

AI-Enabled Library Informatization Management: Application Value, Technical Foundations, and Core Scenarios

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Abstract: In library informatization management, the application of artificial intelligence technology can not only improve management efficiency, but also optimize user experience and empower knowledge services. The application of artificial intelligence technology in library informatization is based on technologies such as big data, the Internet of Things, generative artificial intelligence, retrieval-augmented generation, semantic vectorization, and multimodal interaction. Artificial intelligence technology has great application value in intelligent resource management, intelligent service supply, and intelligent space operation in libraries, and can provide necessary support for the construction and operation of smart libraries.

Keywords: artificial intelligence technology; library; informatization management

1 Introduction

Under the background of deep integration of informatization and intelligence, libraries, as important carriers of knowledge dissemination and service, are faced with urgent needs to improve management efficiency, optimize user experience, and innovate service models. The rapid development and wide application of artificial intelligence technology have brought new opportunities and challenges to library informatization management.

2 Application Value of Artificial Intelligence Technology in Library Informatization Management

2.1 Improving Management Efficiency

Artificial intelligence technology applied in library informatization management can significantly improve management efficiency. Compared with traditional informatization management models, an AI-based management system can automatically complete basic business tasks, including automatically identifying book information and performing classification, cataloging, and label generation; using robot inspection technology to identify misplaced, missing, and damaged books and synchronously update system inventory; and using AI image recognition technology to support simultaneous scanning and borrowing/returning of multiple books, thereby greatly improving management efficiency and reducing manual input. The application of AI technology can also optimize resource scheduling, intelligently analyze shelf borrowing popularity, automatically recommend book shelving paths and set replenishment priorities for popular areas, intelligently coordinate and control water, electricity, air conditioning, and lighting equipment in the library to reduce energy loss, and review digital resource formats for automatic duplicate checking, format conversion, copyright compliance detection, etc., improving management efficiency while reducing management costs. AI-based informatization management systems can also realize data-driven decision-making. Based on analysis of borrowing data, user visit patterns, equipment operation monitoring data, management reports, and other data, they provide decision-making basis for human resource allocation, book acquisition, resource layout, equipment maintenance, etc.

2.2 Optimizing User Experience

Supported by AI technology, library informatization management can provide users with a better and more

humanized experience. AI-based informatization systems can replace traditional keyword retrieval with multimodal retrieval, provide 24/7 intelligent customer service to quickly answer basic questions such as borrowing and return rules, overdue processing, and resource locations, and solve the problem of “difficult wayfinding” in the library through indoor intelligent navigation, thereby simplifying interaction processes and improving user experience. AI-based informatization systems can extend service scenarios, intelligently push digital resources to users' mobile phones to meet fragmented reading needs, provide real-time answers to in-depth questions such as literature retrieval and paper writing through AI-assisted remote consultation, and provide intelligent reservation services according to users' time and the library's actual situation, allowing users to enjoy high-quality services outside the library.

2.3 Empowering Knowledge Services

The application of AI technology in library informatization management can empower knowledge services. AI systems can comprehensively analyze and deeply mine collection resources, automatically extract key information, identify citation relationships and thematic associations among documents, construct academic maps that clearly present knowledge contexts and research evolution paths, and integrate scattered resources into thematic knowledge bases, thereby laying a good foundation for fully leveraging the value of collection resources. AI systems can also accurately match users' knowledge needs, intelligently push personalized resources suitable for users, assist in writing literature reviews, provide tools for intelligent translation, text polishing, and format standardization, and customize industry knowledge service packages for external users such as enterprises and communities, comprehensively improving service value [3].

3 Application Foundations of Artificial Intelligence Technology in Library Informatization Management

3.1 Big Data Technology

Big data technology is the foundation for applying AI technology in library informatization management. Big data technology can comprehensively collect multi-source data from libraries and form structured, reusable datasets through data cleaning and standardization, thereby providing basic materials for AI algorithm training and function realization. Big data technology can also perform correlation analysis and trend prediction on massive data, providing decision-making basis for the operation of AI systems. Big data technology can also monitor various business process data of libraries in real time, providing optimization directions for AI-driven process automation, thereby improving library management efficiency [4].

3.2 Internet of Things Technology

IoT devices can perceive the physical state of the library in real time, thereby providing real and dynamic data input for AI systems. IoT technology can break down barriers between physical devices and systems in libraries, realize interconnection, and enable AI systems to call data and issue instructions across devices. IoT technology also supports real-time data collection and transmission, ensuring that AI systems can obtain the latest data in real time and improving the timeliness of library informatization management [5].

3.3 Generative Artificial Intelligence

Generative AI, as an AI technology different from traditional machine learning, can generate text, images, and other content that conform to logic and meet needs based on massive data training. In library informatization management, the application of generative AI technology can lay a technical foundation for functions such as intelligent cataloging and metadata generation, collection resource optimization, intelligent question-answering systems, personalized recommendations, literature review and information extraction, automated process processing, and decision support [6].

3.4 Retrieval-Augmented Generation Technology

The application of retrieval-augmented generation technology in library informatization management can use a “retrieval + generation” collaborative model to retrieve a knowledge base for user questions, then input the retrieval

results as context into a large model to generate answers, thereby ensuring the accuracy and credibility of answers while reducing the time users spend searching for information. This technology can also improve document processing capabilities, understand readers' natural language expressions and identify their search intentions, greatly lower the threshold for users' retrieval queries, optimize readers' service experience, and support personalized services [7].

4 Core Application Scenarios of Artificial Intelligence Technology in Library Informatization Management

4.1 Intelligent Resource Management

4.1.1 Intelligent Acquisition Management

In traditional library informatization management, acquisition management often finds it difficult to accurately match demand, and procurement and demand are prone to being disconnected. With the support of AI technology, library informatization management can realize intelligent acquisition management. By applying AI technology, it is possible to conduct correlation analysis on demand-side data such as readers' borrowing records, search history, reservation data, and feedback evaluations, as well as supply-side data such as collection utilization, number of copies, disciplinary construction needs, and new book trends in the publishing industry. Machine learning models can be used to predict demand trends for various resources. Combined with constraints such as library budgets, collection gaps, and disciplinary development plans, acquisition lists can be intelligently generated to achieve supply-demand matching. Moreover, the AI system will automatically track resource borrowing and reservation after acquisition, optimize the acquisition model through algorithm iteration, and dynamically adjust acquisition strategies to further improve acquisition accuracy [8].

4.1.2 Intelligent Processing of Unstructured Resources

Libraries contain a large number of unstructured resources, such as scanned paper documents, audio lectures, and video courses. These resources are often difficult to directly retrieve and utilize. The application of AI technology in library informatization management can intelligently process unstructured resources and improve their utilization efficiency. Relying on technologies such as optical character recognition, speech recognition, and image recognition, AI systems can identify and extract key information from unstructured resources, and then use natural language processing, semantic vectorization, and other technologies to process the extracted information, obtaining standard structured data and integrating it into the database. In this way, effective integration, management, and utilization of unstructured resources can be achieved, solving the problem of long-term idle and difficult-to-use unstructured resources under traditional management models.

4.1.3 Dynamic Optimization of Collection Resources

With the support of AI technology, library informatization management can achieve dynamic optimization of collection resources, thereby promoting resource utilization and reducing management costs. Based on IoT, AI systems collect data such as book borrowing paths, shelf dwell time, and library traffic distribution, and through large model algorithms analyze and process these data, automatically generating collection layout optimization plans. AI systems can also, for scenarios such as regional library alliances and multi-campus libraries, intelligently analyze the resource utilization and reader distribution demand data of each library, thereby generating appropriate cross-library resource allocation and sharing plans. AI systems can comprehensively analyze data such as borrowing frequency, publication age, content timeliness, and disciplinary update speed to effectively identify low-value resources such as outdated textbooks that have not been borrowed for a long time and ordinary books with duplicate content, thereby supporting resource weeding and updating [9].

4.2 Intelligent Service Supply

4.2.1 Virtual Librarian Service

AI technology supports virtual librarian services in libraries, enabling full-scenario, 24-hour uninterrupted service.

Compared with human librarians, it has advantages such as lower cost, all-weather service, fast response speed, and wide coverage. Virtual librarians are built on technologies such as natural language processing, speech recognition, and computer vision. They can accurately identify user intentions and respond quickly, call system data, and rely on system models, computing power, and programs to provide users with high-quality services [10].

4.2.2 Personalized Resource Recommendation

Compared with traditional management models, AI-based library informatization management can recommend personalized resources to users based on collaborative filtering algorithms and user profiling technology. The system can comprehensively collect and analyze user data to generate personalized user profiles, and then push resources matching the profiles in a targeted manner, reducing readers' information acquisition costs, allowing potentially needed resources to actively reach readers, and improving the utilization rate of collection resources.

4.2.3 Intelligent Reference Consultation and Research Support

AI-based library information management can break through the limitations and barriers of traditional reference consultation, greatly expand the coverage of consultation services, and enable consultation services to truly solve various user needs. AI systems can provide comprehensive consultation services based on large model databases, including literature retrieval, resource use, disciplinary knowledge, and library policies. They can also realize a hybrid answer model of “intelligent preliminary review + manual review” based on technologies such as retrieval-augmented generation, semantic vectorization, and knowledge base construction, balancing consultation response time, coverage, and accuracy. Library AI systems can also support research. Based on natural language processing, machine learning, knowledge graphs, and big data classification technologies, they provide users with research support such as literature management and analysis, data processing and visualization, and achievement assistance and transformation.

4.3 Intelligent Space Operation

4.3.1 Intelligent Space Reservation and Management

Supported by AI technology, library informatization management systems can provide users with full-process intelligent reservation services, automatically verify reservation rules, and display remaining reservable time slots and space status in real time, allowing users to log in through different channels such as the official website, App, and mini-programs to reserve various spaces. The system uses AI algorithms to analyze space usage data and supply-demand patterns, automatically adjusts reservation time divisions for frequently reserved and crowded spaces, and recommends themed activities for underutilized spaces.

4.3.2 Intelligent Environmental Control

Based on IoT, big data, and other technologies, environmental data in various areas of the library are comprehensively and real-time collected. AI systems can monitor and analyze the collected data in real time, and intelligently adjust corresponding equipment in spaces where preset environmental comfort thresholds are exceeded, thereby creating a comfortable environment for users.

5 Conclusion

In summary, the application of artificial intelligence technology is the key to promoting the improvement of library informatization management. Libraries need to proceed from their own actual conditions, steadily advance the process of informatization construction, actively try to introduce and apply various artificial intelligence technologies, proactively cooperate with relevant enterprises, and continuously expand the scope and depth of AI technology application in library informatization management, thereby building smart libraries that conform to the development trend of the times.

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