in areas including digitized libraries, multi-media systems, geographical information systems, participatory computing, and electronic commerce.

Robotics applications in the Library Operations:

Certainly, the definition of a robot succinctly characterizes it as "an automatically controlled, reprogrammable, multi-purpose manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in automation applications." Certainly, robots are presently showcasing their abilities in rolling, flying, climbing, and navigating challenging terrain, autonomously devising strategies to reach their desired destinations. Libraries maintain their procurement of a significant quantity of printed materials even as they expand excellent selection of materials and services for digital libraries. Absolutely, While expanding their selection of electronic library services and resources, libraries still buy a lot of printed items.

An automated scanning system is what Comprehensive Access to Printed Material (CAPM) initiative seeks to build, capable of both on-demand and batch scanning, to facilitate real-time access to printed item through a website interface. Users will initiate the CAPM system, prompting the activation of a robot tasked with retrieving the required item. The item will be transported by a robot to another robotic device, responsible for its opening and automatic page-turning. In order to provide extensive capabilities, the CAPM system will make use of already installed scanners, OCR software, and indexing systems created by the Electronic Knowledge Centre including full-text searching, analysis, and browsing, along with the exploration of text-based image files.

CONCLUSION

India's academic libraries adoption of the AI technology is viewed as a fresh impetus for the development of smart libraries. The incorporation of artificial technology in particular areas of libraries has been started by librarians in order to keep up with current worldwide trends. Below are some innovative applications of artificial technology in the operational aspects of school, college, university libraries Furthermore, apart from the application of AI in NLP, Pattern Recognition, and Robotics across various library functions, expert systems are also employed in Reference Service, Cataloguing, Classification, Indexing, and Acquisition. The use of computers with intelligence in library functions reduces laborious and mistake-prone tasks, enhances access to research materials, and reduces the necessity for human intervention and substitution.

RECOMMENDATIONS

According to the conclusions drawn from the above findings, it is advisable for academic libraries across the nation to give precedence to the integration and adoption of artificial intelligence within In the modern technology-based information and communication era, libraries must assure effective and efficient administration and service delivery of their libraries. the incorporation of artificial intelligence is essential across all facets of academic libraries.

Academic libraries must ensure that they provide on going training and development opportunities for all their staff to enable them to effectively implement artificial intelligence within the library system.Academic libraries should make it a priority to offer continuous training and development opportunities to their entire staff, empowering them to proficiently integrate artificial intelligence into the library system. AI has to be introduced at all levels of national education curriculum so that graduates from these institutions may work in every industry and apply their knowledge of AI to the advancement of the country.

REFERENCES:

[1] AI tools for libraries. (2023). Computers in Libraries, 43(4), 14-16. Retrieved from https://www.proquest.com/trade-journals/ai-tools-libraries/docview/2809560501/se-2

[2] Chhetri, P. (2023). Analyzing the strengths, weaknesses, opportunities, and threats of AI in libraries. Library Philosophy and Practice, , 1-14.

[3] Kristin, W. (2016). "Libraries in an Artificially Intelligent World," Public Libraries, [Online]. Available: http://publiclibrariesonli ne.org/2023/09/libraries-in-an-artificially-intelligentworld/ Accessed AUG 2023.

[4] Liu, H. (2016). Artificial Intelligence and Its Evolution. Beijing: Science Press,5-8

[5] Irizarry-Nones, A., Palepu, A., & Wallace, M. (2017). Artificial intelligence (AI). Retrieved from:www.bu.edu/lernet/artemis/years/2017/projects/FinalPresenations/A.I.%20Presentation

[6] Hussain, A. (2023). Use of artificial intelligence in the library services: Prospects and challenges. Library Hi Tech News, 40(2), 15-17.

[7] Jacknis, N. (2017). The AI- enhanced library. Retrieved JULY 3, 2023 from: https://medium.com/@NormanJacknis/the-ai-enhanced-library-a34d96fffdfe

[8] Jha, S. K. (2023). Application of artificial intelligence in libraries and information centers services: Prospects and challenges. Library Hi Tech News, 40(7), 1-5. doi:https://doi.org/10.1108/LHTN-06-2023-01

[9] LaPierre, S. S. (2023). Facial recognition in photo archives. Computers in Libraries, 43(4), 4-8. Retrieved from https://www.proquest.com/trade-journals/facial-recognition-photo-archives/docview/2809559811/se-2

[10] Panda, S., & Chakravarty, R. (2022). Adapting intelligent information services in libraries: A case of smart AI chatbots. Library Hi Tech News, 39(1), 12-15. doi:https://doi.org/10.1108/LHTN-11-2021-0081

[11] https://www.sketchbubble.com/en/presentation-artificial-intelligence.html

[12] Subaveerapandiyan, A. (2023). Application of artificial intelligence (AI) in libraries and its impact on library operations review. Library Philosophy and Practice, , 1-19