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The Optimization Development Model of Traditional Ethnic Sports under the Computer Intelligent Particle Swarm Algorithm

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ABSTRACT

This study aims to use the computer-intelligent particle swarm algorithm to optimize the development model of traditional ethnic sports. By analyzing the characteristics and problems of the development of traditional ethnic sports, combined with the advantages of the particle swarm algorithm, an optimization model was constructed, and an empirical study was carried out. The model for applying the particle swarm algorithm to optimize the development of traditional ethnic sports was proposed. In the model construction, the development problems of traditional ethnic sports were transformed into an optimization problem. The model was solved using the particle swarm algorithm's search and optimization capabilities, and an optimal decision scheme was obtained. The computer-intelligent particle swarm algorithm can scientifically and effectively solve the problems faced by the development of traditional ethnic sports.

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1. Introduction

Traditional ethnic sports, as an essential part of ethnic culture, are of great significance in maintaining and inheriting ethnic culture, promoting ethnic unity, and enhancing ethnic confidence. However, due to the influence of historical, social, and cultural factors, traditional ethnic sports face challenges and problems in modern society, such as inheritance difficulties, resource shortages, ideological conflicts, etc. Therefore, optimizing the development of traditional ethnic sports has become a pressing issue to be solved [1]. Traditional optimization methods are often limited to experience and intuition, making it difficult to find the optimal solution. Developingcomputer-intelligent algorithms provides a new idea for solving this problem [2]. As a type of computer intelligent algorithm, the particle swarm algorithm has the advantages of global search, adaptability, and fast convergence speed. It has achieved remarkable optimization effects in many fields. Applying the particle swarm algorithm to the optimization model of traditional ethnic sports

development can enhance the development effect and sustainability of traditional sports by optimizing resource allocation, policy-making, and inheritance methods [3].

By analyzing the difficulties of traditional sports in inheritance, resources, and ideology, we clarify the direction and objectives that need to be optimized. Understand the basic principles and characteristics of the particle swarm algorithm and determine its applicability and advantages through analysis of its algorithm process and parameters. Then, build an optimization development model of traditional ethnic sports [4]. Transform the development problems of traditional ethnic sports into an optimization problem to define development goals, decision variables, and constraints. Use the search and optimization capabilities of the particle swarm algorithm to optimize model parameters and find the optimal solution. Finally, the effect of the optimization model is verified through empirical research [5]. Select specific cases of traditional ethnic sports development, apply the optimization model to practical problems, and compare with traditional methods. Evaluate the effects and feasibility of the optimization model in traditional ethnic sports development through the analysis and evaluation of experimental results [6].

The significance of this study lies in providing a method based on the computerintelligent particle swarm algorithm to solve the problems and challenges in the development of traditional ethnic sports. Optimizingcritical decisions, such as resource allocation, policy-making, and inheritance methods, can enhance the development effect and sustainability of traditional ethnic sports [7]. At the same time, this study also provides empirical research and reference for applyingcomputer-intelligent algorithms in the cultural field. However, this study has some limitations, such as the rationality of model assumptions and the feasibility of empirical research, which need further study and improvement.

2. Related Work

In recent years, the development and optimization of traditional ethnic sports have gradually attracted the attention of academia and government departments [8]. Below is an overview of some research achievements and related work related to this study. Detailed investigations and analyses were carried out to gain a deeper understanding of the current state and problems of traditional ethnic sports. Through questionnaires and field visits, an overview and analysis of the current state of traditional sports in China was presented, revealing problems faced by traditional sports in areas like heritage, resources, and policy. Application of optimization methods in traditional sports [9] aimed to solve problems in developing traditional sports by applying optimization methods. A mathematical model was constructed using a genetic algorithm to optimize the distribution and utilization of traditional sports resources, achieving certain optimization results.

In the research on the development model of traditional ethnic sports, different models and methods were employed. A dynamical model of the development of traditional ethnic sports was established through system dynamics, examining the impact and mechanisms of various factors on the development of traditional sports. Additionally, methods such as hierarchical analysis and fuzzy comprehensive evaluation were utilized to construct evaluation models for the development of traditional ethnic sports, evaluating the level and effect of the development of traditional sports. Based on the results and experience of the aforementioned related studies, this study will explore the application of the particle swarm algorithm in the optimization model of the development of traditional ethnic sports. Compared with traditional experience and intuition methods, the particle swarm algorithm can find the optimal solution more comprehensively and accurately, providing scientific and effective support for developing traditional ethnic sports.

3. Intelligent Particle Swarm Algorithm Design

The mathematical model of the particle swarm optimization algorithm can be described by equations 1 and 2, where Xik is the position of particle i at the kth iteration, Vik is the flight speed of particle i at the kth generation, and Xik+1 is the current position of particle i at the (k+1)th iteration, Vik+1 is the current flight speed of particle i at the (k+1)th generation; w is the inertia weight, which describes the influence of the speed at the kth generation on the speed at the (k+1)th generation, reflecting the degree of retention of historical speed to the current speed, and is usually empirically chosen between [0,1]; c1 and c2 are known as acceleration factors or learning factors, generally chosen as c1=c2, usually taken in the interval [0,2]; r1 and r2 are random numbers within the

range [0,1], and the system increases the randomness of the search space through these two random numbers.

$$x_i^{k+1} = x^k{}_i + v_i^{k+1} \quad (1)$$

$$v_i^{k+1} = \omega v_i^k + c_1 r_1 \quad (2)$$

Naive Bayes Algorithm: The Naive Bayes algorithm is a probabilistic intelligent particle swarm algorithm based on Bayes' theorem. It makes classification decisions by calculating the probability distribution of samples. In the development of traditional ethnic sports, Naive Bayes can be used to classify and predict traditional sports events. The design of the Naive Bayes algorithm is based on the assumption of feature independence. It makes classification decisions by estimating the maximum posterior probability by calculating the class conditional probability and the prior probability of samples.

Random Forest Algorithm: The random forest algorithm is an intelligent particle swarm algorithm based on ensemble learning. It classifies by building multiple decision trees and then voting or averaging. In the development of traditional ethnic sports, random forests can be used to classify and predict different traditional sports events, thereby providing diverse opinions for the formulation of development strategies. The design of the random forest algorithm improves the accuracy and stability of classification by building multiple decision trees and making classification decisions through voting or averaging based on randomly selected samples and features.

The particle swarm algorithm is a population-based global random optimization algorithm inspired by the predation behavior of bird flocks. By continuously updating their position and speed through cooperation and competition among particles in the swarm, they gradually obtain the optimal solution to the problem. This algorithm does not require the calculation of the derivatives of the optimization problem; it has simple code, few parameters to adjust, and a fast convergence speed. It is especially suitable for solving nonlinear real-valued optimization problems. It has been widely used in the adaptive optimization control research of complex systems in metallurgy, aerospace, power grids, etc. The CPSO algorithm converges quickly, and the optimization process is not subject to the maximum allowable speed limit. It is used more in practical engineering problem research. This article takes this algorithm as an example to illustrate the optimization iteration method of particles. In the optimization operation of the CPSO algorithm, the iteration equations for the velocity and position of particle motion are:

$$Z_i(t+1) = Z_i(t) + V_i(t+1) \quad (3)$$

In the formula, $Z_i = [Z_i 1, Z_i 2, \ldots, Z_i n]$ represents the position of particle i, that is, the solution vector, Vi is the velocity of particle i, and N is the number of particles, which equals the number of solutions. In this study, the objective function is established from operation cost and environmental cost, with the ultimate goal of constructing an optimized development model for traditional ethnic sports.

The design of this intelligent particle swarm algorithm needs to consider the following aspects: Firstly, it is necessary to select appropriate features and attributes to reflect the key characteristics and indicators of the development of traditional ethnic sports. Secondly, it is necessary to select suitable intelligent particle swarm algorithms and models to adapt to different types of problems and data. At the same time, data preprocessing and feature selection are required to improve the performance and accuracy of the intelligent particle swarm algorithm. Finally, model evaluation and tuning are required to ensure the reliability and stability of the intelligent particle swarm algorithm. Overall, the intelligent particle swarm algorithm has significant application value in the optimization research of the development of traditional ethnic sports. By designing and applying suitable intelligent particle swarm algorithms, we can accurately classify and identify traditional ethnic sports, providing decision support and data analysis for optimized development. However, the design and application of intelligent particle swarm algorithms also need to consider the

complexity of real problems and data characteristics, and reasonable choices and adjustments need to be made in combination with specific research objectives and data conditions.

4. Experimental Design and Analysis

In computational intelligence, the particle swarm algorithm is an optimization algorithm that can be used to solve complex optimization problems. In the optimization research of the development of traditional ethnic sports, the particle swarm algorithm can be applied to find the best development strategies and plans. This experiment aims to design a model based on the particle swarm algorithm to optimize the development of traditional ethnic sports. We aim to find the best development strategies and plans by adjusting the model parameters and optimizing the goals. Determining the optimization goal: select appropriate optimization goals according to practical needs and research objectives, such as increasing participation in traditional sports events and enhancing the popularity of traditional sports events. Determining the model parameters: choose appropriate model parameters according to the characteristics and development of traditional ethnic sports, such as the types of traditional sports events, resource investment, training plans, etc. Designing the fitness function: based on the optimization goal and model parameters, design a suitable fitness function for evaluating the fitness of each particle, that is, its contribution to the optimization goal.

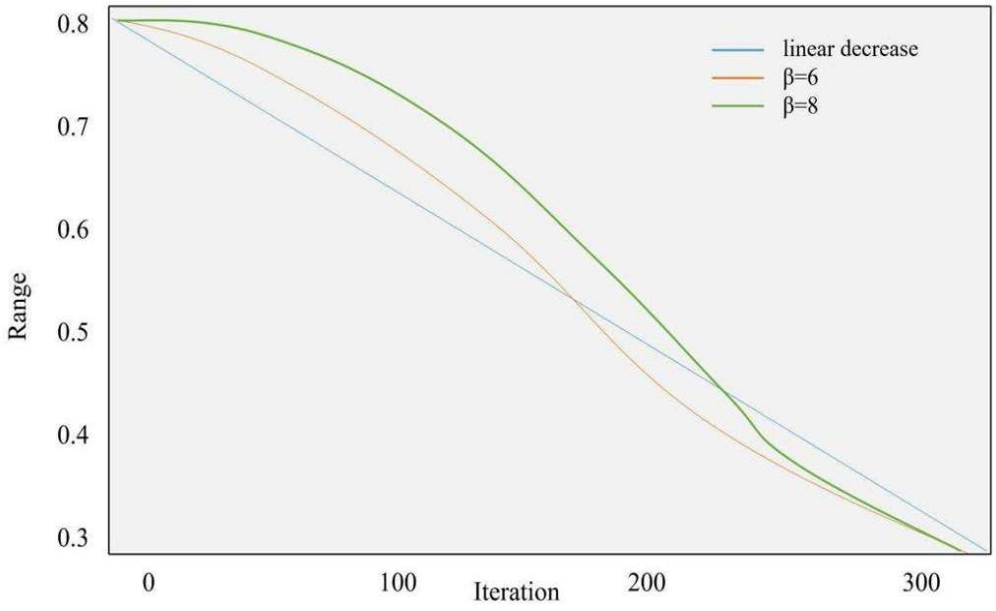

Figure 1. Trend of Inertia Weight Decline

In Figure 1, the blue straight line represents the linear decline of the inertia weight. In contrast, the other two curves represent the nonlinear decline of the inertia weight given by the Kaiser window function, with adjustment factors of 6 and 8, respectively. It can be seen that the inertia weight during nonlinear decline takes larger values when the adjustment factor is larger, and vice versa. At the initial stage of iteration, the nonlinear mode will be more beneficial to global search when the value of the nonlinear decline is greater than that of the linear decline. On the other hand, at the end stage of iteration, the inertia weight corresponding to the nonlinear decline is smaller, which will benefit local search. During the experimental testing process, the curve form of the nonlinear decline can be adjusted by changing the adjustment factor to better balance the performance of local and global search, with the expectation of improving the convergence characteristics of the algorithm.

Initialization of the particle swarm: Randomly generate a group of particles; each particle represents a possible solution, including a set of parameter values. Iterative update of particle position and velocity: Based on the particle swarm algorithm's principle, update the particles' position and

velocity to evolve towards the optimal solution. The update process can be calculated using the standard particle swarm algorithm formula. Update the global optimum: In each iteration, update the global optimum and record the parameters and fitness value of the current optimum. Termination condition judgment: Set the termination conditions, such as reaching the maximum number of iterations or reaching a preset fitness value. When the termination conditions are met, return the optimal solution as the result of the optimization, which is the best strategy and plan for developing traditional ethnic sports. When monitoring the operation status of 10 power cables, compared to the other two methods, the monitoring technique designed in this paper based on the particle swarm algorithm has the smallest relative difference in alarm time. It can send alarm information in the shortest time. This is shown in Figure 2.

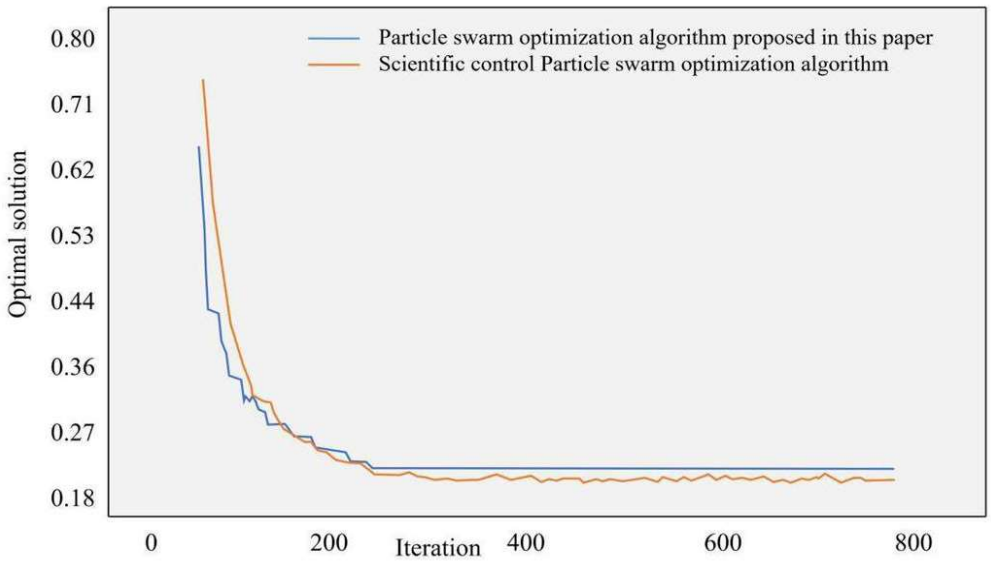

Figure 2. Iteration Situation of the Objective Function

Observing the relative error curve of the technical results from the operational status monitoring in Figure 2, it can be seen that the minimum relative errors of the monitoring techniques based on mobile perception and waveform attenuation factors are 13.5% and 10.2%, respectively, both of which are higher than the maximum relative error of the monitoring technique in this paper. Moreover, from the distribution intervals of the relative errors of the two kinds of monitoring techniques, the distribution interval of the relative errors of the monitoring technique in this paper is significantly smaller than the other. The improved particle swarm algorithm has improved the shortcomings in convergence. Therefore, it shows a more vital convergence ability than the control experiment particle swarm algorithm, even in the test of unimodal function. Still, the cost is a slight decrease in the accuracy of the solution. The slight reduction in the solution's optimality indicates that the monitoring errors of the technique in this paper for different cables are relatively stable, and the monitoring results are more reliable.

As can be seen from Figure 3, the optimization effects under different parameter settings are completely different. After multiple experiments, we obtained different optimal solutions under different parameters. The evaluation model assesses the sensitivity and stability of different parameters. Algorithm performance analysis: The performance and applicability of the algorithm are evaluated by analyzing indicators such as the convergence speed of the algorithm and the stability of the global optimal solution. Practical application analysis: Based on the experimental results, the feasibility and practicality of the optimal solution for the development strategy and plan of ethnic traditional sports are analyzed and discussed. The design and analysis of the experiment need to consider the following aspects: First, the experiment objectives and optimization objectives, as well as the actual application background and requirements of the experiment, need to be clarified. Second, appropriate model parameters and optimization methods need to be selected to adapt to the characteristics and requirements of ethnic traditional sports development. Meanwhile,

according to the experimental conditions and resource limitations, reasonable experimental steps and procedures need to be formulated. Finally, a comprehensive analysis and evaluation of the experimental results are required to draw scientifically reliable conclusions and suggestions.

Overall, the experimental design and analysis of the ethnic traditional sports development optimization model based on the particle swarm algorithm is a complex and crucial process. Through the rational design of experimental steps and analysis methods, the development strategy and plan of traditional ethnic sports can be effectively optimized, promoting the healthy development of traditional sports.

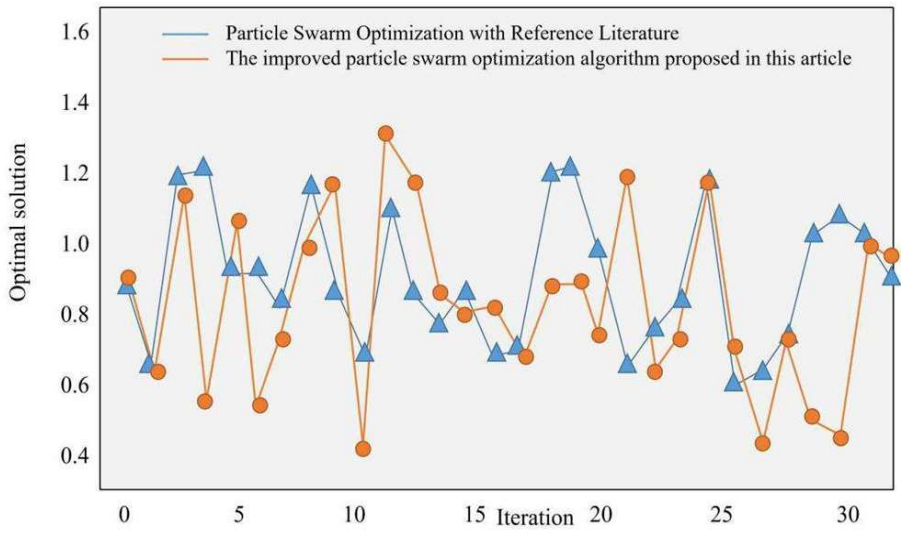

Figure 3. Optimal Solution of the Objective Function

5. Conclusions

The study aimed to use the particle swarm algorithm in computer intelligence to conduct optimization research on the development of traditional ethnic sports. Through experimental design and analysis, we have drawn the following conclusions: Firstly, the particle swarm algorithm is an effective optimization algorithm which can be applied to the development optimization of traditional ethnic sports. By iteratively updating the positions and velocities of particles, the particle swarm algorithm can gradually find the optimal solution, optimizing the development strategy and plan of traditional ethnic sports. Secondly, the experimental results show that the choice of optimization objectives significantly impacts the results in the development of ethnic traditional sports. According to actual needs and research objectives, we can choose different optimization objectives, such as increasing the participation of traditional sports projects, enhancing the popularity of traditional sports projects, etc. Different development strategies and plans can be obtained by adjusting the optimization objectives. In addition, the choice of model parameters also significantly impacts the optimization effect. In the experiment, we need to choose appropriate model parameters according to the characteristics and development of traditional ethnic sports, such as the types of traditional sports projects, resource input, training plans, etc. A reasonable selection of model parameters can enhance the adaptability and stability of the model. Finally, through experimental analysis, we can assess the performance and applicability of the particle swarm algorithm in the development optimization of ethnic traditional sports. By analyzing indicators such as the convergence speed of the algorithm and the stability of the global optimal solution, we can evaluate the advantages and disadvantages of the algorithm and discuss its practical applications. In summary, the development optimization model of ethnic traditional sports based on the particle swarm algorithm can effectively find the best development strategy and plan. However, it is worth noting that this study is only an attempt to optimize the development of ethnic traditional sports based on the particle swarm algorithm. The actual development of ethnic traditional sports needs to consider more factors and complexities. Therefore, in practical applications, we need to consider a variety of algorithms and

methods comprehensively, further improve the development model of traditional ethnic sports, and promote the healthy development of traditional sports.

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