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Design of a Smart Tourism Management System through Multisource Data Visualization-Based Knowledge Discovery

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Abstract: Nowadays, tourism management is a universal concern in the world. It is important for generating tourism characteristics for travelers, so as to digitally facilitate tourism business scheduling. Currently, there is still a lack of technologies that are competent in managing tourism business affairs. Therefore, in this paper a smart tourism management system is designed through multisource data visualization-based knowledge discovery. Firstly, this work presents the total architecture of a tourism management system with respect to three modules: data collection, data visualization, and knowledge discovery. Then, multisource business data are processed with the use of visualization techniques so as to output statistical analysis results for different individuals. On this basis, characterized knowledge can be found from previous visualization results and demonstrated for travelers or administrators. In addition, a case study on real data is conducted to test running performance of the proposed tourism management system. The main body of public service tourism is the government or other social organizations that do not regard profit as the main purpose; public service tourism a general term for products and services with obvious public nature. The testing results show that user preferences can be mined and corresponding travelling plans can be suggested via multisource data visualization-based knowledge discovery means.

Keywords: multisource data visualization; knowledge discovery; smart tourism management; statistical analysis

Citation: Qin, Z.; Pan, Y. Design of a Smart Tourism Management System through Multisource Data Visualization-Based Knowledge Discovery. *Electronics* **2023**, *12*, 642. https://doi.org/10.3390/electronics12030642

Academic Editors: Peiying Zhang, Haotong Cao and Keping Yu

Received: 11 December 2022
Revised: 17 January 2023
Accepted: 23 January 2023
Published: 28 January 2023

1. Introduction

Data visualization is an important basis for mining and analyzing data. With the rapid development of Internet of things technology, massive amounts of data only have information value after being effectively interpreted and expressed [1]. Especially with the continuous improvement of the current data capacity and complexity, data visualization has brought people a more convenient way of data analysis. However, at the same time, with the continuous improvement of people's requirements for data mining and analysis, people's requirements for visualization technology are also constantly improving [2]. Effective interpretation has become an urgent problem to be solved in the field of data research [3]. This paper implements a big data platform for storing and managing tourism data, including GIS and spatial data, which is visualized through heat and cluster maps [4].

The integration of existing internal business systems, administrative office systems, external portal websites and e-commerce websites, mobile phone applications in the scenic area, etc., achieves a seamless connection between the internal and external management systems of the scenic area and data exchange [5]. Furthermore, plans to build a big data center, comprehensive dynamic monitoring, and public announcement platform can finally provide guidance and suggestions for improving the management and service capabilities and operational efficiency of scenic spots, improving the satisfaction of tourists and exploring the promotion of the construction of smart scenic spots on tourism development, therefore, combining the quantitative method of tourist-carrying-capacity with the development of the times [6]. In the current era of intelligent development of scenic spots, big data

technology can be used to monitor and scientifically manage the carrying capacity of scenic spots in real time and visualize the data collected in scenic spots, which is beneficial for scenic spot managers to make scientific decisions and inform tourists of various information about scenic spots in real time [7]. Thus, research on tourist carrying capacity based on data visualization will help to combine the management of scenic spots with modern technology and enrich research on tourist carrying capacity [8]. The establishment of a smart tourism public service platform can improve the government's ability to manage, serve, and supervise the tourism industry, guide tourism enterprises to operate with integrity, enhance tourism competitiveness, and create a more fulfilling and secure tourism environment for tourists [9]. Smart tourism is gradually transforming destination tourism management from a traditional method to a modern one. With the support of new technologies such as the mobile Internet, smart tourism can begin to provide instant information on tourism, thereby transforming destination tourism management from the traditional model of post-event management and passive processing to real-time management with an updating effect [10]. Since smart tourism also brings convenience to tourist attractions, tourist attractions themselves are willing to actively improve service quality, improve management levels, and strengthen the interaction between tourism companies [11]. Tourists and the tourism environment would benefit from a higher level of efficiency, thereby promoting tourism [12]. The combination of smart tourism and destination tourism management can not only improve the management level of destination tourism enterprises, but it can also realize the comprehensive integration of tourism information and tourism resources, and monitor and manage destination tourism in real time [13]. This combination has a positive impact on the overall development of tourist destinations [14].

However, the integration of the Internet and the travel industry cannot be limited to this field [15]. Customers do not need to use websites to search for relevant information but could instead view more dynamic and vivid non-static images with the help of certain interactive requirements [16]. A non-static screen covers the interactive functions and is based on the database platform, which greatly reduces the maintenance work on a website. The technical level of a website based on the non-static screen can reach more people and meet more requirements of customers, such as providing the background and contact information of a business representative, the distribution and management of the platform, etc. This is no longer just online information that is distinct from the server unless the customer requests a full online link as needed. The most important factor in this is to use the website to transmit and present information, to better highlight the relevant content. The travel online platform is combined with a computer to launch the relevant travel information.

2. Related Work

Tourism development countries have an early understanding of smart tourism and are at the forefront of smart tourism construction, forming a relatively complete public service platform for smart tourism, which is more intelligent and modern than other countries [17]. From the perspective of the supply of tourism public services, Li et al. pointed out that in terms of service skills, relevant departments should organize employees to improve their skills in order to achieve the goal of improving the overall service capability of the tourism industry [18,19]. Through on-the-spot research, Shengdong et al. pointed out that public safety monitoring of tourist destinations is an important part of the construction of tourist public services, and efforts should be made to develop and construct this part [20]. Since the concept of a public service platform was first proposed, the research on public service platforms has developed rapidly [21]. Domestic scholars have a unified understanding of the development of smart tourism, and based on different perspectives, they also put forward suggestions for the development of smart tourism [22]. Qureshi and others believe that smart tourism is composed of tourists, developers, service providers, and managers [23]. These subjects all have one thing in common, that is, wisdom, and they support the big system of smart tourism.

Most studies on tourism carrying capacity have been conducted from the perspective of the supply of resources and facility carrying capacity. In other words, taking the scale, environment, and facilities of the scenic spot as constraints, the carrying capacity of the scenic spot is estimated, and the maximum number of tourists is calculated based on a static analysis [24]. Second, few scholars have paid attention to the internal relationship and interaction mechanism among various tourism carrying capacity indicators. Third, most studies on tourism carrying capacity assess a single environmental attribute [25]. Only when we fully understand the natural ecological attributes of tourism resources and the service attributes of tourism products can we realize the sustainable development of scenic spots while making rational use of scenic resources. The key role of visualization technology in the era of big data is obvious. Judging from the fact that major commercial enterprises have invested heavily in the study of data analysis techniques, the demand for data analysis and mining is constantly increasing [26]. Through this platform, the government can grasp the dynamics of tourism enterprises and tourists in real time, realize real-time supervision, and improve the quality of government services and efficiency using appropriate data analysis processing and expression methods. It is very important for enterprises to predict the market and seize market opportunities. At present, the Chinese tourism industry currently has up to 500 million pages of travel website data and the application of big data has received increased attention from the tourism industry. The tourism industry conducts in-depth data mining and analyses based on various Internet information data processing and management technologies, which help the tourism industry to predict tourism demand in advance and further improve tourist satisfaction. Furthermore, data analysis helps to avoid inappropriate tourism products and achieve accurate sales [27].

Based on the key technologies of the visualization system of the current massive tourism statistical data, a visualization system is designed for the characteristics, data structure, and data characteristics of tourism statistical data. A tourism visualization system was developed based on: the specific type of tourism statistical data used; the demand for a statistical data visualization platform that carries out an analysis and, at the same time, carries out the visualization system architecture design; the design of the tourism visualization system from the technical point of view; and the pre-processing of data and use of ArcGIS software to realize the visualization of urban roads. This paper introduces the difficulties in establishing a visualization system of massive tourism statistical data and proposes solutions based on these difficulties. In particular, for the realization method of the clustering graph, the clustering algorithm is used for the corresponding improvement and realization.

3. Technical Analysis of Tourism Information Data Visualization

Visualization technology is mainly used to display abstract data so that users can better understand abstract data and abstract knowledge. The underlying data sources of visualization technology mainly include spatiotemporal data and non-spatiotemporal data. Spatiotemporal data refers to data containing the spatial coordinates of objects, trajectory data, spatial data, and other types of data contained in tourism statistics; non-spatiotemporal data includes text information, multimedia data, etc.

Utilizing a thermal distribution map is the most common way to study the distribution of geographic trajectories. It uses blocks of different colors superimposed on the map to illustrate the spatial distribution and density of crowds on the map in real time. Usually, the darker the color of the heat distribution map, the higher the degree of crowd gathering. At the same time, the heat distribution map can also be used to describe changing trends in the population distribution. The principle of the heat distribution map is very simple. The system background only needs to obtain the number of mobile users in the area through the base station and it renders the map color according to the number of users to display the population distribution information in the area in real time. The generation of the cluster map also avoids data occlusion caused by too many markers on the map, especially when

massive point data are loaded, it is difficult to distinguish each element, and the meaning of visualization can be lost if the required information cannot be viewed with the naked eye.

The basic idea of the cluster map is to aggregate and count the entities in a small area and present the statistics. Since the aggregation process is determined according to the area displayed on the screen, the cluster map will also change accordingly when the map is zoomed in and out [28]. The number of aggregated groups will be reduced and more surrounding points will be absorbed when zoomed out. On the contrary, the points will be distributed into more groups when zoomed in. When zoomed in to a certain extent, the point elements in some sparse areas will not be aggregated. Instead, it is displayed directly according to the symbol of the render layer:

$$A = \left[a_1^2, a_2^2, \ldots, a_m^2\right] \tag{1}$$

Different variable relationships are represented by the changes in the horizontal axis and the number axis. In the damage degree of different structures to the house, the horizontal axis represents different structures, and the vertical axis represents the degree of damage. Through the vertical axis corresponding to the horizontal axis, we can see the damage degree of different structures to the house. The model is established based on the following theories. Data that can represent spatial information, such as pictures and graphic data, can be stored in the form of files, and attribute data continues to be stored in a two-dimensional relational database. The two types of data are stored and managed in the form of files and relational databases. However, they have previously established a connection through the target ID or internal link code, thereby managing the object's space and attribute data at the same time, as shown in Figure 1.

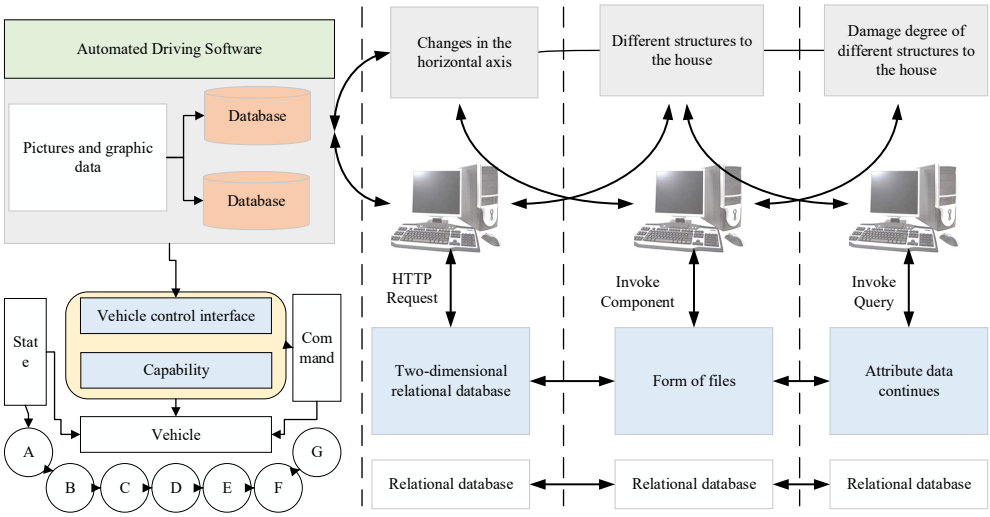

Figure 1. Tourism information data visualization technology.

In the mode of the file-relational database collaborative management system, spatial data and attribute data are independently stored, managed, and queried, and the two are only connected through their respective IDs. How to use these data to achieve the precise management and control of scenic spots is a practical problem that managers of scenic spots expect to solve. Expressing the complicated data in an intuitive and convenient form can attract people's attention and help scenic spot managers make scientific and efficient decisions. For geometric figures, the GIS system uses high-level language programming so it can directly manage the storage files of these spatial data, and spatial information such as graphics can be edited and operated directly on the user interface without transfer. However, for attribute data, due to the limitations of traditional management methods and commercial software development models, they must still be stored and managed by a relational database management system. Therefore, the editing operation of attributes

and the display operation interface of graphic images are separated. The user cannot operate synchronously; to establish a connection, the GIS developer can only call the interface software of GIS and ODBC in the software, and operate through the connection ID between them, and then the spatial data, attribute data, and any one of the support protocols for relational database connections can determine the influence or radiation range of a certain type of object. The stacking conditions include rules for intersection, union, and identification:

$$R = \begin{bmatrix} r_{11}^2 & r_{12}^2 & \cdots & r_{1m}^2 \\ r_{21}^2 & r_{22}^2 & \cdots & r_{2m}^2 \\ \cdots & \cdots & \cdots & \cdots \\ r_{n1}^2 & r_{n2}^2 & \cdots & r_{nm}^2 \end{bmatrix} \tag{2}$$

This management mode means that both spatial data and attribute data are managed by a relational spatial database management system. Software manufacturers of relational spatial database management systems do not expand and change the system, but GIS software manufacturers expand based on relational databases, so that they can manage relational attribute data and non-relational spatial graphics images at the same time. This database management system has two management modes [29].

An infographic is an information expression form composed of pictures, collars, text symbols, and other elements, which helps the audience selectively receive information in a large batch of data. The tourism information of Yuncheng, China, covers many aspects, such as geographical location, history and culture, specialty foods, tourist attractions, customs, and other important information elements that can be expressed using information graphics. This information and its important elements can be extracted for visual creative expression in order to interpret tourism information from the perspective of visual communication through the rich visual elements of information graphics:

$$D = NRCC^* w_1 - FCC^* w_2 - MCCw_3 \tag{3}$$

To improve tourist satisfaction and enhance the image of tourist destinations, more cities have begun to pay attention to the construction of urban services, Social organizations are the main body of tourism public services and have participated in the operation of tourism extensively.

The tourism platform is a complex comprehensive service system that places the government, enterprises, and tourists on a communication platform, and each subject can obtain the services they need on the communication platform. Through this platform, tourists can obtain high-quality services to meet personalized and diversified tourism needs; tourism enterprises can obtain massive resource information and enjoy one-stop service. Furthermore, the government can grasp the dynamics of tourism enterprises and tourists in real time, realize real-time supervision, and improve the quality of government services and efficiency, as shown in Figure 2.

Scientific research has found that human eyes are more sensitive to visual information such as color, shape, and size. For the real-time data of scenic spots, how to present them scientifically and visually, and how to use these data to achieve precise management and control of scenic spots, are practical problems that managers of scenic spots expect to solve. Expressing complicated data in an intuitive and convenient form can attract people's attention and help scenic spot managers make scientific and efficient decisions. Victoria Harbor is located between Hong Kong Island and the Kowloon Peninsula; it has the world's largest container freight center "Kwai Chung Container Terminal". Victoria Peak is 554 m above sea level and is the highest peak on Hong Kong Island. Formerly known as Raqi Mountain, Peak Park is the best place to enjoy the night view of Hong Kong, and the "Spark of Qishan" is listed as one of the wonders of the world. There is a Madame Tussauds wax museum in the Lingxiao Pavilion at the top of the mountain. Lantau Island is the largest outlying island in Hong Kong. The Cheung Sha Wan beach is 2 km long and is the longest beach in Hong Kong. In the fishing village of Tai O, the unique "shacks" floating on the

water are known as the "Venice of Hong Kong". On the opposite side of the temple is Muyu Mountain. On the top of the mountain is the Big Buddha of the Temple of Heaven, which is the largest open-air bronze Buddha in the world. Its lotus throne and platform are exactly like the Temple of Heaven in Beijing. The big data visualization adjustments of the tourist carrying capacity of scenic spots mainly include the real-time collection of the scenic spot ticket sales quantity and the remaining unsold tickets, the sales quantity and remaining quantity of scenic spot sightseeing cars, and the reservation of hotels and hotel rooms in the scenic spot and hotel rooms [30]. The remaining data are the parking space of each parking lot in the scenic spot and the weather conditions of the scenic spot.

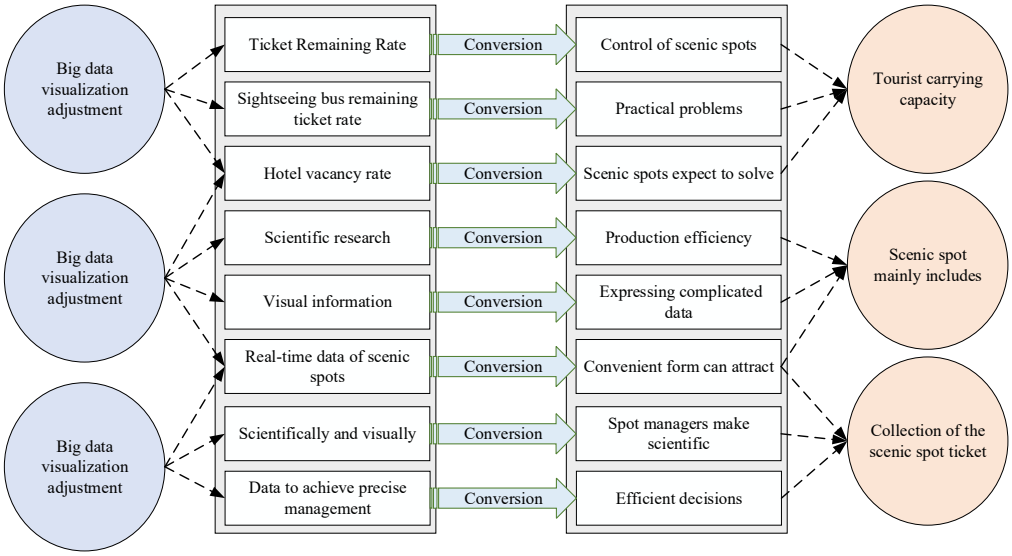

Figure 2. Adjustment of big data visualization.

Tourism activities will cause damage to the natural environment of the scenic spot including domestic wastewater, exhaust gas, and solid waste generated by restaurants and hotels, and noise generated by the operation of tourism and entertainment facilities. However, when the number of tourists exceeds the range that the scenic ecosystem can bear, it is necessary to artificially relieve the adjustment pressure of the scenic spot or limit the number of tourists. Through this two-way adjustment, the tourism carrying capacity of the scenic spot and the ecological environment of the scenic spot can be balanced.

Facility carrying capacity refers to the completeness of various facilities in a tourist destination and is an important evaluation criterion for the ability to meet the needs of tourists [31]. It includes the number of parking lots, the number of hotel beds, the degree of transportation convenience, the completeness of communication and other infrastructure, the supply capacity of basic energy such as water, electricity, and gas, and the investment scale and density of scenic spots. The psychological carrying capacity of tourists is an important factor in whether tourists are satisfied with their travel experience, and it refers to the maximum crowding degree that tourists can bear without affecting the travel experience.

The main function of the tourism data visualization information platform is to count, analyze, and display different types of data for the acquired tourism statistical data. The main data sources studied in this paper include travel information of passengers, booking information of passengers, positioning information of passengers, etc.

3.1. Design Optimization of Smart Tourism Information Management Platform

There are many kinds of visualization technologies, and effective use of these technologies is an important practical significance of visualization development. The visualization system is based on a hierarchical overall system. It is composed of a data access layer, a business logic layer, and a user presentation layer. Users can query directly through

the query window. The administrator selects and records the user's favorite travel route according to the user's recent history, and saves the route. The system is shown in Figure 3.

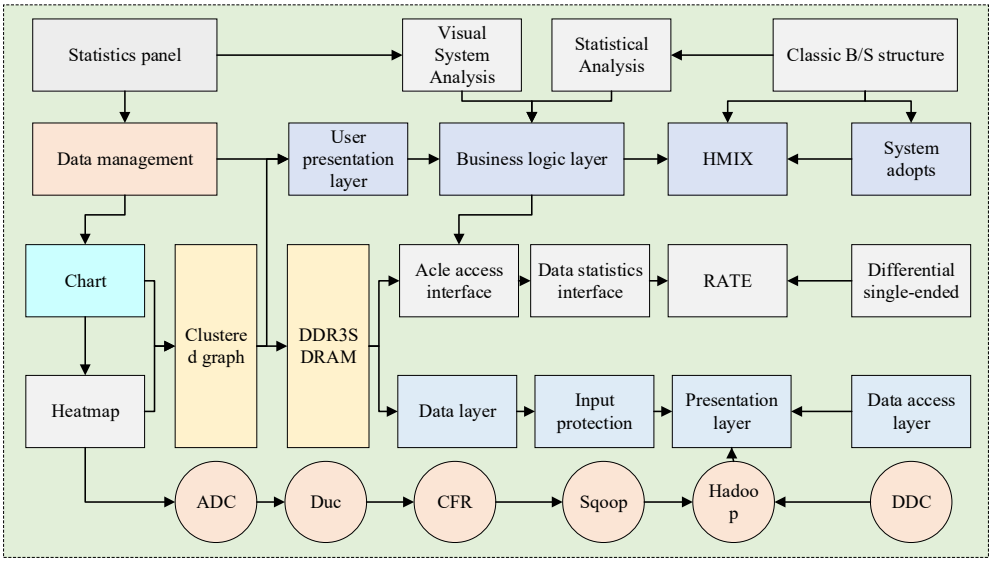

Figure 3. Overall design of the system.

First, the relational database Oracle stores and organizes the relevant data of tourism statistics. At the same time, for a large amount of data, the Hadoop framework is used in the system to process the data in order to be able to efficiently complete big data analysis and information mining tasks and transfer the data in Oracle and Hadoop through the open-source tool Sqoop.

The construction plan of smart scenic spots based on a cloud platform needs to build a reasonable system structure to meet the large-scale applications of internal and external networks and wide-area networks; at the same time, the plan needs to determine a smart tourism industry model to achieve intelligent and scientific management of the tourism industry; in addition, a domain model design method should be adopted. Through induction and abstraction, the key concepts and core business points in the business are obtained, and the business reality scene is truly replicated in the business system to improve its usability. Smart tourism is supported by cloud computing, the Internet of things, high-speed mobile communication technology, and intelligent terminal equipment to meet the development needs of future tourism management in terms of management intelligence, service automation, tourism personalization, and information equivalence. Therefore, in the construction of smart tourism, we should focus on the application of a new generation of information technology, integrate tourism information resources with tourists as the center, and improve the automation and intelligence level of tourism services. In the construction of the smart tourism system, all application services are firstly based on the acquisition of user information and data, and then we used corresponding information means to achieve one-to-one communication with tourists, as shown in Table 1.

Table 1. Application of Smart Tourism System.

Number	Name	Name_Type	Type	Length
1	Ai_id	Recreation item number	String	255
2	Am_id	Entertainment hall number	String	255
3	Ai_name	Entertainment show	String	255
4	price	Recreational item quotation	Float	16
5	Write_time	Entry time	String	255

Efficient data access response to massive location information requires efficient data index storage structure design. The indexing technology can speed up data retrieval, thereby realizing fast responses to user requests. This brings great difficulty to location-based data updating. For the basic geographic data of scenic spots, data can be updated through methods such as surveying, mapping, and remote sensing; for cooperative targets such as tourism operation vehicles and staff in scenic spots, special terminals can be installed or distributed to realize real-time reporting of location information; for the target, it is difficult to obtain its location distribution in the scenic spot in real time.

The two most basic factors in tourism economic activities are tourism demand and tourism supply. The relationship between these factors is the unity of opposites. The exchange value is expressed as a quantitative relationship or proportion in which one use value is exchanged for another use value. The reason why commodities with different use values can be exchanged with each other according to a certain ratio is that they are all labor products, and the labor of commodity producers is condensed in them. This kind of indiscriminate human labor condensed in commodities is the value of commodities. The value of a commodity cannot be expressed by itself; it must be expressed by another commodity through exchange. The main content of tourism economic activities is the mutual transformation of their contradictory movements. Whether supply and demand can adapt and coordinate with each other is the essence of the contradiction between supply and demand in the tourism market. Information service occurs between information users and service staff, information resources, and information service systems. The service is one or a series of behaviors that can meet users' information needs [32]. Information services should not only manage information resources but also manage information activities and information users. The main characteristics of information services are high user participation, deep contact with users, and high knowledge intensity. Information management refers to a set of organized work activities in which people acquire information and knowledge and then classify and use the data. It is a scientific plan for various related factors in human society's information activities, including people, information, technology, and institutions, organization, control, and coordination, so that the obtained realization information resources can be developed and utilized more rationally and effectively.

3.2. Tourism Information Data Visualization Results

It is necessary to put together the heat map of tourist flow of a day for comparative analysis. From red, yellow, and green to blue at the end, it shows the number of passengers in the range shown from more to less. The range of people corresponding to the specific colors is shown in Figure 4.

The K-means algorithm first needs to determine an initial division according to the initial cluster center, so that the selection of the initial cluster center has a great impact on the clustering results. The biggest feature of smart tourism is that it can promote the management efficiency of scenic spots. Contactless ticket purchase, a real-name system for time-scheduled reservations, and automated admission free traditional ticket sales and inspection staff from complicated manual operations. Everyone is an on-site order manager, improving direct services to tourists and assisting with tourists' online shopping. The planning has increased the friendliness of scenic spot services to tourists, which includes the construction of a complete smart ticketing system. Smart tourism can promote the service reconstruction of scenic spots. It is conducive to the analysis of tourist attractions, moving lines, and consumption behaviors of tourists, optimizes the layout of products and tourist moving lines in scenic spots, and promotes more consumption by tourists, breaking through the single ticket economy. Especially under the normalization of the epidemic situation, the relevant national policies and the needs of the scenic spot for epidemic prevention and control are superimposed. The deployment of the real-name time-scheduled ticket reservation system will regulate the passenger flow of the scenic spot in a way that can be described as "cutting the peak and filling the valley", improving the efficiency of tourist reception and alleviating the epidemic situation. Moreover, in the K-means algorithm, since

the K value in the K-means algorithm is given in advance, it is difficult to determine the appropriate K value. It can also be seen from the figure that although the obtained cluster visualization results can roughly reflect the number of vehicles in a certain area, the results do not accurately reflect the actual distribution of the current vehicle locations.

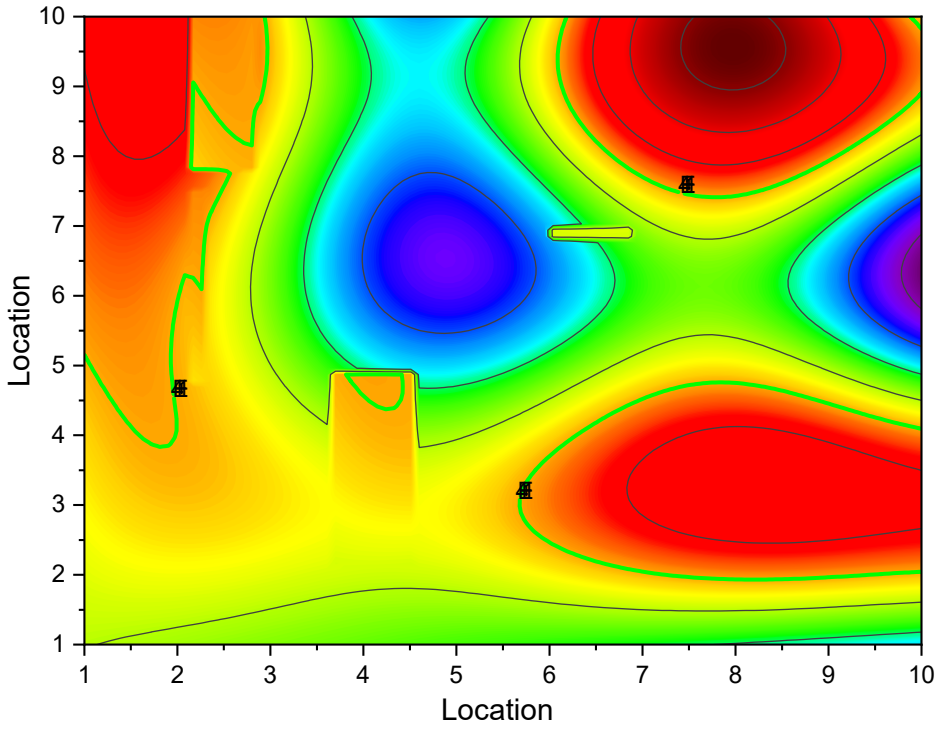

Figure 4. Example of visualization results.

According to the existing land classification vector map and traffic information vector map, through coordinate transformation and reasonable data layering in ArcGIS software, two-dimensional vector data structures of point, line, area, and text types are obtained, which is convenient for expressing geography intuitively. In this paper, the results of the buffer analysis in the previous step include the buffers of all towns within the province. It is necessary to extract the buffers within the county under study. Therefore, the overlay analysis function can be used to compare the buffers with the county's buffers.

The ecological environment carrying capacity of the scenic spot is mainly calculated in the following three aspects: one is the purification and absorption capacity of pollutants by the natural ecosystem of the scenic spot, the second is the treatment capacity of pollutants by the artificial system, and the third is the per capita carrying capacity per unit of time. Compared with the natural purification capacity, the purification capacity of the artificial system and the pollutant discharge of tourists and residents are more controllable. Therefore, the calculation of the ecological environment carrying capacity is based on the pollutant treatment capacity of the artificial system (Figure 5).

The spatial analysis module of ecological resources includes two functions: buffer analysis and overlay analysis. Overlap analysis is the operation of stacking two or more layers of map features to generate a new feature layer. The stacking conditions include rules for intersection, union, and identification. Overlay analysis can be used to extract GIS spatial features. To obtain the buffer area within the county, select the input layer and overlay layer in the dialog box; then, select the analysis method, output path, and file name, and click the analysis button.

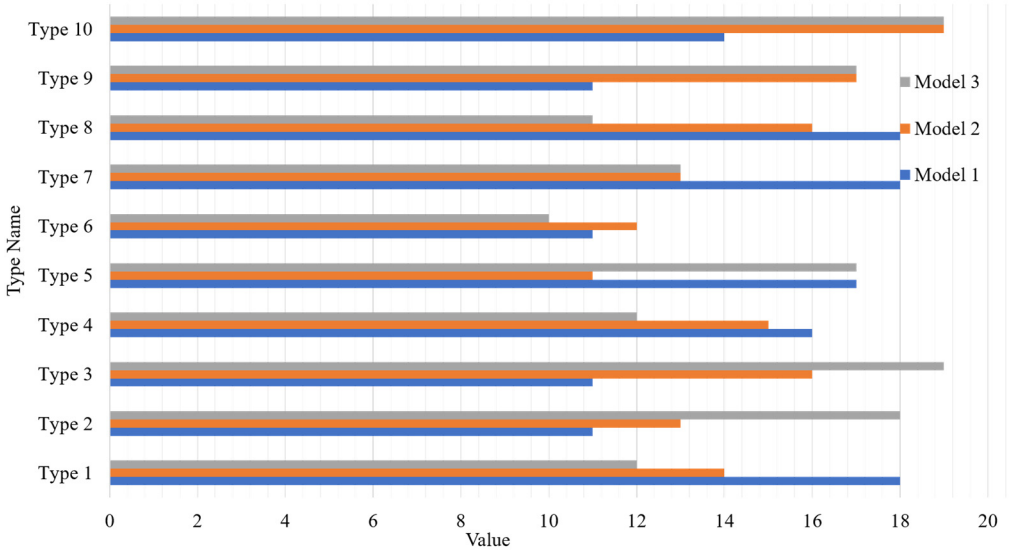

Figure 5. Schematic diagram of big data analysis of scenic spots.

After the comprehensive management platform software of the scenic spot is started, the identity of the user will be verified through the identity authentication package. The location distribution viewing function can view the geographic location distribution of tourists, sightseeing vehicles, and other fixed resources in the scenic spot through the real-time received cache information of the positioning terminal. Through this two-way adjustment, the protection and sustainable development of the scenic spot can be realized. The information management package can manage the basic information of the resources and positioning terminals in the scenic spot through the static structure data of the scenic spot in the orientation database and can manage the user information at the same time. The historical track playback function can realize historical track query and playback by querying the latitude and longitude information in the historical location database. In the process of realizing the emergency rescue mission in the scenic spot, the emergency management package will manage the basic information of the teams and individuals participating in the rescue task through the information management package and realize the location positioning of the parties involved in the search and rescue task through the location distribution query package.

4. Platform Optimization Results

The scenic data sharing and exchange function are based on the sharing, integration, and unification of existing system data, especially the sharing of related data resources, eliminating "information islands" and "data chimneys", and realizing scenic environmental monitoring and scenic e-commerce. The interconnection and data sharing of various information systems such as information and internal business systems in the scenic spot form a unified data service layer to provide data services for upper-layer applications. At the same time, it realizes the exchange and sharing of information and data across departments and systems. Through business collaboration and data sharing and data exchange between different levels, units, and departments, it can meet the data exchange needs between internal and external information systems, and provide government, tourism, and tourism services. Businesses and tourists provide basic information services updated in real time.

The core design module provides various possible line information in detail in the line formulation and fully displays it to the user. When searching, it can be filtered according to the conditions, or it can be directly queried through the query window. The administrator selects according to the user's last history. The user's favorite travel route will be recorded, and the route will be saved. At the same time, it can comprehensively count the most selected routes and make the route a popular route. In addition, the tour guide user can see the current most popular route and can choose the route as the first choice. To complete

the data training wizard, after a period of use, the inappropriate lines can be filtered out and the lines can be deleted or stored in the database as an alternative.

The next time the user visits, the system will recommend the surrounding hotels to the user based on the recorded data. At the end of the program code, we added a code that can automatically overwrite the old geographic location. When the geographic location of the user changes, the system will overwrite the location and recommend new content to the user such as surrounding famous attractions, special restaurants, and affordable hotels. It is worth mentioning that the system can also recommend routes for users to experience more interesting places, and provide information on similar attractions.

The detection of configuration items and systems is particularly important for configuration item testing and system testing. The following is a further description of this additional testing. Performance testing is also what we usually call black-box testing: instead of testing the code, black-box testing is carried out by testing the functions displayed in its interface, designing use cases for basic function points and steps, and evaluating the process of the system and each function point. The process of carrying out the test operation is shown in Figure 6.

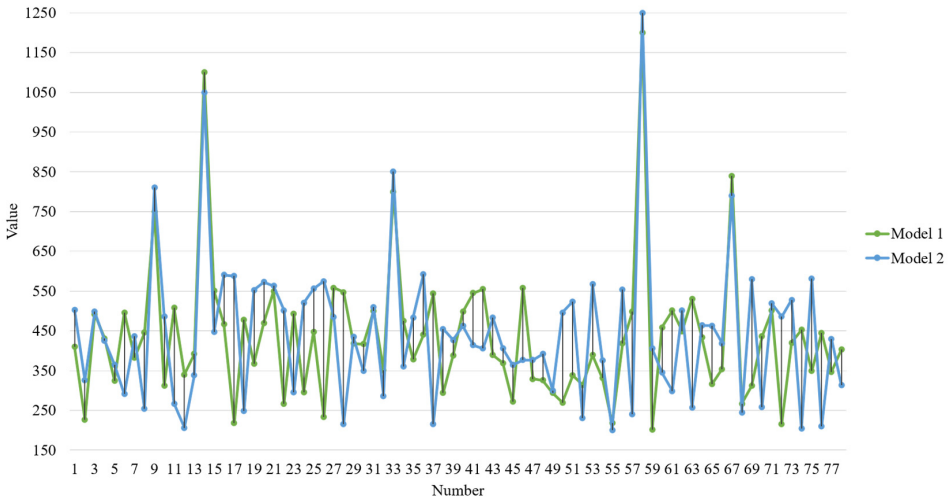

Figure 6. Response time distribution diagram.

We used JMeter to stress test several main businesses in the system in about 10 min at the same time, with a total of 1000 concurrent operations. From the test results, the response time of most requests is within one second. Occasionally, the request dependence time is 2 or 3 s, but after processing, it quickly returns to the right track, and the overall request error remains within 0.1–0.3%, as shown in Figure 7.

In the actual situation, the daily carrying capacity of the Mount Emiel scenic area is approaching the maximum carrying capacity year by year during the peak tourist period, and the passenger flow of the Quanshay Alley scenic spot often far exceeds the maximum tourist carrying capacity calculated in this paper during the peak holiday season. Simply put, can this solution solve the problem well after implementation and let us move forward to a better position? Cultural (political) feasibility is a measure of whether the solution is in line with our cultural customs. For example, the main staff of a Chinese project is Chinese but only provides Western food, especially for international projects. Special attention should be paid to these. Technical feasibility mainly measures whether the solution is practical and reasonable. It examines whether the technologies adopted for the solution are stable and mature, whether the personnel are proficient in these technologies, and whether technical expert support is needed. Generally, there is no problem. Schedule feasibility is important in determining whether deadlines are enforced or expected, determining the pace and pressure of work. Economic feasibility is the bottom line of many projects and measures project benefits and costs. Legal feasibility is that the solution is always subject

to legal constraints, such as copyright law and so on. Measuring feasibility needs to be evaluated in these six aspects, and there are usually certain conflicts. For example, the optimal solution is often the solution with the lowest economic feasibility, which requires sitting down and communicating with the client. The overload of tourists brings great inconvenience to the management of these two scenic spots, and tourists also reduce their tourist satisfaction due to the congestion of the scenic spots.

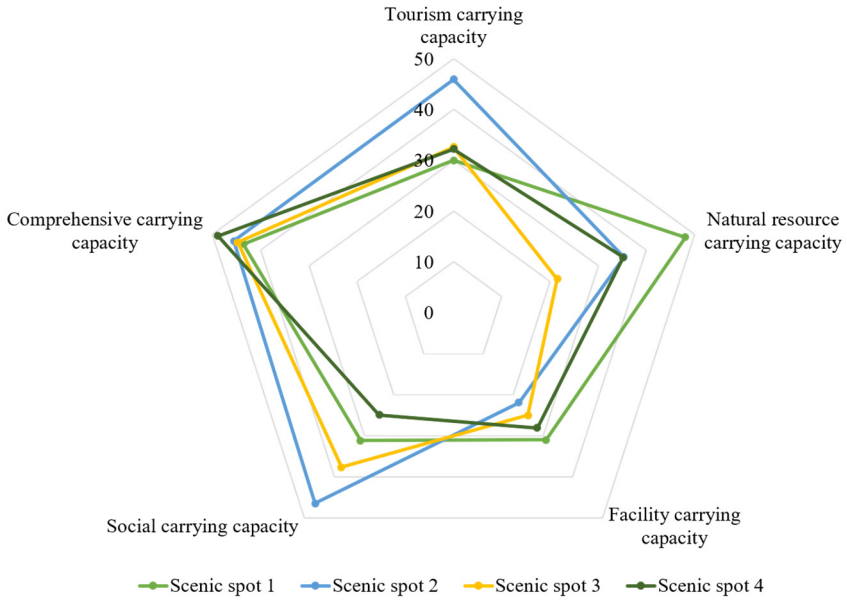

Figure 7. Comparison of the carrying capacity of scenic spots.

Therefore, in practice, the scenic spot should use big data technology to detect the real-time tourist volume of the scenic spot according to the tourist carrying capacity of the scenic spot, establish an early warning and forecast system, formulate a tourist volume management system in the scenic spot, and activate the emergency response of the scenic spot when the tourist volume of the scenic spot is overloaded. The management system and the implementation of tourist diversion measures ensure the smoothness of the scenic spot and the satisfaction of tourists in the scenic spot.

5. Conclusions

This paper designs a visualization framework based on tourism. A reasonable analysis of tourism big data can be closer to the needs of passengers and make processing estimates and judgments about passengers. The use of big data is not only a way to analyze consumer demand but has also begun to become an important asset with extremely high economic and practical value. For the tourism industry, the rational use of big data can effectively help companies take the lead in future market competition, and using the database of the tourism industry for analysis, calculation, and reasoning can also effectively help companies understand tourism-related market opportunities. Understanding market opportunities can truly help companies improve the satisfaction of tourism services, improve customer conversion rate, and promote the vigorous development of the tourism industry. While adding interest, big data analysis also increases interactions with users behind the tourism data, making the information displayed in the era of big data more unique, with more diverse display styles that are easy to disseminate and it can disseminate tourism information to a greater extent. At the same time, it is necessary to constantly explore the advantages of other media, and constantly improve to add new vitality to the tourism visualization industry. In this era of the explosive growth of data, only by grasping contemporary technology can we better grasp market opportunities.

Author Contributions: Conceptualization, Z.Q.; methodology, Z.Q.; validation, Y.P.; formal analysis, Z.Q.; data curation, Y.P.; writing—original draft preparation, Z.Q.; writing—review and editing, Y.P. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: The data can be obtained from authors upon reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

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