Development of Library Scholarly Communication Services Based on User Profiles

Authors: 陈安琪

Date: 2024-08-15T00:00:00+00:00

Abstract

With the advent of the Internet+ era, academic communication has witnessed new development trends: informal communication is flourishing, virtual community-based exchanges are becoming more prevalent, and academic information continuously improves throughout the communication process. Libraries serve as crucial venues for building academic communication platforms and providing academic communication services. This article proposes collecting user data and introducing user profiling technology to deliver more personalized academic resources and communication services, forming an academic communication service framework comprising a data layer, profile layer, personalized service layer, and feedback layer to enable targeted service optimization.

Full Text

The Development and Construction of Library Academic Exchange Services Based on User Portraits

Abstract

With the advent of the Internet+ era, academic exchanges have witnessed new development trends. Informal exchanges are flourishing, communication based on virtual communities is becoming more prevalent, and academic information is continuously refined throughout the exchange process. Libraries serve as crucial platforms for constructing academic exchange venues and providing academic exchange services. This paper proposes that by collecting user data and introducing user portrait technology, libraries can provide more personalized academic resources and exchange services. This approach forms an academic exchange service framework comprising a data layer, portrait layer, personalized service layer, and feedback layer, thereby enabling targeted service optimization.

Keywords: Academic Exchange; Internet+; User Portrait; Academic Resources; Personalized Service

Academic information exchange has long been a focus of China's library and information science community, and providing readers with academic information exchange services and spaces constitutes an essential component of library operations. Library academic information exchange services offer users access to academic information and resources, as well as platforms for information exchange. Both general users and academic researchers can derive inspiration for scholarly research from these services, communicate and disseminate their academic ideas and achievements, thereby promoting the sharing of academic knowledge. In the Internet+ environment, the speed of information transmission continues to increase, its scope continues to expand, and the user groups covered by academic information exchange services are becoming increasingly diverse. Different user groups have varying needs for academic information. By employing user portraits to accurately grasp the characteristics and needs of different populations, libraries can facilitate the construction of a personalized academic information exchange service system and develop reasonable quantitative evaluation schemes, further improving service efficiency and fully leveraging the role of library information services.

1.1 Basic Concepts of Academic Information Exchange

Information exchange refers to the process of transmitting and exchanging information among people, encompassing both active and passive exchanges. This exchange is bidirectional and enables information to continuously "evolve" [1]. Academic information exchange is a type of information exchange that refers to information activities where two or more users transmit and exchange academic knowledge with each other. Its essence is knowledge sharing, which can generate certain academic outcomes through exchange. The American Library Association (ALA) defines academic information exchange as the process through which people publish and acquire various academic knowledge and preserve it long-term in certain institutions or systems [1].

1.2 Basic Models of Library Academic Information Exchange

Currently, numerous in-depth studies have been conducted on information exchange models. Commonly used models include Lasswell's "5W Model" covering five major elements in the information exchange process [2]; the Shannon-Weaver model describing five stages of information exchange [3]; Mikhailov's scientific communication model based on dividing information exchange into formal and informal categories [4]; and Schramm's mass communication model based on the cyclic feedback process of information exchange [5]. Libraries serve as preservation and management institutions for academic information. They guide users in sharing academic information by providing academic information exchange services. Users are both creators and consumers of academic information. After receiving information, users can reprocess and recreate it to form new informa-

tion and share it again with other users. The dynamic information interaction among users, along with the support and guarantee provided by libraries for these information interaction activities, constitutes the basic model of library academic information exchange.

1.3 Target Users of Library Academic Information Exchange Services

Users of library academic information exchange services can be categorized into general users, deep users, professional users, and authoritative users. General users are learners and information receivers in academic exchanges. They browse and consult more information while publishing less. They utilize library academic information exchange services to pose questions to professional and authoritative users and accumulate academic experience by learning from information resources published by other users. Deep users are the most active groups in academic information exchange. They typically focus on research in specific academic fields, actively share their relevant achievements while extensively browsing information, and engage in high-quality interactions and sharing with other users. Professional users are academic leaders and information providers who have already made achievements in their research fields, possess profound insights, and produce high-quality research outcomes. They promote the sharing and exchange of academic information by uploading and sharing their professional knowledge. Through exchanges and interactions with other users, they can gain both a sense of self-worth and new inspiration for academic research. Authoritative users, also known as evaluators of academic information, are opinion leaders in the academic information exchange process who hold significant discourse power in their research fields. They guide the direction of academic exchanges, instruct other users' academic research, and draw attention to relevant academic fields by evaluating the knowledge, innovation, and value of information.

The roles of these various users undergo dynamic changes during the academic information exchange process. Through continuous exchange and learning, general users and deep users can produce their own academic achievements and develop into professional users capable of providing and sharing academic information. Simultaneously, professional users and authoritative users may also discover their knowledge gaps or develop interest in new academic problems during exchanges with other users, and then receive relevant academic information again in the role of general users.

2. Development Trends of Academic Exchange in the Internet+ Environment

With the development of Internet+ technology, academic information exchange has gradually evolved from traditional information exchange to academic exchange in the Internet+ environment, exhibiting new characteristics and trends.

2.1 Flourishing Development of Informal Academic Exchange

Traditional information exchange includes both formal and informal exchange. Formal exchange refers to exchange conducted through media that process and store academic information, also known as indirect exchange, characterized by high accuracy and authority of transmitted information, such as academic publishing. Informal exchange, formerly known as direct exchange, mainly refers to face-to-face academic exchanges, such as academic seminars, where scholars express their views on academic issues, helping to stimulate academic inspiration.

In the network environment, both exchange models have undergone significant changes. Compared with formal exchange, informal academic exchange has become more popular through continuous development. Traditional informal exchange models such as academic conferences require long preparation periods, involve certain human and material resources, and are limited by venue and time constraints, restricting participation numbers and limiting the effect of academic exchange to attendees only. The development of Internet+ effectively addresses these issues. Emerging communication technologies are widely applied in academic exchanges. Teleconferences and video conferences break through time and space limitations, enabling more scholars to participate in online academic exchanges and maximizing the effectiveness of academic exchange.

2.2 Increased Popularity of Virtual Community-Based Academic Exchange

In the Internet era, social media has developed rapidly, and various online academic forums, blogs, and open access platforms have become indispensable channels for academic information exchange. These virtual communities differ from past paper-media-based exchange methods and possess the following characteristics: (1) Real-time interaction is achieved. Academic information can be shared in real-time between users, and between users and library academic librarians, through the Internet, enabling one-to-one, one-to-many, and many-to-many sharing [6]. (2) The degree of multimedia in academic information has increased. With the development of computer technology, data storage capacity has expanded and transmission speed has accelerated, making the forms of academic information increasingly diverse and multimedia-oriented, no longer limited to text and images. Users can find audio and video materials of academic conferences and reports in virtual communities, and researchers can also share their academic achievements in multimedia formats within these communities. (3) Various stages of information exchange are closely integrated. Academic information exchange requires multiple stages including information publishing, organization, retrieval, transmission, and utilization. In virtual academic communities, the immediacy and interactivity of information exchange are enhanced, blurring the boundaries and sequences between various stages and forming a tighter information closed loop [6].

2.3 Continuous Improvement of Academic Information During Exchange

The development of Internet+ has accelerated information dissemination and interaction among information users. Traditional formal academic information exchange used paper documents as carriers and was dominated by publishing institutions, with few communication channels between users and publishers, resulting in serious lag in their interactions. In the Internet+ era, channels for academic information dissemination and exchange have become increasingly diversified. Formal publishing is no longer the only channel for researchers to publish their academic achievements. Blogs, personal homepages, BBS, electronic journals, and academic information exchange platforms provided by professional societies and libraries all facilitate researchers in displaying and exchanging academic achievements. Compared with traditional academic exchanges, these Internet-based exchange methods are more interactive. Researchers can instantly receive feedback on their academic viewpoints through other users' comments and replies, collide with inspiration during exchanges, and continuously improve their academic achievements. In the Internet era, the formation of academic information is no longer isolated work by individual researchers or institutions behind closed doors, but rather a process that pools wisdom from multiple parties and can be continuously enriched and improved during dissemination and exchange, enhancing accuracy.

3.1 Concept and Construction Process of User Portraits

The concept of user portraits was first proposed by Alan Cooper, who believed that user portraits are user models established based on data [8], featuring iterability, clusterability, knowledgeability, timeliness, interactivity, and segmentation [9]. In the Internet+ era, user portraits have evolved into a more specific concept: they are abstract, tag-based user models generated through data collection, statistical analysis, and mining of user attributes, behaviors, and preferences [10]. These models can effectively grasp user characteristics and needs, enable precise push of information and services, and have been widely applied in multiple fields. User portrait construction includes four stages: data collection, data processing, data modeling, and portrait generation, as shown in Figure 1 [Figure 1: see original paper].

Figure 1. User Portrait Construction Process

Data obtained during the data collection stage is divided into explicit data and implicit data. Explicit data, also known as static data, can be obtained through user information registration, questionnaires, and other methods, mainly including personal information such as user gender, major, age, research direction, contact information, school, and workplace. Implicit data dynamically records users' online and offline behaviors during library usage, including behavioral data such as user search, access, browsing, and download behaviors, as well as exchange and interaction with other users, plus preference data such as user

comments and likes.

The data processing stage requires using statistical methods and visualization techniques to screen, clean, and filter massive, disordered data according to the needs of building user portrait models, particularly some semi-structured and unstructured data. After processing, the data has a unified format, with erroneous, duplicate, and valueless parts removed, forming a high-quality dataset that lays the foundation for subsequent data analysis and application.

In the data modeling stage, algorithms such as LDA and Topic Model are needed to mine relationships between data, and user tag systems are generated based on regression prediction and machine learning [11]. In addition to constructing individual portraits, clustering algorithms and association analysis methods are also required to mine correlations between data, achieve classification of user groups, and complete group model construction.

The final portrait is visually presented through tags, with each tag assigned different weights to further improve portrait accuracy [12]. Each user and user group is assigned multiple tags, including basic attributes, behavioral characteristics, and interest preferences, forming individual and group portraits [13]. User portraits help libraries anticipate user needs and provide personalized services. Meanwhile, as users generate a series of behavioral data during service usage, the process of applying user portraits to provide services is also a process of continuously collecting data to further improve user portraits.

3.2 Academic Exchange Service Framework Based on User Portraits

This study constructs a new academic exchange service model based on user portrait technology combined with the overall development trends of academic exchange under the Internet+ background. The model consists of a data layer, portrait layer, service layer, and feedback layer, as specifically shown in Figure 2 [Figure 2: see original paper].

Figure 2. Framework for Library Personalized Academic Exchange Services

3.2.1 Data Collection The data layer is responsible for data collection, including user static data, behavioral data, and academic information resource data that libraries can provide. The data layer serves as the premise and foundation of the entire service framework.

User data includes static data and behavioral data. Static data primarily refers to users' basic attribute information, such as gender, age, education level, and research direction, which is typically structured data that can be collected through user registration forms and user management systems. Dynamic data mainly includes behaviors and preferences demonstrated by users when searching for and browsing academic resources, as well as when conducting academic information

exchanges with other users during service usage. This data is typically semi-structured or unstructured. Internal network data can be collected through access logs, while Internet data requires web scraping software.

Academic information resources include paper resources such as library collections of academic journals, digital resources such as electronic journals and databases, and shared resources on the Internet, such as CNKI databases and MOOC course resources. With the development of Internet+, information is growing explosively. Therefore, libraries must not only collect massive amounts of academic information but also conduct targeted deep mining and integration to facilitate user retrieval and utilization.

3.2.2 Portrait Construction The portrait layer generates individual and group portraits of users through mining and analysis of user data collected by the data layer, presenting them through visual tags. This layer serves as the basis and foundation for constructing the personalized service layer. The portrait layer runs through the entire academic exchange service process, as dynamic behavioral data generated during users' service usage helps libraries continuously improve user portraits to provide more precise personalized services.

(1) Construction and Application of Individual Portraits

General users of academic exchange services include university students who are new to academic exchange services, researchers who have just entered the field of scientific research, and other users interested in academic research. The effective data for general users is concentrated in static explicit data and simple behavioral data such as searching and browsing. Although the data has high structural integrity and accuracy, it is not comprehensive enough, resulting in lower portrait accuracy. Meanwhile, with the arrival of the Internet+ era, some scientific researchers engaged in long-term academic work are also paying increasing attention to library academic exchange services, shifting their focus from traditional academic exchanges to online virtual academic exchanges. These users are defined as deep users, professional users, and authoritative users. They demonstrate higher initiative in sharing and exchanging academic viewpoints and achievements and can generate substantial behavioral and preference data for constructing more accurate individual portraits.

As service providers, libraries can identify users with high similarity by comparing user tags and predict user preferences and needs based on similarity. Specifically, common attribute and behavior tags can be assigned to users a and b, with tag weight vectors $\mathbf{A}$ and $\mathbf{B}$ respectively. The cosine similarity function can then be used to calculate the cosine value of the angle between $\mathbf{A}$ and $\mathbf{B}$, thereby computing tag similarity. The cosine value ranges between 0 and 1, with smaller values indicating lower similarity between two users.

(2) Construction and Application of Group Portraits

Group user portrait models categorize users into different academic research

groups based on research direction and level. After completing individual portraits, clustering analysis methods such as K-Means can be employed to extract k portraits as cluster centers from n individual portraits. The distance from other portraits to these centers is calculated, and each individual portrait is assigned to the nearest class, thereby constructing different user groups and drawing group portraits [14]. To provide targeted personalized services, libraries need to ensure high matching between the services and resources provided and user groups. Therefore, the KNN classification algorithm can be adopted to calculate the matching degree between each group portrait and the academic exchange resources and services that libraries can provide. Resources and services can then be adapted to corresponding user groups based on their characteristics [14], designing personalized online academic exchange platforms and organizing academic exchange activities to further achieve efficient flow of academic information.

3.2.3 Personalized Services The personalized service layer can be divided into individual service modules and community interaction modules, with specific service content matched using content-based recommendation, collaborative filtering recommendation, and hybrid recommendation methods based on user portraits. Content-based recommendation generates recommendation lists according to the matching degree between user portraits and recommended content. Collaborative filtering recommendation conducts recommendations through collaborative cooperation. User-based collaborative filtering needs to identify groups with high similarity to target users based on user portraits and recommend services preferred by these groups to target users. Content-based collaborative filtering needs to establish a similarity matrix of service content, identify parts similar to content preferred by target users, and generate recommendation lists. Hybrid recommendation combines the advantages of both methods, can fully leverage the role of user portraits, and improves the utilization rate of resources and services.

Individual service modules match resources and services needed by users based on individual user portraits and present them to users through information push, reference consultation services, and research plan customization. Users can also engage in one-on-one academic exchanges with library academic librarians or other users through messages, emails, and adding friends. Community interaction modules are academic information exchange platforms built by libraries for researchers, enabling one-to-many and many-to-many academic exchanges, including academic forums, resource sharing platforms, and interactive communities. The advantage of academic forums lies in their ability to clearly set different academic themes based on user group portraits, helping users locate topics of interest and conduct interactive exchanges through posting and replying. Resource sharing platforms allow users to independently upload and download academic resources, achieving resource interoperability. Interactive communities have stronger immediacy, and users can more easily find like-minded academic partners and spark ideas by joining different communities.

3.2.4 Evaluation and Feedback The final layer is the feedback layer. Libraries can obtain user evaluations of services through surveys and email follow-ups, and users can also interact with librarians and provide feedback through emails and messages. Additionally, libraries can analyze user utilization and satisfaction with academic information exchange services by collecting behavioral and preference data from users' use of these services. User evaluation and feedback data also constitute part of the user data that needs to be collected by the data layer. After processing and mining, this data becomes the basis for libraries to improve user portraits, integrate resources in a targeted manner, and continuously optimize services.

4.1 Strengthening Integration and Mining of Academic Information

Academic information resources are the foundation of academic exchange. As providers and managers of academic exchange services, libraries must perform well in integrating and mining academic information, conducting orderly centralized processing of scattered information across various platforms [15] to maximize resource utilization efficiency. First, quality control of information must be strengthened. Academic information on the Internet is growing explosively, containing much duplicate, outdated, erroneous, or intellectual property/copyright-infringing information, all of which are substandard and should not be published or disseminated on library academic exchange platforms [16]. Second, the digitization of paper resources should be accelerated. Compared with paper resources, digitized academic information resources can be used simultaneously by multiple users and are more convenient for dissemination and exchange. Traditional academic information resources are primarily paper-based collections, some of which have become outdated. Libraries should mine valuable information for digital processing to give paper resources new vitality. Finally, inter-library cooperation should be actively developed to achieve collaborative resource construction and sharing. When developing academic information resources, individual libraries are prone to redundant construction, wasting human and material resources. Through inter-library cooperation to achieve interoperability of academic information resources, concentrating the strength of multiple libraries to build high-quality academic databases can effectively avoid resource waste and information fragmentation.

4.2 Enhancing Service Interactivity and Entertainment

To further optimize user experience of library academic exchange services and increase users' willingness to participate in academic exchanges, libraries should adopt a user-centered perspective and enhance service interactivity and entertainment.

Enhancing interactivity requires first transforming library service concepts and methods, shifting from the past one-way service model and passive provision of reference consultation services and answering user questions to proactively pushing academic resources according to user needs, organizing academic salon

activities, setting up thematic discussion areas on library academic exchange platforms, and sending surveys to obtain user feedback. Second, libraries should explore using mobile terminals to conduct academic exchange services. Mobile services feature high flexibility and strong interactivity, breaking time and space constraints and enhancing user stickiness. With the arrival of the Internet+ era, the penetration rate of mobile Internet access has surpassed that of computers [17], making the promotion of mobile services by libraries an inevitable trend. Libraries should actively build academic exchange services based on mobile terminals, such as adding academic exchange functions to mobile library apps or developing apps and mini-programs that provide academic exchange services, enabling users to access services more conveniently.

Enhancing service entertainment can effectively optimize user experience and mobilize users' enthusiasm for participating in academic exchanges. Libraries can add user point systems and achievement systems to academic exchange platforms to record and reward users for uploading academic resources and sharing academic achievements. Additionally, during the process of digital integration of academic resources, multimedia technology can be employed to transform dry academic information into entertaining audio, video, and MOOC courses, making it more accessible to new users.

4.3 Building a Sustainable and Efficient Service Team

Academic exchange service is a dynamic interactive process, so the service team should also actively explore and experiment, continuously developing and improving through practice. First, because users of academic exchange services have professional academic information needs and relatively high information literacy and professional levels, librarians in the service team also need to continuously enrich themselves and improve service standards. Libraries should regularly conduct training for academic exchange service teams, organize inter-library exchange and learning, and help team members improve their professional abilities. Team members should also develop awareness of autonomous learning, continuously summarizing and improving in their work. Second, libraries should introduce performance incentives to stimulate the potential of service teams. Libraries should further clarify the positioning and responsibilities of academic exchange service teams, implement dedicated positions and individual accountability, and specify the work content of each position. Simultaneously, a KPI performance evaluation system should be introduced, with evaluation indicators refined to individuals, and the proportion of performance evaluation results in librarian excellence evaluation and promotion should be increased, thereby fully mobilizing team members' enthusiasm, promoting business development, and optimizing library services [18].

References

[1] Yang Zhuo. Research on Academic Information Exchange Behavior of College Students in Network Environment[D]. Kunming: Yunnan University, 2017.

[2] Cao Ruiqin, Liu Yanling, Tai Yangfang. Information Exchange Mode in the MOOC Context[J]. Journal of Library and Information Science in Agriculture, 2018(10): 119-123.

[3] Shannon C E, Weave W. The Mathematical Theory of Communication[M]. Urbana: the University of Illinois Press, 1949.

[4] A.I. Mikhaylov. Scientific Communication and Informatics[M]. Xu Xinmin, et al., trans. Beijing: Science and Technology Literature Press, 1980.

[5] Zhao Xu. Research on Information Exchange Mode in Online Communities[D]. Changchun: Jilin University, 2010.

[6] Qu Wenjian, Li Linqian, Hu Yuan. Exploration on Academic Information Exchange Mode in University Digital Library Community[J]. Research on Library Science, 2016(7): 59-64, 5.

[7] Liu Jia. Research on Methods and Models of Network-based Academic Information Exchange[D]. Changchun: Jilin University, 2006.

[8] Cooper A. The Inmates are Running the Asylum: Why High-Tech Products Drive Us Crazy and How to Restore the Sanity[M]. Sams Publishing, 2004.

[9] Xu Pengcheng, Bi Qiang, Zhang Han, et al. Construction of Digital Library User Persona Model under Data-driven Environment[J]. Library and Information Service, 2019(3): 30-37.

[10] Zhang Haitao, Cui Yang, Wang Dan, et al. Research on User Persona in Online Health Community Based on Concept Lattice[J]. Journal of Intelligence, 2018, 37(9): 912-922.

[11] CWS_{CHEN}. Principles, Technology Selection and Architecture Implementation of User Persona[EB/OL]. [2019-12-11]. https://blog.csdn.net/SecondLieutenant/article/details/8115

[12] Wang Lingxuan. Analysis of Personalized Service for Library Consortium User Data Based on User Persona[J]. Information and Computer, 2020(14): 165-168.

[13] Li Hui, Han Koulan, Li Ying, et al. Preliminary Study on Reading Promotion in University Libraries Based on User Persona[J]. Assets and Finances of Administration and Institution, 2020(12): 119-120.

[14] Zhang Yanliang, Zhang Chao, Li Jing. Research on KNN Classification Recommendation Algorithm Based on Dynamic User Persona Tags[J]. Information Science, 2020(8): 11-15.

[15] Jin Yan. Research on Network Information Resource Integration[J]. Modern Intelligence, 2007(7): 40-43.

[16] Zhao Xue. Problems and Countermeasures of Information Dissemination in Online Virtual Academic Communities[J]. Research on Library Science, 2017(1): 43-48.

[17] Liu Dan. Research on Service Marketing of Medical Libraries Based on SoLoMo Concept[D]. Jinan: School of Management, Shandong University, 2015.

[18] Chen Lijuan, Chen Bin, Liu Haixia. Performance Evaluation System of Xiamen University Library[J]. Library Tribune, 2020(1).

[19] Qu Xingyu, Zhou Jinli, Yuan Yongcui. Application Analysis of Foreign Information Literacy Education Platforms Based on Web 2.0[J]. Research on Library Science, 2013(9): 19-22.

Author Biography: Wang Ling, female, born in 1987, Master, Librarian. Research interests: Information resource management, User persona.

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