Bulletin of Nexus
Multidisciplinary International Research Journal, Double-Blind Peer Reviewed, Open Access Journal
ISSN : 3065-7865 / Volume-3, Issue-1 ,January 2026

Original Article

Artificial Intelligence in Libraries

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Manuscript ID:
BN-2026-030115

ISSN: 3065-7865

Volume 3

Issue 1

January 2026

Pp. 81-86

Submitted: 15 Dec 2025

Revised: 25 Dec 2025

Accepted: 10 Jan 2026

Published: 31 Jan 2026

DOI:
10.5281/zenodo.19274739
DOI link:
https://doi.org/10.5281/zenodo.19274739

Abstract

This paper presents Artificial intelligence (AI) is transforming libraries by enhancing operational efficiency, personalizing user services, and optimizing resource management through technologies like machine learning, chat bots, and robotics. Key applications include automated cataloging, intelligent search, and predictive analytics. While AI improves information accessibility, it also necessitates addressing ethical concerns, data privacy, and the need for new librarian skills. Artificial intelligence (AI) is transforming modern libraries from traditional repositories into dynamic, intelligent information hubs by automating complex manual tasks and personalizing the user experience. Research indicates that AI integration significantly improves operational efficiency and user satisfaction

Key Words: *Artificial Intelligence, Library Automation, Chatbots, Robotics, Natural Language Processing, Digital Libraries, Librarianship, Big Data, Smart Libraries*

Definition: -

Artificial Intelligence is a transformative technology that simulates human intelligence in machines, enabling them to perform tasks that require reasoning, learning, decision-making and problem solving. In recent years, AI has gained significant attention across various sectors due to its ability to analyze data, automate processes, and offer personalized experiences. This Chapter provides a foundational understanding of AI, explores its components, and highlights its relevance to library science.

Bridging Artificial Intelligence with: -

The Integration of Artificial Intelligence into library science is an exciting development that has the potential to revolutionize how libraries function. Artificial Intelligence has ability to enhance the user experience, streamline library management processes, and ensure that library resources are utilized efficiently. Bridging Artificial Intelligence with library science involves applying Artificial Intelligence's capabilities, such as machine learning, natural's language processing, and computer vision, to address the challenges face by modern libraries. This section provides a detailed discussion of how Artificial Intelligence technologies can be leveraged to modernize libraries, improve resource accessibility, and enhance decision-making processes.

Key Innovations:

AI in Libraries:

Libraries use AI in robotic automation and expert systems, Librarians can provide instructional information on artificial intelligence and answer basic questions on what it is, how it is being used, and the future AI. Librarians can form collaborations with companies, schools, colleges, universities, workforce agencies, community organizations, and others that might benefit from AI.

As with drones, driverless vehicles, 3D Printing, and other emerging technologies, librarians can play an integral role providing resources to patrons who want to learn more about AI, will be displaced by these technologies, and who might want to pursue careers in these areas.

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How to cite this article:

Naik, A. M. (2026). Artificial Intelligence in Libraries. Bulletin of Nexus, 3(1), 81–86.
https://doi.org/10.5281/zenodo.19274739

Quick Response Code:

Website: https://bnir.us

Chatbots -

Chatbots in library science are increasingly utilized to transform traditional services into 24/7 "libraries without walls". They primarily serve as **virtual assistants**, handling routine inquiries so librarians can focus on complex research support.

Core Applications

- **Reference Services:** Chatbots answer frequently asked questions (FAQs) about operating hours, location of materials, and borrowing policies.
- **Resource Discovery:** They assist users in navigating complex catalogs, finding specific journals or databases, and locating peer-reviewed articles.
- **Account Management:** Patrons use bots to check loan statuses, renew borrowed items, and place holds on materials.
- **Information Literacy:** Some advanced bots act as instructional tools, guiding students through citation formats and effective research techniques.
- **Personalized Engagement:** Bots can provide tailored alerts for new arrivals in a user's field of study or upcoming library workshops.

Automated Cataloguing -

One of the core functions of any library is the organization of resources to ensure easy accessibility for users. In traditional systems, cataloguing and classification were carried out manually using standardized methods.

- **Dewey Decimal Classification System :-**

  DDC became one of the most widely used classification systems. It Organized knowledge into ten main classes, each further divided into subclasses.
- **Library of Congress Classification:-**

  Developed in the United States, the Library of Congress Classification was more detailed that the DDC and suited the needs of larger academic libraries. It Categorized books by subject areas, represented by letters and numbers, such as 'QA" for mathematics.
- **Manual Entry :-**

  In the absence of computers, librarians meticulously recorded details of each resource-title, author, publication date, and classification code-on physical cards. These cards were then stored in card catalogues, usually housed in wooden drawers.
- **Card Catalogues :-**

  Card catalogues were the primary tools for resource discovery in traditional libraries. These catalogues stored bibliographic information on individual cards, which users could browse to locate desired materials.
- **Structure of Card Catalogues :-**

  Each card in the catalogue provided basic information about a book or resources, including its title, author, subject, and call number. Cards were arranged alphabetically by title, author, or subject in separate drawers.
- **How Users Accessed Resources :-**

Users searched through the drawers to find the card corresponding to their required book. Once they located the card, they noted the call number to locate the book on the shelves.

Robotics:

Libraries have always been the place where people of all ages could visit to gain knowledge and have fun. With robots appearing in every facet of our lives, people are curious about them and are going to their public libraries to learn about them and, in some libraries check them out as if they were a book or other material. Robots can be found in all types of libraries, they are being used as a teaching tool in several public libraries. Libraries may use robots for tasks like surveillance, guiding users, or delivering materials.

Natural Language Processing :-

Natural Language Processing (NLP) is a branch of artificial intelligence that allows computers to understand, interpret, generate, and work with human language (both speech and text) to bridge the gap between human communication and machine understanding. It powers everyday applications such as chatbots, translation services, and voice assistants by using machine learning, deep learning, and linguistics.

Key Aspects of NLP in AI:

Core Components: NLP combines computational linguistics (rule-based modeling) with statistical, machine learning, and deep learning models to process language.

Key Functions:

Natural Language Understanding (NLU): Focuses on machine reading comprehension, intent recognition, and sentiment analysis.

Natural Language Generation (NLG): Enables systems to generate human-like text from structured data.

Techniques: Tokenization: Breaking text into smaller units (words, phrases).

Named Entity Recognition (NER): Identifying and categorizing key information (names, locations) in text.

Sentiment Analysis: Determining the emotional tone of text.

Machine Translation: Translating text from one language to another.

Evolution: Modern NLP has shifted from rule-based systems to advanced deep learning models, such as transformers (e.g., BERT, GPT), which significantly improved contextual understanding and generative capabilities.

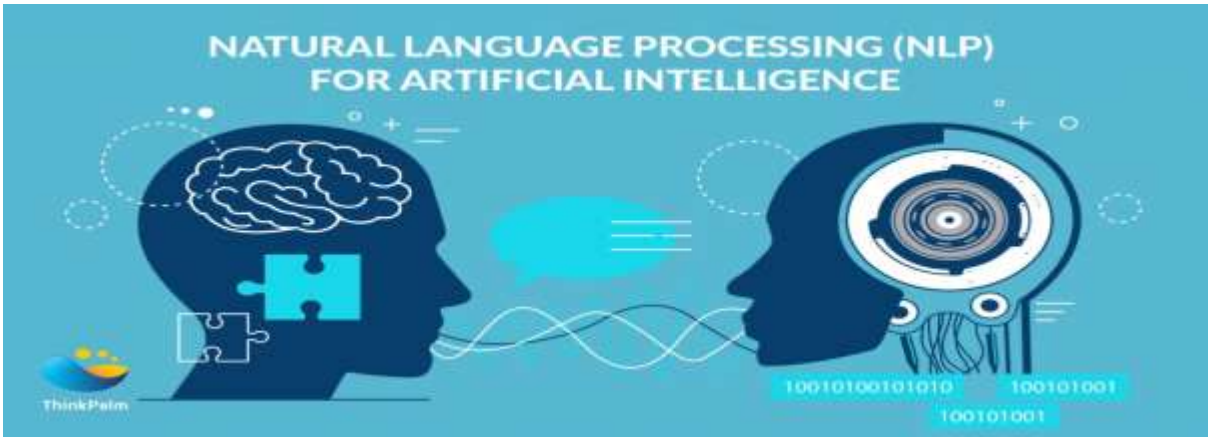
Applications:

Virtual Assistants: Siri, Alexa, and Google Assistant.

Customer Service: Chatbots and automated email processing.

Data Analysis: Extracting insights from text data, such as social media or support tickets.

Content Creation: Generating reports and summaries



What is NLP?

Natural language processing (NLP) is a subfield of computer science and artificial intelligence (AI) that uses machine learning to enable computers to understand and communicate with human language.

NLP enables computers and digital devices to recognize, understand and generate text and speech by combining computational linguistics, the rule-based modeling of human language together with statistical modeling, machine learning and deep learning.

NLP research has helped enable the era of generative AI, from the communication skills of large language models (LLMs) to the ability of image generation models to understand requests. NLP is already part of everyday life for many, powering search engines, prompting chatbots for customer service with spoken commands, voice-operated GPS systems and question-answering digital assistants on smart phones such as Amazon's Alexa, Apple's Siri and Microsoft's Cortana.

NLP also plays a growing role in enterprise solutions that help streamline and automate business operations, increase employee productivity and simplify business processes.

Drones:

As with other modern-day tools, libraries are prepared to help patrons understand how drones work, how they can be utilized constructively, and how to negative the complex implications of their widespread use.

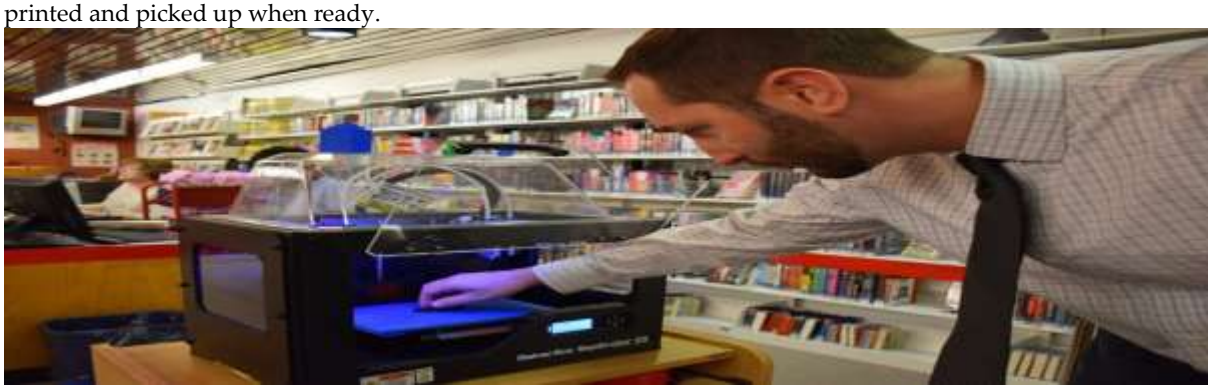
Libraries can provide resources on drones at all levels such as providing introduction to drones, where to purchase drones, the cost of drones, the advantages and disadvantages of drones, understanding FAA rules and regulations, how to build drones, how to use 3D printing to print drones, bringing in drone vendors to showcase their products, collaborating with schools to prepare students for careers in STEM and STEAM areas, and collaborating with workforce and other career-related organizations to retain unemployed and underemployed adults for technical financially lucrative careers with drones.

The small flying devices remotely controlled are another trendsetter in science nowadays. Either by adding a new technology at the library or creating workshops for users where they can learn to build and use a drone, the libraries can benefit a lot from its use.

3D Printing in Libraries:

3D printers are being used in all types of libraries, whether they are academic, medical, public, school, or special libraries, With 3D Printers becoming more affordable, its not surprising to find libraries providing 3D Printing stations for their patrons. For a small fee, uploaded files can be printed and picked up when ready.

Librarians with our zest for knowledge and passion for imparting it to others have always been on the forefront of technology. Many academic public and school libraries have become the centers where people can learn about and use 3D Printing.



Big Data Implications for Library:

As experts at as searching, retrieving and analyzing data, librarians are uniquely suited to work with big data. Librarians possess a unique set of interpersonal and technical skills that can turbo-charge research and development of new datasets and also reduce the amount of startup work involved. Mary Ellen Bates writes in "Big Data Ait's So Big" that "We info pros were using Big Data (Which is what value-added online services are) long before most of our colleagues knew what online research even meant."

Big Data creates competitive advantages for organizations, and how librarians can make big data visible, accessible, and usable by creating taxonomies, designing metadata, and developing systematic retrieval methods.

In addition, librarians can use big data tools to analyze data sets to make them simple, searchable and useable.

Big data can be used in many areas in information sciences including data management, curation and archiving, search and retrieval, interdisciplinary research, and the LIS curriculum.

Some other areas of growth for big data in library and information science include high-intensity performance computing, advanced statistical and computational methods, virtual reality systems, diversity formats data management, digital preservation, and curation.

Huwe writes that "Prestigious university libraries, including the Universities of California, Michigan, Pittsburgh, and Washigton, have launched data management as a core service.

Many academic libraries are experimenting with big data. They are examining their own data metrics in order to make key decisions.

Artificial Intelligence Security Systems:

In the modern era, libraries are not just repositories of knowledge but also hubs of intellectual interaction, digital resources, and valuable assets. With the advent of Artificial Intelligence libraries can enhance their security frameworks, ensuring a safe and efficient environment for users, resources and staff. Artificial Intelligence powered security systems have revolutionized traditional library security by incorporating advanced technologies such as facial recognition, automated book tracking, their prevention and behavioral analysis.

This chapter explores explores the role of Artificial Intelligence in modernizing library security, covering key innovations and their implications.

- **Facial Recognition for Member Authentication :-**

Facial recognition technology has emerged as one of the most innovative and effective tools in modern security systems. It uses advanced artificial Intelligence algorithms to identify individuals by analyzing their facial features. In libraries, facial recognition is revolutionizing member authentication, offering a seamless and secure way to verify users and grant access to services. This technology not only enhances security but also improves user convenience by automating many processes traditionally handled manually.

In this section, we will discuss how facial recognition works, its applications in libraries, its benefits, challenges, and potential future developments.

Conclusion –

Integration of Artificial Intelligence into libraries marks a **paradigm shift** from traditional, manual repositories to **dynamic, intelligent information hubs.** While AI does not replace the essential human role of librarians, it fundamentally enhances their capacity to serve patrons by automating routine tasks and providing deep, data-driven insights The integration of **Artificial Intelligence (AI)** in libraries marks a revolutionary shift from traditional storage-based institutions to dynamic, user-centric **smart libraries**.

Acknowledgment
The author expresses sincere gratitude to all those who contributed, directly or indirectly, to the completion of this paper titled *"Artificial Intelligence in Libraries."*
I am thankful to my colleagues and fellow librarians for their constructive suggestions and professional support during the preparation of this work. I also acknowledge the academic environment and guidance provided by Savitribai Phule Pune University, which encouraged scholarly research and innovation in library science.

Financial support and sponsorship
Nil.

Conflicts of interest
The authors declare that there are no conflicts of interest regarding the publication of this paper

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