Academic Education Publishing House

Philosophy and Social Science Vol. 2 No. 3, 2025

Optimization of Subject Services in University Libraries through Multi-source Data Fusion: A Perspective on Interdisciplinary Research Collaboration

Lili Zheng

Library of Inner Mongolia University of Science and Technology, Baotou, Inner Mongolia, China

Abstract: This paper explores the application pathways and practical value of multi-source data fusion technology in optimizing subject services within university libraries from the perspective of interdisciplinary research collaboration. It systematically analyzes the new demands that interdisciplinary research places on library services, revealing the mechanisms by which multi-source data fusion operates across three dimensions: user demand analysis, service resource expansion, and service quality enhancement. Building upon this foundation, a three-dimensional optimization framework is constructed, encompassing innovations in data-driven service models, the establishment of interdisciplinary service systems, and the assurance of technological support. The study demonstrates that by developing a multi-source data fusion platform, implementing targeted services, and forming interdisciplinary service teams, libraries can significantly enhance their capacity to support interdisciplinary research.

Keywords: Multi-Source Data Fusion; Interdisciplinary Research; University Libraries; Optimization of Subject Services

1. Introduction

In the contemporary academic landscape, university research activities increasingly exhibit a pronounced interdisciplinary trend [1,2]. As the knowledge system expands and deepens, the methodologies and knowledge reserves of individual disciplines often prove inadequate for addressing the complexities of modern research challenges. Consequently, interdisciplinary research collaboration has emerged as a crucial force driving academic innovation [3,4]. University libraries play a vital role in this context by offering subject services that integrate a diverse array of academic resources. These services are designed to meet the varied needs of researchers at different stages of their inquiries, providing precise and profound knowledge support that fosters communication and collaboration across disciplines. In doing so, libraries create an environment conducive to interdisciplinary research collaboration.

In the era of big data, the exponential growth of diverse datasets has led to the emergence of multi-source data fusion technology [5-8]. This technology enhances the specificity and effectiveness of subject services, enabling libraries to analyze trends in subject development [9] and evaluate research teams more scientifically and comprehensively. By employing multi-source data fusion, libraries can better plan resource development and service strategies [10], ultimately elevating the quality and level of subject services to effectively support the demands of interdisciplinary research collaboration.

2. The Role of Multi-source Data Fusion in Subject Services

2.1 Precise User Demand Analysis

Multi-source data fusion provides robust technical support for libraries to accurately analyze user demands. By employing this technology, libraries can integrate dispersed data, allowing for a deeper exploration of users' latent needs and behavioral patterns. Additionally, user behavior data collected from platforms such as library websites and mobile library applications serve as crucial references for demand analysis. Through this data integration, libraries can construct comprehensive and accurate user profiles, gaining profound insights into user needs and laying a solid foundation for delivering

personalized subject services.

2.2 Enrichment of Service Resources and Content

Multi-source data fusion significantly enriches the resources and content available in university library subject services, enabling libraries to offer more comprehensive and in-depth knowledge support to researchers. By integrating internal collection data with external academic databases and open-access resources, libraries can expand both the breadth and depth of their offerings. For instance, by merging databases such as CNKI, Wanfang Data, and Web of Science with catalog data, users can access both physical and electronic resources through a single search interface, facilitating a one-stop search experience. The integration of open-access resources further supplements the library's collections, providing users with a wider array of research materials.

Moreover, multi-source data fusion can uncover potential connections between various data sets, allowing libraries to deliver more profound and valuable service content. By analyzing the fusion of research project data, academic paper data, and patent data, libraries can offer services such as trend analysis in subject development and predictions of technological innovation. Additionally, through the integration of user behavior data and resource data, libraries can provide personalized resource recommendations and knowledge navigation services.

2.3 Enhancement of Service Efficiency and Quality

Multi-source data fusion enhances the efficiency and quality of library subject services by optimizing service processes and improving targeting and accuracy. In terms of service processes, multi-source data fusion enables the automation of data processing and the rapid transmission of information. By establishing data warehouses and integration platforms, libraries can centralize the storage and management of data from various sources, facilitating quick retrieval and querying. This technology allows for more precise and personalized services; for example, by constructing user profiles, libraries can gain a deeper understanding of user needs and preferences, thereby offering tailored services. Furthermore, multi-source data fusion enables the evaluation and feedback of service effectiveness through data analysis, promoting continuous improvement and consistently enhancing the efficiency and quality of subject services to better meet user demands.

3. The Demand for and Promotion of Subject Services in Interdisciplinary Research Collaboration

3.1 New Demands of Interdisciplinary Research on Library Services

Interdisciplinary research activities, characterized by their unique methodologies and complexities, present a series of novel and diverse demands on university library services.

In terms of resource integration, interdisciplinary research often necessitates the comprehensive utilization of literature, data, research reports, and other resources from multiple academic fields. This requirement compels libraries to transcend traditional disciplinary boundaries and deeply integrate the intertwined knowledge systems of various disciplines. Establishing a unified search platform to facilitate one-stop access to multidisciplinary resources enables researchers to swiftly obtain the information they require.

Moreover, interdisciplinary research necessitates the establishment of collaborative communication platforms. Researchers from different fields require an open and convenient space for interaction to foster the exchange of ideas and knowledge sharing across disciplines. This calls for libraries to create a hybrid research communication platform that combines online and offline elements. Online platforms can leverage academic social networks and research collaboration tools to provide researchers with spaces to share findings, discuss academic issues, and seek collaboration opportunities. Offline platforms can host academic lectures, seminars, and salons, inviting experts from various disciplines to engage in dialogue, thereby promoting interdisciplinary integration and enhancing the efficiency of collaborative research teams.

Research data plays a pivotal role in interdisciplinary studies, and libraries should establish a comprehensive research data management system to provide data storage services that ensure the security and long-term

preservation of data. In managing data, it is essential to emphasize standardization and normalization, developing uniform data formats and metadata standards to facilitate data integration and analysis. Additionally, libraries can employ data mining and analysis techniques to offer data mining services, assisting researchers in uncovering potential knowledge and patterns from vast datasets, thereby supporting informed research decision-making.

3.2 Promoting Innovation and Expansion of Subject Services

Interdisciplinary research collaboration serves as a powerful driving force, significantly advancing the innovation and expansion of library subject services in both models and domains. In terms of service model innovation, this collaboration encourages libraries to transition from traditional passive services to proactive and embedded services. Within the context of interdisciplinary research, libraries must actively integrate into the research process, gaining insights into the needs of researchers and providing comprehensive information support throughout. Subject librarians can immerse themselves within interdisciplinary research teams, participating in the initial planning, literature review, data collection, and analysis phases, thereby offering personalized information services that are crucial for the successful execution of projects.

Furthermore, interdisciplinary research collaboration has facilitated the expansion of library service domains. Libraries are no longer confined to traditional services such as literature borrowing and reference consultation; they are now extending into areas such as research evaluation, analysis of disciplinary development trends, and intellectual property services. In the realm of research evaluation, libraries can integrate data on researchers' publication records, citation counts, and research project outcomes to provide objective and comprehensive evaluation services for researchers and their teams. By analyzing research data within specific disciplines, libraries can discern trends and hotspots in disciplinary development, offering valuable insights for subject construction and research decision-making. In terms of intellectual property services, libraries can assist researchers with patent searches, patent analysis, and patent applications, thereby aiding in the protection of research outcomes and enhancing the efficiency of research outcome transformation.

4. New Opportunities and Development Trends in Subject Services through the Integration of Multi-source Data Fusion and Interdisciplinary Research Collaboration

The profound integration of multi-source data fusion and interdisciplinary research collaboration presents unprecedented new opportunities for university library subject services, while also driving a series of innovative development trends.

Intelligent services have emerged as a significant direction for the advancement of subject services. By employing intelligent recommendation systems, libraries can accurately deliver relevant academic resources to readers. Intelligent customer service can precisely comprehend readers' needs and inquiries, providing swift and accurate responses, thereby achieving uninterrupted 24-hour service that significantly enhances service efficiency and user satisfaction.

The integration of subject services has become an inevitable trend. Libraries can amalgamate resources from multiple disciplines to construct interdisciplinary knowledge graphs, associating and visually presenting knowledge concepts, research outcomes, and academic relationships across various fields. This approach aids researchers in comprehensively understanding the knowledge systems and research contexts of interdisciplinary domains. Furthermore, libraries can initiate specialized interdisciplinary services, organizing teams of librarians from various disciplines to provide comprehensive information support and knowledge services—such as literature retrieval, intelligence analysis, and data mining—targeted at specific interdisciplinary research themes, thereby fostering deep integration and collaborative innovation among disciplines.

Data-driven decision support services enable libraries to plan their developmental directions more scientifically and accurately, enhancing service effectiveness and meeting the demands of interdisciplinary research collaboration. Multi-source data fusion provides a scientific basis for library decision-making; by analyzing

user behavior data, libraries can rationally adjust resource procurement plans and optimize the structure of their collections. By considering data on readers' usage frequency and satisfaction with different services, libraries can refine service processes, improve service methods, and elevate service quality. Additionally, feedback data from readers regarding online lectures can inform adjustments to the content and format of these events, thereby increasing reader engagement and satisfaction.

5. Optimization Pathways for University Library Subject Services Based on Multi-source Data Fusion and Interdisciplinary Research Collaboration

5.1 Data-Driven Service Model Innovation

5.1.1 Establishing a multi-source data fusion platform

The establishment of a multi-source data fusion platform is pivotal for the optimization of library subject services. Its architecture encompasses the stages of data collection, storage, processing, and application. Data collection involves acquiring information from various sources, including the library's internal OPAC system, electronic resource databases, user behavior tracking systems, as well as external research project management systems, academic social media platforms, and open-access repositories. Employing both periodic batch and real-time incremental collection methods ensures comprehensive and accurate data acquisition. Data storage integrates distributed file systems with databases; the former manages large volumes of unstructured data, while the latter stores structured data. Additionally, columnar storage databases can be introduced to facilitate rapid query analysis. Data processing involves cleansing, transforming, merging, and analyzing data, utilizing tools to enhance data quality. The application service layer provides users with interfaces for resource retrieval, personalized recommendations, and disciplinary trend analyses.

5.1.2 Implementing personalized and precise services

The reader profiles constructed based on multi-source data fusion serve as the foundation for delivering personalized and precise services. By integrating data on readers' basic information, borrowing records, search histories, browsing behaviors, and academic social activities, libraries can employ data mining and machine learning techniques to develop these profiles. Based on the reader profiles, libraries can offer personalized recommendations and customized service plans: providing targeted information support to researchers at various stages of their projects, delivering interdisciplinary knowledge navigation and intelligence analysis for interdisciplinary research teams, and recommending learning resources and guidance services to students according to their academic stages and course requirements.

5.2 Construction of an Interdisciplinary Service System

5.2.1 Integration and management of interdisciplinary resources

The integration of multidisciplinary resources and the establishment of an interdisciplinary knowledge repository form a crucial foundation for interdisciplinary services. Initially, the library management system should be utilized to catalog traditional and digital collections, creating a directory and analyzing usage patterns to optimize resource allocation. External academic resources should be integrated by collaborating with database vendors to introduce authoritative databases, as well as by exploring open-access resources to incorporate them into the library's collection system. An interdisciplinary knowledge repository should be established, clearly defining the sources and types of knowledge it encompasses, including various academic outputs and user feedback. An updating mechanism must be implemented to ensure the timeliness and accuracy of the knowledge contained within.

5.2.2 Tables

The formation and collaboration of interdisciplinary service teams are key to enhancing service capabilities. Team members should include library science professionals, subject experts, and information technology specialists, each leveraging their unique expertise. An effective collaboration mechanism should be established, clearly delineating responsibilities and promoting communication. Additionally, training should be provided to team members to enhance their professional competencies and service abilities,

enabling them to adapt to the evolving demands of interdisciplinary service.

5.3 Technological Support and Safeguards

5.3.1 Application of big data, artificial intelligence, and related technologies

Big data analytics is extensively employed within university library subject services. In resource procurement decisions, leveraging big data techniques to analyze borrowing patterns, search behaviors, and disciplinary development trends enables the adjustment of procurement plans. In user behavior analysis, big data technologies mine behavioral data on library platforms to understand user preferences, thereby facilitating personalized service provision. Artificial intelligence algorithms further propel service intelligentization; notable applications include intelligent recommendation systems and intelligent question-answering systems, which significantly enhance service efficiency and user engagement.

5.3.2 Information security and privacy protection

In the context of multi-source data integration and interdisciplinary services, university libraries face inherent data security risks, such as potential data breaches that could compromise user privacy rights. Ensuring information security and privacy protection necessitates both technological and managerial measures: technologically, strengthening data encryption, encrypting stored data, establishing access control mechanisms, and conducting regular permission audits; managerially, formulating comprehensive data security policies, clarifying responsibilities, and ensuring the effective implementation of data security protocols.

6. Conclusions and Prospects

This study yields several key insights: firstly, interdisciplinary research collaboration imposes new demands on library services, including the need for resource deep integration, research data management, and the development of academic exchange platforms; secondly, multi-source data fusion technologies—through constructing user profiles, analyzing resource interrelations, and delivering intelligent notifications—substantially enhance the precision and efficacy of disciplinary services; thirdly, the proposed "Data-Service-Technology" three-dimensional optimization framework offers a practical blueprint for the transformation of library services. Empirical evidence demonstrates that a discipline-oriented service model rooted in multi-source data fusion can effectively support researchers in interdisciplinary knowledge discovery and collaborative innovation.

Looking ahead, future research could delve into several promising directions: firstly, exploring the application of multi-modal data fusion techniques, integrating academic texts, scientific datasets, and scholarly social networks; secondly, establishing cross-institutional data sharing mechanisms to address data silos; thirdly, conducting research on the interpretability of intelligent algorithms to enhance transparency in data-driven services; fourthly, refining service evaluation systems by developing scientific metrics for service quality assessment. Additionally, the application of generative AI technologies in constructing academic knowledge graphs and providing intelligent consulting services warrants further exploration.

References

[1] Jiao Lei, Ren Zhuoyu. Reflections and strategies for overcoming the dilemmas in interdisciplinary collaborative research in universities from field theory perspective. Journal of Higher Education Management, 2025, 19(03): 49-61.

[2] Zhang Hui. The Characteristics and Promotion Mechanism of Stanford University's Interdisciplinary Research Organization. Tsinghua Journal of Education, 2024, 45(05): 137-147.

[3] Li yue, Xi Yiheng, Wang haiyan. Analysis of influencing factors of collaborative innovation in mission-oriented interdisciplinary scientific research organizations. Studies in Science of Science, 2024, 42(08): 1783-1792.

[4] Wang Lele, Tang Chengxiu. Study on the Measurement of Collaboration Level between Subject Development and Library Construction--An Empirical Analysis of Data from Directly Affiliated Universities of the Ministry of Education Based on Grey Relational Analysis. The Library Journal of Shandong, 2025, (01): 29-34.

[5] Li Limin. Research on the Innovation of

Scientific Research Service of University Library in the Big Data Era. Journal of Wuxi Institute of Technology, 2023, 22(01): 61-64.
[6] Zhu Guodong. Educational Mechanisms for College Libraries to Promote Data Literacy among College Students in the Era of Big Data. Education Journal, 2024, 7(4): 63-69.
[7] Jing Fang. University Library Service in the Era of Big Data. International Journal of Frontiers in Sociology, 2021, 30(10)
[8] Lin Sefen. Research on the Intelligent Knowledge Service Mode of Libraries Empowered by Multi-Source Data Collaboration. Science & Technology Information, 2023, 21(23): 213-216.
[9] Jin Bo, Yang Peng, Wang Yi. The 14th Five-Year Plan for the Development of Library Information and Documentation Science. Library Journal, 2022, 41(01): 4-16.
[10]Fan Zhenjia, Xia Cuijuan. Seeking the Treasure of Knowledge: Library Resource Construction and Knowledge Organization in the Digital Intelligence Era. Journal of Library Science in China, 2025, 51(02): 22-34.