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Research on Intelligent Service of Academic Library Driven by Big Data

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Abstract: Driven by Big Data (BD), academic libraries are facing the challenge of service transformation. This article focuses on the smart service of academic libraries driven by BD, aiming at building a scientific and efficient smart service model and helping the development of education and scientific research in universities. In this article, using the methods of literature research and theoretical analysis, the related theories of BD, the concept of intelligent service in academic libraries and their relationship are deeply analyzed, and the discussion is carried out from three elements: data, technology and personnel. It is found that the data sources of academic libraries are diverse, covering collection resources, readers' borrowing and online interactive data, and the quality should be strictly controlled. Key BD technologies, such as data mining and machine learning, provide support for smart services, but they face the problem of technology update and integration. The transformation of personnel role to data analyst and service designer requires a variety of abilities. Based on this, this article constructs an individualized, proactive and intelligent management service mode, which provides theoretical support and practical guidance for the development of intelligent service in academic libraries.

1. Introduction

Big Data (BD), with its remarkable characteristics of mass, diversity, high speed and value, has a profound impact on all fields of society, and academic libraries are no exception [1]. With the continuous advancement of education and teaching reform in universities and the increasing frequency of scientific research activities, the demands of educators and learners for library services are becoming more diversified and individualized. The traditional library service model has been difficult to meet these new demands, and academic libraries are facing unprecedented challenges [2-3].

In this context, it is extremely urgent and important to study the intelligent service of academic libraries driven by BD. This article aims to explore how BD can empower the intelligent service of academic libraries and provide solid theoretical support for building a scientific and efficient intelligent service model. On the one hand, it is expected to improve the service quality of academic libraries with the help of BD technology, realize the accurate allocation and efficient utilization of resources, and meet the growing information needs of educators and learners. On the other hand, by promoting the innovation and transformation of library services, it will help the vigorous development of education and scientific research in universities and enhance the overall

competitiveness of universities.

In order to achieve the research goal, this article mainly uses literature research and theoretical analysis. By extensively consulting relevant literature at home and abroad, this article combs the research status and development trend in the fields of BD and intelligent service in academic libraries, and draws on the research results and experience of predecessors. Futhermore, combined with library science, information science and other related theories, this article makes an in-depth theoretical analysis of the relevant elements and mode construction of smart service in academic libraries driven by BD, with a view to contributing valuable insights to the development of this field.

2. The relationship between BD and intelligent services in academic libraries

BD is massive, and the data scale is huge and continues to grow rapidly; Diversity, covering structured, semi-structured and unstructured data types [4]; High speed, fast data generation and circulation; Value, although the value density is low, it can release great value through deep excavation [5]. BD technology includes data acquisition technology, such as web crawler and sensor acquisition, which is responsible for obtaining all kinds of data; Data storage technology, such as distributed file system, is used to store massive data; Data processing and analysis technologies, such as MapReduce and Spark framework, realize efficient data processing and mining.

The intelligent service of academic library takes users as the center and provides intelligent, individualized and active services with the help of modern information technology. It breaks through the limitations of traditional library services, and is no longer just about borrowing and returning books and providing resources [6]. Intelligence is embodied in the use of intelligent equipment and technology to realize the automation of service process and the intelligence of resource retrieval. Personalization customizes exclusive services and resource recommendations based on user behavior, preferences and other data. Proactive is based on data analysis to predict user needs and push services and information in advance [7]. Smart service is closely connected with traditional service, which is the foundation, and smart service is upgraded and expanded with the help of new technologies.

BD lays the data foundation for the intelligent service of academic libraries. Collection resource data, reader borrowing and behavior data, etc., reflect the utilization of resources and user needs [8]. BD technology empowers smart services, analyzes user preferences through data mining, and realizes accurate resource recommendation; Use machine learning to predict users' needs, promote active service, and help academic libraries move from traditional service to a new era of intelligent service.

3. Analysis on the elements of BD-driven intelligent service in academic libraries

(1) Data elements

The data source of academic library is extensive and complex, which is the basis of realizing intelligent service [9]. The main data sources include: collection resource data, covering all kinds of paper books, electronic documents, multimedia materials and other detailed information, such as book title, author, publishing house, publication year, collection location, literature category and so on. Readers' borrowing data, recording readers' borrowing time, returning time, borrowing frequency, etc. Online platform interactive data includes readers' search records, browsing behaviors, comments and feedback on library websites and mobile applications.

Data quality directly affects the effect of intelligent service. Taking accuracy as an example, if the information such as book title and author in the collection data is wrong, readers will not be able

to obtain the required resources accurately. In terms of completeness, it will be difficult to comprehensively analyze readers' reading habits without some records of readers' borrowing history.Timeliness is also very important, and outdated reader interest data can't support accurate recommendation at present. To improve the data quality, it is needed to establish a strict data entry audit mechanism, and at the same time clean up and update the data regularly.

(2) Technical elements

There are many key BD technologies that support the intelligent service of academic libraries. Data mining technology can discover potential patterns and knowledge from massive data. For example, association rule mining can find out the combination of books that readers often borrow at the same time, and provide a basis for resource recommendation. Machine learning algorithms, such as classification algorithms, can classify readers and predict the borrowing tendency of different types of readers [10]. Natural language processing in artificial intelligence technology can realize intelligent question answering system, allowing readers to interact with library system in natural language to obtain information.

However, the application of technology faces many challenges. First of all, the technology is updated rapidly, and academic libraries need to constantly follow up and learn new BD technologies, such as the transformation from traditional relational database storage technology to distributed storage technology. Secondly, it is the problem of technology integration, and different technologies need to be effectively coordinated. In order to meet these challenges, libraries should strengthen cooperation with technical teams and conduct technical training and exchange activities on a regular basis.

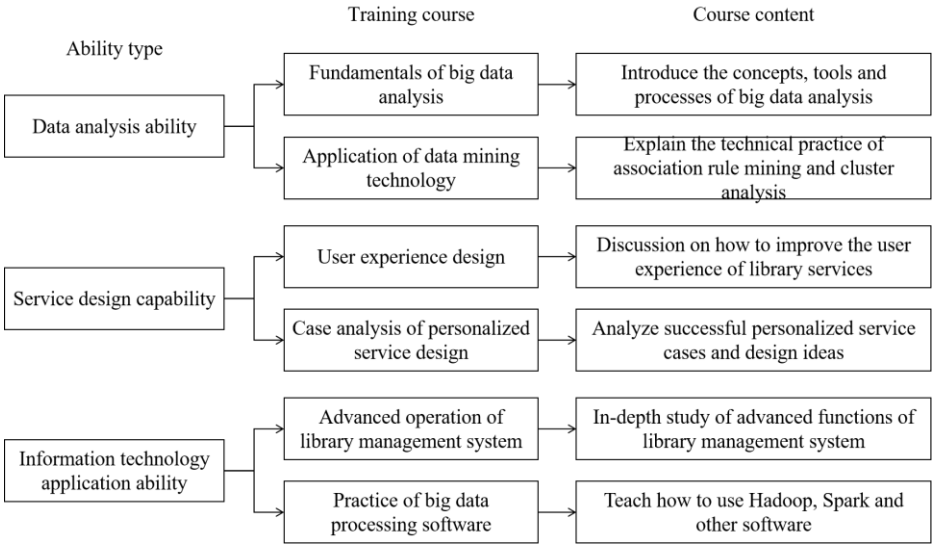

Figure 1 Training courses for improving the ability of university librarians

(3) Personnel elements

Under the smart service mode driven by BD, the role of academic library staff has changed significantly. From the traditional role of borrowing and returning books and sorting out resources, it has gradually changed to a data analyst and service designer. Data analysts need to have the ability of data analysis, and can use professional tools to dig and analyze the collection data and reader data in depth, so as to provide data support for service optimization. Service designers should combine the data analysis results to design individualized and proactive services that meet the needs of readers.

Staff should have a variety of abilities. In addition to the above data analysis and service design capabilities, it is also needed to master the application ability of information technology and skillfully use BD processing software and library management systems. Futhermore, service

innovation ability is also indispensable to adapt to the changing needs of readers and technical environment. In order to improve the ability of personnel, academic libraries can formulate systematic training plans, such as organizing BD analysis courses and service innovation seminars on a regular basis. As shown in Figure 1, corresponding courses are set for different ability requirements to help staff improve their ability and better promote the development of smart services.

4. The model construction of intelligent service in academic library driven by BD

(1) Individualized service mode

Individualized service mode aims to provide customized service experience according to readers' unique needs and preferences. With the help of BD to analyze readers' historical borrowing records, search behavior on the online platform of the library and feedback on resources, academic libraries can accurately grasp readers' interests.

Taking individualized resource recommendation as an example, through the deep excavation of readers' long-term borrowing data, we can find their specific interests in the subject field. Table 1 shows the resource recommendation priorities set for different reader interest intensities. It can be seen from the table that for readers with high interest intensity, cutting-edge and in-depth research materials are given priority; For readers whose interests are beginning to appear, they should first push basic and easy-to-understand resources to guide them to explore further.

Table 1 Example of individualized resource recommendation priority

Reader's interest intensity	Recommended resource type	Priority order
High	Frontier research works in the field	1
	Proceedings of related academic conferences	2
	In-depth academic lecture information	3
Middle	Classic introductory reading	1
	Domain review article	2
	General academic lecture information	3
Low	Interesting popular science materials	1
	A brief introductory article	2

(2) Active service mode

The proactive service model emphasizes predicting readers' needs based on BD and providing services in advance. For university educators and learners, their learning and scientific research needs have certain regularity and stages. The library uses BD to analyze information such as students' curriculum arrangement, learning progress and teachers' research project progress, so as to realize active service.

For example, at the beginning of the semester, the core textbooks, bibliographies and related online learning resources needed for the course are actively pushed for students who take specific professional courses. With the progress of the course, according to the difficulty of the course and the teaching progress, the auxiliary learning materials, such as the analysis documents of the key and difficult points of the course and the relevant case sets, are pushed in time. For scientific researchers, at the project establishment stage, they will actively provide the analysis report of domestic and foreign research status and information of potential cooperation teams in this field. Table 2 presents the specific contents of active service in different stages in detail, and provides valuable information accurately according to the key needs of different stages to help educators and learners carry out their learning and scientific research activities efficiently.

Table 2 Examples of proactive service content changing with stages

Stage	Service object	Active service content
Beginning of semester	Student	List of core teaching materials of the course, electronic links of bibliography
	Teacher	Brief report on frontier research in scientific research project field
Mid-course	Student	Analysis documents and related case sets of key and difficult points of the course
	Teacher	Push the latest research results related to the project
At the end of the semester	Student	Course review package, exam questions over the years
	Teacher	Suggestions on publication of project achievements and periodical recommendation

(3) Intelligent management service mode

Intelligent management service mode realizes efficient management of library resources and space with the help of BD. In the aspect of collection resource management, by analyzing the data of borrowing frequency, shelf time and damage, the strategy of resource procurement, storage and maintenance is planned reasonably. For popular resources that are frequently borrowed and kept in good condition, timely supplement copies; For resources that have not been borrowed for a long time, evaluate whether it is needed to take them off the shelf or adjust the storage location. In space management, real-time monitoring of data such as the flow of people and the time distribution of use in each region can dynamically adjust the space function.

5. Conclusions

This article focuses on the intelligent service of academic libraries driven by BD, and has achieved rich results. In terms of data elements, it is clear that academic libraries have a wide range of data sources, including collection resources, reader borrowing and online platform interaction. These data provide the cornerstone for intelligent services, but the accuracy, completeness and timeliness of data quality are very important, and strict mechanisms need to be established to guarantee them. On the technical level, key technologies such as data mining and machine learning strongly promote intelligent services, but the challenge of technology upgrading and integration cannot be ignored. Libraries should strengthen technical cooperation and personnel training. In terms of personnel factors, the role of staff has changed significantly, and they need to have many abilities such as data analysis and service design, and their abilities can be improved through systematic training.

Based on the analysis of the above factors, the individualized service model can accurately recommend resources and customize learning space according to readers' behavior; Active service mode can predict readers' needs and provide support for the whole process of scientific research; Intelligent management service mode helps the intelligent allocation of library resources and space. With the continuous development of BD technology, the intelligent service of academic libraries is expected to be integrated with more emerging technologies to achieve cross-school collaborative services and provide better and more efficient services for educators and learners in universities.

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