ProbStudy on Factors of Tourism Situation Under COVID-19 Epidemic Situation

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Abstract.COVID-19 has a significant impact on the tourism industry. This paper collects the longitude and latitude information of the national 5A scenic spots and draws the relative distribution map and scatter plot through the particle swarm optimization algorithm. It is concluded that the distribution of 5A scenic spots is related to their geographical location. After that, we use the DESTEP analysis model and PESTEL analysis model to analyze the factors that may affect the evaluation level of scenic spots and the relationship between them. Then the comprehensive scoring formula of the scenic spot is obtained based on the AHP analytic hierarchy process and entropy method. The index system to measure the reception capacity of the scenic spot is constructed, and the variance and standard deviation are tested. Finally, the method of K-Means cluster analysis is used to classify the scenic spots and determine the comprehensive score of the scenic spots in the collected data. The lower the potential risk of the epidemic in the region, the smaller the scope of the scenic area, the lower the potential risk of the epidemic in the region, the smaller the flow, the greater the maximum instantaneous carrying capacity of the scenic spot; take the government as the main body, put forward differential management schemes for scenic spots with different risk levels.

Keywords*:* COVID-19, Tourism, AHP analytic hierarchy process, K-means.

1 INTRODUCTION

The epidemic of pneumonia infected with new coronavirus has had varying degrees of impact on all walks of life. With a particularly severe impact on t the spread of the COVID-19 virus,

ICIDC 2022, June 17-19, Qingdao, People's Republic of China

DOI 10.4108/eai.17-6-2022.2322862

different countries have taken various measures to restrict the movement of population. It leads to a decline in the number of visitors to the scenery. Moreover, this has directly led to a reduction in the sources of economic income and slowed down the national economy's growth rate. Meanwhile, the problem such as the reduction of the labor income of scenic workers. The measures must be taken to weigh the interests of all parties and put forward the scientific tourism. Therefore, measures must be taken to weigh the interests of all parties and put forward the scientific tourism plans under the circumstance of the pandemic. COVID-19 has affected the tourism industry to varying degrees. Effective measures must be taken to tackle the problems.

2 ANALYSIS OF THE FACTORS INFLUENCING THE EVALUATION LEVEL OF SCENIC SPOT

2.1 Data Analysis

We inquired about the evaluation levels and the maximum daily carrying capacity of the eight attractions, based on the approved guidelines for the maximum carrying capacity of scenic spots in the tourism industry standard of the People's Republic of China, and the instantaneous spatial carrying capacity that affects the maximum carrying capacity C_1 and daily carrying capacity C_2 made the following definitions.

Instantaneous space carrying capacity of scenic spots C_1:

$$C_1 = \sum X_i / Y_i \tag{1}$$

X_i--the effective visitable area of the ith site;

Y_i--Tourist unit visit area of the first attraction, i.e., the essential space carrying the standard.

Scenic area daily carrying capacity C_2:

$$C_2 = \sum X_i / Y_i \times Int\left(\frac{T}{t}\right) = C_1 \times Z \tag{2}$$

T -- the effective opening hours of the scenic spot per day;

t -- the average visit time of each tourist in the scenic area;

Z-- the average daily turnover rate of the whole scenic area, i.e., Int (T/t) is the integer part of the value of T/t.

Based on formulas (1) and (2) can be obtained, the evaluation level of the scenic spot generally depends on the environmental quality and service quality of the scenic spot, and the evaluation level generally uses A~5A to divide the evaluation level. The table 1 is shown as follows.

TABLE 1. THE EVALUATION LEVEL OF THE SCENIC SPOT

Scenic Area	Evaluation level	Daily carrying capacity (million)	Daily carrying capacity (million)
Beijing Palace Museum	5A	8	2.3
Beijing Tiantan Park	5A	17.5	5.8
Beijing Gongwangfu Scenic Area	5A	4	1
Beijing Summer Palace	5A	18	8
Beijing Olympic Park	5A	50	21.7
The Thirteen Ming Tombs in Beijing	5A	11.7	5.8
Beijing Badaling-Mutianyu Great Wall Tourist Area	5A	14.3	3.7
Beijing Yuanmingyuan	5A	7	2.2

2.2 Characteristic analysis

Based on the collected data, we used Origin mapping and Matlab's particle swarm algorithm to show the distribution characteristics of these famous scenic spots through raster network relative distribution and distribution scatter plot, and the specific scenic spots relative distribution raster map and scatter plot are as follows in the figure 1:

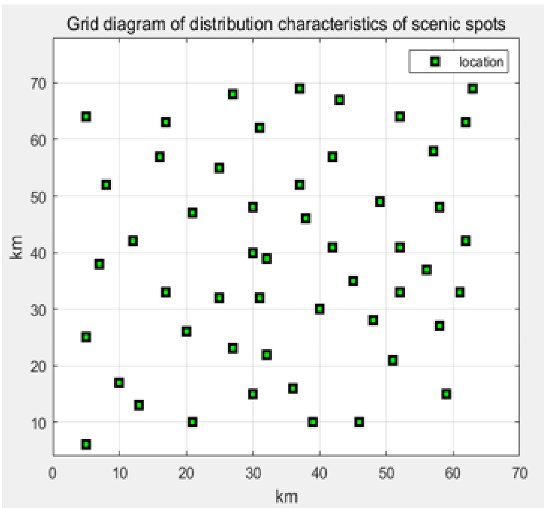

Figure 1. Grid diagram of distribution characteristics of scene spots

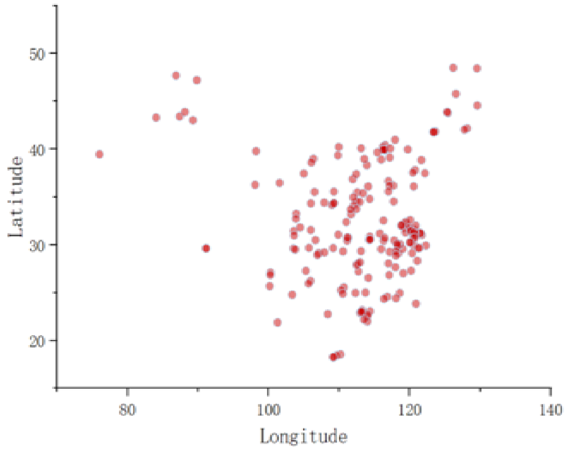

Figure 2. Scatter diagram of scenic spot distribution

From the above image (Figure 2), it can be found that the distribution of 5A scenic spots is related to the geographical location where the scenic spots are located, and the geographical location depends on the latitude and longitude where the area is located. The above analysis can conclude that taking the Heihe—Tengchong geographical divide as the boundary, the distribution of 5A scenic spots in the southeast direction is hotter than the northwest.

In addition, the location of the scenic spot also affects the level of economic development, consumption level, urban population density, geographical advantages, and transportation conditions, which in turn will impact the evaluation level of the scenic spot. The number of guests received and an in-depth analysis of the above factors are conducted to explore their relevance. Based on the DESTEP analysis model and PESTEL analysis model, these two big data models are practical tools applied to analyze the macro environment, not only to analyze the external environment but also to identify all the forces that have an impact on the organization and are a way to investigate the external influences on the organization. The hierarchical correlation is mapped by Mindmaster software, and the image is shown in the figure.3 below:

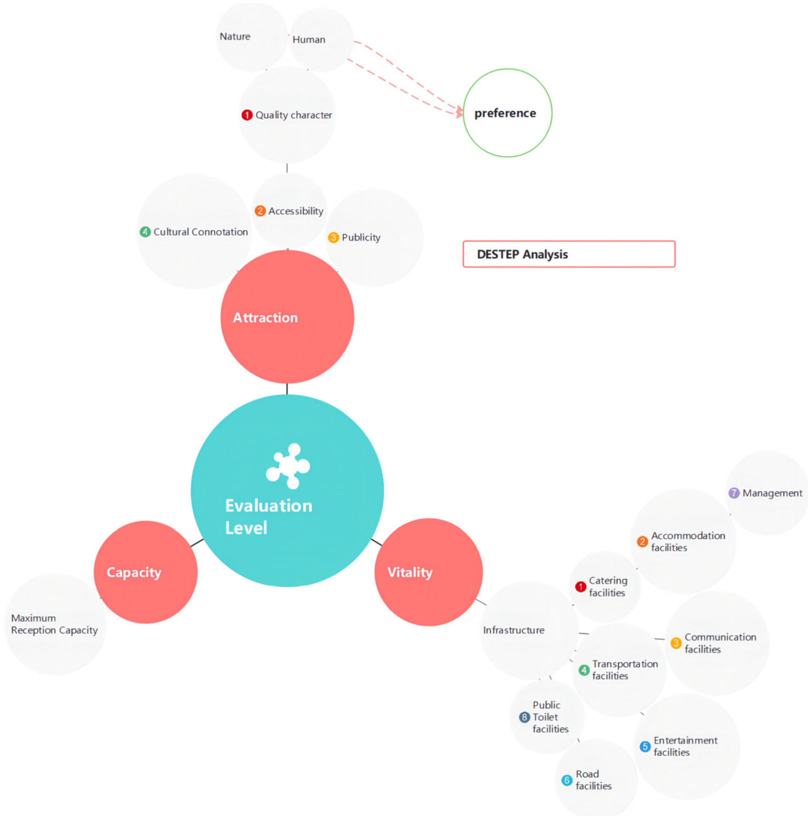

Figure 3. DESTEP Analysis

3 The evaluation system of reception capacity of Scenic spot based on Entropy weight method

The paper used the above evaluation model to construct the index evaluation system of scenic spots and to assess and reasonably classify them quantitatively, and the steps of using the entropy value method to determine the index weights include [7][8].

First, using the comprehensive evaluation method, construct the original index data matrix:

$$X=\{X_{ij}\}_{m\times n} \quad (0\leq i\leq m,\ 0\leq j\leq n) \tag{3}$$

i and j are the horizontal and vertical coordinates of the judgment matrix, respectively, and m and n are 9 of the maximum.

Data normalization: Positive indicators:

$$X = \frac{X - X_{\min}}{X_{\max} - X_{\min}} \tag{4}$$

M-row-n-column matrix composed of all evaluated values X={x11,x12,...,x1j,...,x1n;x21,x22,...,x2j,...,x2n;......;xi1,xi2,...,xij,...xin;......;xm1,xm2,...,xmj,...,xmn},Xmax=max{x11,x12,...,x1j,...,x1n;x21,x22,...,x2j,...,x2n;......;xi1,xi2,...,xij,...xin;......;xm1,xm2,...,xmj,...,xmn},Xmin=min{x11,x12,...,x1j,...,x1n;x21,x22,...,x2j,...,x2n;......;xi1,xi2,...,xij,...xin;......;xm1,xm2,...,xmj,...,xmn}

Negative indicators:

$$X = \frac{X_{\max} - X}{X_{\max} - X_{\min}} \tag{5}$$

$Y = \{y_1, y_2, \cdots, y_n\}$ Y_j is the weight of each evaluation index. Calculate the composite score for each year.

$$Z = \sum_{i=1}^{n} X_{ij} Y_j \tag{6}$$

i and j are the horizontal and vertical coordinates of the judgment matrix, respectively.

Based on the above (3) (4) (5) (6) formula, then the integrated weight determination method is used. Total weighting is a method to determine the weight of each factor by combining objective and subjective weights according to a specific proportional relationship. To achieve the unification of subjective and objective weights, it can reflect the information of subjective and objective weights to the greatest extent, this paper selects the integrated weighting method, which combines subjective assignment (AHP) and objective assignment (entropy method), and the composite weight coefficient of the index obtained has the characteristics of both subjective and objective assignment methods, which makes the final evaluation results more reasonable and scientific.

Based on the above principle analysis, we can deduce its judgment matrix as follows in the figure 4:

	A	B	C	D	E	F	G	H	I
1		2	5	5	6	6	3	2	3
2			5	5	2	3	4	2	2
3				2	2	2	2	1/3	1
4					3	1/2	2	1	1
5						1/3	2	1	1/2
6							3	1/2	1/2
7								1/2	1/3
8									3
9									

Figure 4. Judgment matrix

Second, the entropy method is a method to objectively determine the weight of each indicator, which is mainly used to judge the dispersion degree of a particular indicator[9]. Generally, the greater the degree of dispersion of the index value, the better the orderliness, and the smaller the entropy value, the greater the final weight is provided. The steps to determine the weight of indicators using the entropy method include[10].

The weight of the value of indicator j in the year i:

$$M_{ij} = \frac{X'_{ij}}{\sum_{i=1}^{n} X'_{ij}} \tag{7}$$

Information entropy of the j_{th} indicator:

$$t_j = -k\sum_{i=1}^{n}(M_{ij} \times \ln M_{ij}) \tag{8}$$

Let $k = \frac{1}{\ln n}$, then $0 \le t_j \le 1$

Through formula (7) and (8), the weight vector of each evaluation index is determined by hierarchical analysis $Y_e = (y_1^{(e)}, y_2^{(e)}, ..., y_n^{(e)})$. The weight vector of each evaluation index is determined by the entropy value method $Y_a = (y_1^{(a)}, y_2^{(a)}, ..., y_n^{(a)})$.

This paper uses MATLAB to assist in calculating its weights based on its discriminant matrix, the Input discriminant matrix. Thus, according to the above deduction process, we construct the following formula for the calculation of the comprehensive scoring of scenic spots by giving the weight coefficients, as shown below.

$$S=(Q + A + P)\times 32.02\%+(PTf+Cf+Af+Tf)\times 39.85\%+C\times 28.18\% \tag{9}$$

Afterward, a test analysis of the results are calculated using the above formula(9), which is conducted and calculated that the mean of the scores was 4.81, the variance was 0.03. The standard deviation was 0.16, and the mean, variance, standard deviation, and numerical count fan charts It can be found that the distribution of each component is more uniform in the average value of 4.81. the proportion of 4 is the most in numerical count353, followed by 4.8. It accounts for 34% of standard deviation 0.16,4.7- 66%. The variance0.03 is 4.9-59%, 4.7-16%, 4.8-25%.

The 3D Confidence Ellipsoid method was used to process the 3D scatter images from the Origin software, which resulted in the 3D confidence ellipsoid images between the scenic evaluation level index, the number of network evaluations, and the composite score, as follows , which is shown in the figure.5:

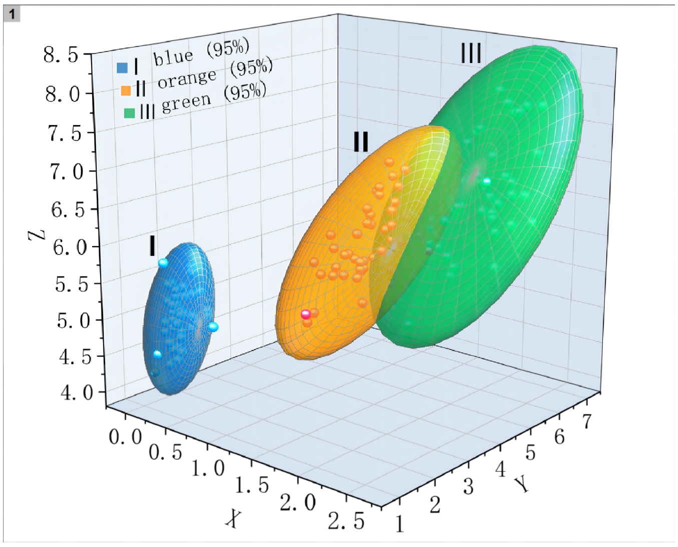

Figure 5 Three-dimensional confidence ellipsoid interval image (X-Scenic spot evaluation index, Y-Number of online comments, Z-Comprehensive score)

Based on the observation of the above three-dimensional ellipsoidal confidence interval graph, we can find that the data shows a clustering distribution. Therefore, we use the K-means cluster analysis algorithm model to perform cluster analysis and classification of the data we collected and the calculation results of the comprehensive score determined by the entropy method. The results are shown in the following figure.

(Maximum eigenvalue: 9.9437

The consistency of this matrix is acceptable!

CI=0.1180, CR=0.0808)

4 CONCLUSIONS

In order to stop the spread of novel coronavirus, different countries have taken different control measures to restrict population movement. This paper focuses on the analysis and research on this issue, which leads to the reduction of people's desire for consumption and the sluggish domestic demand, which has a negative impact on the economic operation of the whole country. First of all, based on the particle swarm optimization algorithm, the longitude and latitude of the national 5A scenic spots are studied, and the distribution maps and scatter maps are drawn, which visually shows the distribution of these scenic spots in the whole country, and draws the conclusion that the distribution of 5A scenic spots is related to their geographical location. Then based on the DESTEP analysis model and PESTEL analysis model, the factors that may affect the evaluation level of scenic spots and the relationship between them are analyzed. Finally, the AHP analytic hierarchy process and entropy method are used to quantify the factors that affect the evaluation level of the scenic spot, build an index system to measure the reception capacity of the scenic spot, and finally determine the comprehensive score of the scenic spot in the collected data.

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