Research on Rural Tourism Feature Segmentation Method Based on Hierarchical Cluster Analysis

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Abstract: The feature division method plays an important role in rural tourism, but there is the problem of inaccurate division and positioning. The traditional deep learning algorithm cannot solve the problem of dividing characteristics in rural tourism, and the effect is not satisfactory. With the continuous development of modern tourism, people's demand for tourism is gradually diversified and personalized. In particular, rural tourism, with its unique natural scenery, traditional culture and pastoral life experience, has become the first choice for more and more urban residents for leisure and vacation. However, due to the diversity and complexity of resources in rural areas, how to scientifically and effectively develop and manage tourism resources and enhance the attractiveness and competitiveness of rural tourism has become the focus of attention in the industry. In this context, hierarchical cluster analysis, as an effective data mining technique, provides a new perspective and method for the characteristic division of rural tourism..

1 INTRODUCTION

The so-called hierarchical clustering analysis refers to the construction of a hierarchical structure of data to gather objects with high similarity together to form different categories or groups (Liu and Ai, et al. 2022). This method does not rely on pre-set classification criteria, and can reveal the internal structure and laws of the data based on its own characteristics (Zhang and He, et al. 2022). In the classification of rural tourism characteristics, hierarchical cluster analysis can help us identify the types of tourism resources in different rural areas, so as to formulate more accurate and efficient development strategies (Zheng, 2022).

2 RELATED CONCEPTS

2.1 Mathematical Description of Hierarchical Clustering Analysis

First of all, through the detailed investigation and data collection of rural tourism resources, including natural landscapes, cultural heritage, folk activities, characteristic industries and other dimensions (Ding, and Zhou, et al. 2022), we can build a comprehensive database of rural tourism resources.

$$\lim_{x\to\infty}(y_i \cdot t_{ij}) = \frac{n!}{r!(n-r)!} y_{ij} \geq \max(t_{ij} \div \quad (1)$$

Among them, the judgment of outliers is shown in Equation (2).

$$\max(t_{ij}) = \mathrm{X}(t_{ij}{}^2 + 2 \cdot t_{ij}) \succ mean(\sum t_{ij} + 4)\mathrm{M} \quad (2)$$

Next, the hierarchical clustering analysis is used to process these data to find which resources have strong correlations with each other and which are relatively independent (Chen and Sun, et al. 2023). The results of this analysis help us to identify the characteristic resources of each rural area, and then determine the direction and focus of its tourism development (Sun and Wang, et al. 2023).

For example, for those rural areas that are dominated by natural scenery, we can discover the distribution and characteristics of their main natural attractions through cluster analysis, and then build ecotourism products around these core resources (JI and PEI, 2022). For villages rich in cultural and historical resources, their unique historical and cultural context can be discovered through clustering,

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and cultural tourism projects can be carried out accordingly.

$$F(d_i) = \sqrt{b^2 - 4ac} \sum t_i \bigcap \xi \cdot \sqrt{2} \to \iint y \tag{3}$$

2.2 Selection of Feature Division Method Scheme

For villages featuring agriculture and handicrafts, cluster analysis can help us understand the current situation and potential of industrial development, and promote the combined development of industrial tourism (Tang and Sha, 2022).

$$g(t_i) = \ddot{x} \cdot z_i \prod F(d_i) \frac{dy}{dx} - w_i \tag{4}$$

In addition, hierarchical cluster analysis can also be used for rural tourism market segmentation. Through the analysis of tourists' behavior patterns, consumption habits and other data, tourists can be divided into different groups, such as parent-child families, backpackers, photography enthusiasts, etc.

$$\lim_{x \to \infty} g(t_i) + F(d_i) \le \sqrt{b^2 - 4ac} \max(t_{ij}) \tag{5}$$

And then provide customized tourism services and products according to the characteristics and needs of different groups, so as to improve the satisfaction and loyalty of tourists.

$$\lfloor g(t_i) \rfloor + F(d_i) \leftrightarrow mean(\sum t_{ij} + 4) \tag{6}$$

2.3 Analysis of the Scheme of the Feature Division Method

In conclusion, hierarchical cluster analysis, as a powerful data analysis tool, shows great potential in the classification of rural tourism characteristics. It can not only help us better understand and grasp the diversity of rural tourism resources, but also guide us to carry out more targeted tourism planning and management, and ultimately realize the sustainable development of rural tourism (Dai and Xu, et al. 2022). With the continuous progress of big data technology and artificial intelligence, we have reason to believe that hierarchical cluster analysis will play a more important role in the field of rural tourism and contribute wisdom and strength to the implementation of rural revitalization strategy.

$$No(t_i) = \frac{\lfloor g(t_i) \rfloor + F(d_i)}{mean(\sum t_{ij} + 4)} \bigcap \mathrm{B} \tag{7}$$

Hierarchical clustering is an exploratory data analysis tool that shows the aggregation process between data points in the form of a dendrogram by constructing a multi-level nested cluster structure.

$$Zh(t_i) = \bigcap \ [\sum \lfloor g(t_i) \rfloor + F(d_i)] \tag{8}$$

With the growth of modern tourism consumers' demand for personalized and experiential tourism, rural tourism has become a new choice for more and more tourists with its unique natural scenery, traditional culture and local characteristics. However, in the face of many rural destinations with different characteristics, how to accurately capture and divide their unique characteristics, so as to provide tourists with more accurate travel recommendations? At this time, an effective multivariate statistical analysis method, Hierarchical Cluster Analysis (HCA), shows its important value.

$$accur(t_i) = \frac{\min[\sum \lfloor g(t_i) \rfloor + F(d_i)]}{\sum \lfloor g(t_i) \rfloor + F(d_i)} \times 100\% \tag{9}$$

In rural tourism studies, HCA was able to classify rural destinations with similar characteristics into the same cluster based on a series of key indicators, while those with high dissimilarities remained independently classified. These indicators may include multi-dimensional information such as geographical location, natural environment, cultural background, tourism facilities, activities, local specialties, etc.

$$accur(t_i) = \frac{\min[\sum \lfloor g(t_i) \rfloor + F(d_i)]}{\sum \lfloor g(t_i) \rfloor + F(d_i)} \Gamma \tag{10}$$

For example, if a region is known for its rich intangible cultural heritage, such as traditional crafts or festivals, they may form a cluster with cultural characteristics at its core, or villages may be grouped together because they have similar pastoral landscapes and agricultural experiences, which can help attract tourists who are interested in rural life.

3 OPTIMIZATION STRATEGY OF FEATURE DIVISION METHOD

The application of hierarchical cluster analysis in the study of rural tourism can not only help managers identify the unique selling points and development potential of each rural tourism destination, but also promote the rational planning and integration of regional tourism resources. For example, through the analysis of the data, local governments can carry out targeted brand building and formulate differentiated marketing strategies, so as to improve the competitiveness and attractiveness of rural tourism destinations.

3.1 Introduction to the Feature Division Method

In addition, from the perspective of travelers, the results of hierarchical cluster analysis can be used as a reference for them to choose destinations.

Table 1: Characteristics classification method requirements

Scope of application	Grade	Accuracy	Feature segmentation method
Geographical environment	I	85.00	78.86
	II	81.97	78.45
Cultural heritage	I	83.81	81.31
	II	83.34	78.19
Ecology	I	79.56	81.99
	II	79.10	80.11

The process of the feature division method in Table 1 is shown in Figure 1.

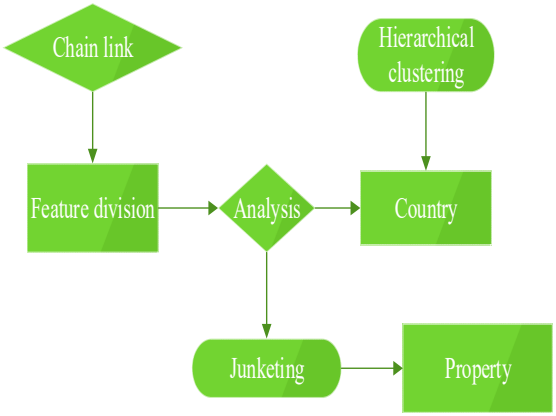

Figure 1: The analysis process of the feature division method

In the fast-paced and stressful living environment of modern society, more and more people are eager to escape the hustle and bustle of the city and seek a place of tranquility and nature. With its unique charm, rural tourism has emerged as the times require, and has become an excellent choice for urbanites to release stress and find spiritual comfort. This article will provide an in-depth analysis of what makes rural tourism unique and how it has become a new trend in modern tourism.

3.2 Characteristics Classification Method

In summary, hierarchical cluster analysis, as a powerful data processing method, has a non-negligible role in interpreting the characteristics of rural tourism. It not only provides decision-making support for tourism managers, but also facilitates the choice of tourists, and promotes the sustainable development and diversification of rural tourism. Therefore, the use of hierarchical cluster analysis to dig deep into the intrinsic value and potential of rural tourism has become an indispensable and important part of today's tourism research and practice. Through this scientific approach, we are able to capture the uniqueness of rural tourism more accurately, and thus contribute to the prosperity of tourism .

Table 2: The overall picture of the scheme of the characterization method

Category	Random data	Reliability	Analysis rate
Geographical environment	85.32	85.90	83.95
Cultural heritage	86.36	82.51	84.29
Ecology	84.16	84.92	83.68
Mean	86.84	84.85	84.40
X6	83.04	86.03	84.32
		P=1.249	

3.3 Feature Division Method and Stability

By understanding the key features and benefits of different clusters, travellers can more quickly identify rural locations that match their travel preferences, whether they are looking for tranquil natural scenery, authentic village life, or historical and cultural traces.\

First of all, the most attractive feature of rural tourism is the authentic and idyllic experience it offers. Compared to traditional tourism, tourists can participate in agricultural activities such as picking

fruits and vegetables, milking cows, and making local delicacies.

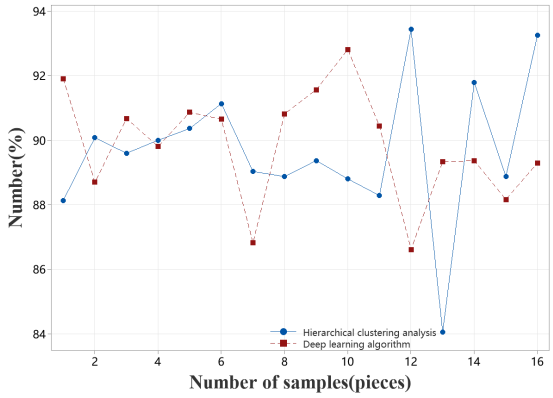

Figure 2: Feature division methods of different algorithms

Table 3: Comparison of the accuracy of the feature division methods of different methods

Algorithm	Survey data	Feature segmentation method	Magnitude of change	Error
Hierarchical clustering	85.33	85.15	82.88	84.95
Deep learning algorithms	85.20	83.41	86.01	85.75
P	87.17	87.62	84.48	86.97

In addition, rural tourism also has strong ecological advantages. Fresh air, pristine water and rich biodiversity in rural areas provide visitors with a natural retreat for wellness. Relaxing in such an environment can effectively relieve the environmental stresses of urban life and have a positive impact on physical health.

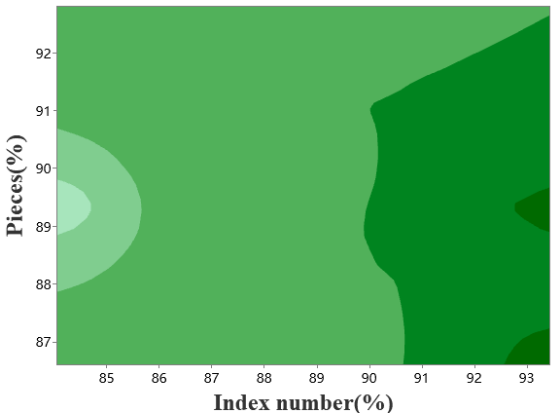

Figure 3: Characterization methods for hierarchical clustering

In addition, many traditional customs and handicrafts are often preserved in rural areas, which are valuable cultural heritage that is hard to find in the process of urbanization. Through rural tourism, visitors have the opportunity to observe and even learn ancient skills such as pottery, weaving, and carpentry up close, which not only enriches their travel experience, but also helps to pass on and preserve these fading traditional skills.

3.4 Rationality of the Feature Division Method

This sense of participation and experientiality is unique to rural tourism, which allows visitors to change from passive sightseeing to active participation, so as to gain a deeper cultural experience and a sense of personal fulfillment.

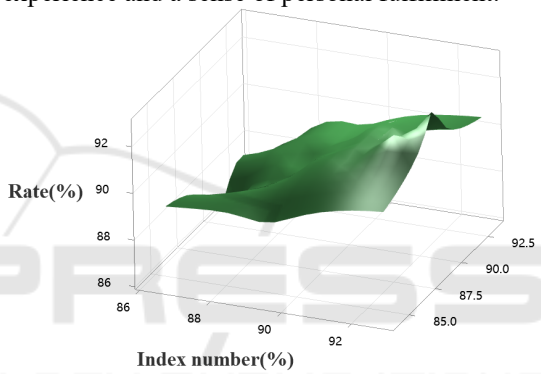

Figure 4: Feature division methods of different algorithms

It is worth mentioning that as the concept of sustainable development is deeply rooted in the hearts of the people, rural tourism plays an important role in promoting local economic development. By encouraging tourists to participate in the local economic life, such as buying farm products and staying in homestays, it not only increases the income of rural households, but also promotes the diversified development of the rural economy.

3.5 The Effectiveness of the Feature Segmentation Method

Finally, the low-density nature of rural tourism is also an attractive factor. Compared to the crowds of popular tourist attractions, rural tourism offers a more private and tranquil way to travel. This spatial freedom and tranquility allows visitors to better enjoy their journey and truly relax physically and mentally.

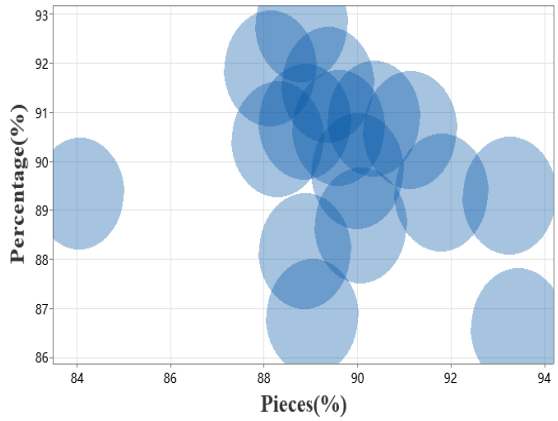

Figure 5: Feature division methods of different algorithms

Undoubtedly, as an important branch of modern tourism, it will continue to be welcomed and sought after by more and more people, and become a green haven for urbanites to return to nature.

Table 4: Comparison of the effectiveness of different methods

Algorithm	Survey data	Feature segmentation method	Magnitude of change	Error
Hierarchical Clustering	82.21	85.92	84.59	82.85
Deep learning algorithms	83.73	84.23	84.41	83.55
P	84.20	87.39	84.76	83.90

It can be seen from Table 4 that the deep learning algorithm has shortcomings in the accuracy of the feature division method, and the feature division method changes greatly, and the error rate is high. The feature division method of the general results of hierarchical clustering analysis is higher than that of deep learning algorithms. At the same time, the feature division method of hierarchical clustering analysis is greater than 90%, and the accuracy does not change significantly. To further verify the superiority of hierarchical clustering. In order to further verify the effectiveness of the proposed method in this paper, the general analysis of hierarchical clustering analysis is performed with different methods, Figure 6 shown.

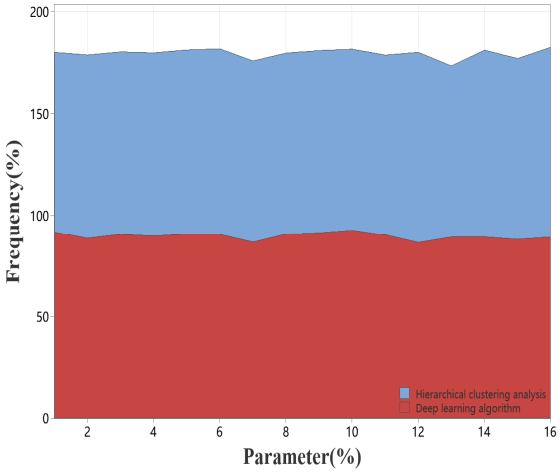

Figure 6: Hierarchical clustering analysis feature division method

It can be seen from Figure 6. that the feature division method of hierarchical cluster analysis is significantly better than the deep learning algorithm, and the reason is that hierarchical cluster analysis increases the adjustment coefficient of feature division method and sets the threshold of Internet information to eliminate the feature division method scheme that does not meet the requirements.

4 CONCLUSIONS

All in all, rural tourism is not just a simple form of tourism, it is a bridge between the city and the countryside, and a dream place for modern people to live in harmony with nature. By providing an authentic rural experience, preserving traditional cultures, promoting ecological sustainability, and supporting local economies, rural tourism has demonstrated its unique and far-reaching appeal.

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