Journal of Innovation and Development
ISSN: 2958-4752 | Vol. 1, No. 1, 2022

Application of data visualization technology in University library service

Xiang Cheng [1, 2]

[1] Philippine Christian University Center for International Education, Manila, 1006, Philippines.
[2] Youjiang Medical university for nationalities, Guangxi, Baise, 533000, China

Abstract: This paper introduces the role of data visualization in the development of information service in the library, as well as the role in scientific research and teaching. Through the analysis of the research status at home and abroad, it is concluded that the university library can establish a perfect service system in terms of data visualization service from the aspects of providing basic services of data literacy, enriching data information resources, training data librarians and service teams, participating in the whole process of data service, opening up the physical space of data service and establishing the platform of data visualization knowledge exchange. At last, it gives the strategy of developing the data visualization service in the library, including training the data librarian, reconstructing the information service system, realizing the whole-process service method, establishing the multi-participation service platform and carrying out the data literacy education reform. The aim is to provide a preliminary method for the library to carry out data visualization service and improve the library service efficiency.

Keywords: Data visualization; Data literacy; University library; Information service.

1. Introduction

A picture is worth a thousand words. William Playfair, the father of data charts, firmly believed that charts are more expressive than data tables. What he expressed was that the human brain's processing speed and quality of visual information transmitted from the outside world are far superior to text processing. Symbols, charts, graphics and other elements (including color choices) can help people quickly understand the data or textual information they represent. There is no unified definition of data visualization. We can conclude from previous in-depth research on data visualization that the goal of data visualization is to unify the connection between text and data in the real world to form easy-to-understand charts, graphics and other forms of expression. The condition for the development of data visualization is the arrival of the era of big data and data economy. Big data provides more data forms for data visualization. Usually, the amount of data is determined according to the scope of analysis that the user wants to analyze. The user only analyzes the author, magazine or institution. For academic portraits, the amount of data required is relatively small, but if users analyze the incidence of diseases, quarterly social and economic performance, or stock market conditions, a larger amount of data is required for statistical analysis in order to achieve reference effect. The era of data economy provides a place where data visualization can be used, which can make data visualization have greater commercial value. The development of metrology and visualization tools provides a theoretical basis and development tools for data visualization. Data visualization realizes the process of visually expressing abstract concepts, visualizing abstract language with concrete graphics, and presenting the meaning, trend and correlation in data with graphs, and enabling people to associate implicit knowledge through images. In a nutshell, data visualization is to use the knowledge of metrology and use visualization tools to form a large number of data in big data into charts and graphics that are easy for readers to understand, and enable readers to obtain deep explicit and implicit knowledge through appearances, a data processing process that provides information support for social and economic development. Julie Steele wrote in "The Beauty of Data Visualization": Data visualization in the narrow sense refers to the presentation of data in the form of statistical charts to convey information; data visualization in the broad sense refers to data visualization, information visualization and scientific visualization, etc. A collective term for multiple fields.

Visual representations of data or information can tell a "story" that would otherwise be buried in spreadsheets and reams of text. The main advantage of data visualization is not only that it makes data more aesthetically pleasing, but it can also communicate key aspects of complex data sets, and people are more attracted to graphs and images. When using data visualization, visuals can grab someone's attention and even improve comprehension and memory. This biological tendency to exploit images is logical and may even explain why the use of data visualization is so prevalent online. Another reason to explore data visualization is that you can easily experiment with tools that generate insightful graphs and images. The growing popularity of free tools makes it increasingly accessible, even for individuals with little or no design or data analysis experience.

2. The role of data visualization

Data visualization is to represent data in a graphical way, which can help people quickly understand the importance of certain data and understand the meaning behind the data. The value of data visualization shows how it actually works.

2.1. Improve the agility and convenience of data understanding

Data visualization greatly reduces the complexity of people's understanding of data and effectively improves the efficiency of information cognition, thus helping people to analyze and reason out effective information faster. "London Ghost Map" is a block map drawn by British doctor John Snow for a cholera outbreak in London in 1854. This map

shows the relationship between the distribution of wells in London blocks and the distribution of cholera patients. The number of patients in the vicinity of one of the wells is too high, and the source of the cholera outbreak is found to be a polluted water pump.

2.2. Provide decision-making suggestions in a constructive manner

Big data visualization tools can describe complex information with some simple graphics. Easily understand a variety of different types of data through an interactive graphical interface. Many companies collect consumer behavior data and then use big data visualization to monitor key indicators, making it easier to spot various market changes and trends. For example, a pharmaceutical company found that in southern China, when the seasons change from late spring to early autumn, the number of minors who go to the hospital for treatment of colds increases significantly. Therefore, the sales department of the company vigorously promotes them in various pharmacies before these times. Traditional Chinese medicines for the treatment of pharyngitis caused by cold symptoms. Through this strategy, the sales of such products of this pharmaceutical company are significantly better than other medicines, and can drive the sales of other medicines produced by the company.

2.3. Quickly understand the connection between data

In an industry or system, there must be some connection between various data, and finding the correlation between business data is a good way to deal with the correlation with the market. For example, in the "invoicing, sales and storage" business of the hospital consumables management department, the distribution system of hospital consumables is used to organically combine clinical needs, order generation, delivery acceptance and invoice settlement, and improve the association of medical consumables at all levels. Data visualization can make Managers immediately discover problems and take action to quickly find out various demand relationships, and link departments, warehouses, and purchases. The delivery party can keep track of department needs, inventory specifications and inventory quantities, and promote inventory optimization and timely replenishment.

2.4. Data visualization makes it easy to spot trends and identify outliers faster

When using literature research to analyze a certain topic of literature, you can analyze the external information of the literature such as author, institution, year, keywords, etc. The development trend of the discipline and a certain prominent element can be clearly seen in the visualization diagram, which is helpful for readers to understand and use the data to carry out further research.

3. Research status at home and abroad

The literature survey found that there is a big gap in the research on data visualization services provided by libraries at home and abroad. The libraries of famous foreign universities have established a relatively complete data visualization service system earlier, but they are the only ones that provide data visualization services in the library industry in my country. It can be counted, according to reports, only two libraries in our country carry out this service, but they are still in the initial stage of development [1]. At present, foreign research on data visualization services provided by libraries mainly focuses on the following aspects:

3.1. Provide primary data literacy services

The library provides data visualization introduction, training, tool use, and consulting services. These services are basic data literacy. They can let readers know about the data visualization-related resources and expertise owned by the library, and provide researchers with data visualization tools. practice opportunities. For example, the Cornell University library shows how to use data visualization knowledge on the homepage; the University of Melbourne library provides users with video training services on VOS viewer visualization software through YouTube videos; A set of 60 data visualization tools, while providing basic information on the tools; the University of Toronto Library sets up a column on its website to help users understand and apply data visualization and provide consulting services. In the training of basic data literacy for beginners, it has played a very good role in guiding education.

3.2. Provide full-process services

More foreign university libraries have launched more in-depth data visualization services, including providing space resources, setting up full-time data librarians, full-process services, and setting up communication communities. The library of North Carolina State University has opened up data experience laboratories, data spaces, teaching and visualization laboratories, visualization studios, and VR studios for researchers; the library of the University of Pennsylvania has also set up advanced analysis and visualization digital laboratories; Du The University of Michigan library hired the director of the data and visualization science center, GIS librarians and map experts, GIS experts, data science experts, data visualization analysts, research data management consultants and interns, etc.; the University of Michigan library set up a digital academic service team ; John Hoya University Library conducts data archiving, prepares data management plans, discovers and accesses data, uses GIS and geospatial data, data visualization, social science and behavioral data statistics, etc.; Princeton University library conducts data planning, data acquisition, Data analysis, data visualization, data publishing and preservation, etc.; Yale University and other books have set up data visualization workshops [2].

Comprehensive research at home and abroad shows that in terms of data visualization services, university libraries can provide basic data literacy services, enrich data information resources, train data librarians and service teams, participate in the entire process of data services, open up data service entity space, and establish data Visual knowledge exchange platform and other aspects to establish a complete service system.

4. The strategy of the library to develop data visualization services

4.1. Cultivate data librarians

Talent is the primary factor restricting the development of library career. From the perspective of knowledge fields involved in data visualization, data librarians need to master relevant knowledge such as library professional knowledge, intelligence analysis, bibliometrics, and the use of

visualization tools. Therefore, it is required that the majors studied by data librarians should focus on library and information science, computer application, statistics and information management. The library's current emphasis on services is subject-oriented services, and data librarians need to master more knowledge about data analysis and utilization than subject librarians. It is the most effective method to carry out special training on data visualization, MOOC teaching and related teaching videos on video websites.

Data librarians do not need to have relevant professional knowledge as a reserve, but also need to acquire corresponding skills through training. Some scholars summarize the skills required by qualified data librarians into four groups of skills [3]. The first set of prerequisite skills includes interpersonal skills and behavioral traits, communication skills in formal written forms of communication, and writing skills to compose technical documentation and case studies. Other attributes related to the professional profile of a data librarian are the ability to adapt to new experiences and to constantly seek professional renewal. The second set of skills is the academic environment in which the research serves, and the policies, research practices and research evaluation activities of relevant academic institutions. A third set of skills is knowledge about data analysis and use, including understanding data types (quantitative, qualitative), metadata standards and schemes (Dublin Core Resource Description Framework), legal and regulatory public resources (copyright and creative commons), and data storage. The fourth set of skills involves information technology knowledge, such as languages (Python, Structured Query Language, Java and Extensible Markup Language), the design and structure of databases, natural language processing tools, Internet of Things and big data, etc.

Although the domestic library started late, we can quickly solve the problem of talent shortage by introducing talents and retraining subject librarians. For example, the National Library has begun to introduce professionals with high data literacy, computer technology background, and visualization application capabilities. team of librarians. The library can focus on cultivating people who are interested in data visualization as data librarians, strengthen the training of data librarians' visual literacy and skills, provide opportunities to participate in professional course training, seminars, academic exchanges, etc., and improve data analysis and visualization of data librarians. Application level and skills of technology and related software tools.

4.2. Reconstruction of information service system

First of all, the library needs to improve the corresponding service content starting from the basic service of data visualization. Show users the application prospects of data visualization operations and disciplines to stimulate researchers' interest, enable users to eliminate the concept of big data and data visualization as irrelevant to their own disciplines, and encourage them to visualize data. Methods and tools to apply to one's own research in the discipline. Add tags related to "Visualization Service Guide" on the library website to provide data visualization-related knowledge; data librarian profiles, responsibilities and contact information, etc.; training courses, teaching training, seminars, lectures and related activities; space facilities and tools Introduction to use, rules and regulations; special resource literature on data visualization, such as learning resources, electronic resources, video collections, etc.

Since data visualization involves many disciplines and knowledge is updated quickly, setting up a professional service team is an effective way to solve the lack of personal quality of data librarians. Famous foreign university libraries have launched data services earlier, and the training and recruitment of data librarians are relatively mature. They have the advantages of high professional quality, deep subject background, and strong competence. They have also established service teams with complementary advantages and mutual cooperation. However, the training of data visualization service teams in my country is relatively lagging behind, and the training and output of talents in the field of data analysis will not be accomplished overnight. Only by cultivating service teams and drawing on their strengths can they adapt to the requirements of data visualization services more quickly. The current subject service in our country's library field is also carried out by forming a subject service team. We have already had good experience in team service. We only need to give play to the advantages of diversified talents in libraries and schools and integrate existing superior resources. Can form a good team quickly.

4.3. Innovative technical support methods to achieve full-process services

At present, in the library field of our country, technical support is generally carried out by the technical department or the information service department. The staff in the technical department of the library have strong technical support capabilities, but they basically provide training services for the use of databases or tool software. Data visualization analysis requires not only mastering the use of databases and software, but also understanding deeper data analysis. The purpose of carrying out the whole process service is to meet the data visualization requirements of data librarians and users. Full-process services generally revolve around the life cycle of scientific data, providing full-process data services such as data acquisition and organization, data analysis, mining and visualization, data storage, sharing and management, and data publishing [2].

Data librarians provide users with guidance on tool selection and technology use, provide users with a comparison of the characteristics of various tools, provide examples of data sets, and introduce in detail how to create interactive panels and mapping of complex networks in various tools, the creation of visual graphics, how to apply them in scientific research and writing, etc. Libraries can use technical resources and building space to design diversified technical services. Demonstrate practice and research results through big data display walls, waterfall data and other visualization equipment to attract readers' interest and passion for visualization research; open a data learning center for users, and actively guide students to participate in innovation and entrepreneurship competitions; increase related software and hardware It provides convenience for users to carry out data analysis and visualization research.

4.4. Multi-party cooperation to establish a data visualization service platform

Libraries can organize data visualization workshops to attract users with the same interest in visualization research to communicate together. Foreign university libraries set up data visualization workshops, which mainly provide knowledge

and skill training such as basic principles of visualization, programming languages, geospatial visualization, information graphics, network visualization, and statistical analysis, and provide support for scientific research, teaching, and learning [4]. Through workshops, learn the use of various visualization tools, the methods and best practices of processing raw big data, and making charts that can be used for scientific research and teaching.

The learning and training of data visualization is inseparable from cooperation and exchanges inside and outside the school. Due to the rapid development of science and technology, it is difficult for librarians to fully grasp the development of visualization technology on their own. With the development of economy and society, the profession of data analyst has emerged, which can be divided into positions such as data visualization experts, advanced data visualization engineers, data visualization developers, data visualization engineers, and data visualization consultants. Run analytics, data planning, and more. Data analysts can help libraries train the use of visualization application scenarios in various industries and disciplines. The library should change the traditional concept, actively carry out interactive exchanges with various industry visualization needs inside and outside the school, and jointly build an interdisciplinary exchange and cooperation platform with scientific research institutions, and actively respond to the opportunities and challenges brought by emerging technologies to library information services [1].

4.5. Education Reform for Data Literacy

The transformation of the library from information literacy to data literacy education needs to be in line with the actual situation of the library and the needs of users. Traditional service methods such as one-on-one consultation and on-site guidance can effectively and quickly solve user needs, but they serve few objects and are not efficient. In terms of education reform, it is connected and integrated with the practice of information literacy cultivation, and uses the advantages of online and offline hybrid teaching methods to develop diversified service forms [2].

A user-friendly curriculum should not only focus on fundamental principles and best practices of data visualization, but also include training in other skills. First, education on data visualization best practices in terms of graphics and visual cognition should be instilled so that students understand the different types of What charts and graphs mean, how they can be used to represent data, and how to present insights appropriately. Visual design principles should also be taught as a basis for how to apply elements such as color, shape, and visual hierarchy in data visualization charts, dashboards, and presentations. Additionally, during the course, students are expected to learn the entire visual analysis process end-to-end, i.e. from data acquisition, preparation, analysis, to visualization and communication of results using tools such as reports, dashboards, and visual data interpretation.

By integrating software into the curriculum, instructors can provide not only software technical training, but also focus on data visualization best practices, the impact of cognitive science on information visualization, and audience-oriented visual design principles, engagement, memory, and retention. Throughout the course, students' mastery of software course materials, hands-on skills and knowledge extension development are assessed in the form of software use assessment and concept application. Students must submit their completed visualizations for review by the instructor.

In order to combine the skill requirements for the final display of visualization, training users' ability to interpret data visualization will be a key teaching content. When displaying visualization works, users need to clearly describe the data collation process, the visualization methods and tools used, the highlighted meaning of chart data, and annotations on related concepts and phenomena. One of the goals of data literacy education is also to integrate technical knowledge with basic skill needs, including communication, research, writing, and creativity. This approach can and should be emphasized in traditional data literacy education courses so that students are familiar with the full process of data visualization.

5. Conclusion

In the era of rapid development of the information society, libraries cannot be limited to providing traditional services. They must play an effective role in providing new information services and supporting scientific research. Data visualization is an emerging technique that presents complex data in a format that is easily understood by the target audience, such as policy makers. Therefore, presenting data visually has many benefits for scientific research as it helps to identify relationships and helps to communicate information in a more interesting way. Because data visualization techniques are useful to researchers across disciplines, librarians should be more aware of the role they should play in providing data visualization services. In order for libraries to be able to provide data visualization services, in addition to providing visualization tools and software on their websites, they must also provide librarians with training programs and continuing education. Researchers must be effectively engaged and encouraged to participate in the data visualization services offered by libraries. Librarians should acquire visualization skills through participation in training programs, workshops, and MOOCs. The library should take the initiative to contact external institutions to jointly develop the whole process of visualization services. Not only should the curriculum content related to visualization skills be set up in the course learning of college students, but also special training should be provided so that they can master the visualization technology in an all-round way and apply it to scientific research and learning. In short, the library's data visualization service can not only meet the scientific research and learning needs of users, but also reflect the value of library services, enhance the attractiveness of the library, and improve the performance of the library.

References

[1] Li Yanli. Research and Enlightenment on Data Visualization Service of University Libraries [J]. Library and Information Guide, 2022, 7(06): 31-35.

[2] Hou Xuelin, Ying Jun, Song Shijie. Research on the Path of University Libraries to Cultivate Data Visualization Literacy [J]. Information Theory and Practice, 2022, 45(10): 139-146. DOI: 10.16353/j.cnki.1000 -7490.2022.10.018.

[3] Kennan M A. Data Management: Knowledge and skills required in research, scientific and technical organisations [J]. 2016.P1-10.

[4] Wen Fangfang, Feng Lingling, Wang Chunying, Cao Fenfang, Li Si, Wei Yinzhen. Practice and Enlightenment of Data Visualization Service in First-class Foreign University Libraries [J]. University Library Journal, 2021,39(06): 78-86. DOI: 10.16603/j.issn1002-1027.2021.06.015.