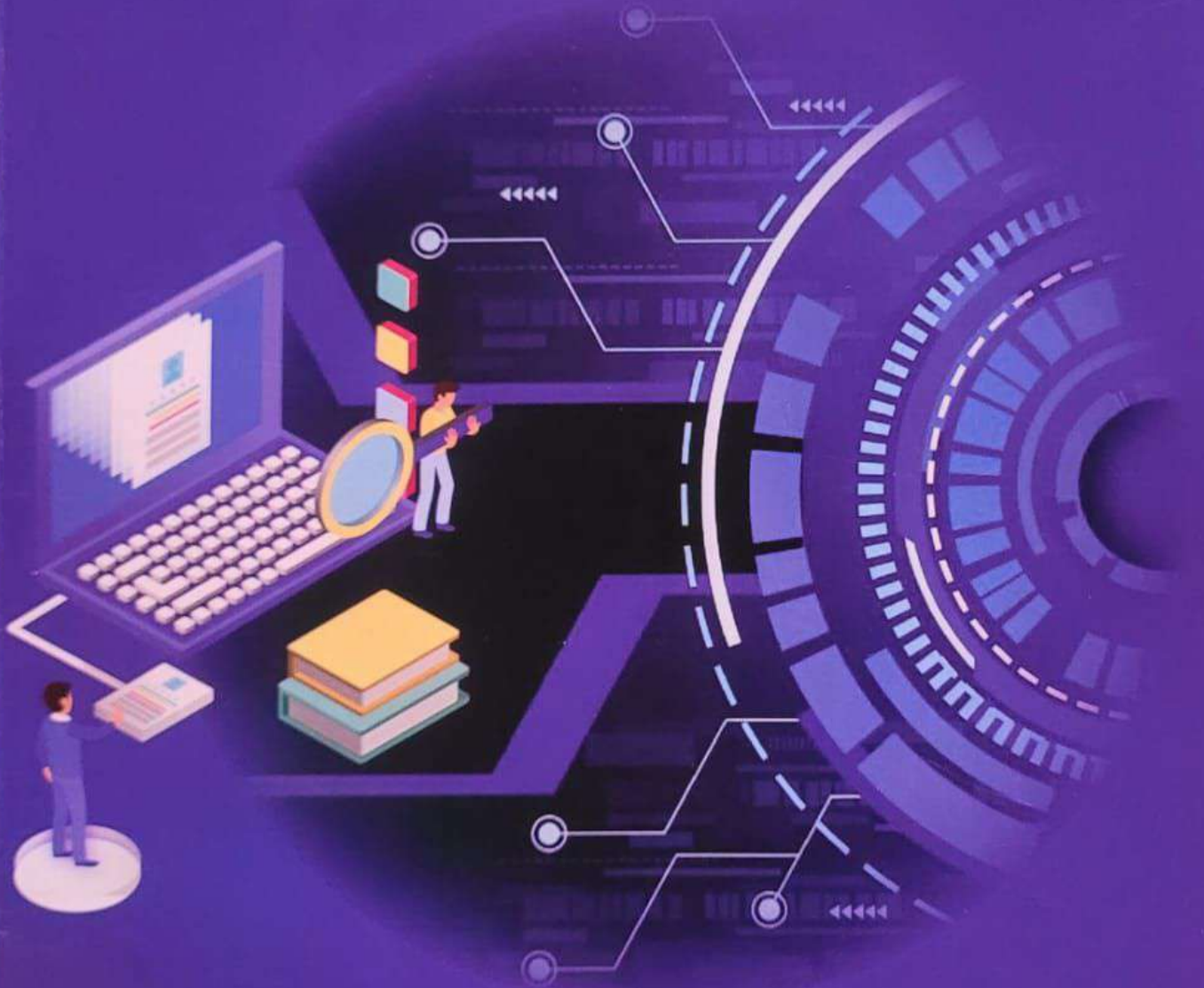


# Management of Digital Information Resources

A Festschrift in Honour of  
*Dr K Nageswara Rao*



**Sudhanshu Bhushan || Dr V Senthil || Dipti Arora**



# Artificial Intelligence in Libraries: An Overview

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## ABSTRACT

These days, one of the newest technologies is artificial intelligence (AI). Although it has been linked to a number of professions, including software industry, business, military, health, and education, its use in library services will encourage wise choices. The best services in the era of information technology can be transformed by artificial intelligence (AI), a technology that is frequently used in libraries. The purpose of this study is to demonstrate how AI is used in library operations such as cataloging, classification, indexing, periodicals database, information retrievals, etc. Several studies have been performed on this subject, but that only address a few applications. Although there is a strong connection between AI and libraries, there are still some unanswered questions about the usage and awareness of AI in library services.

**Keywords:** Artificial intelligence (AI), Library, online services, Machine learning, Interactive Learning Support, Digital Asset Management, chatbots, Search ability,

## 1. INTRODUCTION

Artificial Intelligence (AI) is a fast-growing subject in libraries that includes a wide variety of computer applications. It entails teaching computers to do things that, if done with human assistance, may be regarded as intelligent. Expanding laptop systems or machines that think, act, and even surpass human intelligence is the ultimate goal of artificial intelligence in libraries, and this has significant implications for librarianship. Libraries are increasingly using artificial intelligence software. They include

expert systems for reference services, robots that examine books and shelves, virtual reality for immersive learning, and more.

Even while it might seem that doing so will drive away patrons, artificial intelligence will most likely improve library operations rather than replace librarians. Their offerings will look better as a result. Libraries' operations and services will benefit greatly from artificial intelligence. Furthermore, in an ever-changing virtual world, it might make libraries even more crucial. In many respects, library services could be completely transformed by AI.

Definition: The term AI describes computer programs that are able to carry out advanced tasks that were previously limited to human performance, such as problem-solving, thinking, and decision-making.

## **2. REVIEW OF LITERATURE**

Artificial intelligence (AI) has grown in importance as a study topic in the twenty-first century across almost all disciplines, including engineering, science, education, medical, libraries, and information among other subjects, such as business, accounting, finance, marketing, economics, stock market, and law and others. Omame, I. M., & Alex-Nmecha, J. C. (2020). Artificial intelligence in libraries. Das, R. K., & Islam, M. S. U. (2021). Application of artificial intelligence and machine learning in libraries: a systematic review. Thomas, S. D., Jha, N. K., Jha, S. K., Sadek, B., & Ojha, S. (2023). Pharmacological and molecular insight on the cardioprotective role of apigenin. Nutrients, Pence, H. E. (2022). Future of Artificial Intelligence in Libraries. The Reference Librarian, Gasparini, Andrea Alessandro; Kautonen, Heli (2022) Understanding Artificial Intelligence in Research Libraries: An Extensive Literature Review: shown the application of AI in many disciplines.

## **3. METHODOLOGY**

The rapid literature review was conducted using primary and secondary data from Google Scholar databases using the keywords artificial intelligence (AI), libraries, higher education, and library access. Additionally, relevant websites were searched to ensure that no updates were missed on the topic.

## **4. ORIGIN OF ARTIFICIAL INTELLIGENCE**

The origins of artificial intelligence (AI) can be traced back to myths, tales, and rumors from antiquity, which described artificial entities created by skilled artisans that possessed consciousness or intelligence. The programmable digital computer, a device built on the abstract foundation of

mathematical reasoning, was created in the 1940s as a direct result of the study of logic and formal reasoning from antiquity to the present. In the summer of 1956, a workshop held on the campus of Dartmouth College laid the foundation for the field of artificial intelligence research. The U.S. and British governments stopped sponsoring haphazard artificial intelligence research in 1974 as a result of pressure from Congress and criticism from James Light hill. Machine learning was used to tackle a variety of academic issues in the early 2000s.

Strong computer technology was readily available, enormous data sets were gathered, and sound mathematical techniques were used, all of which contributed to the success. Deep learning outperformed all other techniques in 2012, demonstrating its revolutionary nature. When the transformer architecture first appeared in 2017, it was applied to create some very cool generative AI applications. In the 2020s, AI investment soared.

## 5. WHY AI IN LIBRARIES?

The operations of libraries and community services could be greatly transformed by AI. By using AI, libraries can become more effective, efficient and sensitive to the needs of their patrons in a variety of ways such as:

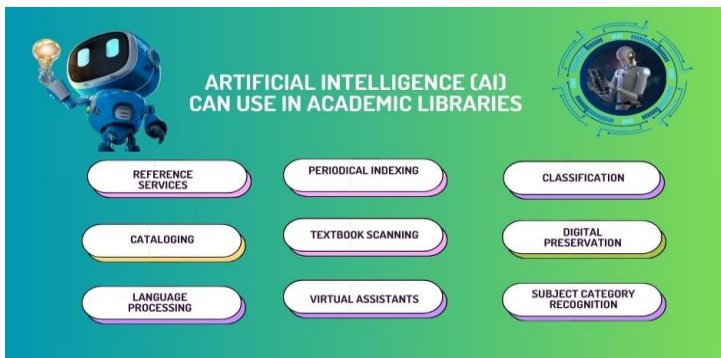


Figure 1: AI modules in Academic Libraries

- Reference services: Through conversational assistants, AI may offer virtual reference services.
- Cataloging: AI can help with cataloging through human-machine interfaces or by writing cataloging text online.

- Classification: AI can help with classification, which is a fundamental function of knowledge organizations.
- Periodical indexing: AI can help increase the quality and uniformity of indexing.
- Digital preservation: AI can help with the digital preservation of historical documents and other materials through image recognition and processing algorithms.
- Language processing: AI can help libraries provide access to resources in multiple languages through translation and language processing tools.
- Virtual assistants: AI-powered virtual assistants can help library patrons navigate the catalog system, answer queries, and provide language translation services.
- Textbook scanning: AI can be used to create software for textbook scanning.
- Subject category recognition: AI can be used to recognize subject categories.

### **5.1 AI-Powered Reference Services:**

AI has the potential to provide virtual reference services through conversational assistants.

#### **5.1.1 24/7 Availability**

Instant Responses: Regardless of operating hours or time zones, AI reference services are available 24/7 to help users immediately. This guarantees that users can get assistance anytime they require it.

#### **5.1.2 Efficient Information Retrieval**

Search Optimization: Using user queries as a guide, AI assistants may swiftly search databases, webpages, or archives to uncover pertinent information. These systems can comprehend and interpret human intent thanks to the application of natural language processing (NLP).

#### **5.1.3 Handling Routine Queries**

Automating FAQs: Artificial intelligence (AI) systems are capable of managing commonly requested questions, like "How can I renew my library book?" or "What are the operating hours?" This allows human reference personnel to focus on more intricate inquiries.

#### **5.1.4 Interactive Learning Support**

**Answering Complex Queries:** Certain AI systems are even capable of handling more in-depth inquiries. For example, they can offer summaries of research articles or recommend other resources in response to a user's query.

#### **5.1.5 Multi-lingual Support**

**Language Translation:** AI reference services can provide multilingual support, enabling users to obtain information in other languages or supporting users from other countries who might not be able to communicate in the service's default language.

#### **5.1.6 Data Analytics for Improved Services**

**Tracking User Queries:** By analyzing patterns in user queries, AI can assist institutions in identifying recurring problems or knowledge gaps. This data can be utilized to improve both the AI system and the broader service given to users.

**Predictive Assistance:** As AI systems advance, they will be able to anticipate user needs and proactively offer services or solutions before the user ever needs to ask, increasing productivity and satisfaction levels.

#### **5.1.7 Cost Efficiency**

**Reducing Operational Costs:** Organizations can save money while maintaining high levels of user assistance by automating routine questions, which eliminates the need for substantial human employment.

### **5.2 AI-Powered Cataloging**

AI can write cataloging content online or assist with cataloguing through human-machine interactions.

#### **5.2.1 Automated Metadata Creation**

**Efficient Data Entry:** AI can create metadata for things automatically, saving catalogers time while manually entering specific information. Title, author, date, subject category, and keywords are all included in this.

**Descriptive Metadata:** AI-driven systems are capable of producing summaries, descriptions, or pertinent tags by analyzing text, image, audio, or video files. This is useful in digital collections where numerous media kinds are cataloged.

### **5.2.2 Image and Object Recognition**

**Automated Tagging:** By assigning relevant categories or subjects to items, AI facilitates the organization of sizable collections. When an AI system examines a collection of photos, for example, it can automatically categorize the photos with terms like "landscape," "portrait," or "historical event."

### **5.2.3 Natural Language Processing (NLP) for Cataloging Text**

**Keyword Extraction:** AI can increase catalog search ability by extracting important terms and phrases from documents using natural language processing (NLP) techniques. This guarantees more accurate and reliable document indexing.

### **5.2.4 Improved Consistency in Cataloging**

**Standardization:** AI systems can assist in making sure that cataloging adheres to certain standards, such as Dublin Core for digital assets or MARC (Machine-Readable Cataloging) in libraries. To guarantee consistency throughout the catalog, AI can identify discrepancies and automatically recommend fixes.

**Classification Systems:** Artificial intelligence (AI) can help reduce human workload by helping to assign classification numbers (such as Dewey Decimal or Library of Congress categories) based on the subject matter of books or other items.

### **5.2.5 Multilingual Cataloging Support**

**Automatic Translation:** Collections may now be accessed by people worldwide thanks to AI-powered language models that can automatically translate cataloging information into numerous languages. International organizations and museums with a wide range of visitors may find this helpful.

### **5.2.6 Predictive Cataloging and Recommendations**

**Pattern Recognition:** AI is able to identify patterns in a collection and make recommendations for classification categories, metadata, or catalog entries based on related items. For instance, an AI system can propose thematic tags or categories if it notices a reoccurring theme in multiple books or artifacts.

### **5.2.7 Enhanced Search ability through AI-Generated Descriptions**

Automated Cataloging Text: AI is capable of producing comprehensive catalog descriptions that encompass the item's significance, background, and any relevant historical or cultural data. This might be especially helpful for online databases or digital collections where users look for descriptions with a lot of context.

### **5.2.8 Crowd sourcing and AI Collaboration**

Collaborative Cataloging: AI technologies can assist human curators in cataloging materials; the AI proposes categories, metadata, or keywords and human experts can verify or improve the ideas.

### **5.2.9 Integration with Digital Platforms**

Online cataloging: Artificial intelligence (AI) can help with real-time cataloging on digital platforms by creating metadata on its own whenever new digital content (such articles, movies, or e-books) is published. Artificial intelligence (AI) solutions that are connected with content management systems (CMS) can make this happen.

### **5.2.10 Error Detection and Quality Control**

Finding Cataloging Errors: AI can detect errors, duplicate entries, and inconsistencies in catalog records automatically, improving database quality management.

## **5.3 AI-Powered Classification**

One of the core tasks of knowledge organizations is classification, which AI may assist with.

### **5.3.1 Enhancing Traditional Classification Systems**

Dewey Decimal and Library of Congress Classification: By evaluating the content and recommending the best classification category, AI can help libraries automatically give Dewey Decimal or Library of Congress Classification numbers to new books and resources.

Hierarchical Classification: AI can assist in categorizing objects into more specific and more general categories by arranging them into hierarchical systems. This makes it possible to organize knowledge more effectively and makes it easier for consumers to navigate complicated classification systems.

### **5.3.2 Dynamic and Adaptive Classification**

**Real-time Classification:** As new content is added to a system, AI may classify it dynamically. For example, AI can automatically tag and categorize newly submitted digital content (such as multimedia files, research papers, and e-books) depending on its topic matter.

### **5.3.4 Classification of Multimedia and Non-Textual Data**

**Audio and Speech Recognition:** By first translating spoken content into text and then analyzing it to apply relevant categories or subject tags, AI may categorize audio recordings or spoken content.

### **5.3.5 Subject and Thematic Classification**

**Automatic Subject Tagging:** By automatically assigning subject tags, AI can help with thematic classification of books, documents, or artifacts. AI may recognize and categorize historical documents based on themes such as "World War II," "Ancient Civilizations," or "Scientific Discoveries" while cataloging them.

**Topic Modeling:** By locating buried themes in the text, AI-driven topic modeling techniques assist in the classification of big document collections. Documents that have similar subjects are grouped together into clusters using these topics.

### **5.3.5 Multilingual Classification**

**Cross-language Classification:** Multilingual AI systems are able to classify content in many languages, which helps international organizations arrange a variety of contents. For instance, an AI system can ensure consistency in language classification by grouping publications in both English and non-English languages under the same subject categories.

### **5.3.6 Classification in Digital Libraries and Repositories**

**Digital Asset Management:** AI algorithms are being utilized more and more to categorize digital assets, including multimedia files, e-books, and research papers, in digital libraries and content repositories. Based on content type, full-text analysis, and metadata, AI assists in classifying these resources into structured groups.

### **5.3.7 Improving Searchability through Classification**

**Semantic Search:** By employing sophisticated classification methods to increase searchability, AI improves search functions. For example, if a user searches for "global warming," the AI system can retrieve not only items

directly labeled with that term but also those classified under related terms like "climate change," "greenhouse gases," or "environmental science."

### **5.3.8 AI-Assisted Knowledge Taxonomy**

**Ontology Development:** AI is able to assist in the creation of ontologies, which are hierarchical structures that outline the connections between various concepts. This is helpful in specialist fields where accurate classification is essential for information organization, like biology or legal studies.

### **5.3.9 Personalized Classification**

**Recommender Systems:** AI may categorize material according to user interaction and then use the classification information to suggest new products. For instance, a digital library's AI-based recommendation system may categorize a user's previous interactions with "data science"-related content and then suggest new books, articles, or datasets under relevant headings.

### **5.3.10 Automation of Complex Classification Systems**

**Legal & Medical Classification:** Artificial intelligence (AI) can automate the classification of legal documents, medical records, or research papers into distinct categories in specialist fields like law or medicine, where classification systems can be complex and extremely thorough. Statutes, case law, and legal precedents are a few categories into which legal texts can be divided.

**Scientific Taxonomy:** Artificial Intelligence can help classify scientific research papers, databases, or biological specimens. This can help ensure that these materials are accurately placed into taxonomies such as biological species classification or physics matter categorization.

### **5.3.11 Error Detection and Consistency in Classification**

**Detecting Misclassification:** AI can detect inconsistencies or flaws in classification, such as objects assigned to the wrong category or subject header. Artificial intelligence (AI) can identify possible problems or recommend remedies by examining vast datasets and patterns.

## **5.4 AI-Powered Periodical Indexing**

AI can improve the consistency and quality of indexing.

#### **5.4.1 Improved Consistency in Indexing**

**Standardized Terms and Keywords:** By using controlled vocabularies like domain-specific taxonomies or Library of Congress Subject Headings (LCSH), AI helps guarantee consistency in the usage of terms among journals. This avoids inconsistencies that could arise from various indexers using different names to refer to the same concept.

**Consistency Across Multiple Periodicals:** AI can guarantee that articles from diverse sources are indexed consistently by using the same set of guidelines and algorithms to multiple periodicals. This is very helpful in research databases or extensive digital archives.

#### **5.4.2 Automated Indexing**

**Text Analysis for Subject Headings and Keywords:** Artificial intelligence (AI) can automatically extract relevant subject headings and keywords from whole articles. Through natural language processing (NLP), artificial intelligence (AI) can identify important themes, subjects, and concepts, generating accurate index entries. Time is saved, and indexing requires less human labor thanks to this automation.

#### **5.4.3 Multilingual Indexing**

**Cross-language indexing:** AI programs that possess multilingualism are able to index journals in many languages. Artificial Intelligence facilitates the creation of unifying indexes across varied media, making them accessible to a worldwide audience, by automatically translating information and assigning pertinent subject headings in multiple languages.

**Language Detection:** AI can identify an article's language and apply the proper controlled vocabularies or indexing rules for that language, providing precise and culturally appropriate classification.

#### **5.4.4 Subject Classification and Thematic Grouping**

**Subject-Based Indexing:** AI is capable of categorizing articles according to their content under particular subject headings or thematic groups. Articles in medical publications, for instance, can be indexed by subject matter analysis and assigned relevant categories under terms like "public health," "cardiology," or "oncology."

#### **5.4.5 Dynamic and Real-Time Indexing**

**Adaptive Indexing:** By examining how users interact with the database, AI systems can continuously learn from and improve their indexing

strategies. For instance, AI can modify indexing algorithms to emphasize phrases that users regularly search for, so improving future indexing.

#### **5.4.6 Handling Large Volumes of Data**

**Scalability:** Compared to human indexers, AI can index enormous volumes of journals far more quickly. Large research databases, where thousands of new articles are added on a monthly basis, will particularly benefit from this.

**Backlog indexing:** AI can bring legacy collections up to date by processing and indexing older, archived periodicals that may not have been indexed previously. This is crucial for digitizing old magazines and enabling contemporary search engines to access them.

#### **5.4.7 Enhanced Precision in Indexing**

**Identifying Specific Sections:** Artificial Intelligence is able to identify more accurate indexing terms by analyzing certain sections of an article, such as the abstract, conclusions, and references. In contrast to extrapolating from the full text, this guarantees that the index accurately represents the main concepts and conclusions of the paper.

**Disambiguation:** AI is capable of disambiguating similar terms or concepts, which helps to make sure that the relevant articles are indexed under the appropriate headings. The index will be more accurate if, for instance, an AI system could discern between "Apple" as a fruit and "Apple" as a technology corporation.

#### **5.4.8 Semantic Indexing**

**Understanding Context and Meaning:** Semantic indexing powered by AI enables systems to perform more than just keyword matching. AI can comprehend an article's fundamental concepts and context rather than just concentrating on surface-level phrases, ensuring that it gets indexed under the most pertinent themes.

#### **5.4.9 Personalized and User-Specific Indexing**

**User-Driven Indexing:** AI is capable of analyzing user behavior and preferences to build customized indexes or suggest content based on previous searches. AI might emphasize indexing phrases relating to a user's field of interest, such as "machine learning," if the researcher regularly looks for papers in this area.

Customized Indexes for Different Audiences: Artificial Intelligence has the capacity to generate customized indexes for diverse user segments, including scholars, learners, and business experts. Users can now locate content that is pertinent to their individual needs thanks to this.

#### **5.4.10 Error Detection and Quality Control**

Identifying Gaps or Errors: AI is capable of finding flaws, gaps, or inconsistencies in current indexes. For example, if an article is misclassified or absent from a given index category, AI can flag this for review or rectification.

Ongoing Maintenance: AI systems are able to keep an eye on and update indexes on a regular basis, making sure they stay current and accurate over time. This is especially helpful in fields where words, ideas, and trends are often changing..

#### **5.4.11 Linked Data and Semantic Web Integration**

Semantic Web: AI enables more sophisticated data retrieval and querying by integrating periodic indexes into the larger semantic web. This implies that users can search the web for relevant concepts in addition to finding specific articles.

#### **5.4.12 Citation Indexing**

Tracking Citations: AI can assist in constructing citation indexes, which track how often an article has been cited by other works. Artificial intelligence (AI) has the ability to automatically recognize and classify references found in publications, producing citation indexes that shed light on the significance and impact of a given work.

### **5.5 AI-Powered Digital Preservation**

Through image identification and processing algorithms, artificial intelligence (AI) can assist in the digital preservation of historical documents and other objects.

#### **5.5.1 Digitization and Image Processing**

High-Quality Scanning: By enhancing the digitalization of physical documents, AI-powered image processing algorithms can improve the quality of scanned images. With AI's ability to modify brightness, contrast, resolution, and other visual components, even fading or damaged documents can be captured with clarity.

Restoration of Damaged Materials: By repairing discoloration, eliminating noise, and filling in missing sections, AI may examine and repair old or

damaged papers and photos. This is especially helpful for historical items that might have deteriorated physically over time.

### **5.5.2 Optical Character Recognition (OCR) for Text Extraction**

**Text Digitization:** Old papers scanned into digital images can be accurately converted into machine-readable text using AI-driven Optical Character Recognition (OCR). Large document collections are easier to search through, index, and analyze as a result.

**Enhanced OCR Accuracy:** AI can read handwritten manuscripts, multilingual texts, and complicated or historical fonts that conventional OCR systems can find challenging. AI systems get better over time through machine learning, becoming able to recognize even the most challenging handwriting or uncommon typefaces.

### **5.5.3 Image Recognition for Object and Content Identification**

**Automatic Identification:** AI is capable of automatically identifying and categorizing objects, symbols, or images found in historical records through the use of image recognition. This is helpful for maintaining non-textual materials in digital collections, such as paintings, diagrams, maps, and artifacts.

**Metadata Generation:** By identifying and classifying visual content, AI is able to produce metadata for saved items. For example, it can identify notable locations on historical maps, important people in antique photos, or creative styles in artwork.

### **5.5.4 Data Compression and File Format Preservation**

**File Format Conversion:** AI can assist save documents in formats that will stand the test of time by automatically transforming obsolete or proprietary file formats into more widely used and standardized ones. This guarantees the continued usability of digital materials as technology advances.

### **5.5.5 Preservation of Audio-Visual Content**

**Speech-to-Text for Audio Transcription:** AI can transcribe audio content into text using speech-to-text algorithms, keeping it in a more searchable and accessible manner, for historical audio recordings or oral histories.

### **5.5.6 Handwriting Recognition and Analysis**

**Handwritten papers:** Digital preservation is greatly aided by AI's capacity to identify and digitize handwriting, even from old papers. Handwritten

documents from long ago that are frequently difficult to read by hand can be transcribed and made available.

**Historical Font and Script Recognition:** While standard OCR systems may find it difficult to read older writing styles and scripts, AI can learn to do so. Based on handwriting styles, it can also determine authorship or geographic origins, giving historians and scholars important context.

### **5.5.7 Contextual Analysis and Knowledge Extraction**

**Knowledge Graphs:** Artificial intelligence is capable of building knowledge graphs, which connect past facts relevant to preserved documents, forming a network of interconnected information. This makes it possible for academics to investigate the connections between various historical eras, records, and artifacts.

### **5.5.8 Automated Metadata Creation and Cataloging**

**Metadata Enrichment:** Through content analysis of texts, photos, and audiovisual assets, artificial intelligence can automatically produce rich metadata for digital collections. Subject classifications, keywords, dates, and even geographical locations can be included in this metadata.

### **5.5.9 Digital Archiving and Search ability**

**Better Indexing:** Artificial intelligence has the capacity to automatically index massive digital archive collections, simplifying the process for users to locate particular documents or data. This covers keyword-based indexing, content-type indexing, and sentiment analysis of historical writings.

### **5.5.10 Fraud Detection and Authenticity Verification**

**Authenticity Verification:** AI is capable of examining old papers to confirm their legitimacy. For instance, by examining patterns in pen, handwriting, or signatures, it can determine whether a document has been altered or spot forgeries.

**Watermark Detection:** Artificial intelligence (AI) may identify watermarks that are buried or other authenticity indicators in old documents, guaranteeing that digital preservation initiatives retain the original materials' integrity.

### **5.5.11 Long-Term Preservation Strategies**

**Automated Monitoring:** AI can keep an eye on the environment for digital preservation and make sure that data is preserved throughout time. This entails identifying problems such as bit rot, file corruption, or

modifications in file accessibility and implementing measures to reduce the associated hazards.

#### **5.5.12 Enhancing Accessibility**

**Multilingual Transcription and Translation:** AI is capable of translating and transcribing historical texts into a variety of languages, opening them up to a worldwide readership. Additionally, it preserves cultural heritage by recognizing and converting text written in rare or out-of-date languages.

**Accessibility for the Visually Impaired:** Artificial intelligence (AI) can produce haptic representations or audio explanations of visual content, such as papers or artwork, to increase accessibility for those with visual impairments.

#### **5.5.13 Crowd sourcing and Public Collaboration**

**Collaborative Annotation:** AI can support crowdsourcing initiatives in which members of the public assist with historical document transcription or annotation. AI programs help by pre-processing the material, making transcribing recommendations, or confirming the veracity of user-contributed data.

### **5.6 AI-Powered Language Processing**

By using translation and language processing techniques, AI can assist libraries in offering cross-lingual access to resources.

#### **5.6.1 Automated Translation of Library Resources**

**Machine Translation:** A variety of languages can be swiftly translated into library content, including books, articles, catalogs, and metadata, using AI-powered translation systems like Microsoft Translator, Google Translate, and DeepL. Libraries are now able to assist patrons with varying language backgrounds.

**Real-Time Translation:** Digital content can be translated in real-time by AI-driven systems, removing the need for human translation and making multilingual content instantly accessible. Users who require instant access to resources in their favorite language may find this handy.

#### **5.6.2 Multilingual Search Functionality**

AI can facilitate cross-language search functionalities, which let users look for resources in one language and get results in another. This is known as cross-language information retrieval, or CLIR. An individual may, for

instance, conduct a Spanish search and receive results containing content in English, French, or other languages.

**Semantic Search Across Languages:** AI interprets user queries and retrieves pertinent content in any language by using natural language processing (NLP). This improves search results across languages by focusing on the meaning and context of the question rather than just matching keywords.

### **5.6.3 Language Detection and Conversion**

**Automatic Language Detection:** AI can streamline multilingual access by automatically determining the language of a document or a user's query. When a user types in a search query in Mandarin, for example, the system can translate pertinent English items or retrieve resources that are available in Mandarin.

### **5.6.4 Multilingual Cataloging and Metadata**

**Automated Metadata Translation:** AI is capable of translating resource metadata into a variety of languages, including titles, abstracts, and subject headings. This guarantees that anyone looking for information in many languages will be able to locate pertinent content.

### **5.6.5 Multilingual Access to Digital Collections**

**Multilingual Digital Libraries:** Libraries may provide multilingual access to their digital holdings thanks to AI-driven translation and language processing capabilities. Language constraints do not prevent users from accessing academic papers, historical materials, or e-books in their preferred language.

### **5.6.6 Language Processing for Special Collections**

AI is capable of processing and digitizing texts in various languages, including those with distinct scripts (such as Arabic, Cyrillic, or Chinese characters). Libraries can conserve multilingual items and make them available online by identifying and digitizing these scripts.

**OCR for Multilingual Documents:** Machine-readable formats can be created from printed or handwritten texts in several languages using AI-driven optical character recognition (OCR) techniques. This makes it possible for libraries to search and digitize multilingual documents.

### **5.6.7 Speech Recognition and Multilingual Virtual Assistants**

**Multilingual Voice Search and Help:** Chatbots and other voice search tools, which are driven by artificial intelligence, have the ability to communicate with users in a variety of languages. By answering inquiries,

assisting users in finding materials, and guiding them through the library's services in their native tongue, this improves the user experience.

#### **5.6.8 Enhanced User Experience for Non-Native Speakers**

User Interface Localization: Artificial Intelligence has the ability to automatically adapt digital library platforms' user interfaces to various languages. This entails adapting menus, buttons, instructions, and other user interface components to each user's preferred language.

#### **5.6.9 Support for Minority and Endangered Languages**

Endangered Language Preservation: By translating, transcribing, and producing materials in minority and endangered languages, AI can help with their digital preservation. This guarantees that these languages will be available to future generations and aids libraries in their duty of cultural preservation.

#### **5.6.10 Translation of Research and Scholarly Content**

Multilingual Abstracts and Summaries: Artificial intelligence has the ability to automatically produce multilingual abstracts or summaries of research publications, which facilitates comprehension of scholarly work by non-native speakers.

#### **5.6.11 AI-assisted Language Learning Resources**

Language Learning Tools: AI-powered language learning materials, like applications that let users practice and advance their language abilities, can be found in libraries. AI can help users learn new languages more successfully by personalizing learning paths, adapting to user competence levels, and providing real-time feedback.

#### **5.6.12 Cross-Cultural and Multilingual User Support**

Real-Time Multilingual Customer Support: AI-driven chatbots can assist customers in a variety of languages, directing them through library resources, responding to inquiries, and assisting them in obtaining materials. This makes library services more inclusive and lowers language barriers for non-native speakers.

### **5.7 AI-POWERED VIRTUAL ASSISTANTS**

These tools can aid library users with language translation, catalog system navigation, and query resolution.

### **5.7.1 Navigating the Library Catalog**

**Advanced Search Features:** To help customers swiftly refine their search results, virtual assistants can aid users with more complicated search features including filtering by publication date, format (e-book, audio book, print), or language.

### **5.7.2 Answering Frequently Asked Questions (FAQs)**

**General Library Information:** Virtual assistants can respond to frequently asked queries about the library, including its hours of operation, its lending regulations, how to get a card, and how to renew books. Customers will not have to wait in line for straightforward inquiries as a result.

### **5.7.3 Language Translation Services**

**Virtual Assistance:** To improve accessibility for patrons who might not speak the library's primary language, libraries serving diverse communities might provide multilingual virtual assistants. The assistant can aid users with understanding library services, navigating the catalog, and even translating.

### **5.7.4 Providing Digital Resource Assistance**

**E-Book and Digital Resource Access:** Virtual assistants can help users access digital resources including online journals, audiobooks, and e-books. In the event that a user lacks experience with e-book borrowing or digital content streaming, the virtual assistant can offer guidance and support them through the procedure.

### **5.7.5 Handling Circulation and Account Management**

**Book Renewals and Holds:** Tasks such as renewing borrowed materials or putting a hold on books that are currently checked out can be automated by virtual assistants. Users can simply request, "Can you renew my books?" or "Hold this book for me when it becomes available," and the assistant will manage the request.

**Library Account Management:** Customers can check the status of their accounts, including due dates for things they've borrowed, fines, and holds, by interacting with virtual assistants. The assistant might email reminders regarding future due dates or advise users about available holds.

### **5.7.6 Event and Program Information**

**Event Calendars:** Users can obtain information about forthcoming workshops, classes, and library activities from virtual assistants. Asking the virtual assistant "What events are happening this week?" can help

consumers stay informed about programs like book clubs, technology workshops, and children's story hours.

**Program Sign-Up Help:** By allowing users to sign up for events or programs directly through the virtual assistant, the process of signing up for classes, lectures, and other library-hosted activities is made easier.

### **5.7.7 24/7 Availability for User Queries**

**After-Hours Support:** Virtual assistants are available to help users access information or manage their accounts around-the-clock, even during regular library hours. This is especially helpful for digital or online library materials, as users could require assistance at any time of day.

### **5.7.8 Accessibility Support**

**Assistance for Users Who Are Visually Impaired:** By using voice-based navigation, virtual assistants can help users who are visually impaired search the catalog, look at resources, and use the library system. This increases accessibility and guarantees that the services provided by libraries are available to all users.

### **5.7.9 Enhancing User Experience**

**Voice-Activated Interactions:** Hands-free interaction is possible with virtual assistants through voice activation. Voice commands allow users to ask inquiries and search the catalog; this is particularly helpful for users who are on the road or have physical constraints.

### **5.7.10 Library Tours and Orientation**

Virtual Assistants can provide virtual tours of the library to newcomers and guests, outlining the locations of important departments, services, and amenities. By doing this, patrons can become more acquainted with the library without having to speak with staff face-to-face.

**New User Orientation:** Virtual assistants can give new users an overview of the services offered by the library, including instructions on how to use the catalog, check out books, and access online resources. This is beneficial for new users who might not be familiar with the library's operations.

## **5.8 AI-Powered Textbook Scanning**

Software for scanning textbooks can be developed using AI.

### **5.8.1 Optical Character Recognition (OCR)**

**Automated Text Extraction:** Page scans from textbooks can be turned into machine-readable text using AI-powered OCR software. This makes textbooks searchable, editable, and accessible by enabling libraries to digitize them.

### **5.8.2 Image Enhancement and Processing**

**De-skewing and De-warping:** When scanned, textbook pages frequently have distorted appearances, particularly if they are uneven or curved. For improved readability, AI can automatically flatten or straighten the scanned images.

**Noise Removal:** AI algorithms are able to eliminate background noise from scanned photos, including smudges and shadows. This is especially helpful for outdated or damaged textbooks.

### **5.8.3 Automated Indexing and Metadata Generation**

**Chapter and Section Recognition:** AI can automatically recognize and label distinct portions of a textbook, such as chapters, headings, and subheadings, making it easier to navigate the digital version of the textbook.

**Metadata Extraction:** Artificial Intelligence can automatically generate the information required for classifying a textbook in library systems by extracting pertinent metadata from textbooks, including the title, author, publication date, and subject areas.

### **5.8.4 Creating Searchable Digital Textbooks**

**Keyword Search Ability:** After a textbook is scanned and processed using AI-powered optical character recognition (OCR), it may be fully searched using keywords. This saves time by enabling researchers and students to find particular subjects or parts without having to turn pages by hand.

### **5.8.5 Automated Summarization and Content Generation**

**Chapter summaries:** AI can produce summaries for every chapter or portion of a textbook automatically, saving students time by allowing them to rapidly understand the main ideas without having to read the entire book.

**Study Guides and Notes:** AI may produce study guides, notes, or highlights of key passages from scanned textbook content, which will help students study more effectively.

### **5.8.6 Accessibility Features for Students with Disabilities**

**Text-to-Speech Conversion:** Students who are dyslexic or visually impaired can listen to textbook information thanks to AI's ability to turn scanned text into speech. This feature can greatly improve access to educational materials for students with disabilities.

**Braille transcription:** By converting scanned textbooks into Braille format, AI-powered solutions can ensure that users who are blind or have low eyesight can access the content in a tactile manner.

### **5.8.7 AI-Driven Quality Control**

**Error Detection in Scans:** Artificial intelligence is capable of recognizing and highlighting flaws, such as misspelled words, improper characters, or formatting problems, in scanned material. This lessens the amount of manual work required to edit and proofread digitized textbooks.

### **5.8.8 Preservation of Historical Textbooks**

**Digitization of Rare or Historical Textbooks:** Textbooks that are too delicate to handle often can be preserved using artificial intelligence (AI)-powered scanning technology. Libraries can preserve these resources from further deterioration and make them available online by scanning them.

**Restoration Damaged Textbooks:** Artificial Intelligence can help repair scanned images of damaged textbooks by reassembling pieces of faded or torn pages or adding missing text.

### **5.8.9 Integration with Learning Platforms**

**Customizable Learning Content:** Using scanned textbooks as a basis, AI can assist teachers in producing interactive exercises or multimedia-enhanced online textbook versions.

### **5.8.10 Cost-Effective Textbook Distribution**

**Digital Lending Models:** Libraries can establish digital lending models for textbooks using AI-driven scanning. These models let students check out digital copies of textbooks for a predetermined amount of time, which decreases the need for hard copies and boosts accessibility.

## **5.9 AI-Powered Subject Category Recognition**

AI is capable of subject category recognition.

### **5.9.1 Automated Classification of Resources**

Natural Language Processing (NLP): With the use of artificial intelligence (AI), systems may examine text to identify important ideas, subjects, and themes in books, articles, and other materials. AI is able to classify the resources into subject categories automatically based on this study.

### **5.9.2 Taxonomy and Ontology Integration**

Custom Taxonomies: Artificial Intelligence can be educated on particular ontologies or taxonomies from libraries (e.g., Dewey Decimal System, Library of Congress Classification). This guarantees that the subject categories that the AI has identified align with the classification scheme of the library.

### **5.9.3 Improving Accuracy and Consistency in Classification**

Elimination of Human Error: When dealing with huge amounts of materials, traditional manual classification might be prone to human error or inconsistency. AI offers a more standardized method, guaranteeing that the same standards are met for all materials.

### **5.9.4 Scalable Classification for Large Collections**

Managing Diverse Materials: AI is capable of classifying multimodal content, including podcasts, videos, and photos, in addition to books and articles. It can determine the topic of these materials and classify them appropriately, improving the searchability of multimedia resources.

### **5.9.5 Subject Recognition for Digital Archives**

Historical Document Classification: Archives, manuscripts, and historical documents that may not have been previously categorized can be categorized with the use of AI. AI systems can enhance the accessibility and categorization of archival materials by identifying the topics covered in these texts.

### **5.9.6 Cross-Disciplinary and Multilingual Classification**

Multilingual Subject Recognition: AI programs are able to learn to identify different language versions of a given subject category. Since AI can analyze and classify content in any language, this is very useful for libraries that provide resources in multiple languages.

### **5.9.7 Enhanced Searchability and Discovery**

Subject-Based Search: AI improves search functionality by precisely categorizing information into subject groups. The ability for users to search

by subject enhances the discoverability of resources inside a library or digital collection by allowing them to find all materials connected to their interest.

### **5.9.8 Assisting in Cataloging and Metadata Creation**

**Subject Headings in Catalogs:** AI can recommend or assign subject headings that fit with recognized library classification systems (e.g., Dewey Decimal Classification or Library of Congress Subject Headings), making it easier for users to identify materials through catalog searches.

### **5.9.9 Integration with Recommendation Systems**

**Personalized Content Recommendations:** By incorporating AI-driven subject classification into recommendation systems, users can find content that is relevant to their interests. For instance, once the system determines that a user has an interest in "data science," it can suggest books or articles that fall under the computer science, machine learning, or statistics categories.

### **5.9.10 Continuous Feedback and Improvement**

**Collaboration and Human Oversight:** AI can operate in tandem with human librarians, who evaluate and approve the categories that AI proposes. This collaborative method ensures that classification remains accurate while benefiting from AI's speed and scalability.

## **6. Conclusion**

Artificial intelligence, or AI, is the creation of computer systems that are capable of carrying out operations that normally require for human intelligence. Learning, thinking, solving problems, perceiving, comprehending language, and even making decisions are some examples of these tasks. Large-scale data processing, pattern recognition, and decision-making are all possible with AI systems.

Applications of artificial intelligence (AI) in a variety of fields: AI helps classify new books, journals, and digital resources in libraries using established systems like the Dewey Decimal System or the Library of Congress classification scheme. Museum art collections, antiquities, and historical artifacts are identified by AI systems based on themes, periods, or materials. Archives: Using metadata and content, AI can classify historical documents, manuscripts, and multimedia files found in digital archives. organizations AI helps classify internal documents, reports, and knowledge bases in

organizations to enhance search and retrieval methods. Academic Libraries: AI can enhance the academic journal indexing process, facilitating the search for publications on specific topics across extensive collections for scholars and students. News Organizations: To help researchers and journalists quickly retrieve articles on current affairs, historical events, or specific topics, artificial intelligence indexes news stories for media archives.

AI-driven indexing promises that scholars will always have access to the most recent research and papers in their fields by improving scientific and technical journal search capability. Organizations that protect cultural heritage: Artificial intelligence (AI) contributes to the preservation of endangered languages, oral histories, and traditional knowledge by digitizing and transcribing content. Public Libraries: AI-powered language tools make it easier for users to access content in their mother tongues, encouraging accessibility and inclusivity and enabling public libraries to support multilingual populations.

AI can handle vast multilingual digital collections, enabling worldwide search functionality and accessibility for individuals with a variety of linguistic origins. Special Libraries: By assisting users in navigating intricate databases or archives, virtual assistants can offer quick access to specialist resources for organizations with specialized collections. School Libraries: To ensure that all students, especially those who live in rural or underprivileged areas, have access to the needed reading materials, schools can employ artificial intelligence (AI) to scan textbooks and make them digitally accessible. Digital Repositories: By using artificial intelligence (AI) to classify enormous volumes of content, large online databases or archives can make it easier for users to traverse digital collections.

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**This festschrift is in honour of Dr K Nageswara Rao.**

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He authored more than 20 articles in journals and conferences. Under his guidance, two candidates were awarded Ph.D Degree from Osmania University, Hyderabad. Dr K Nageswara Rao served as Editor-in-Chief of the Defence Science Journal, Defence Life Science Journal and DESIDOC Journal of Library & Information Technology and DRDO Monographs series.

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