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Research Article

Intelligent Tourism Marketing and Publicity Methods for Revenue Enhancement

Ying Lu[1] **and Bo Cui**[2]

[1]*School of Applied Technology, University of Science and Technology Liaoning, Anshan 114051, China*
[2]*Engineering & Research Institute of Ansteel Corporation, Anshan 114000, China*

Correspondence should be addressed to Ying Lu; z51414013@stu.ahu.edu.cn

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For online e-commerce platforms, big data intelligent marketing is an essential tool for promoting companies, creating pictures, participating in competitions, and engaging customers. This also gives traditional marketing a new sense of precision and a new approach to increasing revenue. Marketing and public relations based on big data analytics and intelligence should be considered important and profitable for the travel and tourism business. Tourism enterprises need to learn to use intelligent technology to guide marketing activities and formulate comprehensive and accurate marketing strategies. Infiltrate the advantages of intelligence into all aspects of tourism marketing, so as to form an intelligent, precise, and modern tourism marketing and publicity model, and help enterprises to improve their income. This work focuses on the research on intelligent tourism marketing and publicity. The main research contents include the following aspects. First, this work proposes a revenue-enhancing tourism marketing and publicity method, which is mainly divided into the use of intelligence to enrich the form of publicity and marketing and the use of intelligence to refine the content of publicity and marketing. Second, this work proposes an IWOA-BP network for evaluating a revenue-enhancing intelligent tourism marketing promotion method. It improves the WOA algorithm by introducing a nonlinear convergence factor and adaptive crossover mutation to construct the IWOA algorithm. Then IWOA is applied to initial weights and thresholds for optimization, which can solve the drawbacks of the traditional BP network and improve the performance and reduce the training time. Third, this work conducts a comprehensive evaluation of the proposed revenue enhancement-oriented tourism marketing and publicity methods and IWOA-BP, and the experimental results verify the feasibility of these methods.

1. Introduction

With the improvement of residents' living standards, the demand for tourism is becoming more and more strong, and the tourism industry developed from this has already played a very important role in the national economy. The tourism industry has shown a vigorous development momentum, and the proportion of tourism in the economic development will be further enhanced. The rapid development of information technology is significant in the vigorous development of tourism. In particular, the development of intelligent tourism not only provides effective information consulting services for the majority of tourists but also provides technical support for the innovative marketing of tourism enterprises. Due to the enhancement of economic strength and the acceleration of the globalization process, not only the international competition has been strengthened, but also the competition among domestic tourist attractions has become more and more fierce. If tourist attractions want to improve their competitiveness, they need to consider making a fuss about communication and marketing methods. The concept of intelligent tourism marketing and publicity is valued by more and more tourist attractions in today's era. The connotation of this concept is to regard scenic spots as enterprises, tourists as customers, and through intelligent marketing and publicity means, the scenic environment, including hard and soft environments, are manufactured as products. The purpose of tourism

marketing and publicity is to make tourist attractions better, through cultural publicity, tourism development, etc., to make consumers pay the bill. To achieve this purpose, it is necessary to utilize intelligent tourism marketing and publicity methods [1–7].

On the one hand, the social needs of groups are gradually changing from material needs to spiritual needs, and consumption levels and needs are becoming more and more diverse. The quality requirements for goods and services are also constantly escalating, and factors such as consumer personalization, customization, and group belonging have gradually become the leading consumer decision-making for many emerging consumer groups. On the other hand, in the context of the Internet, intelligent transformation is an inevitable trend of economic and social development. Under the background of digitalization and intelligence, the tourism market structure has changed, and market competition has become more fierce in the digital age. In order to establish a brand image in the competition and seize market share, major tourism platforms have used big data to carry out various precise marketing activities. In such a market environment, learning to make good use of big data to carry out marketing, mining user needs, and carrying out targeted promotion is very important to enhance the core competitiveness of enterprises [8–14].

Intelligent tourism marketing is conducive to changing the traditional concept of scenic spot management and comprehensively improving the image of tourist scenic spots. Intelligent tourism marketing is different from the past tourism management in terms of word creation, and also has a big difference in meaning. The difference between the two is that the management of the latter places too much emphasis on administrative tendencies, while the former is more inclined to guide the construction of scenic spots with theories of marketing. In terms of purpose, the main purpose of scenic spot management is to strengthen interaction and ensure the harmony of scenic spots. Tourism marketing and publicity can bring changes to the scenic environment, enhance the attractiveness of tourist attractions, and enhance the overall image of the scenic spots. Intelligent tourism marketing is conducive to building a tourism brand and establishing a competitive advantage in tourist attractions. Building a tourism brand can bring various benefits to tourist attractions, such as enhancing the attractiveness of business investment, enhancing the pride of residents in the scenic area, and ensuring the interests of residents. And it is conducive to the scenic spot to participate in the competition and enhance its influence in the country. The building of tourism brands is also of great significance. Through brand building, the scenic spot can have a clear positioning. And it has a certain degree of recognition nationwide, attracting foreign business investment and social resources, etc. Many scenic spots have noticed this, and actively promote intelligent tourism marketing and publicity through various means to create a unique brand advantage for tourism. Intelligent tourism marketing is conducive to promoting the innovation of tourism taste and realizing the sustainable development of scenic spots. The formulation of tourism marketing promotion strategy can refer to the marketing strategy. Taking tourists as consumers, what efforts should be made to meet the needs of consumers is what tourism marketing needs to pay attention to. By analyzing the development status of the scenic spot and its possible future development trend, it is necessary to use a growth-oriented development strategy by analyzing scenic spots [15–20].

To promote the high-quality development of the tourism industry, this work studies tourism marketing and publicity methods for revenue enhancement. First, this work proposes a revenue-enhancing tourism marketing and publicity method, which is mainly divided into the use of intelligence to enrich the form of publicity and marketing and the use of intelligence to refine the content of publicity and marketing. Second, this work proposes an IWOA-BP network for evaluating a revenue-enhancing intelligent tourism marketing promotion method. It improves the WOA algorithm by introducing a nonlinear convergence factor and adaptive crossover mutation to construct the IWOA algorithm. Then IWOA is applied to initial weights and thresholds for optimization, which can solve the drawbacks of the traditional BP network and improve the performance and reduce the training time. Third, this work conducts a comprehensive evaluation of the proposed revenue enhancement-oriented tourism marketing and publicity methods and IWOA-BP, and the experimental results verify the feasibility of these methods.

2. Related Work

Literature [21] believed that if a region wanted to successfully use destination tourism marketing, it should plan a detailed marketing strategy in the scenic spot development stage. Moreover, if a region wanted to develop a tourist destination, it not only depended on the planning and marketing of the scenic spot itself, but also on the support of the local government. This also involved issues such as whether the development of tourism destinations harmed the interests of local residents, and whether it could bring sustainable economic development to residents. These all affected how companies used tourism marketing methods scientifically. Literature [22] proposed that tourism enterprises could increase the exposure of tourism enterprises according to the influence of the Internet, so as to convert the traffic obtained by enterprises into the competitiveness and productivity required by enterprises. Literature [23] believed that with the continuous progress of the Internet era and marketing theory, the importance of intelligent marketing to scenic spots is self-evident. It proposed that the scenic spot used intelligent media to strengthen the interaction with tourists, which could invisibly strengthen the publicity of the scenic spot and increase loyalty to the scenic spot in the interaction with the tourists. Literature [24] studied the role of mobile marketing in tourism marketing in the era of intelligent marketing. The research results showed that the status of consumers in the process of searching for travel information was the most important reason for triggering behavior, and videos with rich content could fully exert the emotional triggering effect. The more participants like video, the more it would affect their engagement

intention and resonance, and the effect of media content richness was positively related to marketing effectiveness. Literature [25] studied the marketing strategy of scenic spots and proposed a sustainable development marketing model. On the basis of sorting out its tourism development process, combined with SWOT analysis and STP analysis framework, a tourism marketing strategy was constructed using the 4P marketing theory system. Literature [26] pointed out that under the political background of supply-side reform, the tourism industry was the gold industry of the tertiary industry, and various regions were vigorously developing tourism. With the continuous development of the tourism market, the number of potential tourists brought by festivals was also very considerable. Reference [27] took scenic spots as an example, used questionnaires and interviews to analyze the current development status of scenic spots and the existing problems in marketing, and improved the tourism marketing strategy of scenic spots according to their existing problems. Literature [28] believed that the growth point of the future economic income would largely depend on the experience of tourists. In this paper, factors that may affect the tourists' sense of experience are expounded, and suggestions on how to enhance the tourists' sense of experience and comfort in the scenic spot were put forward.

Literature [29] pointed out that when tourists choose tourist destinations, they pursued the cultural experience brought by scenic spots. According to the current preference of tourists in pursuit of a sense of cultural experience, the scenic spot could try to integrate the local characteristic culture with the tourism of the scenic spot, launched the marketing strategy of the region, and put forward the concept of cultural tourism. Literature [30] proposed that with the continuous development of tourism, consumers enjoyed more tourism with cultural elements and enjoyed the sense of experience brought by tourism. The trend of taking food culture as the center of tourism marketing had begun to appear in the tourism market. Literature [31] proposed the current marketing problems, and proposed a tourism marketing strategy centered on food culture according to the current problems. Literature [32] expounded on the development trend of the current tourism market, and the current competitive trend of the tourism market had been separated from the way of relying on price wars. With the improvement of people's material living standards, the competition to build scenic spots had begun. Most scenic spots did not have brand awareness. In the development and exploration of scenic spots, according to the actual situation of their own scenic spots, they could create a brand strategy suitable for the actual operating conditions of the scenic spots and improved popularity. Literature [33] pointed out that with the improvement of living standards, consumers were more inclined to choose comfortable and enjoyable travel modes. Gone was the situation where group tours did not pay attention to the diet of the tourist destination in the past. Now more young people usually made a strategy for the diet of the tourist destination before choosing a tourist destination. Tourism food marketing had begun to have an impact on the profitability of scenic spots, and food and beverage marketing had begun to affect scenic marketing. Literature [34] believed that the emergence of new media had made the connection between people more convenient, and people's opinions and evaluations on a certain thing through new media have diversified voices. Many industries had seized the characteristics of new media and used the characteristics of new media as the main focus to develop their own industries. Literature [35] believed that although many scenic spots were using marketing methods with good performance at this stage, due to a large number of tourism resources, some tourism resources were inherently insufficient or the scenic spots did not pay enough attention to intelligent marketing. Literature [36] studied the intelligent strategy of tourist attractions, analyzed the current situation of intelligent marketing of scenic spots, and gave suggestions for improving tourism intelligent marketing. Reference [37] introduced in detail the contribution of intelligent marketing to the marketing of scenic spots in the Internet era. It allowed potential users to truly see the characteristic scenic spots of the scenic spot, thus generating the idea of who want to experience it themselves and attracting tourists to the scenic spot. Literature [38] believed that the intelligent marketing of scenic spots should be combined with traditional marketing methods, which was more beneficial to the economic benefits of scenic spots. Through the above analysis, the popularity of the Internet had brought us intelligent new media, and intelligent marketing in tourism marketing was also an important marketing method.

3. Method

First, this work proposes a revenue-enhancing tourism marketing and publicity method, which is mainly divided into the use of intelligence to enrich the form of publicity and marketing and the use of intelligence to refine the content of publicity and marketing. Second, this work proposes an IWOA-BP network for evaluating a revenue-enhancing intelligent tourism marketing promotion method. It improves the WOA algorithm by introducing nonlinear convergence factor and adaptive crossover mutation to construct the IWOA algorithm. Then IWOA is applied to initial weights and thresholds for optimization, which can solve the drawbacks of the traditional BP network and improve the performance and reduce the training time.

3.1. Intelligent Tourism Marketing Promotion Strategy. The first is to use intelligent technology to enrich the forms of marketing and publicity, and intelligence provides innovative forms of tourism marketing and publicity. This article will discuss how to combine intelligence with different forms of marketing promotion from the level of membership marketing and opinion leaders, break the limitations of traditional marketing models, and make promotional activities more in line with tourism characteristics and consumer psychological needs. Like other e-commerce platforms, travel products pay more attention to the marketing management of members. The more common affiliate marketing methods are push messages and

e-mail advertisements, which are based entirely on user data within the platform. This can directly connect with the target audience, but there are also disadvantages such as disturbing the user, causing the user to be bored and numb, and even causing the user to uninstall the software. Therefore, in the process of carrying out tourism marketing and publicity, we must make full use of intelligent analysis and grasp the scale of publicity. When carrying out marketing promotion, it is first necessary to establish a user database to subdivide audience characteristics, regions, and preferences. This part can be completed by the customer's own choice, or a user model can be established through big data analysis of user behavior. At the same time, in the process of marketing and publicity, we must grasp the publicity time, which will directly affect the acceptance of the audience's publicity information, and set corresponding time nodes according to different groups of people. For travel, the travel tips and experiences of travel experts can undoubtedly play the role of opinion leaders. The sharing of these experts from social media on the Internet does not directly involve product promotion and brand marketing, but explores each different travel location from the perspective of travelers. This kind of communication form of putting oneself in the shoes, through the reprinting and promotion of social media and special websites, will form an amplification effect, and over time, the travel notes of these talents will become more authoritative. Prediction is an important function of intelligence, and it is also one of the attributes of opinion leaders. Traditional opinion leaders may gain experience based on personal behavior, while data is epoch-making, and these experiences and future expectations can be revealed through data. The predictive information detected by these data is then combined with the opinions of opinion leaders, thereby expanding the professionalism and authority of its marketing promotion content.

The second is to use intelligent technology to refine the promotion content. In the presentation of marketing promotion content, advertising copy and visual presentation are two important contents. This article talks about how to use intelligent technology to make the copy content more targeted, the product display more representative, and the visual presentation more experiential. The first is to create targeted promotion copywriting. In the process of using the media, the audience gives up the opportunity to actively interpret and replaces the active establishment of self-awareness with passive sensory enjoyment. That is to say, the communication content presented by the carrier can exceed the rational influence on the audience to a certain extent. There are large differences between the groups of users to which different types of headlines are intended. On the whole, title copy can be divided into two categories: rational copy and emotional copy. Most of the keywords involved in the title of the rational copy are numbers and rational words, which can directly show the interests in tourism products, and this type of copy is often more attractive to rational consumers. Perceptual vocabulary is divided into two directions: curiosity and emotion. The starting point of perceptual vocabulary is to stimulate the emotional nerves of the audience, thereby generating emotional resonance. A copywriting style that combines sensibility and rationality is easier to catch the user's attention. For the same target group and the same series of travel products, the copywriting style that combines the virtual and the real will eventually get a higher click-through rate and order conversion. The second is to create impactful visual displays. Society has already entered the era of the eyeball economy, and audiences are reluctant to spend a lot of time reading advertising copy. On the contrary, the display of advertisement images or video content has a greater visual impact and influence on users. In the process of big data marketing, it is necessary to be able to recognize the importance of visual presentation, and to improve the visual experience as the ultimate goal. For the content of pictures, through data statistics, the pictures with the highest ranking of users' clicks are the most used for marketing and promotion, and the effect will be better in attracting the attention of similar consumers. The third is to set up a dedicated product page. Using data can make the presentation of tourism product information more representative. Through this customized advertising page, on the basis of attracting potential consumer groups, the conversion rate of tourism product sales can be greatly improved. The purpose of setting up a dedicated travel product page is to make travel products more targeted. Through personalized copywriting and creative visual impact, segmented audiences can be diverted to the tourism product display page, and whether these more accurate target users can make purchases depends on the product in the final analysis. These exclusive travel products are based on the answers obtained by users' search behaviors and transaction traces.

3.2. BP Algorithm. The signal of the BP network is propagated forward, and the error is propagated backward. After the forward propagation is processed by each layer, when there is an error between output and expected result, it enters the backpropagation. The weight of each layer is adjusted one by one, which can not only solve the nonlinear problem between the input and output but also complete the function of self-learning. The BP network can also learn and store the mapping relationship between input and output without knowing that there is a certain mapping relationship between functions. Through the comparison of input samples, the network weights and thresholds are continuously adjusted.

$$y = f\left(\sum w_i x_i + b\right), \tag{1}$$

where w is weight, x is the feature, and b is the bias.

The input layer, the hidden layer, and the output layer are all components of the BP network. In general, the number of nodes in the input layer and the output layer corresponds to the dimensions of the input vector and the output vector. You have complete freedom in determining the number of nodes and layers in the hidden layer, and the ideal number can be chosen based on the actual model requirements. Generally speaking, the higher the accuracy required for model training, the more hidden layers and nodes are required, but the computational complexity will also increase. BP structure is demonstrated in Figure 1.

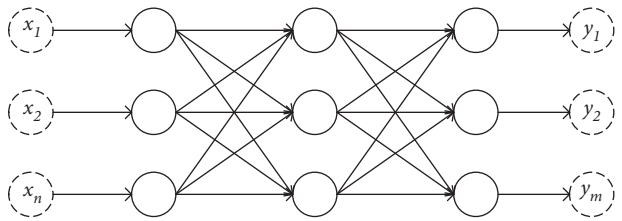

Figure 1: BP structure. The commonly used activation function in BP network is Sigmoid.

$$\text{Sigmoid}(x) = \frac{1}{(1 + \exp(-x))}, \tag{2}$$

where x is the input.

The application of the BP network is very extensive, and it has many advantages. First, it can store information in a distributed manner. When it comes to neural networks, information is not merely stored in a single location, but rather spread over all of the processors and the connections between them. Instead, it is dispersed throughout the network based on the type of data being transmitted. When the input signal of the neural network changes suddenly, it does not affect the correct output of the network, so the neural network has a strong ability to defend against faults and fault tolerance. Second, it can process information in parallel. For the input and output information, each neuron processes and outputs in a massively parallel manner, and each neuron in the same layer can process the information at the same time. This method of parallel processing and information storage greatly improves the emergency response capability of the system, improves the computing speed of the system, and improves the real-time performance of the neural network. Third, it combines information storage and processing into one. The storage and processing of BP network information are integrated, and each neuron not only has the function of storage but also has the function of information processing. The change of connection weights between neurons not only reflects the memory of information, but also reflects the process of information processing. Fourth, its self-organization and self-adaptive ability are strong. The neural network can learn and quickly adapt to the characteristics of the system with uncertainty, and can automatically find the law according to a certain relationship between the input and output of the system, and memorize it into each weight of the neural network.

BP network exposed more and more shortcomings, mainly in the following aspects. The first is the contradiction between learning rate and stability. The gradient descent algorithm has a small learning rate during the learning process, resulting in a slow convergence rate. The additional momentum method is usually faster than the simple gradient method because it takes into account not only the effect of the changing trend on the error surface but also the effect of the error on the gradient. However, to ensure the stability of the learning process, a higher learning rate is usually selected. The second is that it is difficult for nonlinear networks to choose the learning rate. For the learning rate in the linear network, if the setting is too large, the learning process will be unstable. On the contrary, setting too small will prolong the learning time and affect the efficiency of learning. The problem that the learning rate of the nonlinear network cannot be valued is still to be solved. The third is the local minima problem. One of the main shortcomings of traditional BP network is that the training process is easy to fall local minima. The generation for local minima is closely related to the selection of network weights. When two initial points are very close together may eventually one will iterate to a local minimum point. When there is a function curve with multiple minima, the algorithm is easy to fall into it and cannot escape, which leads to the failure of network training. The fourth is that the initial weight dependence is too strong. The BP network has a strong dependence on the initial weight. The initial weight has a certain influence on the training time of the neural network and the reliability of the final training result. Selecting different initial weights for training will often converge to different local minima, which is why the results obtained from each training will be different. However, in most cases, random numbers are used as initial weights, which not only affects the learning efficiency of the BP neural network, but also has low practical value.

3.3. WOA Algorithm. The WOA algorithm is a population-based optimization algorithm proposed by simulating the hunting behavior of humpback whales. It realizes the local development function of the algorithm through the shrinking and wrapping or spiral upward mechanism and realizes the global exploration function of the algorithm through the random search mechanism. The algorithm mainly has three behaviors: surrounding the prey, attacking the prey, and randomly searching for the prey.

An approach to a solution can be approximated as a humpback whale circling its prey, and this process can be compared to the computer process of searching for a solution. Updated positioning surrounds the target if it's judged that it's the best prey available at the moment.

$$\begin{aligned} D &= \left|X(t) - \text{CX}_{\text{best}}(t)\right|, \\ X(t+1) &= X_{\text{best}}(t) - \text{AD}, \\ A &= a\left(2r_1 - 1\right), \\ C &= 2r_2, \end{aligned} \tag{3}$$

where t is the iterations, A and C are the coefficient vectors, $X_{\text{best}}(t)$ is the best whale position, and $X(t)$ is the current position.

When humpback whales attack their prey, there are mainly two ways of shrinking and surrounding or spiral surrounding. The shrinking and surrounding mechanism is realized by reducing the parameter value. The spiral encirclement mechanism is to update the position through the spiral position formula, so as to hunt the selected target prey. During the actual hunt, humpback whales swim around their prey in a shrinking circle while simultaneously swimming along a spiral path. In order to simulate these two simultaneous hunting behaviors, the algorithm assumes a probability of 50% to choose between the shrinking

encirclement mechanism and the spiral encirclement mechanism, so as to update the position vector.

$$X(t+1) = \begin{cases} X_{\text{best}}(t) - \text{AD}, & p < 0.5, \\ D * \exp(bl) * \cos(2\pi l) + X_{\text{best}}(t), & p \geq 0.5, \end{cases} \tag{4}$$

where b is the logarithmic spiral shape constant, l is a random number.

Whales' hunt for prey can be compared to the process of finding the best solution to a problem. The whale algorithm can also be used to search for prey using the same method based on the change of vector A. By changing the value of A to be greater than 1 or less than −1 to force away from the current best position vector, allowing for a global random search.

A basic algorithm, a few adjustments, and a straightforward implementation are all WOA's advantages. As a result, there is no way to prevent the whale algorithm from slipping into a local best. 'It still has flaws like slow convergence, limited convergence accuracy, and an easy fall into local optimum, like other clever algorithms.

3.4. Improved WOA and IWOA-BP Algorithm. The search technique is largely determined by parameter value adjustment in the WOA algorithm. The global search method is used when the absolute value is larger than 1, while the local search technique is used when the absolute value is less than 1. The convergence factor dictates the parameter value's magnitude. Convergence factor is a measure of how well the algorithm can search globally. When the convergence factor is low, its capacity to do local searches is more powerful. When the algorithm reaches its middle and late stages, the convergence factor drops linearly from 2 to 0, making it easy to fall into a local optimal solution. A nonlinear convergence factor (NCF) is utilized to solve these issues. Its value is kept high in the beginning and low in the latter stages of the process. The algorithm's convergence speed is boosted as a result of balancing global and local search abilities in the early stages.

$$a = 2 - \frac{1.7}{1 + \exp\left(-\alpha\left(2t - t_{\max}\right)/2t_{\max}\right)}, \tag{5}$$

where α is the control factor.

Combining two individuals from separate parents to produce a new person is known as the crossover process in genetic algorithms and can significantly improve the algorithm's global optimization capabilities. The process of mutation refers to the creation of a new individual through the alteration of a specific gene on the individual, allowing the algorithm to perform local optimization. To avoid early convergence in an iterative process, it can keep population variety intact. This study provides the crossover and mutation technique to the genetic algorithm in order to improve its global optimization ability to further improve the performance of the whale algorithm.

For the crossover operation, individuals in the population are first selected and paired with each other at random. Then let the paired individuals perform crossover operations according to a predetermined probability. For crossed individuals, the calculation of the crossover operation is as follows.

$$\begin{aligned} y_i^{k+1} &= \beta y_i^k + (1-\beta) y_j^k, \\ y_j^{k+1} &= \beta y_j^k + (1-\beta) y_i^k, \end{aligned} \tag{6}$$

where β is a random number.

For mutation operation, let individuals perform mutation operation according to a predetermined probability.

$$y_i^d = y_i^d (1 + 0.5\nu), \tag{7}$$

where ν is a random number.

The algorithm's ability to optimize itself was profoundly impacted by his work on establishing crossover and mutation probabilities. When the likelihood of crossover is low, the rate at which new people are generated is slower, and the capacity to perform a global search is diminished. The frequency of acquiring new individuals through mutation operation decreases when the mutation probability is low, and the variety of the population cannot be maintained. Individuals close to the optimal answer may be wiped out if the mutation chance is high enough, resulting in a nearly random search. This research uses an adaptive crossover and mutation (ACM) system, which allows the likelihood of crossover and mutation to be changed with the population's evolution.

$$\begin{aligned} p_c &= \begin{cases} \dfrac{k_1 (f_{\max} - f)}{f_{\max} - f_{av}}, & f \geq f_{av}, \\ k_2, & f < f_{av}, \end{cases} \\ p_v &= \begin{cases} \dfrac{k_3 (f_{\max} - f')}{f_{\max} - f_{av}}, & f' \geq f_{av}, \\ k_4, & f' < f_{av}, \end{cases} \end{aligned} \tag{8}$$

where $f_{\max}$ is the maximum fitness, f_{av} is the average fitness, f is the larger fitness of the two individual performing crossover, and f' represents the fitness of the mutant individual.

Crossover and mutation operations are less likely to occur when an individual's fitness is better than the average, allowing it to be passed down to future generations. When an individual's fitness is lower than the average, crossover and mutation operations are more likely, making it easier for the individual to be eliminated.

An upgraded version of the IWOA algorithm is used to create IWOA-BP. Optimizing the BP network's initial weights and thresholds with the revised IWOA method relies on using the training error of the BP network as a measure of population fitness. A final step is to apply these optimum values as initial values for the BP network. The pipeline of IWOA-BP is demonstrated in Figure 2.

The specific operation steps of the IWOA-BP network are divided into some steps. The first step is to initialize the BP network, determine the main structure of the network, and generate initialization weights and thresholds. The second

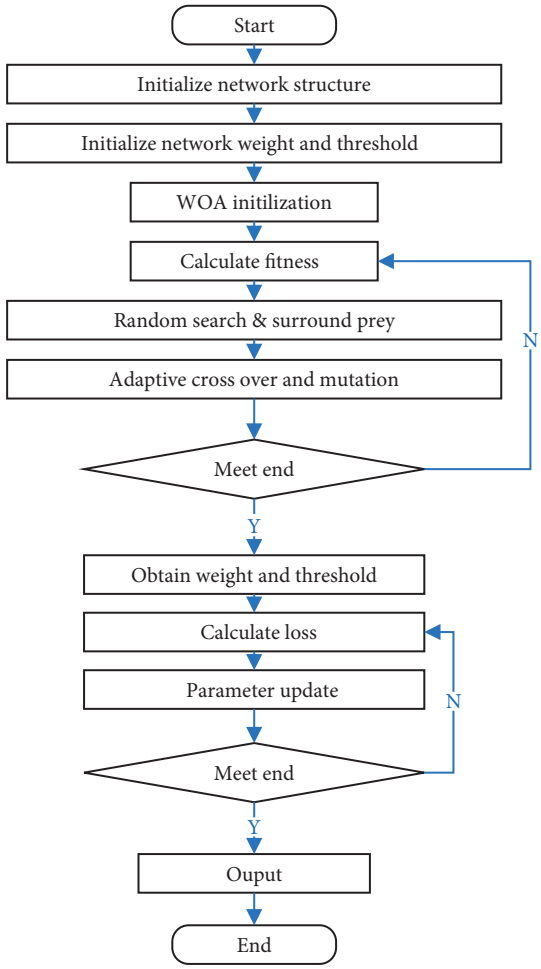

Figure 2: IWOA-BP pipeline.

step, the initialization of IWOA, converts the initialization weights and thresholds in the above steps into position vector of the improved IWOA, and initializes other parameters of the IWOA algorithm. At the same time, MSE is utilized as the fitness of the improved IWOA. The third step is to calculate fitness, find the position of optimal fitness, record the position vector and use it as the current optimal individual position, and calculate average fitness. The fourth step is to choose a strategy to surround or randomly search for prey. The fifth step is the individual crossover, individual crossover operation is performed according to the established adaptive crossover probability. The sixth step is an individual mutation, and the individual mutation operation is conducted via established adaptive mutation probability. The seventh step is to output the results. When the maximum number of iterations of the algorithm is met or the required error accuracy is reached, the algorithm ends, and the optimized weights and thresholds are output to the BP network.

4. Experiment and Analysis

4.1. Dataset. This work collects the tourism revenue data under the corresponding intelligent tourism marketing publicity method to construct the data required for the training and testing of the IWOA-BP network. The dataset contains a total of 29,187 samples, of which 19,038 are training samples, and the rest are test samples. Each data sample contains 8 feature indicators, as demonstrated in Table 1, and the corresponding label is the income level. The evaluation indexes in this work are accuracy and precision.

$$Acc = \frac{(TP + TN)}{(TP + FN + FP + TN)},$$
$$Rec = \frac{TP}{(TP + FN)}. \quad (9)$$

4.2. IWOA-BP Training Experiment. This work analyzes the training of the IWOA-BP network. The main analysis objects are the training loss, training accuracy and training recall during the network training process. The data are demonstrated in Figure 3 and Figure 4.

With the increase in training times, the loss of the IWOA-BP network shows a downward trend, and the correct rate and recall rate show a downward trend. When the number of training reaches 50 epochs, all three tend to stabilize, at which point the network training has converged.

4.3. Method Comparison. To verify the feasibility of IWOA-BP for evaluating the income effect of the intelligent tourism marketing and publicity method, this work compares it with other methods. The compared methods include SVM, KNN, and DBN. The comparison data is demonstrated in Table 2.

IWOA-BP method can obtain the highest accuracy rate and recall rate. Compared with other machine learning methods, this method can achieve different degrees of performance improvement in both accuracy and recall.

4.4. Nonlinear Convergence Factor Analysis. This work uses nonlinear convergence factor (NCF) to improve the traditional WOA algorithm. To verify the superiority of this improvement, the performance of traditional convergence factor (TCF) and NCF are compared respectively. The comparison data is demonstrated in Figure 5.

Compared with the traditional convergence factor, after using the improved nonlinear convergence factor, the IWOA-BP network can achieve a 1.9% and 1.6% improvement in accuracy and recall.

4.5. Adaptive Crossover and Mutation Analysis. This work uses adaptive crossover and mutation (ACM) to improve the traditional WOA algorithm. To verify the superiority of this improvement, the performance of traditional crossover and mutation (TCM) and ACM are compared respectively. The comparison data is demonstrated in Figure 6.

Compared with the traditional crossover and mutation, after using the improved adaptive crossover and mutation, the IWOA-BP network can achieve a 1.6% and 1.1% improvement in accuracy and recall.

Table 1: Feature indicators of data sample.

Index	Feature
x_1	Operating profit margin
x_2	Return on assets
x_3	Return on capital
x_4	Capital appreciation rate
x_5	Account recovery rate
x_6	Inventory turnover
x_7	Profit per capita
x_8	Reception per capita

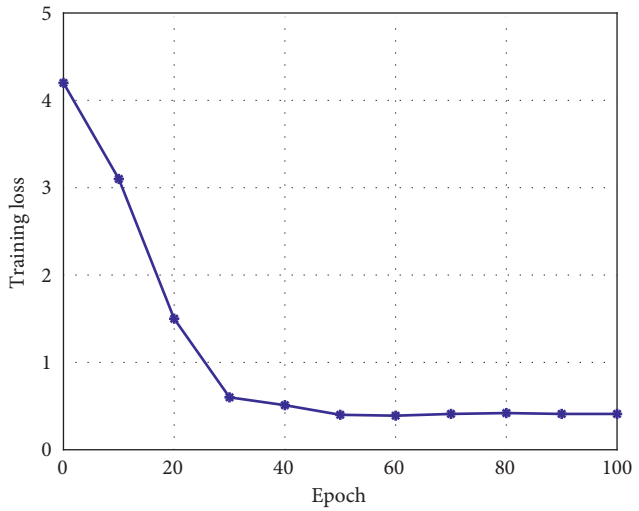

Figure 3: Training loss analysis.

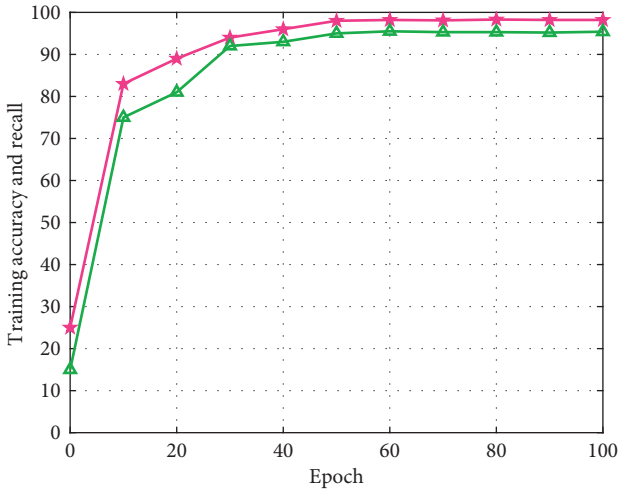

Figure 4: Training accuracy and recall analysis.

4.6. IWOA Analysis. This work uses the IWOA algorithm to optimize the BP network. In order to verify the superiority of this optimization measure, the accuracy and recall rate of the traditional BP, WOA-BP and IWOA-BP methods are compared respectively. The comparison data is demonstrated in Table 3.

Table 2: Comparison with different method.

Method	Accuracy	Recall
SVM	90.3	87.8
KNN	92.1	89.6
DBN	93.3	91.1
IWOA-BP	95.1	92.7

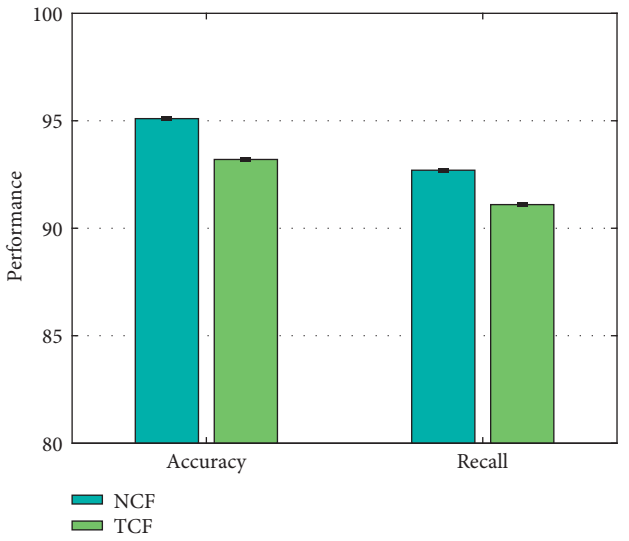

Figure 5: Nonlinear convergence factor analysis.

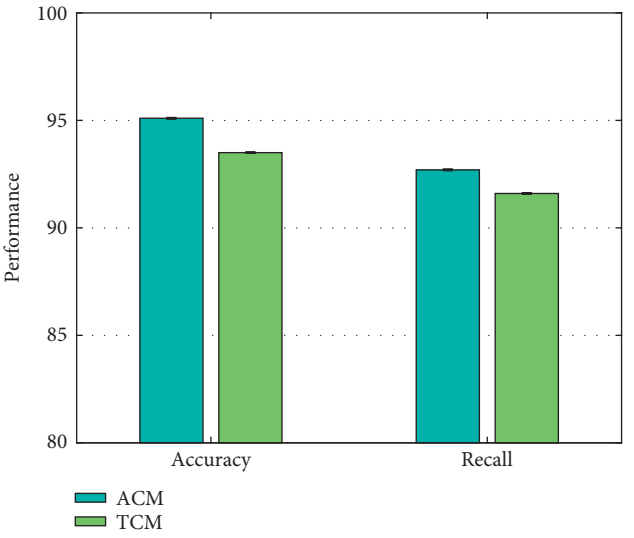

Figure 6: Adaptive crossover and mutation analysis.

Table 3: Comparison of BP, WOA-BP and IWOA-BP.

Method	Accuracy	Recall	Training time
BP	91.9	90.3	297 min
WOA-BP	93.7	91.4	238 min
IWOA-BP	95.1	92.7	189 min

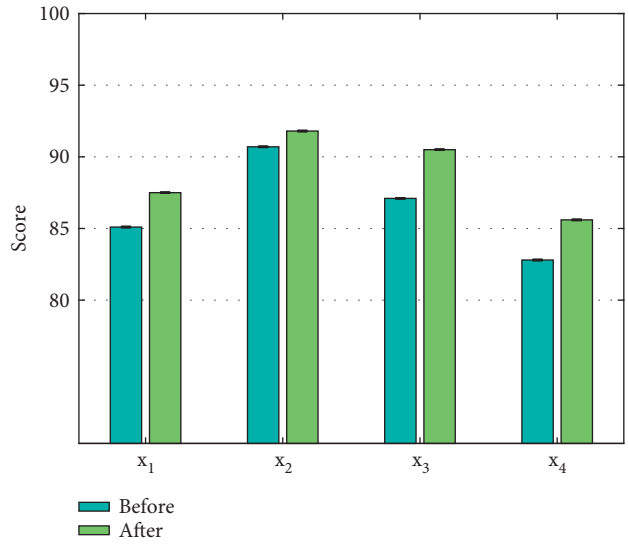

Figure 7: Comparison of scores for the first four indicators.

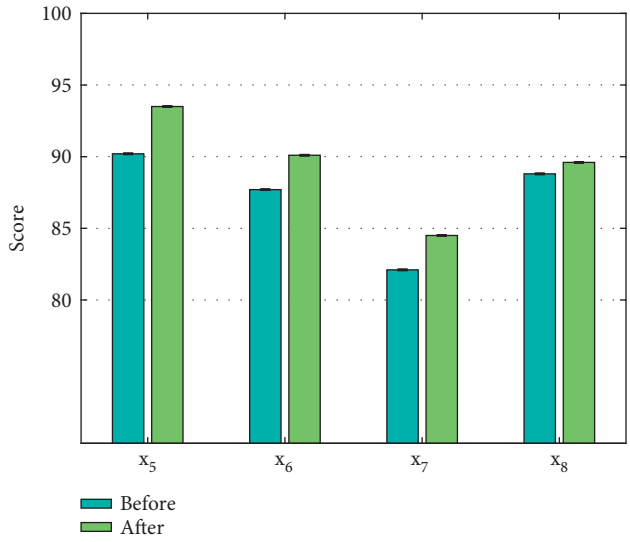

Figure 8: Comparison of scores for the last four indicators.

As illustrated in the comparison data in the table, the performance of the traditional BP network is the lowest, and the training time is the longest. After the introduction of WOA for optimization, the accuracy and recall rate of the network have improved, and the training time has decreased. These performances can be further improved after BP is optimized with the improved IWOA.

4.7. Intelligent Tourism Marketing Promotion Strategy Analysis. This work proposes a series of intelligent tourism marketing promotion strategy, to verify that these strategies can promote tourism revenue, this work compares the tourism efficiency indicators before and after using these strategies, which are the same as those in Table 1. The comparison results are demonstrated in Figure 7 and Figure 8.

According to the data shown in the figure, after using the intelligent tourism marketing and publicity strategy proposed in this work, each indicator of tourism revenue can get a corresponding score improvement. This verifies the feasibility and superiority of the strategy designed in this work.

5. Conclusion

With the improvement of residents' living standards, the demand for tourism is becoming more and more strong, and the tourism industry developed from this has already played a very important role in the national economy. The tourism industry has shown a vigorous development momentum, and the proportion of tourism in the economic development will be further enhanced. The tourism industry is in a period of rapid development, and the level of tourist demand is gradually rising. Information technology is constantly changing and upgrading, and the direction and method of tourism marketing and publicity are in urgent need of research and innovation. The traditional tourism marketing propaganda is mainly based on offline travel agencies, the marketing strategy is to attract tourists with low-cost marketing, the marketing channels and marketing methods are single, and the design of tourism products cannot meet the needs of tourists. With the continuous updating of scientific and technological information in modern society and the rise of emerging technologies such as big data intelligence, the era of intelligence has emerged, which has special social research and application value for intelligent tourism marketing. To promote the high-quality development of the tourism industry, this work studies tourism marketing and publicity methods for revenue enhancement. First, this work proposes a revenue-enhancing tourism marketing and publicity method, which is mainly divided into the use of intelligence to enrich the form of publicity and marketing and the use of intelligence to refine the content of publicity and marketing. Second, this work proposes an IWOA-BP network for evaluating a revenue-enhancing intelligent tourism marketing promotion method. It improves the WOA algorithm by introducing nonlinear convergence factor and adaptive crossover mutations to construct the IWOA algorithm. Then the IWOA algorithm is applied to the initial weights and thresholds of the BP network for optimization, which can solve the drawbacks of the traditional BP network and improve the performance and reduce the training time. Third, this work conducts a comprehensive evaluation of the proposed revenue enhancement-oriented tourism marketing and publicity methods and IWOA-BP, and the experimental results verify the feasibility of these methods.

Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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