Hindawi
Mobile Information Systems
Volume 2022, Article ID 7500042, 11 pages
https://doi.org/10.1155/2022/7500042

Research Article

Research on the Construction Path of Characteristic Tourism Resource Development System and Platform under the Background of Rural Revitalization

Xiaomei Kang

Tangshan Normal University, Tangshan 063000, China

Correspondence should be addressed to Xiaomei Kang; kangxm@tstc.edu.cn

Received 16 June 2022; Revised 5 July 2022; Accepted 27 July 2022; Published 25 August 2022

Academic Editor: Le Sun

In order to improve the development effect of tourism resources with rural characteristics, this paper combines the digital communication signal modulation technology to process the related data of tourism resources. Moreover, before the quadrature demodulation of the tourism information signal is carried out in this paper, the symbol rate is estimated, and the signal-to-noise ratio and the symbol rate of the digital communication signal are estimated to improve the development effect of tourism resources. The estimation of the signal symbol rate is obtained by statistical analysis of the instantaneous characteristics of the signal in the time domain, and it can also be obtained by measuring the length of the adjacent transition points of the instantaneous amplitude. In addition, this paper constructs a rural characteristic tourism resource development and management system based on communication signal modulation technology. Finally, through test research, this paper verifies that the rural characteristic tourism resource development platform proposed in this paper has a good effect on the development and management of rural characteristic tourism resources.

1. Introduction

Tourism resources and tourist attractions are synonymous expressions of the same thing (tourist objects), and it is generally believed that tourism resources are Western tourist attractions [1]. From the perspective of linguistics and etymology, the complex relationship between tourism resources and tourist attractions is a divergence arising from the mixing of two sets of discourse systems at home and abroad at the beginning of domestic tourism research. Therefore, Yusof and others believed that tourism resources were originally intended to be tourist attractions, and the reinterpretation of the definition of "resources" gave different meanings to "tourism resources," which led to disputes with tourism attractions [2]. The meaning of a word depends on the word itself and the understanding of the word. The rupture and discontinuity of tourism resources and the disputes over their relationship with tourism attractions are ultimately due to differences in attitudes and understandings of the connotation, boundaries and essential attributes of tourism objects under different discourse backgrounds. Although the above-mentioned scholars' analysis revealed some facts and academic theories of China's tourism resources research in the early years, which has its important value and reason, it still ignores the discourse of tourism resources research [3].

The original meaning of "resources" refers to the natural mineral resources buried underground for development and utilization and later extended to all natural and social things with economic value and available for use. From the etymology and literal understanding, tourism resources obviously refer to all the elements with economic value and tourism development, which are economic concepts and have instrumental rationality and value judgment [4]; tourism attractions are the name of "things," which are simple and clear. It points to "things," emphasizing the objective properties and attractive properties of things without a clear value orientation. Except for the types of objects, the attractiveness of tourist attractions is rarely debated [5]. From the perspective of core objects, tourism resources include tourism attractions with development value and other resource elements; and tourism attractions include both “objects” that can be developed and elements that are not suitable for tourism development [6]. Therefore, according to the existing academic understanding, tourism attractions and tourism resources have both commonalities and differences, resulting in the above-mentioned debate on the relationship between tourism resources and tourism attractions, as well as differences in understanding of tourism objects and their attractiveness. Tourists do not need to think about and care about the economy and development standards of things [7]. Literature [8] clarifies the attractiveness of tourist attractions and especially emphasizes tourists as the target of attraction, and they all take tourists as an important component into the tourist attraction system. Literature [9] emphasizes that tourist attractions can make tourists experience motivation only when their markers are positively related to tourists’ needs. However, attraction is subjective, nonfunctional, and even irrational. Therefore, the term tourist attraction profoundly reflects the individuality in Western society.

Rural tourism developers and local relevant departments and governments should realize that the development of local tourism resources should not blindly pursue economic benefits but should pay more attention to ecological benefits, social benefits, and cultural benefits. Pay equal attention to resources, fully tap the local cultural heritage and cultural characteristics, and regard it as a major point to attract tourists [10]. In the development process of the rural tourism industry, it is necessary to take the concept of sustainable development as a guide to realize the integration of different types of resources in the future. In the past, many rural tourism resource development projects had low resource utilization rate and poor overall construction level. They did not hesitate to destroy ecological resources and waste natural resources for economic benefits. This kind of development method at the expense of the natural environment is not desirable. Even if a large economic benefit is obtained in the short term, the ecological damage caused by it is difficult to repair [11]. Therefore, when developing tourism resources, based on the characteristics of local villages, we should analyze characteristic resources, classify resources, and formulate resource development plans and long-term business plans in a targeted manner [12]. Social experts can be invited to evaluate the feasibility of various resource development, minimize the negative impact caused by resource development, reduce the damage to the local natural ecological environment, implement the concept of sustainable development, and truly realize rural revitalization [13].

Developers should be aware of the disadvantages brought about by the homogenization of tourism products, try their best to plan the villages to be developed with innovative thinking, and seek characteristics that are different from other rural tourism spots based on the characteristics of local villages. We should closely follow the pace of the times, observe and investigate popular tourism products of popular attractions, carefully analyze their characteristics and advantages, find out why they are popular and loved by tourists, analyze the diverse needs of tourists, and implement them into local rural tourism. In the industry, local tourism products are given a new look, and tourism products with distinctive characteristics and in line with the aesthetics of tourists are developed [14]. By collecting information on local rural products, we will vigorously develop native products, attract tourists with their unique flavors, drive the consumption of native products, and bring new economic growth points to local rural tourism. At the same time, it should rely on the local natural and cultural environment, such as tracing history and culture, and making it into corresponding popular science books, works of art, endow it with profound cultural characteristics, and face the mass market with innovative eyes [15].

Villages have their own specific development history, which can be used to create different types of tourism themes and make them into multiple tourism sections. For example, some areas with significant revolutionary significance can be featured with the theme of red tourism, especially the life, agricultural tools, or buildings that played an important role in the revolutionary base during the revolutionary period. When visitors visit, introduce them to the local events, wars, the use of these agricultural tools and their functions at that time and can also allow tourists to personally operate these agricultural tools, experience the life of the year, and create a refreshing visual experience for tourists through the creation of various corresponding situations, enriching the rural tourism. new cognition, and gain historical knowledge and experience revolutionary culture. Under this premise, the scope, content, and value of rural tourism have been further expanded, and the cultural connotation and spiritual level of rural tourism have been improved. In the follow-up, under the unintentional or intentional publicity of tourists, it will attract more tourists to travel and further promote the local economic development [16].

With a vast land and abundant resources, villages in different regions have their own different characteristics and rich tourism resources, but because of their strong independence and lack of mutual connection, they lack advantages in complementary resources. In the process of developing rural resources, the same area needs to focus on strengthening the connection between scenic spots, so as to achieve resource sharing and information sharing, so as to create more characteristic and high-quality tourist routes, and provide tourists with one-stop services to meet the needs of tourists. Diversified needs [17]: implement modern management in rural areas, increase capital investment, strengthen the construction of various convenient infrastructures, improve the service level and service ability of tourism practitioners, improve their cultural literacy and personal quality, and provide tourists with better services. Local township and county-level governments should also strive to attract more social capital and investment, so that the development of local rural resources can obtain more human and material support [18].

In order to improve the development effect of tourism resources with rural characteristics, this paper combines digital communication signal modulation technology to process tourism resources-related data.

2. Estimation of Related Parameters for Modulation Type Identification of Digital Communication Signals

2.1. Signal-to-Noise Ratio Estimation Algorithm for Digital Communication Signals. The main function of the signal-to-noise ratio is to directly reflect the quality information of the communication signal. In the process of digital communication signal processing, signal-to-noise ratio, as a key indicator, is an essential prior knowledge to measure the accuracy of signal processing method selection. In the adaptation process, the signal-to-noise ratio is usually used as the main parameter to measure the quality of the channel.

The SNR estimation can be divided into constant envelope signal SNR estimation and nonconstant envelope signal SNR estimation according to the different modulation modes of the received signal. In contrast, the constant envelope signal-to-noise ratio estimation is simple and can be expressed as:

$$\mathrm{SNR} = 10\log\frac{[E(a(n))]^2}{\mathrm{var}[a(n)]}. \tag{1}$$

In formula (1), $a(n)$ is the instantaneous envelope of the signal. It can be seen that the estimation of the signal-to-noise ratio of the constant envelope only needs to analyze the signal envelope. The expected square value of the instantaneous envelope of the signal is regarded as the useful signal power, and the variance value of the instantaneous envelope of the signal is regarded as the noise power. Then, by definition, the signal-to-noise ratio of the constant envelope signal can be found.

For the signal-to-noise ratio of the nonconstant envelope signal, the method in formula (1) cannot be simply used for estimation, but the singular value decomposition method of the autocorrelation matrix is used. After the useful signal passes through the Gaussian white noise channel, it is sampled without distortion by the signal receiver, and the sampled signal is

$$y(n) = x(n) + \omega(n). \tag{2}$$

In formula (2), $x(n)$ is the sampling sequence of the useful signal, $\omega(n)$ is the sampling sequence of Gaussian white noise, the mean value of the signal is 0, and the variance is denoted as σ_w^2. The signal sequence $x(n)$ and the noise sequence $\omega(n)$ are independently distributed, and the autocorrelation matrix of the signal $y(n)$ is

$$\begin{aligned} R_{yy} &= E\left[y(n)y(n)^H\right] \\ &= E[x(n)+w(n)]\left[x(n)+w(n)^H\right] \\ &= E\left[x(n)x(n)^H\right] + E\left[w(n)w(n)^H\right]. \end{aligned} \tag{3}$$

In formula (3), R_{xx} and R_{ww} are the autocorrelation matrix of useful signal $x(n)$ and Gaussian white noise signal $\omega(n)$, respectively. It can be seen that the autocorrelation matrix R_{yy} of the received signal $y(n)$ is equal to the sum of the autocorrelation matrix of the useful signal $x(n)$ and the Gaussian white noise signal $\omega(n)$. Since R_{yy}, R_{xx}, and R_{ww} are all symmetric matrices, the singular value decomposition of them has the following:

$$\begin{aligned} R_{yy} &= V\Lambda_Y V^H, \\ R_{xx} &= V\Lambda_x V^H, \\ R_{ww} &= \sigma_w^2 I. \end{aligned} \tag{4}$$

I is a unit matrix of order m, V is an orthogonal matrix, Λ_x is a diagonal matrix, which can be expressed as $\Lambda_x = \mathrm{diag}(r_1, r_2, \ldots, r_p, 0, \ldots, 0)_{\max}$, m is the order of the diagonal matrix Λ_x, the diagonal elements need to satisfy $r_1 \geq r_2 \geq \cdots \geq r_p$, and the value of p is less than m.

According to the properties of matrix transformation, formula (4) can be further expressed as:

$$V\Lambda_Y V^H = V\Lambda_x V^H + V\Lambda_w V^H = V(\Lambda_x + \Lambda_w)V^H. \tag{5}$$

Among them,

$$\Lambda_y = \mathrm{diag}(a_1, a_2, a_m)_{m\times m} = \begin{bmatrix} r_1+\sigma_w^2 & \cdots & & & 0 \\ \ddots & & & & \\ & & r_p+\sigma_w^2 & & \vdots \\ & & & \sigma_w^2 & \\ & & & & \ddots \\ 0 & & \cdots & & \sigma_w^2 \end{bmatrix}. \tag{6}$$

It can be seen that the signal subspace is a p-dimensional subspace formed by $r_1, r_2, \cdots, r_p$, and the noise subspace is a $m-p$-dimensional subspace formed by σ_w^2. The p-dimensional signal subspace and the $m-p$-dimensional noise subspace constitute the signal space. On the basis of the spatial decomposition of the signal, the power of the received signal $y(n)$ can be decomposed into the sum of the power P_x of the useful signal $x(n)$ and the power P_w of the noise signal $\omega(n)$. The powers of the useful and noise signals can be expressed as:

$$\begin{aligned} P_x &= \sum_{k=1}^{P} r_k = \sum_{k=1}^{P}\left(a_k - \sigma_w^2\right), \\ P_w &= m\times\sigma_w^2. \end{aligned} \tag{7}$$

According to the definition of SNR, as long as the dimension p of the signal subspace and the variance σ_w^2 of white Gaussian noise are determined, the SNR of the received signal can be estimated. The value of p can be estimated according to the minimum length criterion (MDL) described in information theory:

$$\mathrm{MDL}[n] = N(m-n)\ln\,\Lambda[n] + \frac{1}{2}n(2m-n)\ln\,N,$$
$$p = \arg\min_{n} \mathrm{MDL}[n]. \tag{8}$$

In formula (11), N is the number of samples, n is the trial dimension, and $\Lambda[n]$ can be expressed as:

$$\Lambda[n] = \frac{1}{m-n}\frac{\sum_{k=n+1}^{m} r_k}{\left(\prod_{k=n+1}^{m} r_k\right)^{1/(m-n)}}. \tag{9}$$

Therefore, the SNR estimation for nonconstant envelope signals can be performed as follows:

First, the algorithm calculates the value of the autocorrelation matrix R_{yy} of the received signal $y(n)$, performs singular value decomposition on the autocorrelation matrix R_{yy}, and obtains m eigenvalues $a_1, a_2, \cdots, a_m$, which satisfy $a_1 \geq a_2 \geq \cdots \geq a_m$.

Secondly, the MDL criterion is used to estimate the dimension of the signal subspace, calculate the variance value σ_w^2 of the Gaussian white noise signal from the formula (10), and bring it into the formula (11) to obtain the estimated value of the signal-to-noise ratio.

$$\sigma_w^2 = \frac{1}{m-n}\sum_{k=p+1}^{m} a_k, \tag{10}$$

$$\widehat{\mathrm{SNR}} = 10\lg\left|\frac{P_x}{P_w}\right| = 10\lg\sum_{k=1}^{P}\frac{\left(a_k - \sigma_w^2\right)}{m\times\sigma_w^2}. \tag{11}$$

The above is the estimation of the signal-to-noise ratio of the received signal through the minimum distance (MDL) algorithm. It can be seen that the estimation result of the dimension of the signal subspace will have a direct impact on the accuracy of the SNR estimation. In addition to this, there is the normalized ratio method, which is also a commonly used signal subspace dimension estimation method.

The normalized ratio method is defined as:

$$v(l) = \left[\frac{\widehat{b}_1^2 + \widehat{b}_2^2 + \cdots + \widehat{b}_l^2}{b_1^2 + b_2^2 + \cdots + b_l^2}\right]^{1/2}, \quad 1 \leq l \leq N. \tag{12}$$

In the practical application of this algorithm, a value close to 1 must be determined first. When l satisfies the smallest integer whose $v(l)$ is greater than or equal to this value, it can be considered that the eigenvalues before l are all “important.” Therefore, l can be determined as the dimension of the signal subspace.

Through the simulation analysis of 2FSK, in the additive white Gaussian noise channel, the signal frequency of the carrier is 1600 Hz, and the sampling frequency of the signal is 18000 Hz. Among them, the length of the observation data is 200 symbols, and the dimension of the autocorrelation matrix is 50. When the signal-to-noise ratio of the received signal changes between −5 and 20, through MATLAB simulation, the influence of the MDL algorithm and the normalized ratio method on the analysis results is shown in Figure 1:

It can be seen that when the signal-to-noise ratio of the received signal is large, the estimation error produced by the normalized ratio method is also large. The normalized ratio method is to complete the estimation of the signal-to-noise ratio by estimating the noise variance. When the signal-to-noise ratio is small, the estimated error can be ignored, but when the signal-to-noise ratio is large, the estimated signal-to-noise ratio will deviate greatly from the real value. Therefore, the SNR estimation based on the MDL algorithm is superior to the normalized ratio algorithm. When using the minimum length algorithm to estimate the signal-to-noise ratio, the influence of the length of the observation data on the estimation result should also be considered. The longer the observation data is, the closer the obtained estimation result is to the true value.

2.2. Analysis of Symbol Rate Estimation Algorithm for Digital Communication Signals. The symbol rate is an important parameter of digital communication signals, and the symbol rate must be estimated before the signal is orthogonally demodulated. The estimation of the signal symbol rate can be obtained either by statistical analysis of the instantaneous characteristics of the signal in the time domain or by measuring the length of the adjacent transition points of the instantaneous amplitude.

The symbol rate is an important parameter for analyzing the characteristics of the signal. The symbol is used to represent each bit in the digital signal, and it can also be directly called “bit.” The symbol transmission rate can also be called the code transmission rate, which refers to the number of changes in symbols per second or the number of binary symbols transmitted per second. The binary baseband pulse stream is represented by a set of random pulse sequences as:

$$x(t) = \sum_{n} a_n g(t - nT_B), \tag{13}$$

a_n is the information code, T_B is the symbol width, and $g(t)$ is the signal waveform, which can be further expressed as:

$$g(t - nT_s) = \begin{cases} g_1(t - nT_B), & \textit{with Probability } P, \\ g_2(t - nT_B), & \text{with}\textit{Probability } 1 - P. \end{cases} \tag{14}$$

The power spectrum of the baseband pulse sequence consists of two parts: continuous spectrum and discrete spectrum:

$$P(f) = f_B P(1-P)\left|G_1(f) - G_2(f)\right|^2 + f_B^2 \sum_{m=-\infty}^{\infty}\left|PG_1(mf_B) + (1-P)G_2(mf_B)\right|^2 \delta(f - mf_B). \tag{15}$$

Among them, $G_1(f)$ and $G_2(f)$ are the corresponding frequency spectra of waveforms $g_1(t)$ and $g_2(t)$, respectively, and $f_B = (1/T_B)$ is the symbol rate. The shape of the continuous spectrum is determined by the baseband pulse waveform, and the shape of the discrete spectrum is determined by the baseband pulse waveform and the statistical

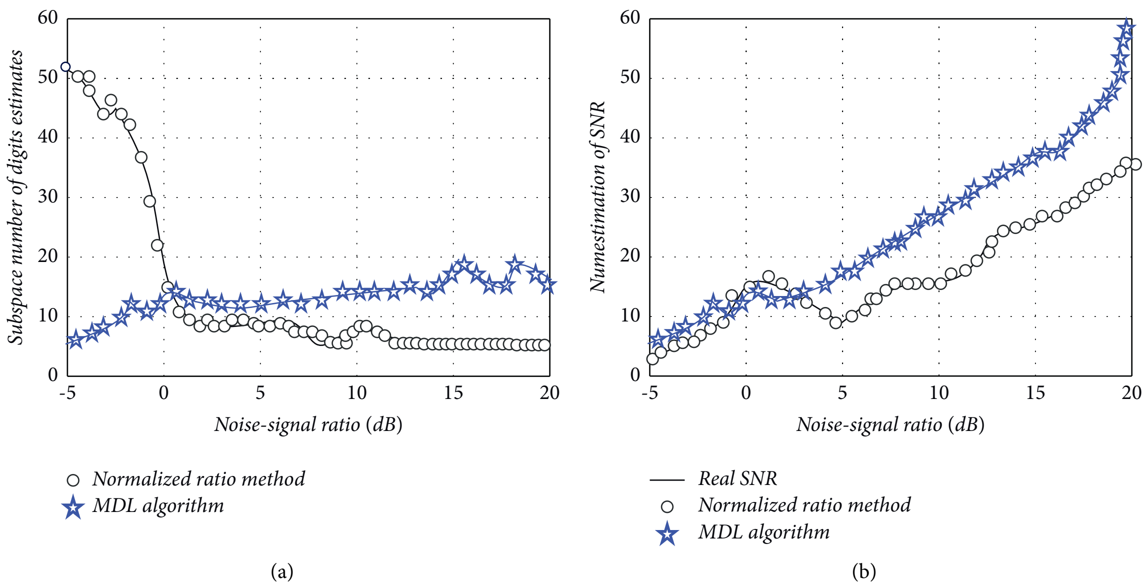

Figure 1: Influence of MDL algorithm and normalized ratio method on analysis results.

characteristics of the transmitted information code. If $g_1(t)$ is a rectangular pulse with signal amplitude A and width T_B, then $G_1(f) = AT_B S_a(\pi f T_B)$.

If the signal is a unipolar pulse signal with equal probability, that is, $g(t) = g_1(t), g_2(t) = 0, P = (1/2), A = 1$, its double-sideband power spectrum is

$$P(f) = \frac{1}{4}T_B\left|S_a(\pi f T_B)\right|^2 + \frac{1}{4}\delta(f). \quad (16)$$

If the signal is a bipolar pulse signal with equal probability, that is, $g(t) = g_1(t) = -g_2(t), P = (1/2), A = 1$, its double-sideband power spectrum is expressed as:

$$P(f) = T_B {S_a}^2(\pi f T_B). \quad (17)$$

In the above, we analyzed non-return-to-zero (NRZ) code sequences with a symbol duty cycle (ratio of symbol pulse width to symbol spacing) of 1. Moreover, in the case where $g_1(t)$ and $g_2(t)$ occur with equal probability, the power spectra of the unipolar pulse signal and the bipolar pulse signal are analyzed. It can be seen that a_n does not have a synchronous time component with T_s. Therefore, in this case, the symbol rate information cannot be directly obtained through the power spectrum.

If the pulse width of the symbol is changed, the duty cycle of the sequence symbol is less than 1, that is, the non-return-to-zero code is changed to the return-to-zero code (RZ). The duty cycle is represented by α, $(0 < \alpha < 1)$, and the pulse width of $g_1(t)$ is αT_B. The power spectral density function of the binary random code when the signal is 0 or 1 with equal probability can be expressed as:

$$\begin{aligned} P(f) &= \frac{f_B}{4}\left|\alpha T_B S_a(\pi f \alpha T_B)\right|^2 + \frac{f_B^2}{4}\sum_{m=-\infty}^{\infty}\left|\alpha T_B S_a(\pi \alpha m f_B T_B)\right|^2 \delta(f - m f_B) \\ &= \frac{\alpha^2}{4}T_B S_a^2(\pi f T_B) + \frac{\alpha^2}{4}\sum_{m=-\infty}^{\infty} S_a^2(\pi m \alpha)\delta(f - m f_B). \end{aligned} \quad (18)$$

The value of f is an integer multiple of f_B, that is, $f = m f_B$. It can be seen that the power spectrum of the unipolar return-to-zero (RZ) code has an obvious discrete spectrum at the symbol rate, and the signal symbol rate can be extracted by searching for the position of the discrete spectral line.

The power spectral density plots of unipolar non-return-to-zero (NRZ) codes and unipolar return-to-zero (RZ) codes are simulated by MATLAB. It can be seen that the signal sampling frequency is 30 MHz, the symbol rate is 2500 B, and the duty cycle of the return-to-zero code is $\alpha = (1/2)$. The simulation results are shown in Figures 2 and 3:

As shown in the figure, when the frequency value of the signal is an integral multiple of the symbol rate, the NRZ code has no frequency component, so the symbol rate value cannot be obtained for the NRZ code. However, at the frequency value $f = \pm f_B$ of the RZ code, there are discrete spectral lines, and at the frequency value $f = \pm 2 f_B$,

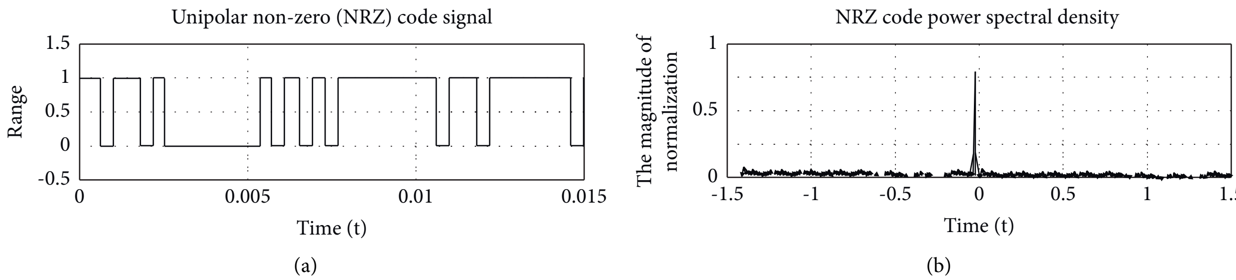

Figure 2: NRZ code power spectral density diagram.

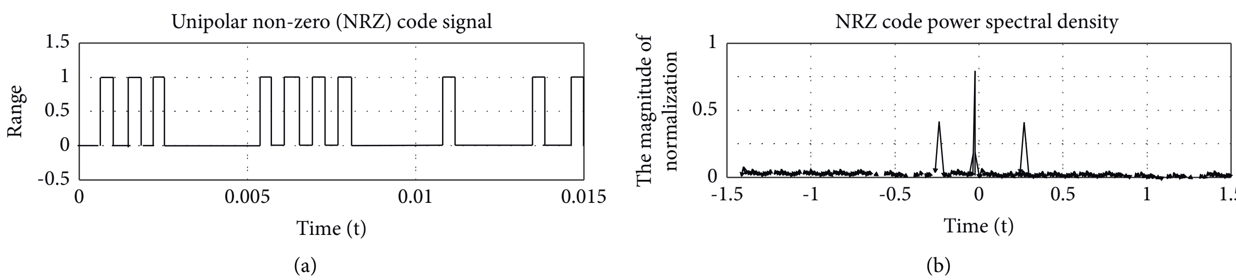

Figure 3: RZ code power spectral density diagram.

discrete spectral lines with lower intensity can also be observed. Therefore, by searching the position of the discrete spectrum, the symbol rate value can be extracted.

2.3. Communication Signal Demodulation. Modulation and demodulation are the key technologies of communication signal transmission. Both parties of the communication demodulate the received signal through the agreed carrier frequency, modulation pattern, symbol rate, and other parameters to recover useful information. In the communication confrontation, because the receiver is passive, it cannot know the modulation parameters of the transmitter in advance. To obtain useful information, only passive demodulation can be obtained. This passive demodulation is called blind demodulation.

2.3.1. Instantaneous Frequency Extraction Method. The symbol width of the MFSK signal is T_B, and the symbol rate is $f_B = (1/T_B)$. The MFSK signal is sampled by a signal with a sampling frequency of f to obtain a real signal $x(i)$. The frequency interval of $x(i)$ is f_{sep}. The instantaneous frequency of the signal can be expressed as:

$$f(i) = \frac{\varphi_w(i+1) - \varphi_w(i)}{2\pi}, f_s. \tag{19}$$

The algorithm performs median filtering on the instantaneous frequency sequence $\{f(i)\}$. If the filter window width n is an odd number, the algorithm takes $n = 2k + 1$, that is, extracts n numbers from the input frequency sequence $\{f(i)\}$, arranges them in order of size, and takes the value in the middle as the output value of the filter. Then, the algorithm obtains new samples and repeats the above calculation process. The filter output $y(i)$ is mathematically expressed as:

$$\begin{aligned} f_{\text{Med}}(i) &= \text{Med}[f(i)|n] \\ &= \text{Median}[f(i-k), \ldots, f(i), \ldots, f(i+k)]. \end{aligned} \tag{20}$$

After filtering, pulses with a period less than $(n/2)$ are suppressed, and pulses greater than $n/2$ are retained. The sequence signal $\{f(i)\}$ is the filtered instantaneous frequency sequence, and it is normalized. If

$$f_j(i) - \frac{f_{\text{sep}}}{2} \le f_{\text{Med}}(i) < f_j(i) + \frac{f_{\text{sep}}}{2}. \tag{21}$$

The quantization result is

$$y(i) = j. \tag{22}$$

Finally, the quantized output sequence $\{y(i)\}$ is obtained. The symbol width is measured on the quantized output sequence, and the demodulated output is obtained according to the measurement result. The demodulation method of the instantaneous frequency is simple and practical, but it has high requirements on the signal-to-noise ratio. When the signal-to-noise ratio is low, it is necessary to find other methods to demodulate the signal.

2.3.2. Short-Time Fourier Transform Method. After the MFSK signal is sampled by a sampling signal with a sampling frequency of f_s, a real signal $x(n)$ with a frequency interval of f_{sep} is obtained. The symbol width of the MFSK signal is T_B, and the symbol rate is $f_B = (1/T_B)$.

If the window function $w(n)$ is a Hanning window, the window width is N. At the same time, the selection of N should meet the requirements of signal processing. If N is too large, intersymbol crosstalk will be caused. If N is too small, useful information will be lost. Generally, $N = (1 \sim 2)f_B$ is selected. The MFSK signal undergoes a windowed short-time Fourier transform as:

$$X(k,m) = \text{STFT}\{x(n)w(n-m)\}. \tag{23}$$

The square of its modulus is as follows:

$$X_P(k,m) = |X(k,m)|^2. \tag{24}$$

The subscript corresponding to the maximum value of the spectrum is k_i, and the frequency corresponding to the maximum value of the spectrum is as follows:

$$f(i) = \frac{k_i}{N}, f_s. \tag{25}$$

For the sliding window function $w(n)$ with the step size P along the sequence $x(n)$, the selection of the sliding step size d should fully consider its influence on the estimation of the signal parameters. Therefore, the general sliding step size is $P = (0.1 \sim 0.5)T_B$. By repeating the above process, the instantaneous frequency sequence $\{f(i)\}$ can be obtained. Then, the instantaneous frequency $\{f(i)\}$ is quantized, filtered, and symbol detected by the same method, and the demodulation of the MFSK signal can be realized.

Fast Fourier transform is usually implemented with FFT. If the frequency interval of the FFT is Δf, I is the ratio of the frequency interval to the frequency resolution, and $I = (f_{\text{sep}}/\Delta f)$ is the fast Fourier transform demodulation signal, I generally takes a value between 8 and 16. When the value is too large and Δf is too small, the computational load is too large. When the value is too small and Δf is too large, the requirement cannot be met.

MPSK is a multi-ary phase-modulated signal that must be processed by coherent demodulation. Therefore, the communication countermeasure reconnaissance must first try to obtain the two parameters of carrier frequency and symbol rate to realize the demodulation of MPSK signal. The general steps of MPSK signal demodulation are to firstly identify the modulation type of the intercepted signal and determine its modulation pattern; second, determine the value of M and determine the hexadecimal number of the modulated signal. Then, the basic parameters of the signal are estimated, and the carrier frequency and symbol rate of the signal are mastered. Finally, the coherent demodulator is used to demodulate the signal MPSK.

(1) Extract the signal carrier frequency

Because in the phase-modulated digital signal, when the symbol information is distributed with equal probability, the transmitted signal does not include the carrier component. Therefore, it is necessary to restore the carrier components first. Commonly used methods include square rate method carrier extraction, autocorrelation method carrier extraction, and high-order cyclic cumulant method carrier extraction. Taking the 2PSK signal as an example, the effectiveness of the square rate method carrier extraction is illustrated.

During the duration of one symbol, the 2PSK signal is expressed as:

$$s(t) = \begin{cases} \cos(\omega_c t + \theta_0), & \textit{Probability is } P, \\ -\cos(\omega_c t + \theta_0), & \textit{Probability } \text{is} 1 - P. \end{cases} \tag{26}$$

If the equal probability distribution, that is, $P = (1/2)$, the power spectrum is as follows:

$$S_\omega = \frac{T_B}{4}\left\{\left|S_a\left[\left(\frac{\omega+\omega_c}{2}\right)T_B\right]\right|^2 + \left|S_a\left[\left(\frac{\omega-\omega_c}{2}\right)T_B\right]\right|^2\right\}. \tag{27}$$

In the above formula, T_B is the symbol width. It can be seen that there is no signal carrier component in the power spectrum of the 2PSK signal with equal probability distribution. The square of the 2PSK signal has

$$s^2(t) = \frac{1}{2}\left[1 + \cos(2\omega_c t + 2\theta_0)\right]. \tag{28}$$

After filtering and removing the DC component,

$$s^2(t) = \frac{1}{2}\cos(4\pi f_c t + 2\theta_0). \tag{29}$$

A single frequency signal is obtained, and the frequency of the signal is $2f_c$, which is 2 times the carrier frequency. By extracting, analyzing, and judging the single-frequency signal, the carrier frequency of the 2PSK signal can be obtained. Similarly, when M is 4, 8, . . ., it can also be handled in the same way.

(2) Blind demodulation of MPSK signal

The carrier frequency of the MPSK signal has been correctly estimated, because the estimation of the symbol rate, the judgment of the signal modulation type and the determination of the M value can be obtained by referring to the previous contents. According to these known parameters, and the final demodulation of MPSK signal can be realized, the principle is shown in Figure 4.

(i) The algorithm extracts the signal carrier frequency and determines the M value of the MPSK signal;
(ii) The algorithm uses the carrier frequency f_c to set the local oscillator (NCO) to construct a digital quadrature demodulator. At the same time, the signal bandwidth is determined according to the analysis results of the power spectrum of the signal, and the parameters of the low-pass filter are set accordingly. The carrier is tracked through the carrier synchronization loop and the initial demodulation of the signal is obtained.
(iii) The algorithm estimates the signal symbol rate and uses it to set the low-pass filter (LPF) and control the sampling clock. The algorithm

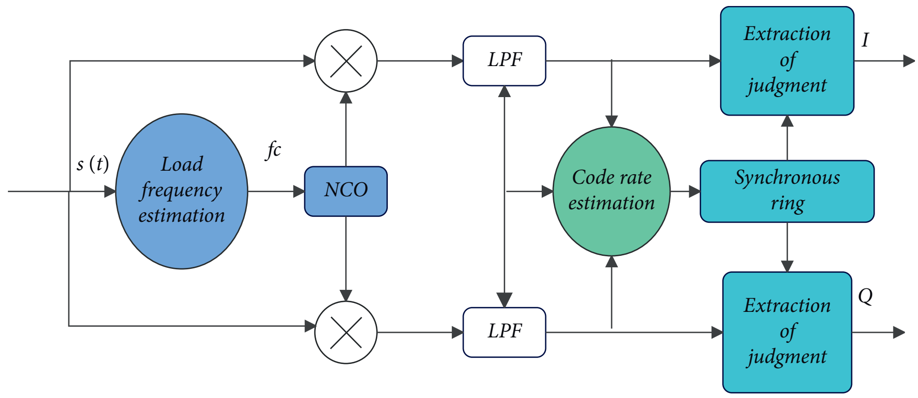

FIGURE 4: The principle of blind demodulation of MPSK signal. The specific steps of demodulation are given in the figure.

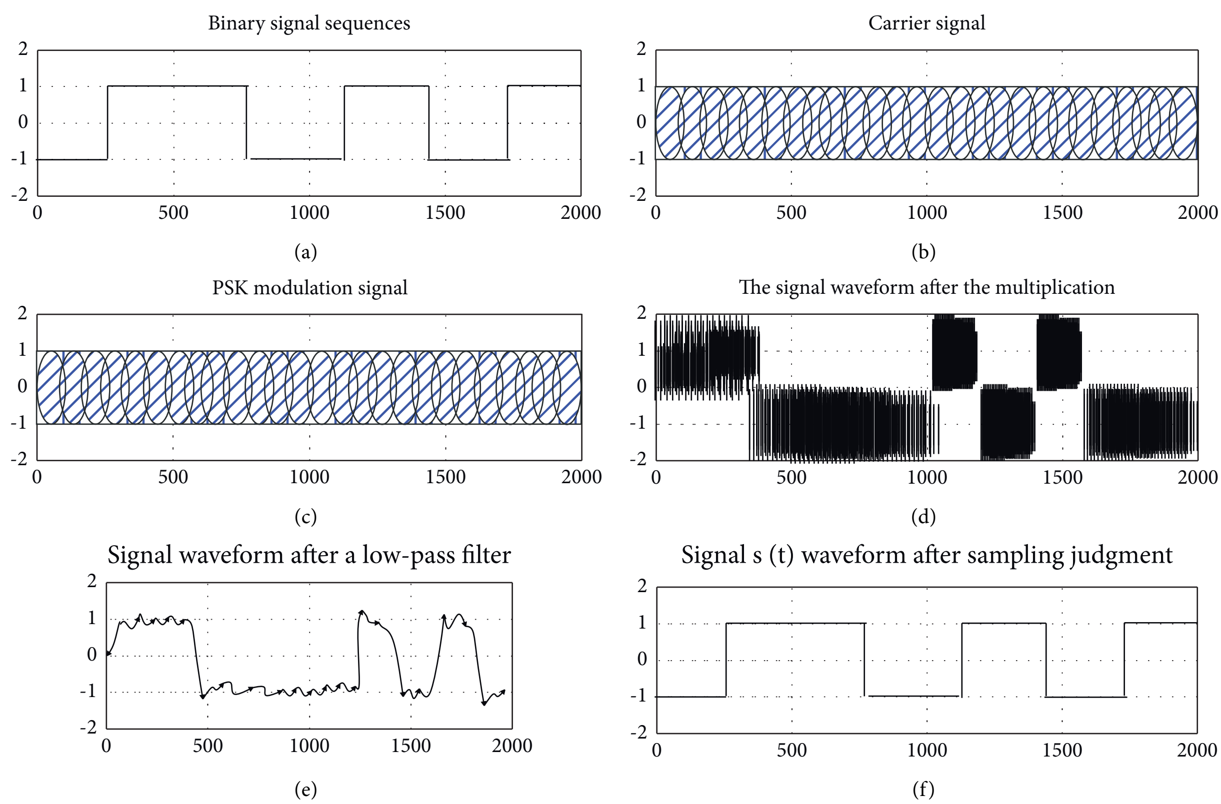

FIGURE 5: 2PSK modulation and demodulation process.

performs low-pass filtering and sampling judgment on the two signals outputted by the initial demodulation and finally completes the demodulation of the MPSK signal. Taking the binary PSK signal as an example, the MATLAB simulation of the signal modulation and demodulation process is performed, as shown in Figure 5.

It can be seen that the key to the blind demodulation of MPSK signal is the estimation of the carrier frequency and symbol rate of the signal. Only in this way can the signal information be accurately demodulated and the baseband signal can be recovered.

3. Rural Characteristic Tourism Resource Development System

Gridization of tourism resources is to spread the tourism resource data in the administrative area into a grid of suitable size according to a certain mathematical model, so as to realize the transformation from the statistical unit of the administrative area to the grid statistical unit. The grid

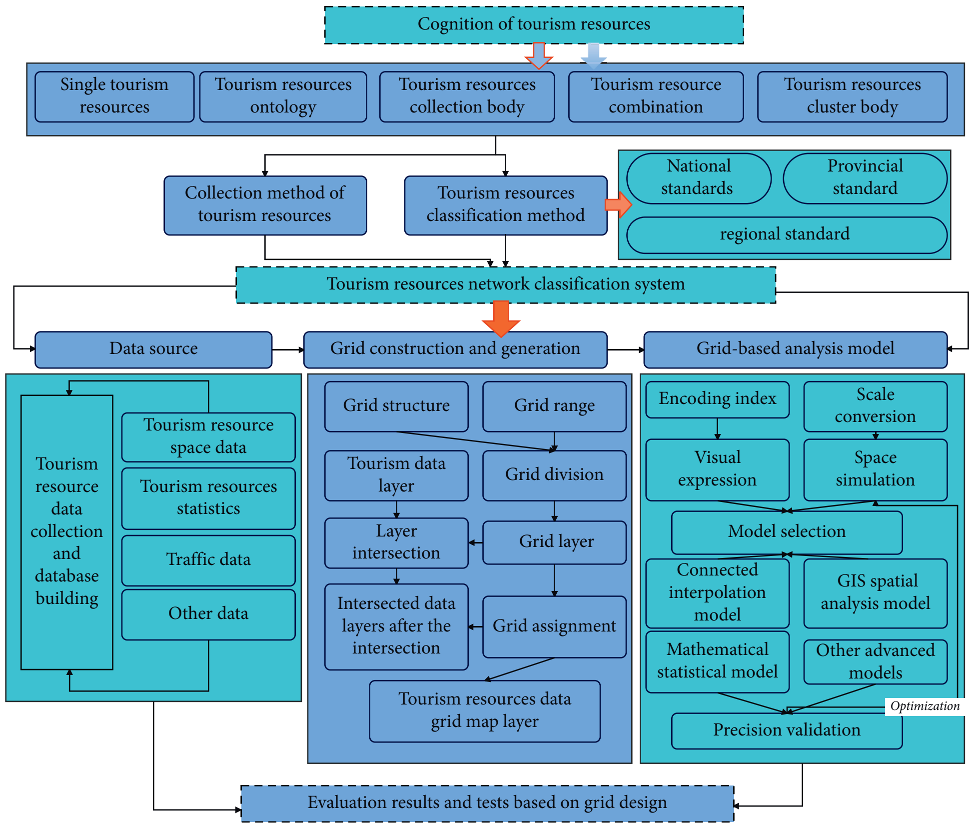

Figure 6: Gridding of rural characteristic tourism resources data.

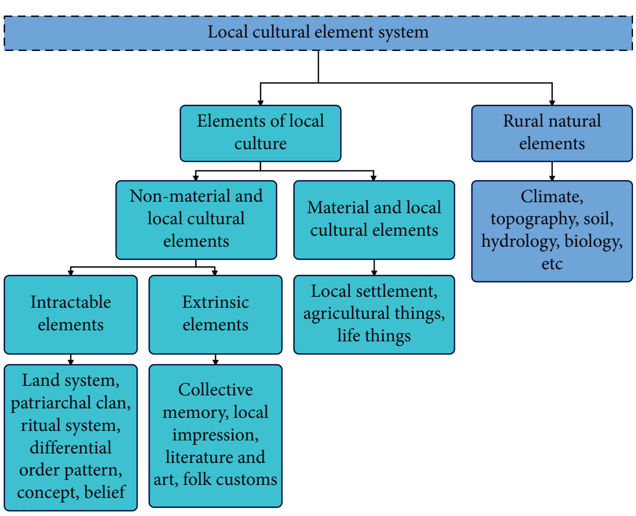

Figure 7: Element system of rural landscape.

method can integrate multi-source tourism resource data to build a spatial model and express the spatial differentiation law of tourism resources in regional units by scale. Moreover, it overcomes the uniform distribution of statistical index values of various tourism resources in each unit caused by the analysis of administrative regions. At the same time, it can also realize the dynamic research of tourism resource law based on grid time series data. Therefore, the grid of tourism resources data with administrative districts as a unit can be used as one of the means of spatial analysis and evaluation of tourism resources. In addition, the grid of tourism resources provides an ideal method for comprehensive analysis of tourism resources (Figure 6).

The elements of the rural landscape refer to the various backgrounds, materials, and symbols that constitute the form and meaning of the rural landscape and exist in the rural space, also known as the constituent elements of the rural landscape, as shown in Figure 7.

Tourism mainly includes six aspects: travel, food, accommodation, transportation, shopping, and entertainment. It involves tourism destination management departments, tourism agencies, tourism intermediaries, tourism transportation departments, tourism hotels, tourism restaurants and tourism enterprises, and other related departments and enterprises. Moreover, its resources have the characteristics of diversity, complexity, distribution, tangibility, intangibility, and uncertainty. In order to realize the sharing of tourism resources, this paper proposes a tourism resource management model as shown in Figure 8.

After the above model is constructed, the effect of the rural characteristic tourism resource development platform proposed in this paper is verified, and the effect of resource development and resource management is carried out through the simulation model, and the experimental results shown in Figure 9 are obtained.

Through the above research, it is verified that the rural characteristic tourism resource development platform

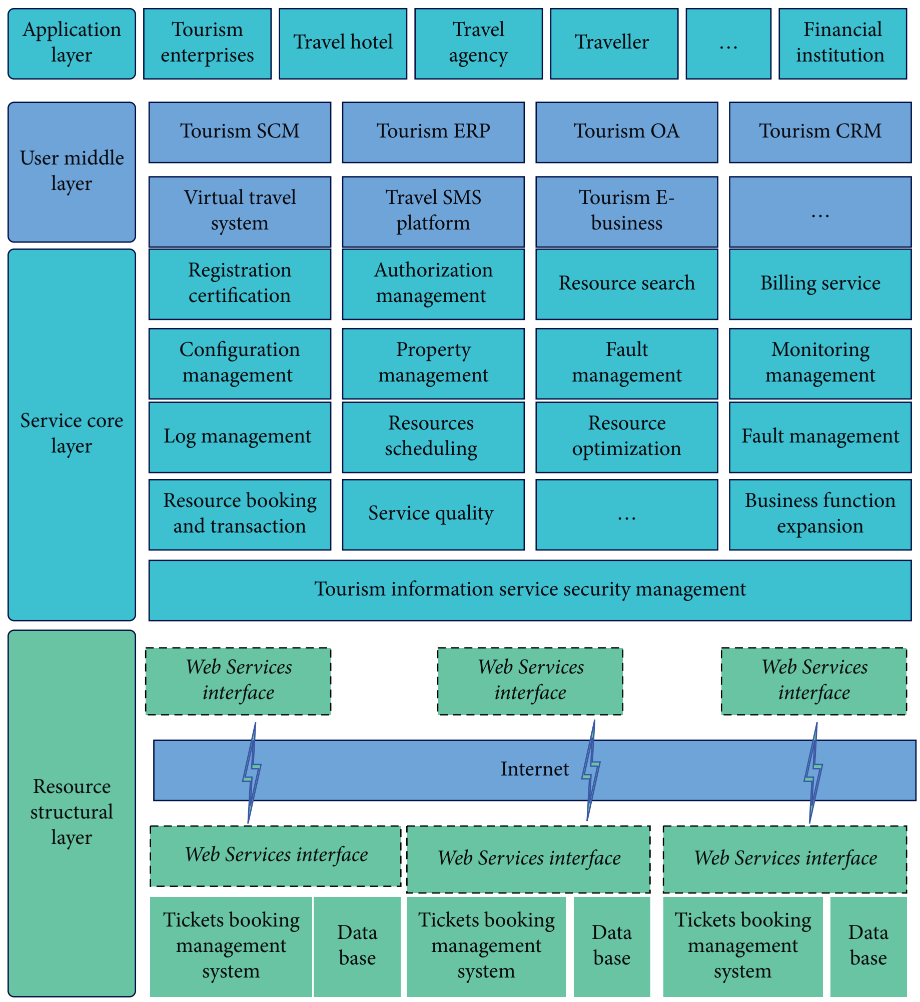

Figure 8: Rural tourism resource management system.

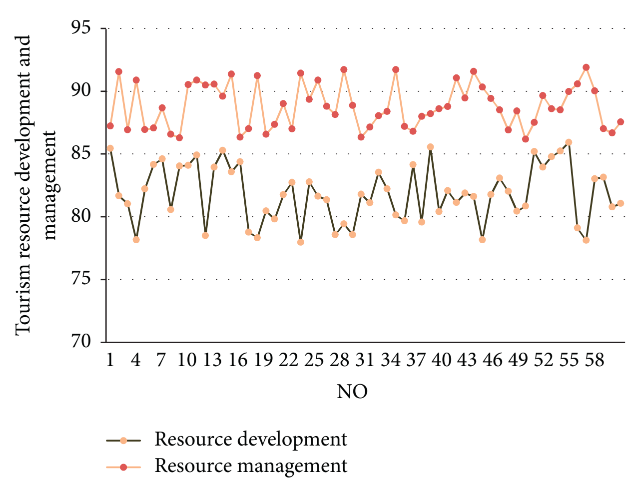

Figure 9: Development and management effects of rural characteristic tourism resources.

proposed in this paper has a good rural characteristic tourism resource development and management effect.

4. Conclusion

In the research of tourism resources, whether it is the traditional research that emphasizes "the theoretical core of tourism resources is the attractive factor" and "tourism resources are the objects of tourists' activities," or emerging research that believes that "tourism resources can attract people to generate tourism motivation" and "attractiveness is the core value of tourism resources," they all regard tourism objects as the core element. Moreover, they will all be "attractive to tourists as a major measure of tourism resources." In order to improve the development effect of tourism resources with rural characteristics, this paper combines the digital communication signal modulation technology to process the related data of tourism resources. Through the test research, it is verified that the rural characteristic tourism resource development platform proposed in this paper has good rural characteristic tourism resource development and management effects.

Data Availability

The labeled dataset used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

Acknowledgments

The research was supported by Hebei Cultural Arts Scientific Planning and Tourism Research Project (no. HB21-YB079).

References

[1] L. T. Tuan, "Environmentally-specific servant leadership and green creativity among tourism employees: dual mediation paths," *Journal of Sustainable Tourism*, vol. 28, no. 1, pp. 86–109, 2020.

[2] Y. Yusof, Z. Awang, K. Jusoff, and Y. Ibrahim, "The influence of green practices by non-green hotels on customer satisfaction and loyalty in hotel and tourism industry," *International Journal of Green Economics*, vol. 11, no. 1, pp. 1–14, 2017.

[3] I. Andersson and L. James, "Altruism or entrepreneurialism? The co-evolution of green place branding and policy tourism in Växjö, Sweden," *Urban Studies*, vol. 55, no. 15, pp. 3437–3453, 2018.

[4] C. Irazábal, "Coastal urban planning in the "Green Republic": tourism development and the nature–infrastructure paradox in Costa Rica," *International Journal of Urban and Regional Research*, vol. 42, no. 5, pp. 882–913, 2018.

[5] H. Wee, N. A. Mustapha, and M. S. Anas, "Characteristic of green event practices in mice tourism: a systematic literature review," *International Journal of Academic Research in Business and Social Sciences*, vol. 11, no. 16, pp. 271–291, 2021.

[6] A. D. Do, Q. V. Nguyen, D. U. Nguyen, Q. H. Le, and D. U. Trinh, "Green supply chain management practices and destination image: evidence from Vietnam tourism industry," *Uncertain Supply Chain Management*, vol. 8, no. 2, pp. 371–378, 2020.

[7] I. Mykola, A. Vadym, P. Anatoliy, H. Yurii, and R. Nataliia, "Features of the content and implementation of innovation and investment projects for the development of enterprises in the field of rural green tourism," *International Journal of Management*, vol. 11, no. 3, pp. 304–315, 2020.

[8] M. Simanjuntak and A. Rumondang Banjarnahor, "Re-investigating the roles of green service-scape to improve tourism performance marketing service dominant logic perspective: a literature review," *Quantitative Economics and Management Studies*, vol. 2, no. 4, pp. 214–232, 2021.

[9] Z. Lili, "Retracted article: prediction of air pollutants and rural green tourism factors based on dynamic migration," *Arabian Journal of Geosciences*, vol. 14, no. 17, p. 1777, 2021.

[10] H. L. T. Trang, J. S. Lee, and H. Han, "How do green attributes elicit pro-environmental behaviors in guests? The case of green hotels in Vietnam," *Journal of Travel & Tourism Marketing*, vol. 36, no. 1, pp. 14–28, 2019.

[11] N. Kongbuamai, Q. Bui, H. M. A. U. Yousaf, and Y. Liu, "The impact of tourism and natural resources on the ecological footprint: a case study of ASEAN countries," *Environmental Science and Pollution Research*, vol. 27, no. 16, pp. 19251–19264, 2020.

[12] R. Kisie, J. Zielińska-Szczepkowska, and D. Taradejna, "Natural and cultural resources of Green Kurpie as drivers of tourism development," *Ekonomia i Środowisko-Economics and Environment*, vol. 65, no. 2, p. 15, 2018.

[13] I. Gallego and X. Font, "Changes in air passenger demand as a result of the COVID-19 crisis: using Big Data to inform tourism policy," *Journal of Sustainable Tourism*, vol. 29, no. 9, pp. 1470–1489, 2021.

[14] C. Anda, A. Erath, and P. J. Fourie, "Transport modelling in the age of big data," *International Journal on the Unity of the Sciences*, vol. 21, no. sup1, pp. 19–42, 2017.

[15] Y. Han and Y. Kim, "A study of measuring traffic congestion for urban network using average link travel time based on DTG big data," *The Journal of The Korea Institute of Intelligent Transport Systems*, vol. 16, no. 5, pp. 72–84, 2017.

[16] D. Fukuda, "Innovative travel survey methods and behavior modeling in the era of big data," *Asian Transport Studies*, vol. 5, no. 3, pp. 436–438, 2019.

[17] A. R. Alaei, S. Becken, and B. Stantic, "Sentiment analysis in tourism: capitalizing on big data," *Journal of Travel Research*, vol. 58, no. 2, pp. 175–191, 2019.

[18] T. Li, J. Wang, J. Huang, and X. Gao, "Exploring temporal heterogeneity in an intercity travel network: a comparative study between weekdays and holidays in China," *Journal of Geographical Sciences*, vol. 30, no. 12, pp. 1943–1962, 2020.