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Research Article

Analysis of Regional Economic Development Differences Based on Intelligent Hybrid Algorithm

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The diversities in the natural, social, and human environment of various regions often lead to the differences in their regional economic development level and industrial structure and layout; moderate regional differences can mobilize economic vitality and improve development efficiency, but excessive differences may lead to social instability or even turbulence. Intelligent algorithms or their improved and hybrid algorithms can recently achieve more suitable solutions to practical problems of nonlinear, discrete, nondifferentiable, and multiple constraints. Therefore, this paper's main point is on the analysis of regional economic development differences based on intelligent hybrid algorithms. On the basis of summarizing and analyzing previous research works, this paper expounded the research status and significance of regional economic development differences analysis, elaborated the development background, current status, and future challenges of intelligent hybrid algorithms, introduced the methods and principles of principal component distance weighting algorithm and sequential quadratic programming algorithm, constructed a basic model for regional economic development differences based on intelligent hybrid algorithm, conducted the construction of analysis index system and the hybrid of intelligence algorithm, analyzed the regional economic development differences based on intelligent hybrid algorithm, performed the principal component analysis and time-space change analysis of regional economic development, and finally carried out a simulation experiment and its result analysis. The study results show that the intelligent hybrid algorithm can simulate the intelligent behavior of certain groups in nature when analyzing the differences in regional economic development, so that it has essentially parallelism, high accuracy, and convergence speed. The study results of this paper provide a reference for further researches on the regional economic development differences analysis based on intelligent hybrid algorithm.

1. Introduction

The development of regional economy, which is a complex system with uncertain, time-varying, and nonlinear characteristics, involves many factors such as politics, economy, culture, society, and environment; these factors restrict and promote each other and ultimately lead to a high degree of nonlinearity in various data reflecting regional economic development [1]. Regional economic difference refers to the fact that, within a unified country, some regions have faster growth rates, higher economic development levels, and stronger economic strength than others, resulting in the coexistence pattern of developed and underdeveloped regions in space, which is the unbalanced regional economic development [2]. Their difference indicators mainly include transaction awareness, transaction behavior, and transaction means and the characteristic of analytical indicator system is to use the above-mentioned difference indicators to describe the macro and microlevels of differential mechanism [3]. Regional economic development depends on objective factors such as natural geographic conditions, traffic conditions, human environment, and historical reasons. Moderate regional differences can mobilize economic vitality and improve development efficiency, but excessive differences may lead to social instability or even turbulence, thereby hindering economic development. Therefore, the analysis of regional economic development differences has important research significance [4].

The traditional quantitative research methods for the analysis of regional economic development differences

include coefficient of variation, quantity graph analysis, standard deviation, and entropy index. The use of data mining techniques to analyze differences in economic development generally uses clustering methods; there are many clustering methods, including mean clustering, fuzzy clustering, hierarchical clustering, and neural networks [5]. In recent years, artificial intelligence algorithms have developed rapidly and are widely used in system optimization problems, such as fuzzy algorithms, genetic algorithms, neural network algorithms, ant colony algorithms, simulated annealing algorithms, chaos optimization algorithms, and particle swarm algorithms [6]. The improved and hybrid algorithms of these intelligence algorithms can achieve more suitable solutions to practical problems of nonlinear, discrete, nondifferentiable, and multiple constraints. Different from traditional mathematical methods, intelligent algorithms solve complex optimization problems by simulating the intelligent behavior of certain groups in nature [7]. The fundamental of regional economic development lies in the continuous evolution and upgrading of the regional industrial structure. Due to competition and choice among individuals, intelligent algorithms are inherently parallel when solving problems, so they have high accuracy and convergence speed [8].

Based on the summary and analysis of previous research results, this paper expounded the research status and significance of regional economic development differences analysis, elaborated the development background, current status, and future challenges of intelligent hybrid algorithms, introduced the methods and principles of principal component distance weighting algorithm and sequential quadratic programming algorithm, constructed a basic model for regional economic development differences based on intelligent hybrid algorithm, conducted the construction of analysis index system and the hybrid of intelligence algorithm, analyzed the regional economic development differences based on intelligent hybrid algorithm, performed the principal component analysis and time-space change analysis of regional economic development, and finally carried out a simulation experiment and its result analysis. The detailed chapters are arranged as follows: Section 2 introduces the methods and principles of principal component distance weighting algorithm and sequential quadratic programming algorithm; Section 3 constructs a basic model for regional economic development differences based on intelligent hybrid algorithm; Section 4 analyzes the regional economic development differences based on intelligent hybrid algorithm; Section 5 conducts a simulation experiment and its result analysis; Section 6 is the conclusion.

2. Methods and Principles

2.1. Principal Component Distance Weighting Algorithm. It is assumed that in an n-dimensional target search space, x particles form a community, where the i-th particle is represented as an n-dimensional vector $X_i = \{x_i\}$ $(i = 1, 2, \ldots, n)$. It continuously evolves to the global optimal solution only by updating the position and velocity, with few adjustable parameters and no gradient information, so it can often converge to the global optimal. When finding the global extreme value and individual extreme value, the particle is based on the following formula to update your speed and position:

$$y_i = ax_i + b(z_i - x_i) + c(z_i + x_i), \tag{1}$$

where y_i is the variation of the particle colony; a is the inertia coefficient; b is the learning factor; c is the variation factor; and z_i is a uniform random number within a certain range.

A single-output layer compact continuous parameter intelligent hybrid algorithm is used to predict the level of regional economic development, and then the output of intelligent hybrid algorithm can be expressed as

$$F_i = \int_{i=1}^{n} \left(\frac{s_i y_i - t_i x_i}{r_i} \right), \tag{2}$$

where F_i is the i-th input variable of the input layer; k_i is the number of neurons in the input layer; r_i is the weight coefficient of the input layer; and s_j and t_j are the expansion factor and translation factor, respectively.

Assuming that the demand vector $U = (u_1, u_2, \ldots, u_m)$ is a random variable defined in the probability space, then the optimal solution of the model is

$$U_{ij} = \begin{bmatrix} u_{11} & u_{12} & \cdots & u_{1m} \\ u_{21} & u_{22} & \cdots & u_{2m} \\ \vdots & \vdots & \cdots & \vdots \\ u_{m1} & u_{m1} & \cdots & u_{mm} \end{bmatrix}. \tag{3}$$

The pheromone volatilization coefficient can be changed according to the needs of the algorithm by a compromise between global optimization and convergence speed, so the theorem can be adapted to the various pheromone volatilization coefficients of the algorithm.

For the time series $f(t)$, if there is only one fluctuation of scale σ in the neighborhood $(t_0 - \sigma, t_0 + \sigma)$ of a certain point t_0, then the local average of $f(t)$ can be expressed as

$$H_\sigma = \sum_{t_0 - \sigma}^{t_0 + \sigma} \left[\frac{f(t)}{g_\sigma} - q_\sigma \right], \tag{4}$$

where g_σ is the decision variable; q_σ is the random demand. The area surrounding the time axis in a period of fluctuation is zero, which is symmetry with respect to the time axis. The idea is that the classification minimizes objective function value and maximizes the similarity between objects in the same cluster:

$$G_i = \sqrt{c(m_i - h_i)(e_i - d_i)}, \tag{5}$$

where G_i is the similarity classification matrix; c is the cluster center point of each category; m_{i} is the number of categories to be divided; h_i is the distance between the i-th data sample and the center point; e_i is the class of sample i; and d_i is the weighting parameter of sample i.

2.2. Sequence Quadratic Programming Algorithm. Generally speaking, the number of neurons in the input layer is equal to the total number of features. After sample feature screening and purification, the number of input layer neurons is generally less than the total number of features. The output of the n-th sample after passing through the model is $k_i = (k_1, k_2, \ldots, k_n)$, n is the number of neurons in the output layer, and then the input sample is weighted to the first layer of the hidden layer:

$$K_n(x) = C + \sum_{i=1}^{n} \varphi_i \frac{k_i}{Q_i}, \tag{6}$$

where C is the total number of samples; φ_i is the total number of features of a single sample; Q_j is the center value of the i-th hidden layer. The coefficient of variation weighting method is to directly assign weights based on the information contained in the original data and the specific calculation is as follows:

$$P(x) = \frac{\sqrt[n]{\alpha K_n(x) - \beta G_i(x)}}{v + 1}, \tag{7}$$

where $P(x)$ is the total number of evaluation objects, v represents the total number of evaluation indicators, $G_i(x)$ is the coefficient of variation of each indicator; α is the standard deviation of each indicator; β is the mean value of each indicator; f_j is the weight of each indicator.

The analysis of regional economic development differences can be expressed as a number of nonlinear optimization problems under the constraints of equality and inequality, and the following deformation strategies are used to find the advantages of replacing the worst points:

$$I_i(x) = \lambda_i P(x) + \varepsilon_i F(x), \tag{8}$$

where $I_i(x)$ is the total number of sample categories in the system; $F(x)$ is the characteristic quantity of the samples in the system; λ_i is the weight of the i-th sample; ε_i is the consumption characteristic of the i-th sample.

If the subscript of the particle corresponding to the optimal position searched by the entire population, the velocity-position iteration equation of each particle in the basic model is as follows:

$$O_i = \frac{E_i(r+1) - T_i(l+1)}{wI_i + 1}, \tag{9}$$

where O_i is the current iteration number; w is the dimension; E_i is the individual cognitive factor; T_i is the social cognitive factor; r is the contraction factor; l is the impact factor.

The design of the hidden layer of the neural network mainly includes the determination of the number of hidden layers and the number of nodes in each hidden layer, so the key point of the hidden layer structure design is to determine the number of hidden layer nodes; the key point of the hidden layer structure design is the design of determining the number of hidden layer nodes as follows:

$$A_i = O_i\left[\xi I_i(x) + \pi P_i(x) + \tau K_i(x)\right], \tag{10}$$

where A_i is the number of hidden layer nodes; ξ is the number of input nodes; π is the number of output nodes; τ is an adjustable constant. This formula can estimate the number of hidden layer nodes, but the specific value needs many experiments to make sure.

3. Basic Model of Regional Economic Development Differences Based on Intelligent Hybrid Algorithm

3.1. Construction of the Analysis Index System. The principle of selecting regional economic difference indicators is generally to adopt the comprehensive indicator system method, that is, the general term for a type of method that comprehensively evaluates and compares the economic development level of various regions through a series of indicators. In an interrelated and interdependent statistical indicator group, the evaluation of regional economic development status involves many factors and the methods commonly used to evaluate regional economic development status are mainly single-factor evaluation and comprehensive evaluation methods. The comprehensive evaluation methods adopt analytic hierarchy process, fuzzy evaluation, artificial neural network, and gray clustering. In order to further improve the quality of evaluation, many scholars have discussed and corrected the deficiencies of various evaluation methods [9]. Quantitative research on comprehensive evaluation indicators is often based on qualitative analysis; core elements and auxiliary elements are subsequently decomposed into residents' education level, technological market turnover, total import and export, total retail sales of social goods, telephone penetration rate, eleven indicators for the number of people, the density of transportation routes, the proportion of graded roads, the management capacity of the government, the relationship between the government and enterprises, and the degree of regional openness. Figure 1 shows the framework of regional economic development difference analysis based on intelligent hybrid algorithm.

There is generally a correlation between economic indicators. Principal component analysis can eliminate the correlation and obtain new principal components as the initial data for clustering. However, the use of principal component distance-weighted cluster analysis can make the clustering effect better because the contribution rate of the principal component factors is different. The first principal component has the largest contribution rate, followed by the second principal component, and again the third principal component with their importance in classification is primary and secondary. The result of the direct replacement of the original data by the principal component factor is to distort the classification, so different weights should be given when calculating the distance between samples to achieve the purpose of adaptive sample data. Among them, the two types of movement methods are detection movement and mode movement. The detection movement is a movement along each coordinate axis in sequence, and the mode movement is a movement along the descending direction of the line of

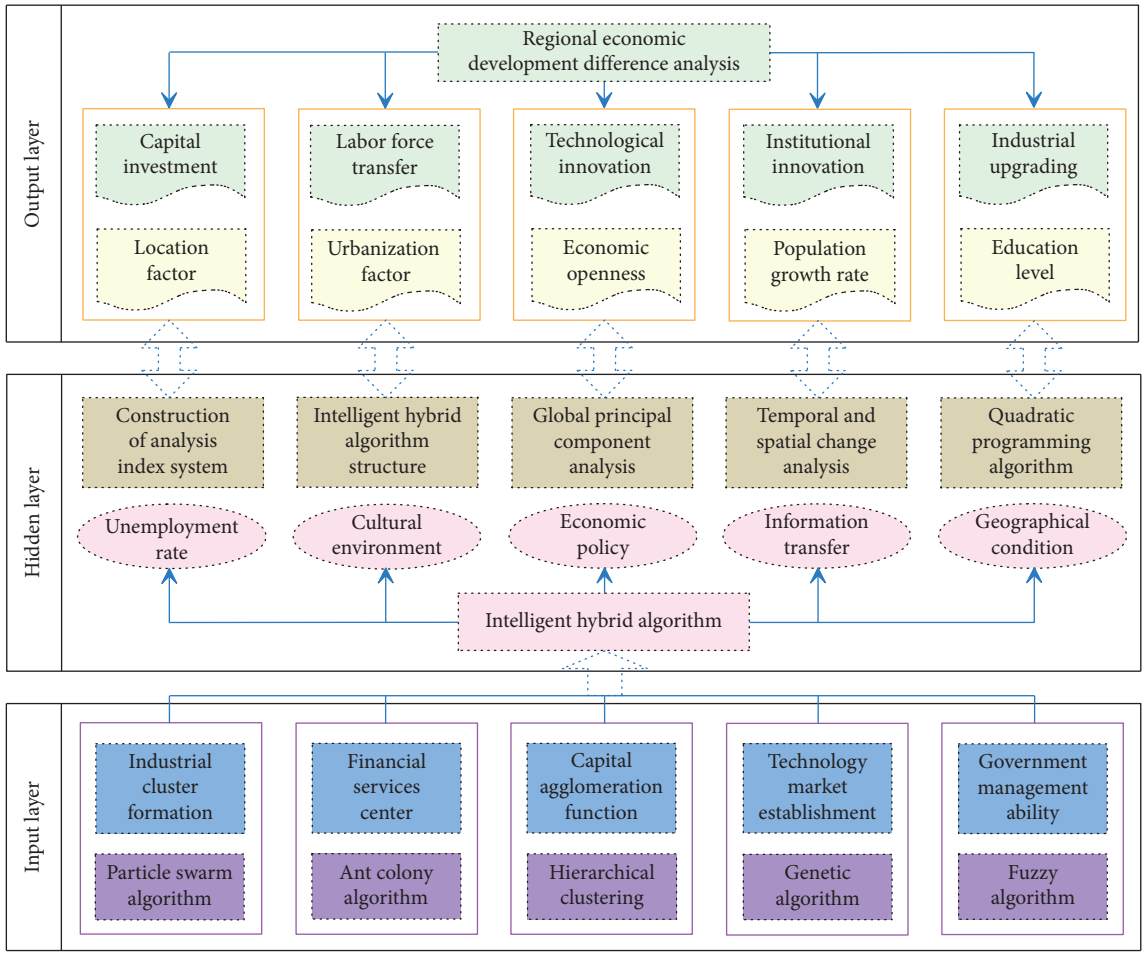

Figure 1: Framework of regional economic development difference analysis based on intelligent hybrid algorithm.

two adjacent detection points. At the same time, nonoptimal particles use aggregation strategy and diffusion strategy for global search to improve the global search ability of the entire population. In the new algorithm, the difference quotient steepest descent strategy and the corrective descent strategy are used to improve the local search ability of the particle swarm optimization algorithm, and the random movement strategy, the aggregation strategy, and the diffusion strategy are used to improve the global search ability of the particle swarm optimization algorithm.

According to the effect on economic growth, economic growth factors can be divided into direct factors and indirect factors. Direct factors include capital and labor input and the efficiency of capital and labor input and output; indirect factors include technological progress, natural resources and natural conditions, and socioeconomic systems and economic policies; indirect factors affect the amount of capital and labor input and input-output efficiency, which ultimately affects economic growth. On a short-term small scale, the difference in the level of regional economic development is affected by the regional differences in the level of employees and investment, and the relationship between regional differences and the differences in the input of various factors is more complicated. On the medium and long-term scales, the differences in the level of regional economic development are affected by the differences in the level of employees and the regional difference in investment level. Therefore, when analyzing the relationship between factor input differences and regional differences, they must not only see the differences in regional development caused by differences in factor input levels but also see the differences in factor input levels caused by differences in the factor input environment caused by regional differences. At the same time, the regional differences in labor and investment levels in small scales are shrinking due to the existence of the long-term cumulative effect, while the regional differences in the medium and long scales have shown an expanding trend, so the long-term effects of level differences of labor and investment should also be paid attention to when formulating relevant policies [10].

3.2. Intelligent Hybrid Algorithm Structure. If the total output and total demand of the agglomeration economic center continue to increase at a certain ratio, its growth model will have a long-term stable equilibrium. Considering the impact of land on the agglomeration economy, it is easier for the growth model of land elements to achieve stable growth equilibrium; the existence of the equilibrium will cause the infinite diffusion of the equilibrium, and the

aggregation diseconomy will cause the convergence of the stable equilibrium. Regardless of whether the regional economy has the characteristics of agglomeration economy or the characteristics of agglomeration diseconomy, the land element becomes an adjustment factor of the economic model, enabling the economic model to achieve stable growth equilibrium. In order to maintain the advantage of the agglomeration economy, the land element will grow more slowly according to a stable growth path; on the contrary, in order to compensate for the bad effects brought about by the agglomeration diseconomy, the land element will increase faster as a centripetal force to increase the advantage of the agglomeration economy (Figure 2). For example, total production and total consumption do not grow steadily, but total production is greater than total consumption, or the overall economic cost increases significantly due to uneconomic agglomeration, the increase in land elements does not have much effect, and an agglomeration economy will appear. The phenomenon of central decline may result in the splitting of the agglomeration economic center into two agglomeration centers or the overall dispersion into multiple economic centers, showing the shrinkage and decline of overall economies of scale.

From the perspective of development economics, balanced growth and unbalanced growth seem to be two sharply opposed development strategies, but in fact, their difference is secondary, and unity of opposites is the essential feature, which should be at different stages of economic development. These models adopt different economic development strategies, give full play to regional advantages, and maximize strengths and avoid weaknesses. From a geometric point of view, the wave law presented by this evolution is invariant through affine coordinate transformation; that is, through stretching and compression in certain directions, the waveforms of different sections are similar to the whole. On the one hand, regional economic development depends on objective factors such as natural geographic conditions, traffic conditions, human environment, and historical reasons; on the other hand, it is affected by subjective factors such as economic policies and development strategies [11]. Regional economic gaps are inevitable and the way to overcome the gap is to create new development poles and strengthen their spreading effects on surrounding areas. According to the characteristics of the modern economy, the development pole should have the functions of capital agglomeration, technological innovation, information transmission, industrial cluster formation, trade and financial service centers, and so on. The formation of the development pole should be a natural development process, mainly relying on market mechanisms, but the government's preferential policies and key investments can accelerate the formation of development poles.

The study of regional economics on the causes of differences in regional economic development is based on the changes in regional economic structure. The theory of regional division of labor is the theoretical basis for the scientific understanding of regional structural changes. Absolute advantage theory, comparative advantage theory, and factor endowment theory all believe that regional differences are the manifestation of the failure of the equilibrium mechanism, and this failure is mainly caused by the imperfection of the market and the institutional bottleneck that hinders the flow of factors. In the process of economic growth, regional differences will automatically disappear with the formation of a unified market and economic integration [12]. The expansion of the gap between the core area and the peripheral area will also arouse tension in social and political relations, unless such tension can be reduced through the accelerated formation of the diffusion effect of the core area or the weakening of the peripheral area's dependence on the core area; otherwise, it will hinder the development of the core area itself. In addition, the regional economic development gradient transfer theory uses gradients to express the differences in the level of economic development between regions and believes that the product life cycle is the source of regional economic differences. Only the high growth rate of aggregate can lead to a high rate of transformation of the production structure; without sufficient changes in aggregate, the evolution of the structure will be severely restricted.

4. Analysis of Regional Economic Development Differences Based on Intelligent Hybrid Algorithm

4.1. Global Principal Component Analysis. Global principal component analysis is based on classic principal component analysis and incorporates the idea of time series. When studying several data table sequences with a time span, first integrate several data tables to obtain a global data table, and then perform principal component analysis. At present, the research on the mutual influence of regional economy, regional energy consumption, and regional ecological environment mainly adopts panel measurement and analytic hierarchy model for quantitative analysis or with the help of various statistical methods, regression theory for data processing, and the results of the analysis of the energy consumption structure. In fact, the economic imbalance between the two regions is not directly related to the size of the regional economic power in the two regions, because the inflow of trade economy into the target region does not increase the value of processing and production at its destination; it is just the price of the products in the two regions (Figure 3). Gap and the real demand of the consumer market are the factors to be considered in the target area to achieve the pursuit of maximizing economic benefits. When nonregional economic factors flow from the thin zone to the agglomeration economic area and the proportion of its flow cost is higher than or equal to the proportion of investment benefits that cannot be recognized by capital investment, these nonregional economic factors will stay at the original starting point and become thin outside the ring [13].

The hybrid fish school algorithm uses the chaotic sequence to initialize the fish school position, introduces the simulated annealing algorithm into the foraging behavior of the fish school, and combines the advantages of the simulated annealing algorithm, artificial fish school algorithm,

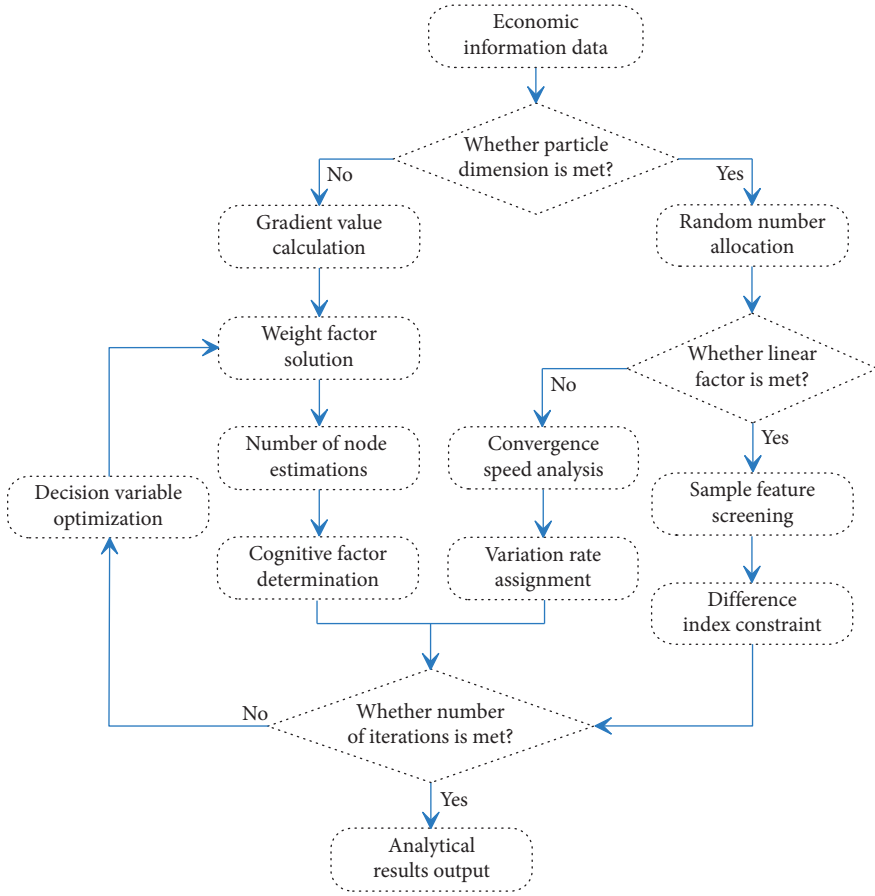

Figure 2: Analytical flowchart of regional economic development difference based on intelligent hybrid algorithm.

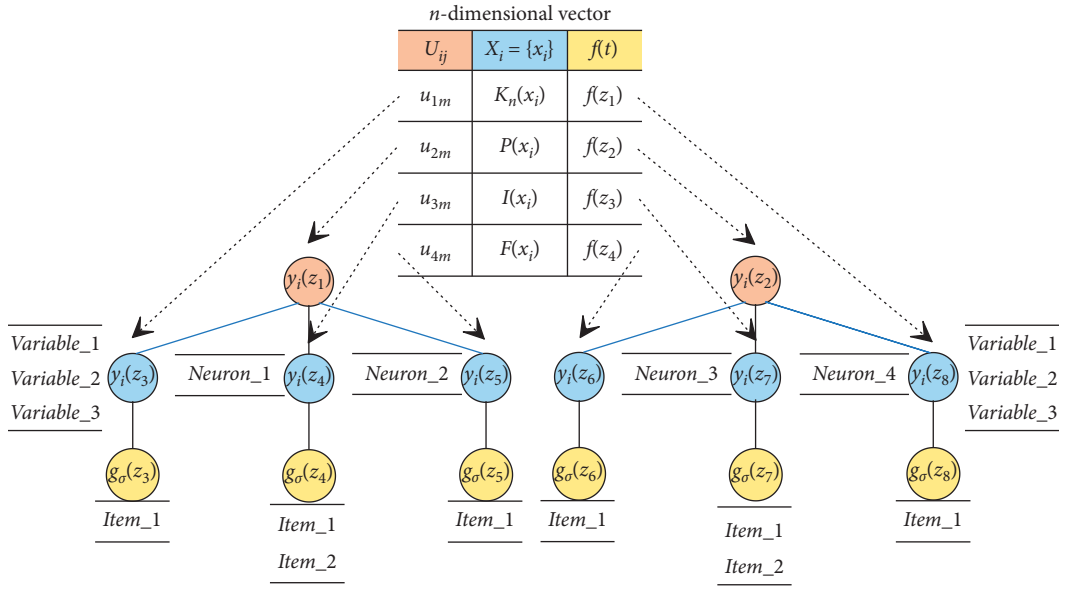

Figure 3: Principles of intelligent hybrid algorithm in analysis of regional economic development differences.

and chaotic motion to improve the overall performance of the algorithm. The fusion of the three intelligent methods takes into account the performance of local optimization and global optimization and overall improves the convergence speed and accuracy of the algorithm and realizes the complementary advantages of the algorithms. In the cluster analysis of the hybrid fish school algorithm, qualitative and quantitative are unified, and the clustering results of the comprehensive evaluation sample points can be visually seen in the three-dimensional plan view, and the simulation

results are ideal. In a multidimensional space, samples of the same type are closer, and the distance between each other is smaller; the samples of different types are farther away, and the distance between each other is greater. According to the characteristics of the samples, a certain similarity measurement method is used to classify the samples with similar characteristics into one category, and finally, the clustering is realized. Chaos is a seemingly irregular movement that occurs in a nonlinear system in nature, and its change process seems to be chaotic but has inherent regularity in essence. Chaotic motion has the characteristics of randomness and determinism, which can traverse all states within a certain range according to its own laws without repetition.

When the economic development is at an early stage, the regional economic differences are generally not very large. As the overall economic development speed of the country accelerates, the economic differences between regions will expand; when the country's economic development reaches a relatively high level, the expansion of economic differences between regions will slow down and then stop [14]. With the further development of the national economy, the differences between regions will show a narrowing trend. Industrial structure refers to the composition among various industrial departments, within each industrial department and between various industries and enterprises. The industrial structure is extremely important to the economic development of a certain region. The fundamental of regional economic development lies in the continuous evolution and upgrading of the regional industrial structure. The eastern region took the lead in implementing an opening-up policy and a market economy. Indicators such as gross regional product, total import and export volume of foreign-invested enterprises, consumption level of rural residents, consumption level of urban residents, per capita disposable income of urban residents, per capita net income of rural households, education expenditure, and local fiscal tax revenue all affect the regional economy factors for development differences.

4.2. Temporal and Spatial Change Analysis. The most important feature of economic systems is complex nonlinearity. One of the most critical reasons why support vector machines can be used in the economic field is that they can handle the complex nonlinearities of economic systems. Clustering mainly calculates the distance from the point to the center point, classifies the sample into the closest category, replaces the original center point with the new center point, then calculates the distance from the point to the center point, and iteratively runs. Its disadvantage is that it only considers the distance and the distance formula may not be perfect and does not consider the density between the point distributions. The support vector machine is transformed into a high-dimensional feature space through nonlinear transformation and finds the optimal curve in the high-dimensional space to classify the two types as much as possible. Mathematically, it can be reduced to a quadratic programming problem with inequality constraints (Figure 4). Compared with clustering algorithms, statistical learning theory and support vector machine methods have become more mature methods to solve limited sample problems and have formed more commonly used methods on the basis of their theoretical systems. It solves the common problems of model selection, dimensionality curse, local minima, nonlinearity, and so on, which exist in various learning methods in the past, and has good generalization ability.

The development of regional economy has two typical characteristics of system integrity and interfactor coherence: many factors in the region have an impact on economic development, these factors are organically connected, and any mechanical division will lead to the system dysfunction of function. The combined effect of these elements is greater than the simple addition of individual elements; therefore, it can be considered that the development of regional economy is a systematic problem (Figure 5). The regional economy is an economic system formed in a certain area and this system consists of natural elements, environmental elements, economic factors, and humanistic factors forming an organic whole. It has an organic connection with the production, exchange, distribution, and consumption of the society during the movement process and also has an organic connection with the ecological environment [15]. Thus, a complex giant system integrating the three branches of economy, society, and ecology will be formed on a larger scale. In different periods of regional economic development, the momentum of growth tends to be relatively concentrated on economic entities with superior geographical conditions and leading industries and innovative industries, that is, the growth pole, and then through three effects between the growth pole and its hinterland. Polarization effect, diffusion effect, and recirculation effect will spread to other economic entities, forming multiple points and then driving the traffic arteries between points.

In terms of research on influencing factors, capital investment, labor transfer, technological innovation, institutional changes, industrial structure, and so on are all hot research objects. At the same time, location factors, urbanization factors, economic openness, initial income, population growth rate, savings rate, education level, and unemployment rate are also important factors that have attracted much attention in recent years. In terms of empirical analysis methods, panel data models, short-panel dynamic spatial error models, and geographically weighted regression analysis methods are commonly used. The human element is the expansion of the capital element. It refers to the quantity, quality, and structure of the labor force, which plays a vital role in the development of the regional economy [16]. Technological factors are the main driving force for accelerating economic growth and the core force for promoting the transformation of economic growth mode. The elements of science and technology include a wide range of content, which is necessary to select representative indicators from three aspects: basic conditions of regional science and technology, input status, and output status to form a comprehensive evaluation. Regional economy is a human economic activity in a certain geographical space and the

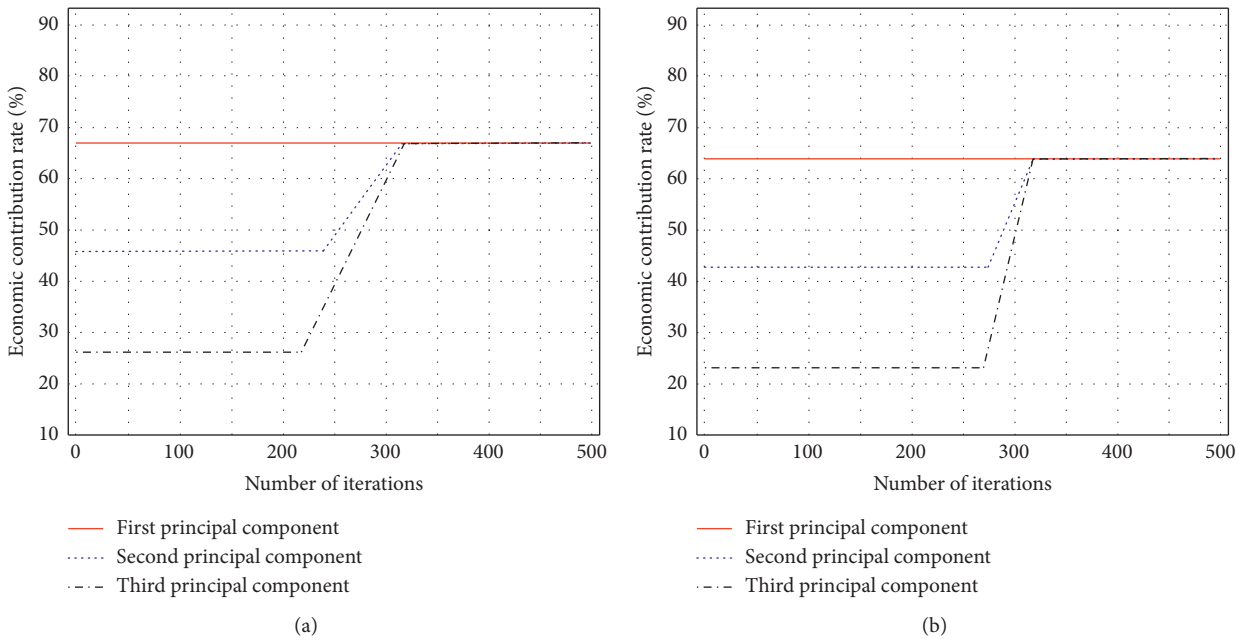

Figure 4: Economic contribution rates of the three principal components with ant colony (a) and genetic (b) algorithm.

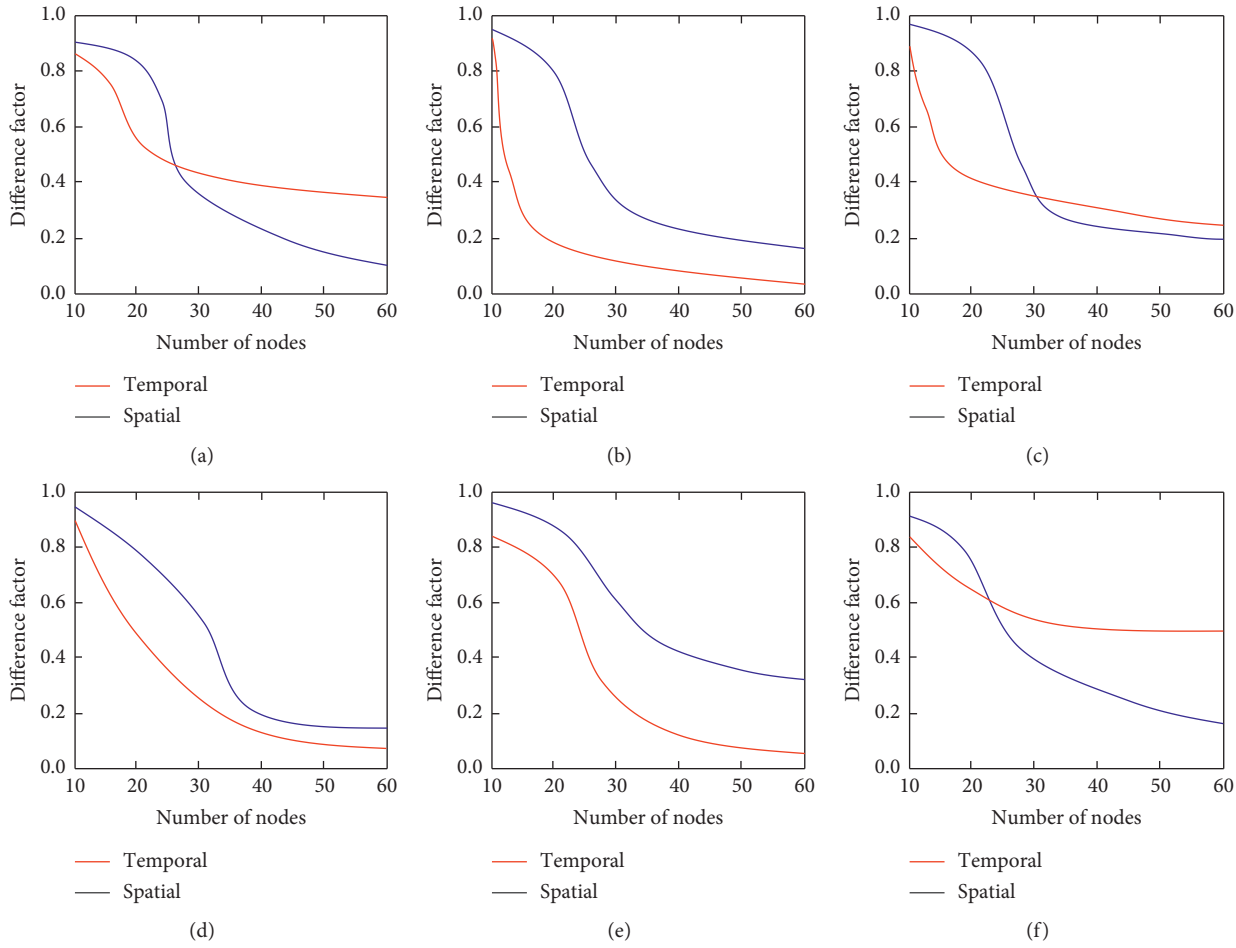

Figure 5: Difference factors of temporal and spatial change of regional economic development with six different intelligent algorithms. (a) Particle swarm algorithm. (b) Chaos optimization algorithm. (c) Ant colony algorithm. (d) Genetic algorithm. (e) Neural network algorithm. (f) Fuzzy algorithm.

natural, social, and cultural environment of various regions has led to differences in the level of economic development, industrial structure, and layout. There are spatial differences in the regional economy, and the regions are independent and related to each other, forming a whole together.

5. Simulation Experiment and Result Analysis

5.1. Simulation Experiment Design. This paper selects typical regions to analyze regional economic development differences based on intelligent hybrid algorithms. With reference to relevant literature, this paper selects 10 indicators in 3 categories to reflect the economic development status of the simulation target area; that is, scale indicators include annual gross product and total fixed asset investment; structural indicators include the proportion of secondary industry value added and value added to the service industry. Proportion and urbanization rate of permanent population; quality indicators include per capita gross domestic product, per capita gross domestic product, per capita retail sales of consumer goods, per capita disposable income of residents, and number of patent applications granted per 10,000 population. These 10 indicators reflect to a large extent the important aspects of simulation target areas such as infrastructure construction, industrial structure adjustment, innovation capability improvement, and social undertaking progress. System refers to a complex of interacting elements, or a system is an organic whole with specific functions synthesized by interacting and interdependent components and the basic characteristics of the system are the integrity and the coherence between elements. Integrity refers to the interdependence between the elements that constitute the system, and coherence refers to the nonadditive nature of the effects of the elements. Many factors in the region have an impact on economic development, these factors are all organically connected, and any mechanical division will cause the system to malfunction.

Interest drive is the driving force for social development and the development and progress of regional economy are closely related to the interest drive of economic entities. The positioning of the economic entities in the regional economy in social relations is based on the basic premise of interest driven and their fundamental purpose is to pursue the maximization of benefits. The development of the regional economy is realized in the process of each economic entity's pursuit of maximization of benefits. Therefore, it is bound to follow the principle of interest driven [17]. Due to government actions and other factors leading to coups in the market environment, technological cooperation between enterprises in the industry, and the redistribution of product competitiveness caused by enterprises' own innovation, the growth pole will be transferred from one place to another. At the same time, because economic entities are interdependent, interconnected, and coordinated, a relatively stable dynamic regional economic system has been formed within a certain period of time. Therefore, it can be considered that the development of regional economy is a systematic problem and regional economy is an economic system formed in a certain area. This system is composed of natural elements, environmental elements, economic elements, and humanities elements as an organic whole. The entity of the regional economy is assumed to be an organization that is driven by profit and seeks ways to increase its profit; that is, the place within a certain range is regarded as a whole as a regional economic entity.

5.2. Result Analysis. Since the economic strength of a region is the core of the comprehensive social and economic strength of the region, the regional economic development level indicator should be selected first. The indicators to measure the level of economic development of a region can be selected from several aspects such as economic aggregate, per capita possession, economic structure, economic operation quality, and economic benefits. For the economic development of a region, resource conditions play a pivotal role. Resource advantage is a concrete manifestation of a regional economic development potential and the prerequisite and foundation for rapid economic development [18]. Therefore, the differences in resource conditions between regions must be fully considered. The indicators that reflect and measure the resource conditions between regions can be selected from several aspects such as natural resources and social resources. The level of infrastructure is closely related to the economic and social development of a region, and the level of infrastructure is also an important factor that cannot be ignored when constructing the index system (Figure 6). The indicators that reflect and measure the level of regional infrastructure can be selected from several aspects such as transportation, post- and telecommunications, and rural infrastructure. The indicators that reflect and measure the level of social development can be selected from several aspects such as education, health, people's living standards, population and family planning, social security, and social security.

In the algorithm, a certain number of simple individuals form a cluster, and each individual searches in the feasible region individually, which makes the whole algorithm have a great parallel characteristic and improves the efficiency of the algorithm. In addition, the optimal solution obtained in each search will be used to guide the next search. This is a social information sharing mechanism, so that this random search is not completely blind, but it drives the search to move in the direction of algorithm convergence. In fact, the distance between cities is constant, it is easy to find the total route length after obtaining the combined plan. This algorithm is a restrictive search technology, which can obtain knowledge in the search process by recording the search history and use it to know the subsequent search direction to avoid the local optimal solution (Figure 7). It is suitable for solving combinatorial optimization problems and can effectively deal with nondifferentiable objective functions. The nonlinear interior point method has the outstanding advantages of good convergence, fast optimization speed, and strong robustness. It is suitable for solving continuous differentiable function optimization problems, but it is difficult to deal with discrete variables; genetic algorithm obtains by random combination of optimization variables. The global optimal solution is suitable for solving various

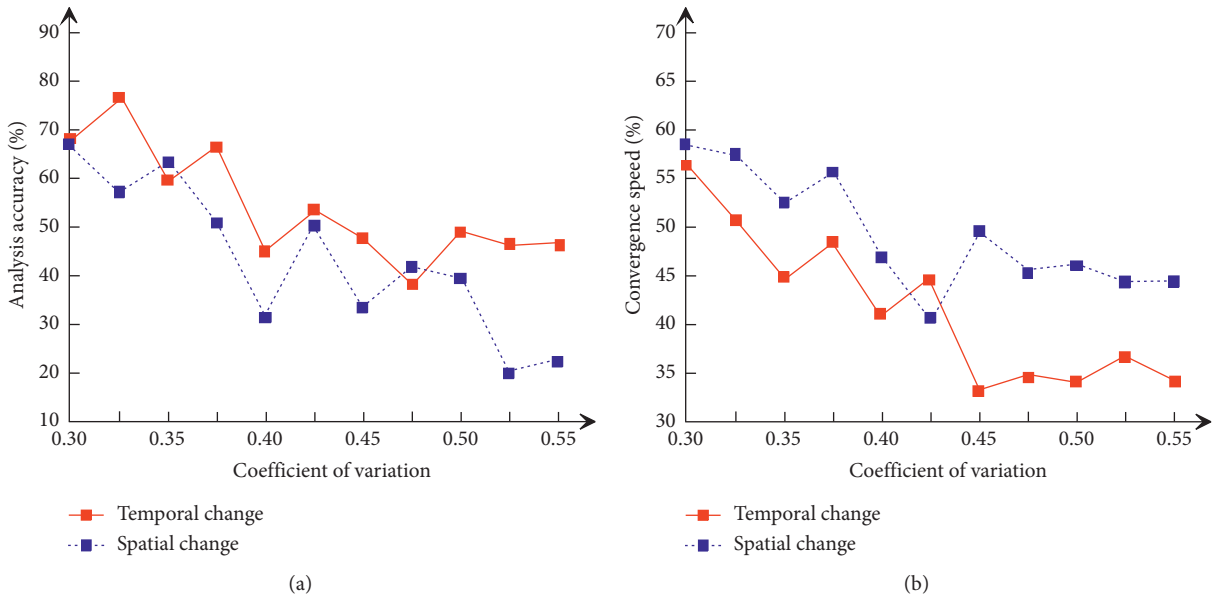

Figure 6: Relationship between coefficient of variation and analysis accuracy and convergence speed in the temporal and spatial regional economic development.

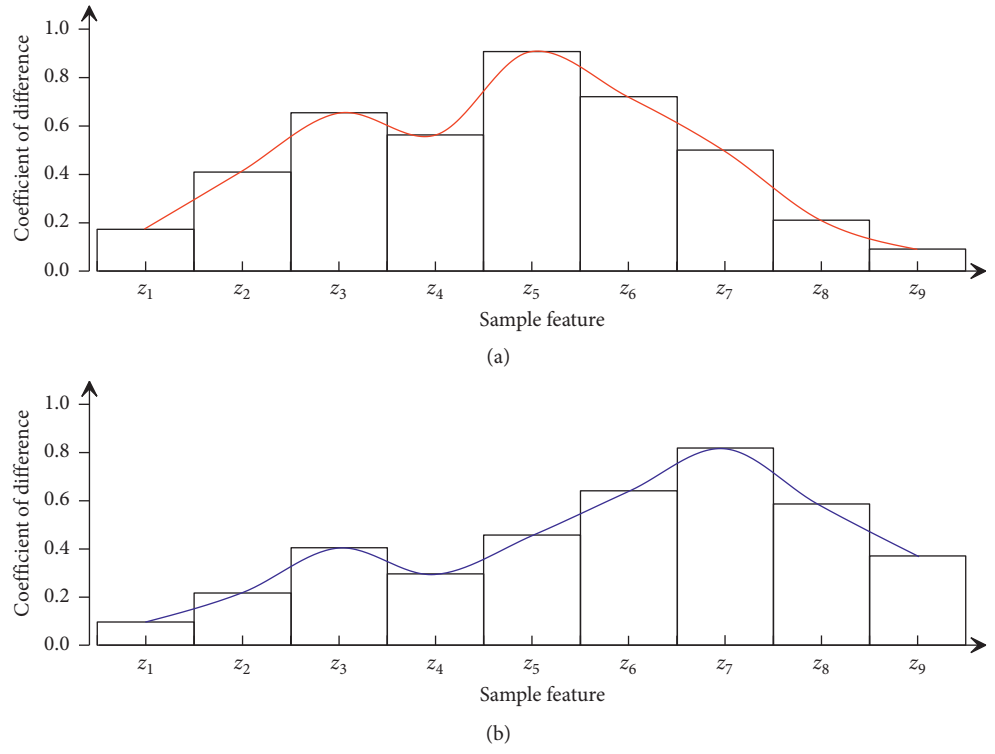

Figure 7: Coefficient of difference of sample feature with neural network (a) and simulated annealing (b) algorithm.

discrete optimization problems, but the optimization speed of genetic algorithm is slow, and it is easy to fall into the local optimal value under certain conditions [19].

A central city is a city of a certain scale that plays a central organizational role in economic activities within a certain geographical area. Central cities are characterized by a solid foundation, high scale efficiency, convenient transportation, concentration of scientific and technological talents, and strong comprehensive competitiveness. As the center of the regional economic network, it plays a vital role in the development of the entire regional economy. In the process of regional economic development, the agglomeration and radiation effects of central cities can make them become the core of regional organization and command economic development [20]. Urban development experience shows that, in the process of urbanization, the central city is the leading

force, and a city system based on central cities is derived. The unbalanced distribution of the entire space innovation activities leads to differences in regional economic growth rates. According to the technology gap theory, the innovation gap leads to the rapid growth of the regional economy, but from the actual situation, the economic gap between the underdeveloped regions and the developed regions tends to increase, which is inconsistent with this theoretical view [21]. The reason is that the innovation gap between the underdeveloped regions and the developed regions is too large, and the corresponding learning ability is lacking, making the relatively backward regions generally have a weaker ability to absorb and absorb advanced technologies, which affects their introduction and imitation of new technologies.

6. Conclusions

This paper constructed a basic model for regional economic development differences based on intelligent hybrid algorithm, conducted the construction of analysis index system and the hybrid of intelligence algorithm, analyzed the regional economic development differences based on intelligent hybrid algorithm, performed the principal component analysis and time-space change analysis of regional economic development, and finally carried out a simulation experiment and its result analysis. There is generally a correlation between economic indicators and principal component analysis can eliminate the correlation and obtain new principal components as the initial data for clustering. However, the development of the regional economy is realized in the process of each economic entity's pursuit of maximization of benefits. Compared with clustering algorithms, statistical learning theory and support vector machine methods have become more mature methods to solve limited sample problems and have formed more commonly used methods on the basis of their theoretical systems. In different periods of regional economic development, the momentum of growth tends to be relatively concentrated on economic entities with superior geographical conditions and leading industries and innovative industries. One of the most critical reasons why support vector machines can be used in the economic field is that they can handle the complex nonlinearities of economic systems. The study results show that the intelligent hybrid algorithm can simulate the intelligent behavior of certain groups in nature when analyzing the differences in regional economic development, so that it has essentially parallelism and high accuracy and convergence speed. The study results of this paper provide a reference for further researches on the regional economic development differences analysis based on intelligent hybrid algorithm.

Data Availability

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

Conflicts of Interest

The author declares that there are no conflicts of interest reported in this paper.

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