Research On The Application Of Big Data Technology In The Digital Integration Of Intangible Cultural Heritage Tourism Resources In The Context Of Cultural Tourism Integration

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Abstract

In order to enhance the value of intangible cultural heritage tourism resources data and better develop intangible cultural heritage tourism, the application method of big data technology in the digital integration of intangible cultural heritage tourism resources under the background of cultural tourism integration is studied. The functions of digital integration of intangible cultural heritage tourism resources based on big data technology under the background of cultural tourism integration are analyzed, and a digital integration platform of intangible cultural heritage tourism resources that includes data layer integration, platform layer integration and service layer integration is built. In data layer integration, considering the multi-source heterogeneity of intangible cultural heritage tourism resource data, the federal learning algorithm is adopted to integrate intangible cultural heritage tourism resource data through feature extraction, feature integration and feature decision-making. In the platform level integration, based on the integration results of intangible cultural heritage tourism resources data, the initial clustering center is determined according to the distribution density of intangible cultural heritage tourism resources data by using the k-clustering algorithm based on density and object direction, and the intangible cultural heritage tourism resources data is clustered according to the clustering direction of intangible cultural heritage tourism resources data. In the service level integration, based on the

clustered intangible cultural heritage tourism resource data and the theory of Resource-Market-Product, an evaluation index system is constructed to evaluate the tourism utilization potential of intangible cultural heritage resources, providing reference for the development of intangible cultural heritage tourism. The experimental results show that the data correlation after data integration of this method is above 0.943, which can accurately evaluate the development potential of intangible cultural heritage tourism resources and significantly improve the regional tourist flow.

Keywords: Integration of culture and tourism; Big data technology; Intangible cultural heritage tourism resources; Digital integration; Federal learning; Theory of Resource-Market-Product

1 Introduction

Intangible cultural heritage is an important part of China's excellent traditional culture, and it is the main force for the development of China's cultural creative industry and tourism industry [1]. Its regionality has become an important driving force to attract tourists. Its inheritance requires that intangible cultural heritage must be transmitted and inherited vertically from generation to generation. In recent years, the frequency of declaration of intangible cultural heritage in China has been increasing, and the protection of intangible cultural heritage has also been paid more and more attention, intangible cultural heritage has been highly concerned and valued by all sectors of society [2]. The tourism development of intangible cultural heritage not only provides new ideas for the development of intangible cultural heritage protection, but also plays a great role in carrying forward the traditional national culture [3]. The integration of tourism and intangible cultural heritage can solve the needs of tourists in many ways, difference, knowledge, beauty, leisure and entertainment, through colorful intangible cultural heritage [4], so as to burst out huge tourism attraction, find new development points for the growing tourism industry, and set off a development boom in various places.

The integration of culture and tourism is a kind of integration of interactive element resources. After the integration of two or more elements of culture and tourism, through cross infiltration, integration

and reorganization, the original industrial field is broken through, so that the industrial boundary shrinks, blurs or disappears, and a new cultural and tourism product format and industrial system are formed through symbiosis and win-win. In the context of cultural and tourism integration, with the improvement of information infrastructure and the development of mobile Internet, cloud computing, Internet of Things and other information technologies, social networks, e-commerce, mobile clients and various intelligent service terminals are rapidly popularized, intangible cultural heritage tourism resource data shows explosive growth, and the tourism field has entered the era of big data [5]. The size of big data lies not only in the size of data, but also in the complexity and diversity of data types, the low density of data value, and the difficulty of data processing and analysis [6]. Big data environment and big data technology bring both opportunities and challenges to intangible cultural heritage tourism. In terms of resource storage, due to the large scale and complex types of intangible cultural heritage tourism resource data, traditional IT architecture and data storage mode have been difficult to meet the requirements of big data of intangible cultural heritage tourism resource [7]; In terms of resource processing, the data processing object, scope and method of intangible cultural heritage tourism resources will change dramatically [8]. For example, user's tourism preference data, tourism business data and tourism industry data will also be included in the data processing category of intangible cultural heritage tourism resource; In terms of resource utilization, the ultimate goal of intangible cultural heritage tourism construction is to provide users with high-quality services based on the utilization of intangible cultural heritage tourism resources. In the big data environment, the traditional service form of intangible cultural heritage tourism is gradually extending to data analysis and data mining, and the processing and analysis of large-scale data will become the main service content of intangible cultural heritage tourism. Intangible cultural heritage tourism resources already have the characteristics of big data. The scattered small data of intangible cultural heritage tourism resources has no great significance, and it is of great significance to conduct a comprehensive big data analysis on the tourism resources of intangible cultural heritage. In the context of cultural tourism integration, on the basis of data opening and information disclosure, the digital integration of intangible cultural

heritage tourism resources based on big data technology combines all intangible cultural heritage tourism resources into an organic whole by integrating complete big data of intangible cultural heritage tourism resources, which is conducive to promoting the co construction and sharing of all intangible cultural heritage tourism data resources, and processing and analyzing them to explore the potential value. It is finally applied to the business process improvement and information service provision of intangible cultural heritage tourism.

In the process of studying multi-source information integration, reference [9] analyzed the complementary information related to information sources in the spatial spectrum obtained by different information sources, took the complementary information as the input of multi-source information integration model, and obtained the final information integration result through neural network, support vector machine and random forest. This method only considers the complementary information, so the data utilization after integration is low. In the study of tourism resource data integration, reference [10] transformed the format of the collected data, and eliminated the operation of tourism resource data collection error and precision test. Based on the collected data, the tourism resources integration system was constructed according to the six major tourism elements, and the SVM theory was introduced to obtain the optimal tourism resources integration scheme. This method takes a long time in the actual application process, which is not conducive to the subsequent application of tourism data. In reference [11], when studying the problem of tourism data integration, the features were extracted from tourism data, the content of tourism data was identified through machine learning and deep learning methods, and the tourism data integration was realized by combining feature vectors. The multi-source characteristics of tourism data are not considered in the application process of this method, which leads to the problem that the error of tourism data feature extraction leads to the error of the final integration result. Aiming at the above problems, the application method of big data technology in the digital integration of intangible cultural heritage tourism resources under the background of cultural tourism integration is studied.

2 Digital integration of intangible cultural heritage tourism resources

2.1 Integration architecture design

The integration of culture and tourism refers to the phenomenon and process that culture, tourism industry and related elements infiltrate, cross, converge and reorganize each other, gradually break through the original industrial boundary or element field, and blend with each other to form a new symbiosis. Culture and tourism are intrinsically linked. Culture and tourism are inseparable. The organic combination and deep integration of the two are the objective needs of the interaction and mutual prosperity of culture and tourism, and also the inevitable law of the development of culture and tourism.

According to the analysis of the connotation, characteristics, objectives and platform construction significance, objectives and principles of the digital integration of intangible cultural heritage tourism resources based on big data technology in the context of cultural tourism integration, the essence of digital integration of intangible cultural heritage tourism resources based on big data technology in the context of cultural tourism integration can be understood as the integration of intangible cultural heritage tourism resources and big data applications based on data integration.

The internal emphasis on the sharing of the big data resources of intangible cultural heritage tourism resources [12] and the external emphasis on the opening of the big data resources of intangible cultural heritage tourism resources are ultimately aimed at mining and analyzing the value of the big data resources of intangible cultural heritage tourism resources in the context of cultural and tourism integration for the business operation and service development of intangible cultural heritage tourism resources in the context of cultural and tourism integration. Therefore, from the perspectives of data integration, data management and data application of intangible cultural heritage tourism resource, the paper analyzes the functions that digital integration of intangible cultural heritage tourism resources based on big data technology should have under the background of cultural tourism integration, as shown in Table 1.

Table 1 Functional analysis of intangible cultural heritage tourism resources digital integration platform based on big data technology in the context of cultural tourism integration

Starting point	Functional support
	Support the construction of a centralized intangible cultural heritage tourism resource data center with multiple centers and levels
Intangible Cultural Heritage Tourism Resources Data Integration	Support distributed storage and flexible expansion of intangible cultural heritage tourism resources
	Parallel processing architecture supporting massive intangible cultural heritage tourism resource data
	Support the integration of heterogeneous intangible cultural heritage tourism resource data in different places
	Support the processing and integration of structured, semi-structured and unstructured intangible cultural heritage tourism resource data
Intangible Cultural Heritage Tourism Resources Data Management	Support mainstream domestic database media
	Support the standardized management of intangible cultural heritage tourism resources based on metadata
	Support the data quality management of intangible cultural heritage tourism resources
	Support the data security management of intangible cultural heritage tourism resources
	Support the sharing and opening of intangible cultural heritage tourism resource data
	Support the call and exchange of intangible cultural heritage tourism resource data
	Support basic operations such as query, retrieval and summary of intangible cultural heritage tourism resources data
Application of Intangible Cultural Heritage Tourism Resources Data	Support the association analysis, multidimensional analysis and data mining of intangible cultural heritage tourism resource data
	Support the construction of business model and comprehensive prediction model of intangible cultural heritage tourism resources
	Support the visualization of the analysis results of intangible cultural heritage tourism resources
	Mobile terminal display supporting the analysis results of intangible cultural heritage tourism resources

Based on the functional analysis of the digital integration of intangible cultural heritage tourism resources based on functional analysis is based on big data, combined with big data processing process and the essential characteristics of digital integration, the complete system architecture of the digital integration platform of intangible cultural heritage tourism resources based on big data technology in the context of cultural tourism integration is divided into the four parts of big data acquisition, storage, processing and application of intangible cultural heritage tourism resources, and the standardization and security management mechanism of the big data of intangible cultural heritage tourism resources are integrated into the construction of the whole digital integration platform of intangible cultural heritage tourism resources. The specific system architecture is shown in Figure 1.

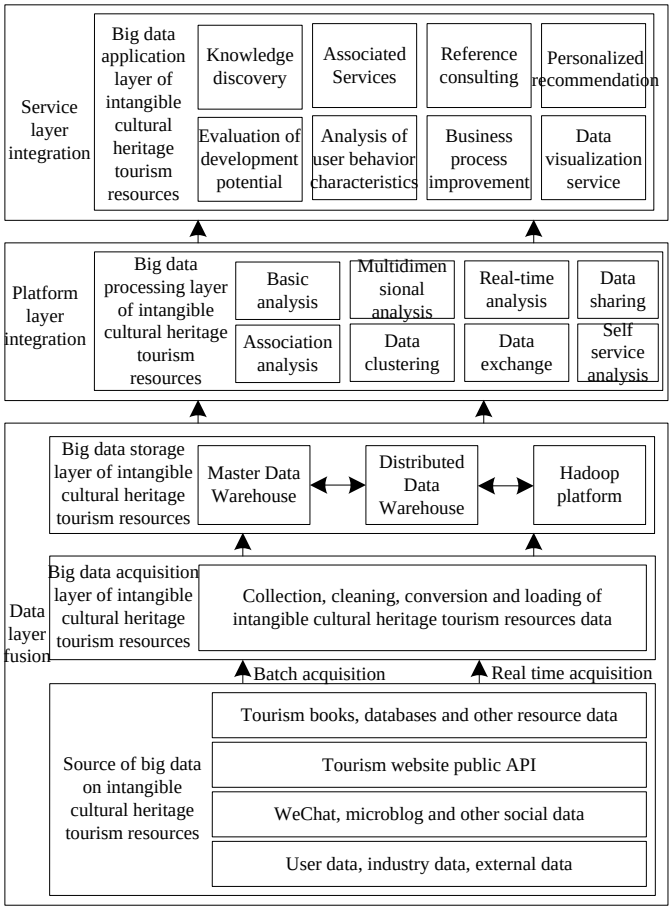


Figure 1 Digital integration platform architecture of intangible cultural heritage tourism resources based on big data technology in the context of cultural tourism integration

The whole platform realizes data integration in the big data acquisition and storage of intangible cultural heritage tourism

resources, platform integration in the processing of intangible cultural heritage tourism resources, and service integration in the application of intangible cultural heritage tourism resources.

In the context of cultural tourism integration, the digital integration platform of intangible cultural heritage tourism resources based on big data technology realizes the digital integration of intangible cultural heritage tourism resources from three aspects: data layer integration, platform layer integration and service layer integration.

In the context of cultural and tourism integration, data layer integration refers to the integration on the original source data of the collected big data of intangible cultural heritage tourism resources. It mainly solves the problems of scattered distribution, heterogeneous and centralized access of intangible cultural heritage tourism resources. Data openness and information disclosure are the basis of digital integration of intangible cultural heritage tourism resources. Users can conduct some simple queries and processing on the basis of data integration of intangible cultural heritage tourism resources. The major sources of the big data of intangible cultural heritage tourism resources are the data related to scenic spot reviews and travel notes, regional cultural resource books, social data such as WeChat microblog, tourism website public API data and relevant external data. Therefore, tourism websites, users, governments and relevant management institutions are the main owners of data resources of intangible cultural heritage tourism resource. Whether the data is open or not is easily affected by the adverse data applications such as user privacy disclosure, intellectual property protection, and data abuse. How to balance the benefit distribution of the owners of intangible cultural heritage tourism resources data, protect user privacy, abide by intellectual property laws and regulations, and ensure that intangible cultural heritage tourism resources data is not illegally used are the key problems to be solved in the digital integration process of intangible cultural heritage tourism resources. In the context of cultural and tourism integration, on the basis of considering big data technology, the data and information disclosure of intangible cultural heritage tourism resources are the mainstream, and relevant departments should formulate laws, regulations and policies to ensure

implementation. In addition, in the process of digital integration of intangible cultural heritage tourism resources, its main characteristics are the large scale and high concurrency of intangible cultural heritage tourism resources data. To achieve digital integration of intangible cultural heritage tourism resources, it is also necessary to establish a multi-center and multi-level centralized data platform to store "multi-source" data generated by individuals of different types of intangible cultural heritage tourism destinations in different regions, different business departments and users with different characteristics. All relevant data of intangible cultural heritage tourism resource are connected through metadata.

In the context of integration of culture and tourism, perfect infrastructure and big data processing technology are the basis for the use of big data of intangible cultural heritage tourism resources. The key to the final realization of digital integration of intangible cultural heritage tourism resources is to solve technical problems. Platform level integration refers to integrating multiple technologies into a unified platform by building an integrated platform or cloud platform to achieve interoperability with multiple technologies and data formats. The characteristics of big data of intangible cultural heritage tourism resources, such as wide sources, large scale, complex types and many unstructured data, make the existing digital resource integration platform face great challenges in data collection, data organization, data processing, data storage, data sharing, data integration, data security, data transmission, data mining, data analysis and utilization, etc. In the context of integration of culture and tourism, the digital integration of intangible cultural heritage tourism resources based on big data technology needs to use the latest data collection technology, data integration technology, distributed data storage technology, cloud computing technology, database technology, distributed file system, data mining technology, data visualization technology [13], knowledge discovery and other technologies to build a digital integration platform of intangible cultural heritage tourism resources with complete structure and functions, and transform the big data of intangible cultural heritage tourism resources with complex structure into a unified and easy to process data standard

and data structure of intangible cultural heritage tourism resources, so as to realize the interoperability of multiple formats of intangible cultural heritage tourism resources data and multiple technologies, and achieve the goal of sharing and fully utilizing the big data of intangible cultural heritage tourism resources.

In the context of integration of culture and tourism, the ultimate goal of digital integration of intangible cultural heritage tourism resources based on big data technology is to fully develop and utilize the big data of intangible cultural heritage tourism resources, provide decision-making support for the construction of intangible cultural heritage tourism destinations, and provide users with comprehensive quality services. Service level integration refers to the integration of service content, form and function through dynamic optimization of service elements and construction of integrated service system on the basis of data integration and platform integration of intangible cultural heritage tourism resource. Data mining and data analysis based on big data technology is the core of big data services for intangible cultural heritage tourism resources. The processing, analysis and mining of large-scale intangible cultural heritage tourism resources data has become the main direction of intangible cultural heritage tourism business. The expansion of service content, the transformation of service strategies, and the improvement of service quality of intangible cultural heritage tourism will rely more on the rules and values found in large-scale intangible cultural heritage tourism resource data. The more rules found, the greater the value is, and the faster the service level of intangible cultural heritage tourism will be improved. With the support of a large number of data analysis for intangible cultural heritage tourism resources, the services for users are more accurate and personalized. Based on a large number of intangible cultural heritage tourism resources data, supported by the digital integration platform of intangible cultural heritage tourism resources, providing users with personalized services, data association analysis, knowledge discovery, data mining, data visualization and other services is the specific form of digital integration services for intangible cultural heritage tourism resources.

2.2 Data integration of intangible cultural heritage tourism resources based on big data technology

In the context of cultural tourism integration, the federal learning algorithm in big data technology is used to achieve the integration of multi-source heterogeneous data of intangible cultural heritage tourism resource in the data integration process of intangible cultural heritage tourism resource. Federated learning is a distributed learning framework [14], in which the original data is collected and stored on multiple edge nodes, model training is performed at the nodes, and then the model is gradually optimized through the interaction between the nodes and the cloud server. Federated learning can use local data from multiple independent edge nodes to jointly train a generalized sharing model, and use model transmission instead of data transmission to avoid the risk of user privacy disclosure.

The multi-source heterogeneous data integration algorithm of intangible cultural heritage tourism resource based on federated learning mainly consists of three parts: feature extraction module, feature integration module and feature decision-making module, as shown in Figure 2.

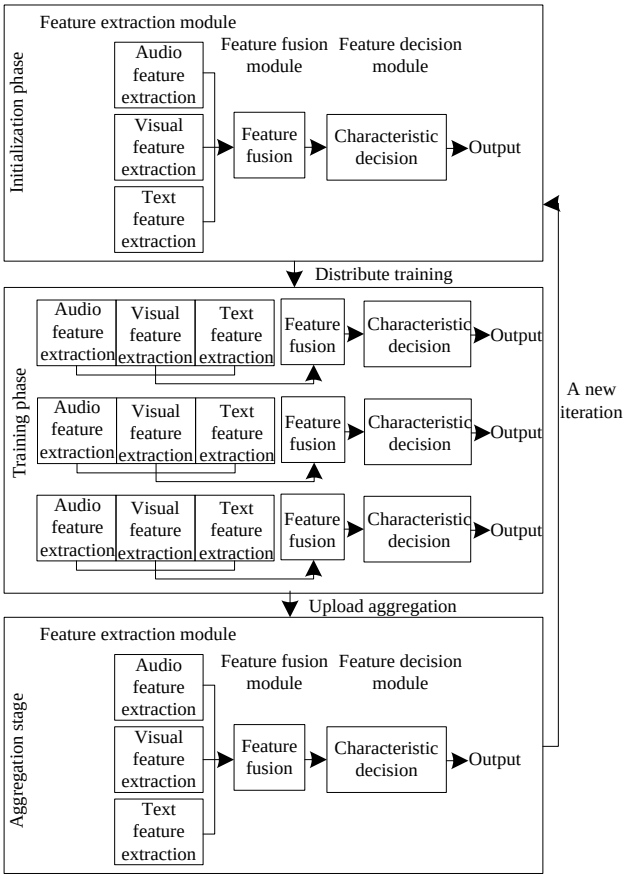


Figure 2 Intangible Cultural Heritage Tourism Resource Data Integration Based on Federated Learning Algorithm

Among them, the feature extraction part is composed of sub networks of feature extraction corresponding to various heterogeneous data of intangible cultural heritage tourism resource.

In the initialization stage, the network parameters of the feature extraction module, feature integration module and feature decision module in the data integration algorithm of intangible cultural heritage tourism resources are randomly initialized, and the initialized modules are distributed to the edge nodes (i.e. the data source of intangible cultural heritage tourism resources).

In the training stage, the edge node selects the corresponding feature extraction module according to the dataset structure of the intangible cultural heritage tourism resource in the local data source of intangible cultural heritage tourism resource, and uses the local dataset of intangible cultural heritage tourism resource to train the feature extraction module, feature integration module and feature decision-making module. The end condition of the new round of training for edge nodes is that the number of training rounds of the local data source of intangible cultural heritage tourism resource node exceeds the given number of training rounds. After the training, the different modules that have been trained will be aggregated.

In the aggregation stage, the average aggregation algorithm is used for the feature integration module and the feature decision-making module. For the feature extraction module, the average aggregation is carried out according to the corresponding feature extraction sub module obtained to ensure the similarity of the features extracted from the intangible cultural heritage tourism resources data of the same mode. Finally, the updated modules are redistributed to the edge nodes for a new round of training.

The specific process of data integration of intangible cultural heritage tourism resource based on federal learning is as follows.

Suppose there are N edge nodes $\{E_1, E_2, \cdots, E_N\}$ participating in the training, and all edge nodes collect M types of intangible cultural heritage tourism resource data with heterogeneous (text structure, video structure and audio structure) characteristics.

In the initialization stage, according to the M collected heterogeneous data of intangible cultural heritage tourism resource, the corresponding feature extraction module F, feature integration module R, and feature decision module B are designed. Then the

data sharing model of intangible cultural heritage tourism resource G can be expressed as:

$$G=\langle F, R, B\rangle \quad (1)$$

Where, $\langle\cdot\rangle$ represents the model splicing operation. Specifically, in the feature extraction module F, the corresponding sub network F of feature extraction is designed for M heterogeneous data of intangible cultural heritage tourism resource, which can be expressed as:

$$F=\langle F_1, F_2, \cdots, F_M\rangle \quad (2)$$

Wherein, F_i represents the feature extraction sub network of the i-th heterogeneous data of intangible cultural heritage tourism resource.

In the feature integration module R, a memory cell W with spatial dimension characteristics of heterogeneous intangible cultural heritage tourism resources data is constructed. After training, the parameters of the tensor expanded along the i-th module can reflect the spatial dimension characteristics of the i-th heterogeneous data of intangible cultural heritage tourism resource. In feature decision module B, through training on the data characteristics of heterogeneous intangible cultural heritage tourism resource after integration, the potential links between heterogeneous intangible cultural heritage tourism resource data are further explored [15] to improve the model's feature expression on multi-source heterogeneous intangible cultural heritage tourism resource data.

Formula (3) is used to represent the integration tensor z_a containing three features: audio structure feature z_v, video structure feature z_t and text structure feature Z:

$$Z=\left(\left(W\times z_a\right)\times z_v\right)\times z_t \quad (3)$$

It can be seen from formula (3) that the size of integrated tensor Z is consistent with the size of memory unit W. Therefore, when the factor matrix satisfies the square matrix constraint, there is an identity relationship between the core tensor and the original tensor in spatial

dimensions. Using this feature, in the initialization phase, it can further set the overall situation and define the feature map of the feature extraction sub network F_i , so as to solve the problem of heterogeneous data integration of intangible cultural heritage tourism resource caused by the uncertainty of heterogeneous data of intangible cultural heritage tourism resource in edge computing.

In the model training stage, the N edge nodes participating in the training adaptively select the corresponding feature extraction sub network F_i for training according to their heterogeneous data type of intangible cultural heritage tourism resource $z=\{z_1,z_2,\cdots,z_k\}k\le M$. In the feature integration module, since the feature map of feature extraction sub network F_i is set as $f_i\in\zeta^{R_i\times R_i}$ in the global initialization definition stage, where ζ represents heterogeneous data set of intangible cultural heritage tourism resource, the tensor size after heterogeneous data integration of intangible cultural heritage tourism resource is constrained to a fixed value $Z\in\zeta^{R_1\times R_2\times\cdots\times R_M}$, which further solves the problem of self-adaptability of multi-source heterogeneous data integration of intangible cultural heritage tourism resource.

2.3 Integration of intangible cultural heritage tourism resources platform based on big data technology

In the context of cultural tourism integration, in the integration process of intangible cultural heritage tourism resources platform, based on multi-source heterogeneous data integration results of intangible cultural heritage tourism resources, it refers to the use of data collection technology, data integration technology, distributed data storage technology, cloud computing technology, data clustering technology, data visualization technology, knowledge discovery and other technologies to build a digital integration platform with complete structure and fully functional for intangible cultural heritage tourism resources [16].

Based on the principle of "birds of a feather flock together" [17], data clustering technology groups the data objects of intangible cultural heritage tourism resource into multiple classes or clusters, so

that there is a high degree of similarity between data objects of intangible cultural heritage tourism resource in the same cluster, while there is a high degree of difference between objects in different clusters. Aiming at the problems of commonly used k-clustering algorithm, such as the need to determine the number of clusters in advance, the difficulty in selecting effective initial clustering center, and the sensitivity to "noise" and isolated point data [18], a k-clustering algorithm based on density and object direction is proposed, referred to as KADD algorithm. The algorithm includes four basic steps:

(1) Calculate the dissimilarity between objects to form the dissimilarity matrix M ;

(2) Calculate the density of clustering objects, select the object with the highest density as the initial clustering center [19], form a cluster of all clustering objects in its field, and then delete these points in the dataset;

(3) Repeat (2) until there are K clusters;

(4) For the remaining objects in the data set, if the minimum distance between it and other objects is less than the radius E , appropriate clusters are assigned according to the direction of the object. Otherwise, it is considered as "noise" or isolated point data.

Taking the interval scale variable as an example, it can calculate the Euclidean distance between object $x=\left(x_1,x_2,\cdots,x_n\right)$ and object $y=\left(y_1,y_2,\cdots,y_n\right)$ using formula (4):

$$d\left(x,y\right)=\sqrt{\left|x_1+y_1\right|^2+\left|x_2+y_2\right|^2+\cdots+\left|x_n+y_n\right|^2} \quad (4)$$

Suppose that the dataset V of intangible cultural heritage tourism resource has n objects, it can cluster them into class k, the density parameter is σ , the domain radius is E , and ψ is the adjustment coefficient of the radius.

The data clustering process of intangible cultural heritage tourism resources based on KADD algorithm is described as follows:

(1) In V , calculate the dissimilarity $d\left(X,Y\right)$ between any two objects of intangible cultural heritage tourism resources to form the dissimilarity matrix M ;

(2) Determine the size of neighborhood radius according to the photographic degree matrix M : $E = \frac{mean(M)}{n^{\psi}}$;

(3) Calculate the density of the intangible cultural heritage tourism resource object in V, find the intangible cultural heritage tourism resource object O_t with the largest density, use it as the initial cluster center to form cluster $V_t\left(1 \le t \le k\right)$, and delete this object from V;

(4) In V, according to M, find the intangible cultural heritage tourism resource objects in domain ξ of O_t, add them to cluster V_t, and delete them from V;

(5) Repeat step (4) until there is no intangible cultural heritage tourism resource object in the field of O_t in V;

(6) Calculate the density of objects in V, find O_t as the initial cluster center, form a cluster $V_t\left(1 \le t \le k\right)$, delete the intangible cultural heritage tourism resource object from V, and return to step (4);

(7) If V is not empty, then the intangible cultural heritage tourism resource object in V will be added to the appropriate cluster according to the direction definition of the intangible cultural heritage tourism resource object, otherwise it will be regarded as an isolated point.

2.4 Service integration of intangible cultural heritage tourism resources based on big data technology

Under the background of integration of culture and tourism, in the integration of service layer of intangible cultural heritage tourism resources, we should fully develop and use the big data of intangible cultural heritage tourism resources, provide decision-making support for the construction of intangible cultural heritage tourism sites [20], and provide users with comprehensive quality services. According to the clustered data of intangible cultural heritage tourism resources, the evaluation of the tourism utilization potential of intangible cultural heritage resources can analyze the

differences in the development potential and impact factors of intangible cultural heritage tourism resources. Based on the analysis results, the main measures to optimize the development of regional intangible cultural heritage tourism can be proposed, which can provide some reference for the development of intangible cultural heritage tourism in other regions.

The Resource-Market-Product (RMP) theory is selected as the research basis to evaluate the potential of intangible cultural heritage resources in different micro spatial units to transform tourism products. According to the theory of Resource-Market-Product, tourism resources (R) can be divided into core resources and peripheral resources. In the process of transforming tourism resources into tourism products (P), due to the differences in the quality and attributes of core resources, the transformation of resources into products can be roughly divided into three types: R-P symbiotic type, R-P promotion type, and R-P concomitant type.

As intangible cultural heritage resources belong to intangible culture, the tourism development of intangible cultural heritage resources needs tangible carriers, so the transformation of their resource products belongs to the R-P concomitant type. At the same time, due to the inheritance of intangible cultural heritage, small scale, decentralized distribution, high cost of resource cultivation and regeneration time, difficult to determine property rights, high investment and uncertain returns, the relationship between intangible cultural heritage culture and intangible cultural heritage tourism also belongs to the R-P promotion type. From the perspective of R-P relationship, measuring the tourism utilization potential of regional intangible cultural heritage resources can be roughly divided into three levels from the inside to the outside: the first level is the core attraction in R, that is, the degree of enrichment of regional intangible cultural heritage resources; The second layer is the space carrier that intangible cultural heritage resources rely on; The third layer is R's peripheral resources, namely the investment potential of intangible cultural heritage resources. Based on this, the construction results of the utilization potential evaluation index system for regional intangible cultural heritage tourism are shown in Table 2.

Table 2 Evaluation Index System of Intangible Cultural Heritage Tourism Resources Development Potential

Target layer	Level I indicators	Secondary indicators
Utilization potential of intangible cultural heritage tourism resources	Enrichment of Intangible Cultural Heritage Resources	Quantity of Intangible Cultural Heritage
		Intangible Cultural Heritage Diversity
		Advantages of Intangible Cultural Heritage
		Advantages of intangible cultural heritage categories
	Intangible Cultural Heritage Resource Carrier	Number of traditional settlements
		Advantages of humanistic scenic spots
		Advantages of natural scenic spots
		Urban Relations in Intangible Cultural Heritage Gathering Areas
	Investment potential of intangible cultural heritage resources	Investment capacity
		Tourism service level
		Traffic conditions

Based on the evaluation index system of the development potential of intangible cultural heritage tourism resources as shown in Table 2, the AHP is used to calculate the index weight, obtain the evaluation value of the development potential of intangible cultural heritage tourism resources, and complete the evaluation of the development potential of intangible cultural heritage tourism resources in the context of cultural tourism integration according to the corresponding grade of the evaluation value.

3 Experimental results

In order to verify the application method of big data technology in the digital integration of intangible cultural heritage tourism resources in the context of cultural and tourism integration studied in this paper, taking a province as the research object, the method in this paper is used to collect the intangible cultural heritage tourism resources information in different aspects of art, music, etc. of the research object, generate several data sets of intangible cultural heritage tourism resources, and conduct digital integration. The results are as follows.

As the main area where the northern minorities gather and the birthplace of the Qing Dynasty culture, the research object has

profound cultural heritage, strong regional characteristics and rich, colorful and colorful multi-ethnic culture. It has a large number of intangible cultural heritage projects in traditional art, traditional dance, traditional drama, traditional folk art, traditional skills, traditional music, traditional medicine, folk customs, folk reference and other different methods. This makes its intangible cultural heritage resources have unique advantages compared with other regions in terms of quantity, variety, content richness, regional distribution and characteristics, which lays a good resource foundation for the tourism development of intangible cultural heritage.

3.1 Analysis of data layer integration effect

3.1.1 Data feature extraction test

Calculating the similarity of intangible cultural heritage tourism resource information is the premise of extracting its features. Taking 200 intangible cultural heritage tourism resources as an example, the paper uses the method in this paper to extract the similarity of the 200 intangible cultural heritage tourism resources, and takes the JACCARD index as the indicator to measure the similarity of intangible cultural heritage tourism resource information. The results are shown in Figure 3.

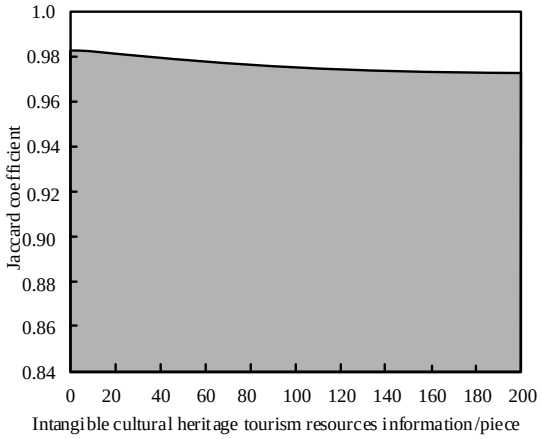


Figure 3 Similarity Test Results of Intangible Cultural Heritage Tourism Resource Information

It can be seen from the analysis of Figure 3 that the more the information on intangible cultural heritage tourism resources is, the lower the value of the Jackard coefficient when extracting the information characteristics of intangible cultural heritage tourism resources in this method is. However, when the number of intangible

cultural heritage tourism resource information is more than 120, the JACARD coefficient value of the proposed method when extracting the features of intangible cultural heritage tourism resource information decreases significantly. When the number of intangible cultural heritage tourism resources exceeds 120, the JACARD coefficient value of this method when extracting the features of intangible cultural heritage tourism resource information shows a relatively gentle downward trend. When the number of intangible cultural heritage tourism resources is 200, the Jackard coefficient value of this method when extracting the information characteristics of intangible cultural heritage tourism resources is about 0.98. The numerical results show that this method can accurately extract the information features of intangible cultural heritage tourism resources and provide a good basis for information integration of intangible cultural heritage tourism resources.

3.1.2 Analysis of integration effect

The data correlation is used to measure the data integration effect of intangible cultural heritage tourism resources in the proposed method. The data correlation represents the correlation degree between the data after the data integration of intangible cultural heritage tourism resources. The higher the value is, the stronger the correlation of the integrated intangible cultural heritage tourism resources data is, the better the integration effect is. The minimum data correlation should be controlled above 0.90. Audio data, video data and text data of intangible cultural heritage tourism resource are taken as examples to analyze the data correlation of the proposed method when integrating different dimensions of intangible cultural heritage tourism resource data. The analysis results are shown in Figure 4.

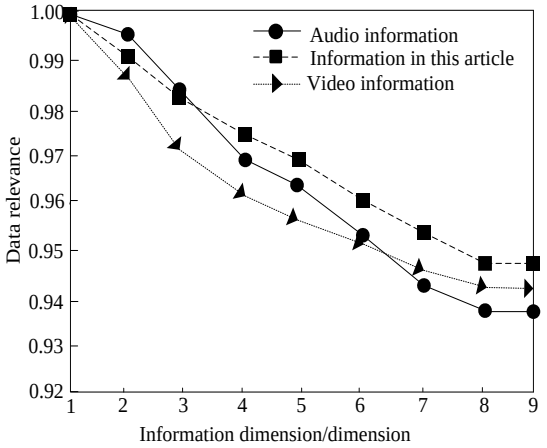
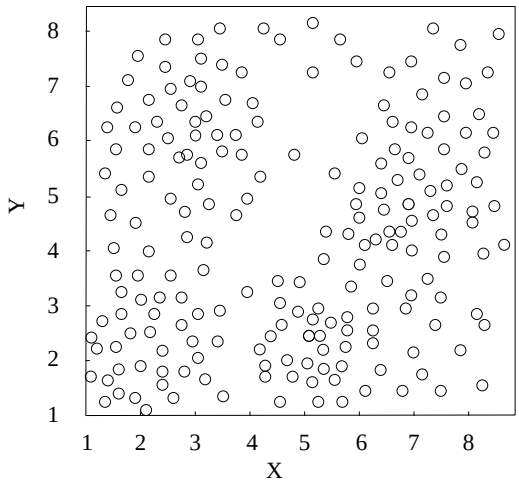


Figure 4 Intangible Cultural Heritage Tourism Resources Data Integration Effect

As shown in Figure 4, with the increase of data dimensions, the data correlation of the three types of intangible cultural heritage tourism resource data integrated by the method in this paper shows a downward trend. When the data dimension is 8 dimensions, the data correlation of the three types of intangible cultural heritage tourism resource data integrated by the method in this paper tends to be stable. The lowest data correlation of the integrated text data is about 0.948, the lowest data correlation of the integrated video data is about 0.945, and the minimum data correlation of the integrated audio data is about 0.943, which exceeds the minimum data correlation setting value. The experiment shows that this method can effectively integrate intangible cultural heritage tourism resource data in different data dimensions, and the data after integration has strong correlation and better integration effect.

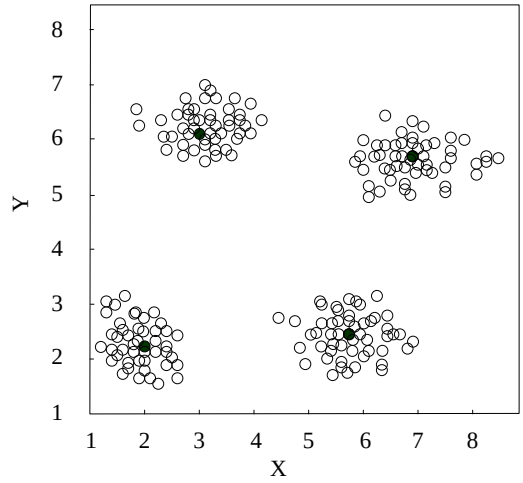
3.2 Data clustering results

In platform level integration, cluster algorithm is used to cluster the data of intangible cultural heritage tourism resource after data integration. Assuming that several data points of intangible cultural heritage tourism resource are randomly distributed, as shown in Figure 5 (a), where noise points account for 8% of the data. The number of clusters in the method of this paper is set to be 4, radius adjustment coefficient and density parameter to be 0.15 and 0.5 respectively. The clustering results of intangible cultural heritage tourism resource data using the method in this paper are shown in Figure 5 (b).



(a) Distribution of Intangible Cultural Heritage Tourism Resource Data

Points in Two Dimensional Space



(b)Clustering results

Figure 5 Clustering Results of Intangible Cultural Heritage Tourism Resources Data in this Method

It can be seen from the analysis of Figure 5 that the method in this paper determines the four lower NG pairs with the largest density according to the density definition, and then determines the radius by the calculation formula of neighborhood radius, thus obtaining the clustering result. The experimental results show that this method can better deal with arbitrary shaped data sets of intangible cultural heritage tourism resources, and also better shield the impact of noise and outlier data, which accurately reflects the spatial set characteristics of the original intangible cultural heritage tourism resource data. It has a positive impact on improving the application efficiency of intangible cultural heritage tourism resource data.

3.3 Evaluation results of the development potential of intangible cultural heritage tourism resources

The development potential of intangible cultural heritage tourism resources is evaluated in the service level integration, and the evaluation results are shown in Figure 6.

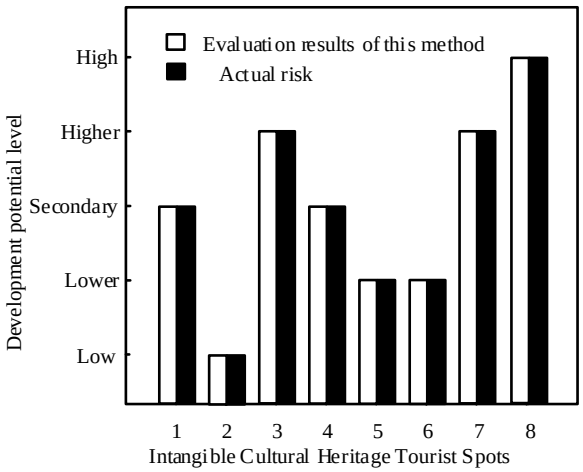


Figure 6 Results of risk level evaluation

It can be seen from the analysis of Figure 6 that the evaluation results of the development potential of the intangible cultural heritage tourism resources of the research object can be effectively obtained by using the method in this paper, and the evaluation results are completely consistent with the actual development potential of the intangible cultural heritage tourism resources of the research object, which shows that this method can accurately evaluate the development potential of the intangible cultural heritage tourism resources of the research object.

3.4 Analysis of actual application effect

In order to test the practical application effect of the method in this paper, the tourist flows of different months in the past five years of the research object are obtained. Based on its average value, the tourist flows of the same month in the next year after using the method in this paper are compared. The results are shown in Figure 7.

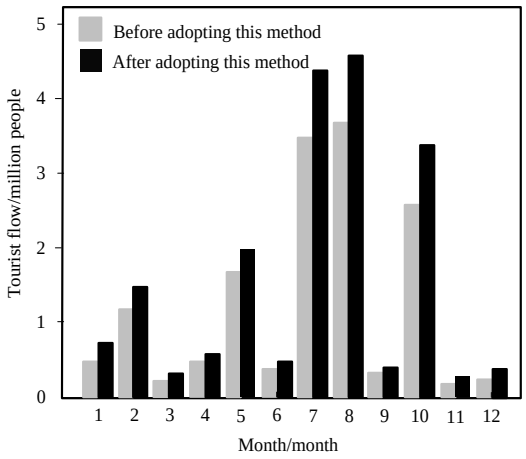


Figure 7 Comparison of tourist flow

It can be seen from Figure 7 that February, May, July, August and October are the peak periods of tourism. Before using the method in this paper, the tourist flow volume of the research object is between 1.2 million and 3.8 million people in the peak period of tourism every year, while the transaction success rate in the off peak period does not exceed 500000 people. After adopting the method of this paper, the tourist flow of the research object in the off peak period shows a small increase trend, and the increase range is about 50000 to 200000 people; At the peak of tourism, the tourist flow of the research object shows a significant upward trend, with an increase range of about 300000 to 1 million people. This shows that the method in this paper can significantly improve the tourist flow of the research object, so that it can obtain greater economic benefits, and has a good practical application effect.

4 Conclusion

Big data is the focus of domestic and international industry and academia in recent years. Big data is characterized by large scale, complex and diverse types, high value density and fast processing speed. This paper studies the application of big data technology in the digital integration of intangible cultural heritage tourism resources in the context of cultural tourism integration. In the research process of this paper, we have referred to a large number of books and references, periodicals and online references, and also paid attention to the practical research progress in many aspects such as big data processing, big data mining, and big data application of intangible cultural heritage tourism resources in real time. However, because big data is an extremely complex new technology, coupled with the lack of our own knowledge structure, we have not learned enough about computer technology, there are still many shortcomings: (1) there is no analysis on the feasibility of the construction of the digital integration platform of intangible cultural heritage tourism resources in the big data era, such as conducting some field surveys and questionnaires to understand whether the construction of the digital integration platform of intangible cultural heritage tourism resources is feasible; (2) This paper focuses on theoretical discussion and logical discussion, but does not combine theory and practice well to make an empirical analysis on the construction of the digital integration platform of intangible cultural heritage tourism resources; (3) The key technologies

of big data storage, processing and application are not understood enough, so that the content is not specific and in-depth enough when building the architecture of the digital integration platform for intangible cultural heritage tourism resources. In the follow-up research process, in-depth research will be mainly conducted on the above issues.

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