Research on DeepSeek-Empowered Enhancement of University Library Information Services: A Case Study of the Ocean University of China Library (Postprint)

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Abstract

DeepSeek, with its powerful natural language understanding and complex task processing capabilities, as well as advantages such as low computational resource requirements and localizable deployment, brings new opportunities for the development of information services in university libraries. This article, combining the practical utilization experience of the Ocean University of China Library, focuses on exploring the empowering role of DeepSeek in reference consultation, information retrieval instruction, scientific and technological novelty search, and reading promotion services. Simultaneously, it identifies challenges inherent in the integration process, including high funding investment for local configuration, difficulties in feeding and integrating private data, insufficient technical support for secondary development, and significant challenges in training for model promotion and usage.

Full Text

DeepSeek-Driven Enhancement of University Library Information Services: A Case Study of Ocean University of China Library

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Abstract: DeepSeek, with its powerful natural language understanding and complex task processing capabilities, as well as advantages such as low computational requirements and support for localized deployment, presents new opportunities for the development of university library information services. This article, based on practical implementation at Ocean University of China Library,

focuses on examining its empowering role in reference consultation, information retrieval instruction, scientific and technical novelty search, and reading promotion services. It also identifies challenges in the integration process, including high costs for localized configuration, difficulties in integrating private data for model training, insufficient technical support for secondary development, and significant challenges in training for model promotion and usage.

Keywords: DeepSeek; Information service; University library; Artificial intelligence

1 Research Review

Since its launch, DeepSeek has rapidly attracted widespread public attention, with scholars immediately following up with research. The academic community has conducted a series of longitudinal studies on DeepSeek, covering innovations in algorithms and software-hardware coordination[3], limitations in reducing harmful outputs through reinforcement learning strategies[4], its role in digital paradigm transformation[6], security levels when subjected to fine-tuning attacks[7], mathematical reasoning capabilities[8], code generation[9], stock market and macroeconomic prediction[11], academic writing performance[12], and LoRaWAN-related engineering tasks[14]. Some studies have focused on DeepSeek' s application potential in biomedical natural language processing[15] and healthcare[16], as well as its application framework in libraries[2]. However, theoretical research remains in its preliminary stages, and studies focusing on the library and information science field are particularly scarce. The author found only a few relevant studies in the CNKI database. This paper aims to explore the practical application of DeepSeek in library information services, using the ongoing series of information services at Ocean University of China Library as a case study. It also proposes balancing privacy protection with data security, addressing potential challenges in the integration process.

2 DeepSeek' s Technical Architecture and Business Model

2.1 DeepSeek' s Technical Architecture

DeepSeek employs a Mixture of Experts (MoE) architecture that decomposes complex tasks into multiple sub-tasks, each processed by different expert models[3]. This approach significantly enhances overall model efficiency and generalization capabilities. The architecture implements shared expert strategies and load balancing strategies, effectively addressing the challenge of optimizing model performance when resources are scarce. DeepSeek has further refined the granularity of expert division to better meet diverse application requirements[18].

The model incorporates a Multi-Head Latent Attention (MLA) mechanism that utilizes low-rank key-value joint compression technology[3]. This innovation successfully solves the problem of efficient attention computation under hardware resource constraints. During the pre-training phase, this mechanism optimizes computational processes and balances memory usage, ensuring efficient model operation even with limited resources. In the inference stage, the mechanism substantially reduces memory footprint and significantly improves inference efficiency. It can also increase the number of attention heads without increasing model size, thereby enhancing reasoning efficiency while maintaining inference speed[3].

Additionally, DeepSeek features advanced Multi-token Prediction (MTP) technology, which predicts multiple tokens simultaneously and selects the optimal result for final output[3]. Research indicates that models trained with this token-level approach demonstrate superior performance in understanding contextual information.

2.2 DeepSeek' s Business Model

In contrast to closed-source large models like ChatGPT, DeepSeek adopts an open-source sharing strategy, making its algorithms, code, and data fully accessible to the public[17]. This openness allows users to participate in model improvement, conduct secondary technical research and development, and further optimize model performance. Researchers can deeply analyze the model' s operational logic, while regulators can implement penetrative regulation to ensure compliant operation. This creates a healthy technical ecosystem[17].

A significant advantage of DeepSeek is its support for localized deployment on local servers or private cloud environments. This deployment approach ensures all data remains stored locally, greatly reducing data leakage risks and meeting user requirements for data security. Users can also perform private data feeding to achieve deep integration between the model and local data, and conduct customized development such as local system integration for personalized fusion applications. According to a WeChat public account post from Ocean University of China announcing "Full-Power DeepSeek-R1 Goes Live at OUC!" , the university deployed DeepSeek-R1 in localized service form, providing more intelligent and convenient services for teaching, research, and administrative functions across campus[19].

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3 DeepSeek Empowering Library Information Services

3.1 DeepSeek Empowering Reference Consultation Services

Reference consultation services play a crucial role in university library information systems. However, traditional reference services are constrained by factors

such as limited librarian positions and disciplinary backgrounds, making it difficult to effectively meet readers' increasingly diverse and specialized information needs. While intelligent robot consultations are widely used, they suffer from low intelligence levels and unsatisfactory service quality[20]. The emergence of DeepSeek presents new opportunities for transforming reference consultation services.

The "DeepSeek + AIGC" service model offers 24/7 availability and multi-threaded processing capabilities, effectively alleviating librarians' workload during peak consultation periods. DeepSeek supports local data feeding and local data storage, enabling university libraries to integrate various data sources—including institutional disciplines, local academic resources, and reference consultation experience—into the model. Through continuous knowledge base updates and optimization, libraries can provide more accurate and specialized reference services for faculty and students.

3.2 DeepSeek Empowering Information Retrieval Instruction

Information retrieval instruction is an important pathway for university libraries to conduct information literacy education and enhance students' information capabilities. Traditional instruction faces challenges such as outdated content, insufficient integration of modern technological tools, and traditional teaching methods that fail to meet students' personalized and deep learning needs.

DeepSeek brings new opportunities for enhancing library information retrieval instruction. The model' s deep thinking process and reasoning capabilities can provide clear and effective answers to complex questions. For example, when consulted about "which is the best library database for finding legal reviews and judicial cases," DeepSeek not only provides a definitive answer but also details its thought process, summarizes the characteristics, advantages, and suitable user groups of different databases, and supplements free alternative resources, thereby expanding and deepening the consultation service.

The integration of DeepSeek into the curriculum system demonstrates significant potential in teaching innovation. The author arranged a special course on "DeepSeek and AIGC Tools: Fundamentals and Applications"in a graduate-level public elective course on information retrieval. A post-course survey of enrolled students revealed that the majority believed it necessary to incorporate generative AI tools like DeepSeek into information retrieval courses. DeepSeek assists in course design by providing teaching ideas and cases, increasing instructional interest, and responding to student needs. For instance, using students' actual thesis topics to construct cognitive conflicts in Boolean logic retrieval teaching, or using real research scenarios such as National Social Science Fund application documents, DeepSeek helps optimize course design and enhance teaching effectiveness.

3.3 DeepSeek Empowering Scientific Novelty Search Services

Scientific novelty search is a critical component of university library information services, providing objective basis for research project initiation, patent applications, and awards applications for faculty, students, and the public. Traditional novelty search models face challenges due to limited dedicated staff, low efficiency, and insufficient capacity to handle large volumes of search requests, particularly in cutting-edge fields like biomedicine and artificial intelligence.

DeepSeek provides new momentum for enhancing novelty search services. In cases where technical background materials are extensive, DeepSeek can quickly help searchers understand core principles, key technologies, and associated risks of unfamiliar technologies. For example, when accepting a search request on "extracorporeal membrane oxygenation (ECMO) specialist nursing protocols," the author used DeepSeek to systematically understand ECMO technology.

DeepSeek also assists in synonym expansion—a common challenge in novelty searching. Searchers frequently read relevant literature and adjust search formulas to improve recall. With DeepSeek's deep thinking and search capabilities, searchers can quickly identify comprehensive core synonyms. For instance, for a search request on "portable tumor gene detection devices," DeepSeek efficiently found synonyms such as "tumor marker detection equipment" and "DNA methylation detection devices," saving considerable time.

After retrieving relevant literature, DeepSeek can assist in novelty comparison and summarization. Searchers can upload scientific documents provided by clients and literature retrieved independently as attachments to DeepSeek, which then helps complete the novelty comparison analysis. Additionally, libraries can integrate appropriately licensed resources into locally deployed DeepSeek systems within intellectual property law frameworks to further enhance search services.

3.4 DeepSeek Empowering Reading Promotion Services

University libraries have actively explored diverse reading promotion activities, achieving many beneficial outcomes. However, traditional reading promotion models face challenges such as unsustainable activities and insufficient innovation. The "Living Library" format, while effective for cultural inheritance and moral cultivation, demands high personnel requirements and is difficult to scale.

DeepSeek injects new vitality into reading promotion services. For organizing thematic booklists—a common reading promotion activity—DeepSeek can efficiently provide personalized recommendations. Based on users' borrowing history, disciplinary background, and other information, DeepSeek can construct user profiles and generate tailored booklists with promotional copy. Ocean University of China Library conducted a reading promotion event titled "Hey Students, DeepSeek Recommends Booklists for You," where DeepSeek compiled a unique booklist covering classic literature, personal growth, and practical

skills[21].

DeepSeek' s emotional computing technology enables it to understand readers' subjective emotions and communicate appropriately. Libraries can build virtual book friend roles using DeepSeek to provide high-quality Living Library services. Ocean University of China Library has established a working group to strengthen AI-empowered reading promotion, proposing a service logic centered on "DeepSeek + Living Library" development and service scenario optimization[23].

DeepSeek also assists in evaluating reading promotion activities. By setting parameters such as participation numbers and resource utilization rates, librarians can conduct preliminary assessments of activity effectiveness. Based on reader resource service needs collected during service processes, libraries can timely adjust resource construction and promotion strategies.

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4 Challenges in DeepSeek Integration for Library Information Services

4.1 High Costs of Localized Configuration

While DeepSeek has relatively low computational requirements compared to ChatGPT, configuring the full-power DeepSeek-R1 requires high-end servers with substantial memory and dual GPUs[2]. For libraries with limited resource construction budgets, this presents a direct financial challenge. Beyond procurement, hardware upgrades, supporting software updates, and ongoing maintenance team costs require substantial continuous investment. The combination of these factors makes localized deployment far from straightforward.

4.2 Difficulties in Private Data Integration

Feeding private data is fundamental to providing high-quality, adapted information services. University libraries possess vast collections of documents, retrieval histories, and other data containing personal information. When using such data for localized DeepSeek deployment, privacy management issues arise. Data must undergo thorough desensitization to uphold information ethics and protect legal rights. Additionally, obtaining authorization for full-text data from commercial databases is extremely difficult, hindering comprehensive data collection. Sensitive data, such as confidential or embargoed theses, poses further challenges. Accidental use of such data in model training could have serious consequences, damaging individual rights and even endangering national interests.

4.3 Insufficient Technical Support for Secondary Development

DeepSeek' s open-source strategy creates pathways for library localization and adaptation, yet libraries face dual challenges of technical implementation diffi-

culty and shortage of specialized talent. University library services have unique characteristics, and off-the-shelf DeepSeek models may not fully align with professional library information service requirements in areas like knowledge organization and reasoning. Precise adaptation requires not only fine-tuning numerous parameters but also seamless integration with existing library systems, potentially encountering interface incompatibility and data interaction blockages.

The shortage of professional technical staff is a major obstacle. Most library personnel specialize in collection management and reader services, lacking expertise in cutting-edge technologies like deep learning and natural language processing. The scarcity of technically proficient librarians significantly hinders secondary development and maintenance efforts.

4.4 Challenges in Model Promotion and Training

After local deployment, DeepSeek will serve all faculty and students, even the public. However, librarians' information technology literacy varies considerably. While some younger, quick-learning staff readily adopt new technologies, others show slower comprehension and acceptance. Training must progress from basic concepts to advanced applications, but the limited time available makes it difficult to elevate all staff to proficient levels within the training period.

The technical principles and operations of DeepSeek involve complex frontiers that are abstract for non-technical librarians. Making these concepts accessible and easy to grasp presents a significant challenge. Developing high-quality training materials requires substantial time and human resources—a considerable burden for libraries with limited human resources. In the rapidly evolving AI landscape, training materials require constant updates to keep pace with model iterations and dynamic business changes.

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5 Conclusion

Traditional university library information service models struggle to meet users' increasingly complex and diverse needs. The vigorous development of artificial intelligence technology brings opportunities for library service innovation. As a representative of advanced AI technology, DeepSeek provides robust technical support for the innovative upgrading of university library information services with its unique advantages.

With collaborative efforts across academia and industry, comprehensive research on DeepSeek empowering high-quality library development will unfold extensively, and its application value will be further excavated, propelling university library information services to new heights. The DeepSeek version used in the examples in this paper is the locally deployed service at Ocean University of China.

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Note: Figure translations are in progress. See original paper for figures.