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Livestock Disease Prevention and Control Management System in Financial Venture Capital

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Abstract: The performance of venture capital not only reflects the fiduciary responsibility, but also provides useful information for investment decisions, is the management guide for investment managers, is the investment guide for investors, it is not only related to the healthy development of venture capital industry, but also has important significance for the prosperity of the entire financial market. As an investment tool with co-existence of risk and income, the risk of fund is mainly manifested in the volatility of fund price. The prediction of fund price volatility can reflect the overall situation of fund companies, and the accurate prediction of fund price has important guiding significance for investment decisions. Based on animal disease prevention and control management system, the fund net value prediction model was established, first with nonlinear damping least square method to optimize Elman neural network learning algorithm, at the same time to carry on the dynamic adjustment, the artificial fish algorithm parameters make the early stage of the optimization can quickly obtain the global optimal solution domain, the late local search to improve the accuracy of the optimal solution. Combined with the advantages of the artificial fish algorithm and Elman neural network, the improved artificial fish algorithm for finding a set of optimal initial weights and threshold, the neural network to establish artificial fish neural network forecasting model, based on an empirical analysis of the representative of the investment fund, and comparing and grey model to predict the results of the analysis, show that the model has good nonlinear reflection ability and learning capability, prediction precision and can accurately predict the change trend of fund net value and the rise and decline of the turning point, to predict the tendency of fund net value provides a effective method.

1. Introduction

Since the establishment of investment fund, the fund industry has developed rapidly. Its scale is constantly expanding, the variety is also increasingly rich, greatly improve the structure of investors,

to the stable and healthy development of the securities history has played an increasingly important role. Although in the past eight years, China's fund market has a considerable development, but compared with the mature market in the west, the scale is still small. At present, the number of funds on the American stock market is much higher than the number of listed companies. Investment fund has great potential in our country.

Fund performance forecast is an important link to promote the healthy development of fund market. In the mature market, scientific and objective fund performance prediction is of great significance to investors, fund management companies and market supervision. For investors, by analyzing the performance of the fund, they can obtain accurate information of the fund's investment effect, timely adjust investment strategies and make correct investment choices. For fund management companies, scientific evaluation of the performance of their funds can not only give specific quantitative evaluation of the performance of each fund manager, but also identify the strengths and weaknesses of their investment strategies, summarize successful experience, improve the shortcomings, and improve the management level of the company. For the regulatory authorities, they can formulate various relevant policies and regulations based on the scientific evaluation of fund performance and operation status. In addition, scientific and objective fund performance evaluation plays a very important role in promoting orderly competition of funds and realizing survival of the fittest. Therefore, the establishment of a scientific fund performance evaluation and prediction system will play a positive role in the standardization and healthy development of China's fund industry.

Since the 1990s, the in-depth research on the prediction, optimization and control of financial system and the extensive application of information and control theory technology in current financial problems have brought challenges to the development of financial engineering. Financial forecasting is an important part of financial engineering [1]. For financial investors, it is difficult to explain the inherent law of stock price, return and risk prediction of financial derivatives by using traditional time series prediction technology. The neural network theory developed in the past decade has gradually become a powerful tool for prediction and modeling of nonlinear dynamic systems [2-3].From its origin to the present, the research and application of artificial neural network have entered a relatively mature stage, and the application field is also expanding [4-5]. At present, artificial neural network has been applied to predict the price, trend and increase of the securities market, and the prediction accuracy is relatively high [6-7].

Elman neural network is different from other feedback networks in that it is a time series recursive neural network with local feedback. Its structure not only contains the input layer, the hidden layer and the output layer, but also a carrier layer. This special unit is a module for recording the historical information of the hidden layer.As a one-step delay operator, the signal received from the output end of the hidden layer is transmitted to the input end of the neuron of the layer, and then forward to the input end of the hidden layer through the output end, thus forming a feedback process. The information of the hidden layer is stored in the continuous layer with a certain delay, which improves the memory of the information of the last time. In this way, the internal feedback is achieved and the intermediate process is reduced, making the network system better than the usual static neural network.Scholar Chen X based on fog is sensitive to temperature change the fact that the temperature through a set of experimental results and error analysis, this paper proposes a new error processing technology, the method includes both denoising and modeling and compensation, after denoising part, this paper proposes a dynamic modified Elman neural network (ENN) modeling method, modeling and compensation results show that this model can effectively reduce the temperature changes and compensation caused by drift [8].Scholar W Xiang by Elman neural network model is established to predict the change of aquaculture water body NH3 - N, record into the water day food, dissolved oxygen in water, water temperature, water temperature, turbidity and

precipitation index as input variables, select the pond NH3 - N content as the output variable, the results show that the model can well simulate the change trend of aquaculture water body NH3 - N, based on Elman neural network prediction model of aquaculture water body nonlinear dynamic changes of NH3 - N content has a strong ability of description,It has good adaptability and accuracy in practical application [9].In order to achieve the optimal operation of power system, power generation must meet the demand of power load [10], the scholar L Yang proposed an improved prediction engine based on Elman neural network (IENN) to predict the load signal, and used the intelligent algorithm to optimize the weights of the prediction engine, and obtained a better prediction result [11].Scholars I Sutrisno in view of the nonlinear system, puts forward an improved particle swarm optimization (IENN) Elman neural network controller, the controller by the ARX (QARXNN) neural network prediction model and a switching mechanism, the switching mechanism, ensure the good running of forecasting model, design the main controller based on IENN, adopt the BP learning algorithm with PSO, the algorithm by adjusting the learning rate to improve learning ability in the process of BP, the performance of the controller is verified by numerical simulation.By comparing with fuzzy switching method and 0/1 switching method, the effectiveness of this method in terms of stability, accuracy and robustness is proved [12].Scholar CH Tsai proposed an Elman neural network controller based on the improved differential evolution algorithm to control the squirrel cage induction power generation system for grid-connected wind power generation, and the experimental results verified the feasibility and effectiveness of the proposed system in grid-connected wind power applications [13].Scholars XL Zhu, a feed-forward neural network based adaptive vector quantization (AVQ) network clustering algorithm, is used for machine tool thermal error compensation in the choice of temperature measurement point, the method used in machining center, measurement point from 18 reduced to a 3, based on the output - input feedback Elman neural network model, established the thermal error and the relationship between the critical temperature measuring points, the results show that this method can effectively eliminate the coupling between the temperature measuring point, improve the accuracy of thermal error model and robustness [14-15].Scholars ZM Bi plane shape defects recognition method at the present time to identify the shortcomings of low accuracy, slow speed of recognition, an improved genetic algorithm improved Elman neural network, because the Elman neural network model has reflect the system dynamic characteristics of the characteristics of the approximate any nonlinear function with arbitrary precision, based on the model of the optimization algorithm can be make identification method has strong generalization ability and faster recognition speed and higher recognition accuracy and the experimental results show that the improved genetic algorithm to optimize Elman neural network model in plane shape defect recognition accuracy is higher than the BP network model,The convergence rate is faster [16].

All the creatures in nature are highly adaptive and flexible in order to adapt to the living environment unattainable [17]. The researchers draw on biological characteristics by studying the intelligent phenomena of living things in the ecosystem mimicking their survival and reproduction to build intelligent methods that can autonomously optimize the system makes up for tradition in many areas

The shortcomings of optimization methods have largely solved complex optimization problems such as phenanthylene, large scale and high dimension in reality.Scholars A Fahim this paper proposed A genetic algorithm based on filtering the mixed variable programming method of solving the global optimal solution for the expression of will consider to optimize the objective function and constraint violation functions in two forms, and then, the genetic algorithm (GA) within the framework of application filtering = set method to solve the problem of reconstruction, using pattern search as A local search to improve the solution, in addition, using genetic rule of matrix to accelerate the search process, termination of the algorithm, the results show that compared with

some existing methods, this method has good application prospects [18]. Scholar T. Chen, the efficiency of the simple genetic algorithm (SGA) can pass some strategies to improve, including the optimal strategy, multi-point crossover, passive identification of design variables, penalty parameter increasing gradually, bit by bit, local search, discussed the use of genetic algorithm for topology optimization problems, and gives the examples show that the method greatly improves the efficiency of genetic algorithm and the optimal solution [19]. Scholars KDM Harris, introduces the structure of the solution using the powder diffraction data implementation of genetic algorithm, and emphasizes the foundation and application of genetic algorithms in this field in the future development opportunities, scope and potential of genetic algorithm with the method of "direct space" structure, the test structure is independent of the experimental diffraction data generation, by comparing the calculation and the experiment of powder diffraction diagram to assess the quality of each structure, through an instance of the known and unknown structure, proves that the genetic algorithm in the molecular crystal powder diffraction data structure to solve the successful application of [20]. Scholar M. Marghany will genetic algorithm applied to the automatic detection of oil spill, is to use from the gulf of Mexico RADARSAT 2 SAR narrow single beam scanning data sequence, studies have shown that the realization of the cross can generate accurate oil spill model, the conclusion through the receiver-operating characteristic (ROC) curve was confirmed, ROC curve shows that using ROC curve with 90% of the line between the area difference can identify the existence of the oil slick footprint, is greater than the surrounding environment features, above all, genetic algorithm can be used as a tool of automatic detection of oil spill [21-22]. Scholar M Reed used the ant colony system (ACS) to solve the problem of capable vehicle routing related to the recovery of household waste and regarded it as a node in the spatial network.For a network with nodes concentrated in a single cluster, the use of k-means clustering can greatly improve the efficiency of the solution [23]. Scholars H Jiang based on basic model LF ant clustering algorithm, proposed an improved ant clustering algorithm (IACC), redefined the ant colony method, similarity in ant and ant colony behavior, this paper proposes a new adaptive parameter adjustment strategy, the results show that the algorithm has better clustering performance and overcome the iterative cycle is long, the shortcomings of slow convergence speed [24]. Scholars J. Cao an improved artificial fish algorithm is proposed to compensate for distortion in the sensorless AO system, analyzes the system of static and dynamic distortion compensation, compared before and after the distortion compensation of optical communication performance, and with the artificial fish algorithm (AFS), the stochastic parallel gradient descent (SPGD) algorithm and simulated annealing (SA) algorithm are compared, and the results show that the convergence of MAFS is higher than the SPGD algorithm and SA algorithm, convergence value is better than that of AFS algorithm, SPGD algorithm and SA algorithm [25]. Scholars Q Liu, the artificial fish algorithm (AFSA) for the first time applied to feed formulation optimization, in order to meet the requirements of the precision of the feed formulation optimization, adopted based on the symbiotic system of AFSA, compared with the original algorithm, greatly improve the convergence precision and speed of the algorithm, the algorithm can not only significantly reduce feed costs, constraint condition and can meet all kinds of nutrition.The optimization performance of this algorithm is better than other existing algorithms [26]. Scholars XY Luan is put forward based on the artificial fish algorithm and rough set attribute reduction algorithm, in view of the AFSA to solve the problem of slow convergence speed in the late iteration by using normal distribution function, cauchy distribution function, the parent crossover operator, mutation operator and improved minimum gap model to improve the AFSA, the results show that the algorithm can effectively search attribute reduction sets, has low time complexity and better global search ability [27]. The scholar l. Ma applied the improved artificial fish swarm algorithm to foreign exchange prediction and multi-objective optimization of investment portfolio, and predicted the short-term exchange rate by using the support vector regression

algorithm of average distance view after optimization of artificial fish swarm algorithm, which improved the accuracy of expected return rate.On this basis, the foreign portfolio model with dual objectives is established [28]. SD Janaki scholars put forward a kind of clustering algorithm based on artificial fish DCE - breast MRI suspicious lesion detection new segmentation method, the main criteria is based on image segmentation of voxel values and parameters of experience model segmentation algorithm, the results show that the segmentation algorithm for doctors in the shortest possible time to locate the suspicious area ability has a great influence [29].

With the development of social economy, fund has become an important tool for people to invest and manage money. Fund performance not only reflects the fiduciary responsibility, but also provides useful information for investment decisions, is the management guide for fund managers, is the investment guide for fund investors, it is not only related to the healthy development of the fund industry, but also has important significance for the prosperity of the entire securities market. As an investment tool with co-existence of risk and income, the risk of fund is mainly manifested in the volatility of fund price. The prediction of fund price volatility can reflect the overall situation of fund companies, and the accurate prediction of fund price has important guiding significance for investment decisions. In this paper, using the theory of neural network identification features, set up the fund net value predicted by the artificial fish neural network forecasting model, first with nonlinear damping least square method to optimize Elman neural network learning algorithm, at the same time to carry on the dynamic adjustment, the artificial fish algorithm parameters make the early stage of the optimization can quickly obtain the global optimal solution domain, the late local search to improve the accuracy of the optimal solution.Combined with the advantages of the artificial fish algorithm and Elman neural network, the improved artificial fish algorithm for finding a set of optimal initial weights and threshold, the neural network to establish artificial fish neural network forecasting model, based on an empirical analysis of the representative of the investment fund, and comparing and grey model to predict the results of the analysis, show that the model has good nonlinear reflection ability and learning capability, prediction precision and can accurately predict the change trend of fund net value and the rise and decline of the turning point, to predict the tendency of fund net value provides a effective method.

2. Artificial Fish Swarm Algorithm

2.1 Basic Artificial Fish Swarm Algorithm

In a certain water domain, individual fish can perceive the water environment according to their own structure and find the place where there is much food, or follow other fish to the destination. In the general natural environment, the most common place for fish is the place where they tend to swim and gather to form a school of fish. Artificial fish swarm algorithm is based on the characteristics of fish in the nature to find food, follow the idea of starting from the bottom, from the bottom up, after the construction of artificial fish model, imitate the four kinds of behavior of individuals and fish swarm, and then carry out the optimization process, to achieve the optimization of the problem.

In a shoal, there is no individual with a core leader to guide the whole shoal to the direction of food and avoid the enemy in the process of food searching. Instead, all fish use their own adaptive behavior to the surrounding environment to find the place with high nutrients. In the overall operation and iteration process of the algorithm, it is not necessary to know relevant knowledge about the problem in advance, and it will not have too high requirements on the target function, such as continuity, derivability, etc., so the artificial fish swarm algorithm has a strong adaptability and can be applied to a wide range of fields.

Artificial fish is a virtual entity based on real fish. The purpose of this is to facilitate the analysis

of practical problems and easy to explain for some complex cases. Inside the artificial fish are some data recording their own characteristics and a series of behaviors where the senses make a preliminary judgment of the environment and make a stress response, and then the fin controls the individual to make corresponding behaviors and activities.

Basic behavior

Unlike humans, fish don't have the ability to reason logically about complex problems and analyze complex problems, it is just a lower aquatic animals, not with the advanced human intelligence, but they can be through the simple behavior and cooperation of individuals and groups to do that, it's called population intelligence.

Foraging is a basic behavior of artificial fish. Most foraging behaviors of fish basically rely on sight and taste to perceive and judge the food concentration and then select the motion direction. Let the adaptive value of the state x_i on the artificial fish be y_i, and randomly select a state x_j within its field of view, and its adaptive value be y_j, and execute the following equation (1). If $y_i<y_j$, then further in this direction, execute the following formula (2); Otherwise, re-select a state x_j in the field of view and re-judge whether it meets the conditions for moving forward until a better state is found. If the try-number is not satisfied, the random behavior is performed, as shown in equation (3) below.

$$x_j = x_i + Visual \cdot Rand() \tag{1}$$

$$x_i^{t+1} = x_i^t + \frac{x_j - x_i^t}{\|x_j - x_i^t\|} \cdot Step \cdot Rand() \tag{2}$$

$$x_i^{t+1} = x_i^t + Visual \cdot Rand() \tag{3}$$

Where, $Visual$ is the field of view, $Rand()$ is the random number of 0~1, $Step$ is the largest step, $\|x_j - x_i^t\|$ is the distance between x_j and x_i.

Fish naturally cluster together to avoid harm and ensure the survival of the population. So there are three rules for fish gathering: first, try to avoid getting too close to your neighbors so they are too crowded, so try to keep them separate; Second, try to keep the same direction with the surrounding partners and calibrate the forward direction; Three is as close as possible to the center interior, in order to better convergence. Let the adaptive value of the current artificial fish state x_i be y_i, and explore the number N_f and center position x_c of artificial fish in its current neighborhood ($\|x_j - x_i\| < Visual$), as shown in equation (4) below. If there is more food and it is not crowded at x_c, go further in the direction of x_c and execute the following equation (5).

$$x_c = \frac{\sum_{j=1}^{N_f} x_j}{N_f} \tag{4}$$

$$x_i^{t+1} = x_i^t + \frac{x_c - x_i^t}{\|x_c - x_i^t\|} \cdot Step \cdot Rand() \tag{5}$$

Once one of the fish in the shoal finds food, the surrounding fish will follow it to the food point. Let the current artificial fish state be x_i, and the maximum adaptive value x_{max} of all the fish in its field of view, and the corresponding adaptive value be y_{max}. If $y_{max}>y_i$ is not crowded around, then the north side moves forward x_{max} and executes the following equation (6), otherwise the foraging behavior is executed.

$$x_i^{t+1} = x_i^t + \frac{x_{max} - x_i^t}{\left\| x_{max} - x_i^t \right\|} \cdot Step \cdot Rand() \tag{6}$$

Random behavior is a default of foraging behavior, which simply means picking a random state in the field of view and swimming in that direction.

These four behaviors are the basic behaviors of the artificial fish. Each artificial fish will consider its surroundings and make the current optimal behavior choice in order to swim to the place with high food concentration.

(1) Behavior choice

At the beginning of artificial fish swarm algorithm, the initial conditions are not high, and each artificial fish is randomly distributed in the water area. The termination condition of the algorithm is usually the number of iterations, but it is not absolute. It can also be some other conditions, which should be set according to specific problems, such as the error value reaches the set minimum error or the fish density reaches the set optimal value.

According to the requirements of the target problem, the individual artificial fish evaluates the current water environment, finds and analyzes the state changes of the surrounding companions and the changes in the value of the objective function, and selects the optimal behavior among the four basic behaviors.

The bulletin board records the status of the optimal artificial fish in a shoal, such as its location and the food concentration in that location, and then USES it for behavioral comparisons. In the whole optimization iteration process, each fish is constantly compared with the state value of the optimal fish recorded on the bulletin board: if the current state of the fish is better than the bulletin board, the state information of the fish is replaced by the state information on the bulletin board, and the above process is repeated until the final algorithm. So the last thing left on the bulletin board is the optimal state of the artificial fish that the algorithm looks for.

One aspect of the autonomy of artificial fish is the evaluation of four basic behaviors. Behavioral evaluation is usually simplified, that is, in the state of each artificial fish, the comparison of all aspects of the situation to choose a fast approach to the optimal solution behavior. When making this choice, a trial method is adopted, that is, several basic behaviors of all artificial fish are simulated, and then the optimal behavior is selected according to the comparison and analysis of relevant evaluation standard data after simulation.

The moving strategy is a supplement to the algorithm on the basis of behavior evaluation, that is, the sequence of several behaviors is arranged in advance. For example, foraging behavior can be performed first; if there is no better execution effect, clustering behavior can be performed; if there is no improvement, rear-end behavior can be performed; and finally, random behavior can be performed. By creating a movement strategy, you can avoid repetitive or useless operations, thus simplifying the process and saving time.

After the artificial fish has performed several behaviors, their state may change from a feasible state to an infeasible state, so at this time, corresponding adjustments should be made. The constraint mechanism can be used to achieve the change of the current situation to alleviate, from infeasible to feasible, to ensure the normal progress of the artificial fish's subsequent activities.

(2) Algorithm steps

Step1: set the initial value of several parameters in the algorithm, including the total number of

artificial fish N, the initial value of each individual state, Step size, Visual field, try-number of attempts, and crowding factor.

Step2: calculate the fitness of all the fish according to the objective function, and use this as the standard to find the optimal artificial fish and record it.

Step3: conduct calculation and analysis to compare the behavior effect after various behavior operations of all artificial fish, then select the optimal behavior operation for execution, and update the information recorded on the bulletin board at the same time.

Step4: after each iteration, the information of the optimal fish on the bulletin board should be compared with the end condition of the algorithm. If the condition is met, the result will be output.Otherwise jump to step 2.

2.2 Improve Artificial Fish Swarm Algorithm

The parameters of artificial fish swarm algorithm are related to the operation and performance of the whole algorithm, especially the Visual field and Step.Since these two parameters are involved in the four basic behaviors of the algorithm, the setting of their initial values directly affects or changes the convergence performance of the algorithm, which attracts more attention from experts and researchers.

The behavior selection of artificial fish is controlled by many factors, among which the visual field and step size of artificial fish have direct and intuitive effects.When Visual is small, artificial fish mainly perform foraging behavior and random behavior, which will highlight the local search ability and weaken the global ability.When Visual is large, it is mainly reflected by aggregation and rear-end behavior, then the algorithm will converge to the optimal value at a faster speed, which shows the global search ability of artificial fish.When the Step size is large, each time the individual moves within the visual range, the distance is large, the convergence is fast, and the time to reach the best can be shortened.When Step is small and the circle of artificial fish is small, the search range is narrow and convergence is slow.View in the traditional artificial fish algorithm and step length is fixed, according to this development, when late in the convergence of artificial fish had gathered around a optimal solution, but still with a fixed step to move forward, stride length is too big, lead to artificial fish swings back and forth swinging around the extreme value point, will seriously affect the accuracy of the optimal solution. It can be seen that the selection of step size in the later convergence is closely related to the later oscillation. The smaller the step size, the lighter the oscillation, the higher the precision, and the larger the step size, the heavier the oscillation, the lower the precision. However, if the step size is too small, it will slow down the convergence speed, so the artificial fish field of vision is insufficient and the local extreme value is prominent, it is difficult to jump out of the local and run to the whole. In order to balance the contradiction between the optimal accuracy and the convergence speed, the field of view and step size are dynamically adjusted by using formulas (7), (8) and (9), as shown below.

$$Visual = a \cdot Visual + Visual_{min} \tag{7}$$

$$\mathrm{Step} = \mathrm{a} \cdot \mathrm{Step} + \mathrm{Step}_{\min} \tag{8}$$

$$\mathrm{a} = \exp(-30(\frac{\mathrm{t}}{\mathrm{T}})^{8}) \tag{9}$$

Where t is the current iteration number and t is the maximum iteration number set. The value of a

is between 0 and 1, and the value curve is inverted s-shaped. When the number of iterations is small, it is l. Then, as the number of iterations increases, it slowly decreases to 0 and remains at the level of 0 in the later period.In this way, in the initial stage of optimal search, there can be a large Visual and Step, see the largest possible area, can find the global optimal solution domain with the fastest speed and the shortest time and move to its surrounding;In the later stage of optimization, Visual field and Step become smaller, so a local search can be carried out in the small range of the global optimal solution domain determined before, so as to make the solution more accurate.

Artificial fish are easy to fall into local optimum and difficult to escape. Sometimes the artificial fish will remain stagnant after several iterations, and the degree of fitness change is very small, so the jumping behavior can change the current situation better. Jump behavior can guide the artificial fish out of the local are due to compulsory and behavior, the parameters of the random jumping behavior description is as follows: if the algorithm n consecutive iterations and after it had been before the maximum number of iterations, the bulletin board on the records of the optimal artificial fish fitness values are lower than a preset value, randomly selected part of the artificial fish, through the type (10) randomly change their parameters.

$$x_i^{t+1} = x_i^t + \beta \cdot \text{Visual} \cdot \text{Rand}() \tag{10}$$

Where, β can be a parameter or a mutation function.

3. Experimental Methods

3.1 Data Sources

(1) Data selection

Generally speaking, the larger the sample size, the more unbiased and effective the model prediction. At present, there are many kinds of funds traded in the domestic market, considering the general requirements of research issues, should choose a more stable fund. Therefore, after the comparative analysis of many kinds of funds, we chose a relatively long time less popular fund - jintai fund for modeling research. The sample data of the fund are from 90 weeks of data published by "securities star", all of which are from China fund network.

(2) Relevant data

This research take the other used in neural network prediction data for every week the cumulative value of the net value of fund, the fund investment, fund turnover, industry concentration, concentration of base stock investment, fund turnover rate, fund, fund discount rate index, nine sets of data, such as China's consumer price index data from China fund net respectively, the state statistical yearbook and the fund management company's web site, comprehensive sort out data.

3.2 Prediction Steps

The artificial fish swarm neural network (AFSA - Elman) short-term load prediction model is built by using artificial fish swarm algorithm and Elman neural network. The model is divided into two processes, one is the training and learning process, the other is the prediction process. Before training and learning, the appropriate training sample is selected from the collected data to train the network. The input sample selects the historical load data and the data of various factors affecting the load. This is the learning process of Elman neural network model. Then the prediction set is input into the trained Elman neural network model for prediction.In this way, the accuracy of the model after learning training can be verified by using test samples. The prediction steps are as follows:

(1) Data preprocessing;
(2) Select the predictive model input variables
(3) The optimal network parameters of Elman neural network prediction model were selected by artificial fish swarm algorithm.
(4) The Elman neural network was trained with the best parameters.
(5) Fit the forecast and evaluate the result.

3.3 Data Preprocessing

(1) Horizontal comparison of data
Before the detection data starts, a maximum variation range is preset for the data to be processed, and then the load values at different times before and after the same time point are compared. If the absolute difference value exceeds the set min value, it is treated as load burr for smoothing, and the formula is shown as follows:

$$x(i,t) = \frac{x(i,t-1) + x(i,t+1)}{2} \tag{11}$$

Where, $x(i,t)$ represents the load value at the t moment of the i-th day.
(2) Longitudinal comparison of data
If the absolute difference exceeds the set threshold, the load data will be treated as abnormal data for correction. The correction formula is shown as follows:

$$\overline{x(t)} = \frac{1}{4}[x(i-2,t) + x(i-1,t) + x(i+1,t) + x(i+2,t)] \tag{12}$$

(3) Data normalization
When more relevant factors are involved, the measurement methods of different factors are different, and the units of measurement adopted are also different, so the scale difference is very large. After the normalization of the input data, the data reach a consistent range and are put between [0,1]. In this way, the influence of the scale range can be balanced by weighting the input factor values of different types in the training, and then the weight value can be iteratively updated.
For the output data of neural network, it is determined by activation function. The commonly used activation function of output layer is Sigmoid function. Its codomain is [0,1]. Before the network training, first of all to handle input data transformation, will be mapped to the activation function of the range, and in the prediction, for network computing the output to the activation function within the range of predicted value, should also be in accordance with the training before the transformation that corresponds to the inverse process to convert the output value in the range of values of the real.
The activation function uses the Sigmoid function, which uses the linear normalization method to convert the output load value to the interval of [0,1], as shown in equation (13) below.

$$y_i = \frac{x_i - \frac{1}{2}(x_{max} + x_{min})}{\frac{1}{2}(x_{max} - x_{min})} \tag{13}$$

(4) AFSA-Elman network model algorithm steps
Step1. Establish the Elman neural network model, initialize the weights and thresholds of each connection layer of the neural network, and encode these data in real Numbers to form artificial fish swarm;

Step2. Preliminary pretreatment and normalization of training sample data of Elman neural network;

Step3. Initialization parameters: determine the number of artificial fish, N, Step, Visual field, try-number, crowding factor δ, weight and threshold X to be optimized, the maximum number of iterations T and the value of the objective function E;

Step4. The number of iterations of initialization t is set to 1. The random generation of initial shoal is composed of N artificial fish, thus generating the initial weights and thresholds of N groups carried by artificial fish:

Step5. Calculate the adaptive value of individual state of each artificial fish respectively, that is, the value of objective function E, compare their sizes, and write the minimum value E and the corresponding individual state to the bulletin board;

Step6. Simulate and compare the clustering and rear-end behavior of all artificial fish, and then use the behavior with smaller E value for actual execution. The default behavior is foraging;

Step7. After each activity, the E value of all fish in the shoal should be compared with the value in the bulletin board, and once it is smaller than the value on the bulletin board, it should be replaced;

Step8. When the number of iterations reaches T, the optimal weight value and threshold value will be output; otherwise, the number of iterations will be increased by 1 and transferred to Step5;

Step9. After the optimization, use the optimal set of weights and thresholds as the initial weights and thresholds for the Elman neural network model training of power load prediction. After the network error is met, the predicted results are output. If the requirements are not met, the output of each layer is calculated, the weights and thresholds are updated, and the error requirements are met.

4. Discussion

4.1 Design of AFSA-Elman Network Model Training Function

The number of nodes in the input layer and output layer of the neural network is set to 5 and 1 respectively.There is no exact method to determine the number of nodes in the hidden layer, so a value can only be roughly determined according to the empirical formula $m = \sqrt{n + h} + c$, in which n, h and m are the number of nodes in the input layer, output layer and hidden layer respectively, and c is an adjustment constant, usually ranging from l to 10. There are 12 hidden layers in this model. The relation between the number of hidden layer nodes and the average output error is shown in table 1.

Table 1. Output errors between the number of nodes in different hidden layers

Number of hidden layer nodes	Prediction mean error (%)	Prediction accuracy (%)
5	4.05	95.89
6	3.90	96.09
7	3.59	96.60
8	3.33	96.67
9	3.21	96.73
10	2.95	97.05
11	2.79	97.24
12	2.65	97.33
13	2.87	97.11
14	3.27	96.66

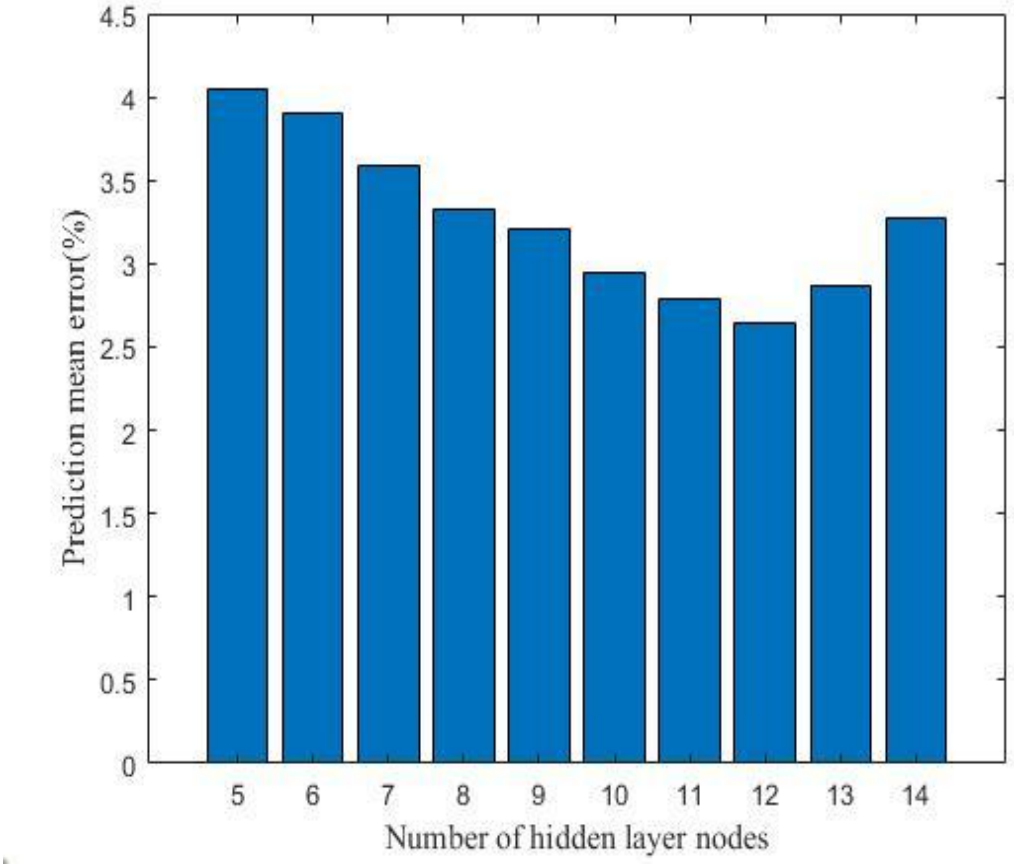

Figure 1. Output errors between the number of nodes in different hidden layers

The number of artificial fish N=100, Visual field =0.7, the maximum Step length is Step=0.5, the crowding factor =0.618, the number of tries =50, and the maximum number of iterations T=1000.δThe maximum training times of neural network are set as 1000, and the training error is set as 0.001.

In artificial fish algorithm to optimize Elman neural network weights and threshold values, because the prediction accuracy of neural networks in evaluation of the error between the predicted and the expected value is used to show that, the error as small as possible, and the fitness value of the artificial fish algorithm is the bigger the better, so the fitness function is the reciprocal of the mean square error of the neural network is used to represent the evaluation.

4.2 Prediction Results of AFSA-Elman

This article is based on a priori information, the use of improved BP neural network model to modeling of fund market, when the hidden layer neurons for 12, network training for a number of 150 of the proceeds of the network system model on the market next week change prediction accuracy is higher, its forecast for the next 10 weeks of data, and the final results are normalized, the result and the real value of the absolute error between the mean value of 0.00938, when the number of hidden layer neurons increased again instead of the error is bigger and bigger.Therefore, the neural network prediction model adopts the optimal network organization, and the prediction results are shown in table 2 below.

Table 2. Weekly net fund neural network model prediction results

Date	Actual value	Predicted value	Relative error
12.01	3.6639	3.6670	0.31
12.08	3.6571	3.6537	0.34
12.15	3.5439	3.5510	0.71
12.22	3.5010	3.5030	0.20
12.29	3.6520	3.6490	0.30
01.05	3.6235	3.6270	0.35
01.12	3.6790	3.6805	0.15
01.19	3.7981	3.8011	0.30
01.26	3.8316	3.8396	0.80
02.02	3.9101	3.9130	0.29

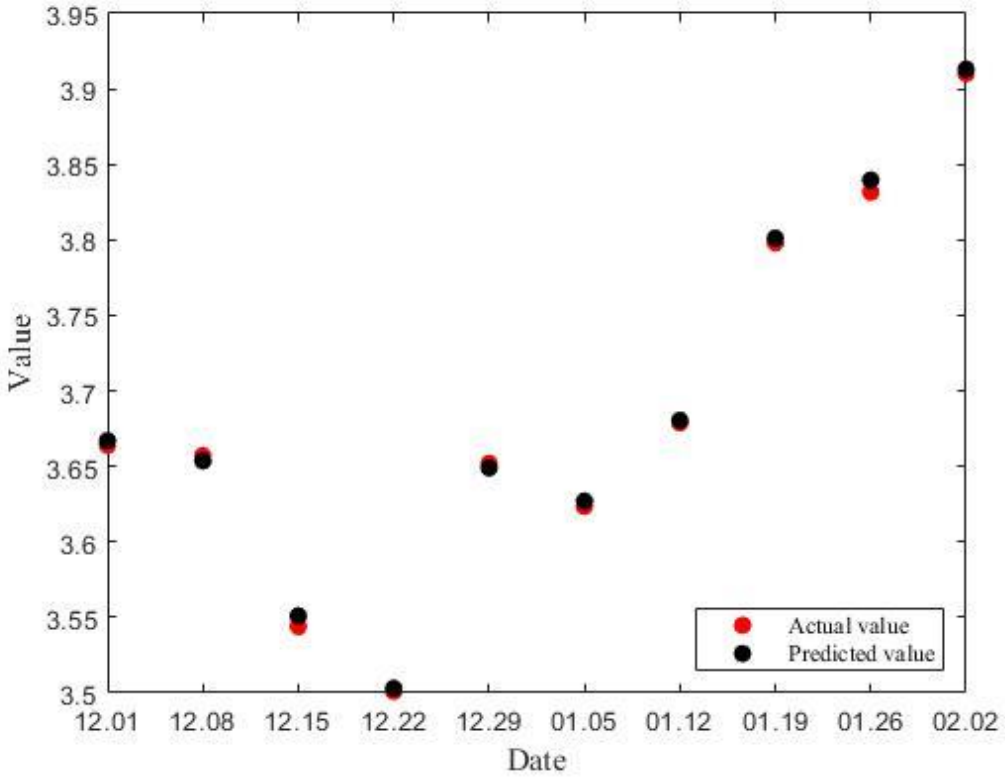

Figure 2. Weekly net fund neural network model prediction results

Compare the forecast curve of the fund with the true net value curve. From the prediction results, the neural network model in this paper is suitable for approximating a discrete nonlinear time series such as fund market data. This network structure can accurately predict the changing trend of weekly net value of the fund and the turning point of the trend change of weekly net value of the fund in the 83rd and 85th weeks with high accuracy.It can be seen that the neural network, after a lot of and sufficient training, has indeed drawn up the data in the external form, and summed up the change law contained in the data of fund net value related indicators, which has a good promotion ability and application value.

4.3 Prediction Test Based on Grey Model

The GM(1,1) model is used to predict the time series of fund net value in the last 10 weeks, and the predicted results are shown in table 3 below.

Table 3. Grey model of fund net value predicts results

Date	Actual value	Predicted value	Relative error
12.01	3.6639	3.9031	6.53
12.08	3.6571	3.9530	8.09
12.15	3.5439	3.9716	12.07
12.22	3.5010	3.9967	14.16
12.29	3.6520	4.0030	9.61
01.05	3.6235	4.0590	12.02
01.12	3.6790	4.0703	10.64
01.19	3.7981	4.0976	7.89
01.26	3.8316	4.1316	7.83
02.02	3.9101	4.1977	7.36

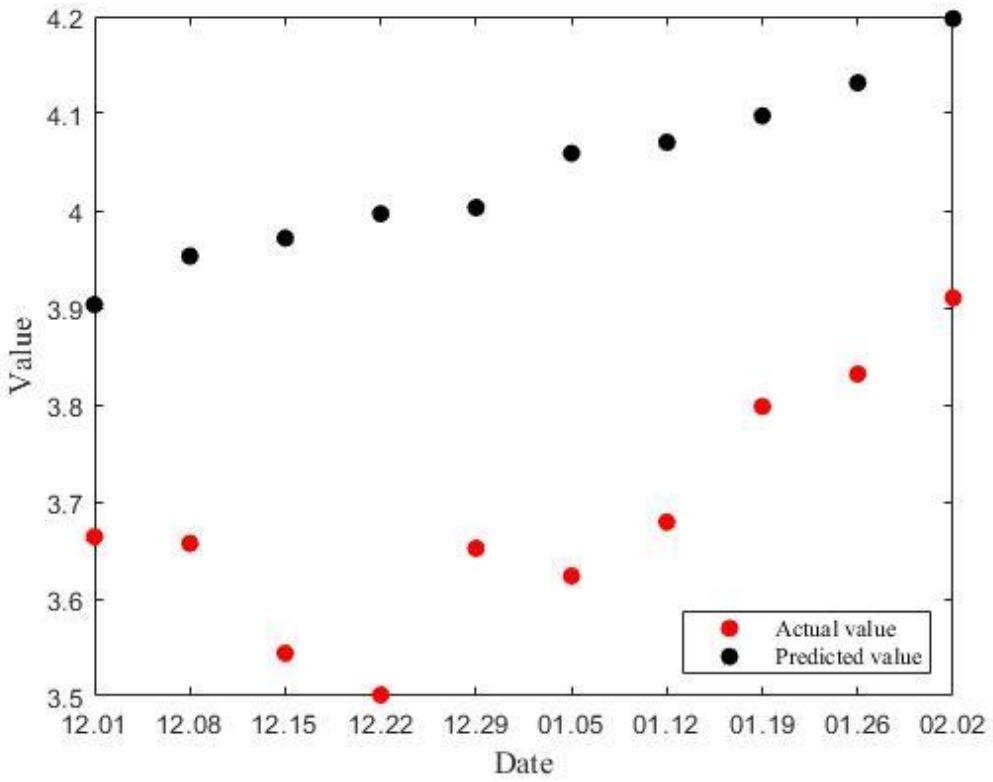

Figure 3. Grey model of fund net value predicts results

To sum up, in this model, the performance of GM model is the best for both simulation effect and prediction effect, but there is not much difference between them. The mean relative error of the predicted values of GM model is 9.62. According to the accuracy grade reference table, the simulation effect and prediction effect of the grey prediction model are acceptable. Therefore, the grey model can be used to make long-term forecast on the net value demand of the fund.

4.4 Comparative Analysis of Model Prediction Performance

In order to compare the superiority of artificial fish swarm neural network prediction model and grey prediction model, the data obtained from the two models were compared, as shown in table 4 below.

Table 4. Model prediction performance comparison

Date	Actual value	AFSA - Elman	Relative error	GM	Relative error
12.01	3.6639	3.6670	0.31	3.9031	6.53
12.08	3.6571	3.6537	0.34	3.9530	8.09
12.15	3.5439	3.5510	0.71	3.9716	12.07
12.22	3.5010	3.5030	0.20	3.9967	14.16
12.29	3.6520	3.6490	0.30	4.0030	9.61
01.05	3.6235	3.6270	0.35	4.0590	12.02
01.12	3.6790	3.6805	0.15	4.0703	10.64
01.19	3.7981	3.8011	0.30	4.0976	7.89
01.26	3.8316	3.8396	0.80	4.1316	7.83
02.02	3.9101	3.9130	0.29	4.1977	7.36
Average error			0.3750		9.62

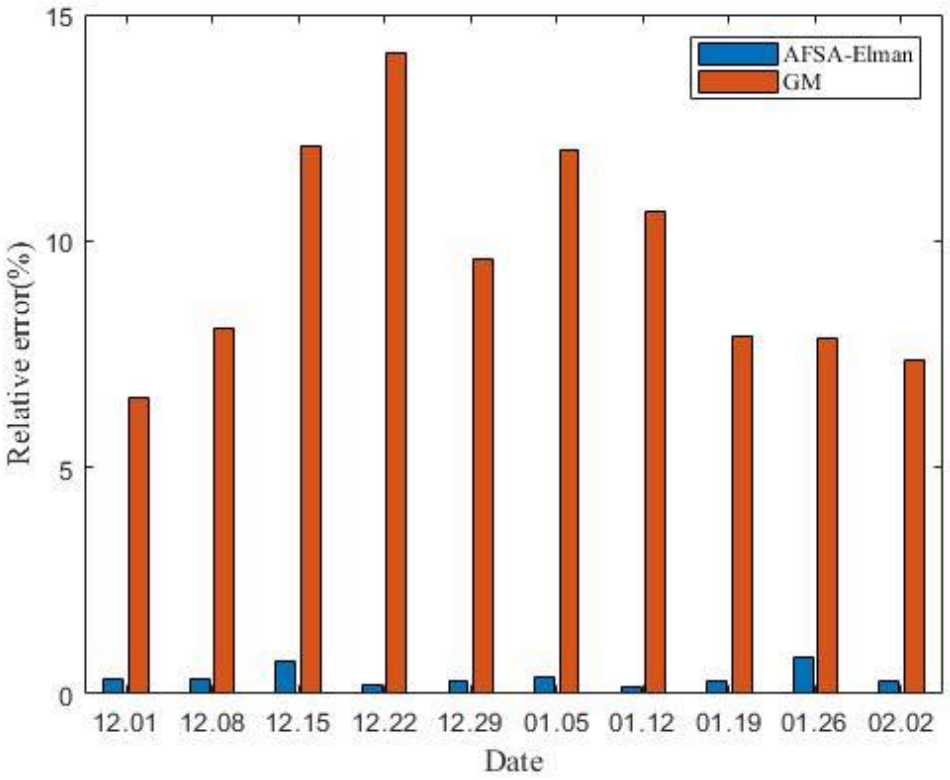

Figure 4. Model prediction performance comparison

It can be seen that the error of the data predicted by the neural network model is 0.3750, and the average error of the data predicted by the grey model is 9.62. As can be seen from figure 4, the prediction of the neural network model is significantly closer to the real value than that of the grey model.Thus, it can be concluded that the prediction of the neural network model is better than the

prediction of the grey model, which can predict the net value of the fund with higher accuracy. Due to the nonlinearity of fund net value data, the longer the prediction time is, the less reliable it is. Therefore, artificial fish swarm neural network is suitable for short-term prediction of fund net value. After the modeling test, under the condition of sufficient training samples, the artificial fish swarm neural network can basically meet high requirements for short-term prediction of fund net value data.

5. Conclusions

Fund performance not only reflects the fiduciary responsibility, but also provides useful information for investment decisions, is the management guide for fund managers, is the investment guide for fund investors, it is not only related to the healthy development of the fund industry, but also has important significance for the prosperity of the entire securities market. As an investment tool with co-existence of risk and income, the risk of fund is mainly manifested in the volatility of fund price. The prediction of fund price volatility can reflect the overall situation of fund companies, and the accurate prediction of fund price has important guiding significance for investment decisions.In this paper, an artificial fish swarm neural network prediction model for net fund prediction is established based on the identification characteristics of neural network theory. The main conclusions are as follows:

(1) This paper explores the new fund investment risk analysis and assessment technology, and enriches and improves the fund investment risk and assessment method system;This paper provides a quantitative analysis technique of fund investment risk based on multiple factors, which is helpful to improve the accuracy of evaluation. A synthetic evaluation method based on artificial fish swarm neural network is provided, which is helpful to improve the scientific evaluation.It provides new ideas and practical methods for individual investors and institutional investors in the fund market.

(2) The advantages and disadvantages of Elman neural network and the basic theory are expounded, its derivation and training process are studied, and the network learning algorithm is improved.The simple development process of swarm optimization algorithm is introduced, and several bionic swarm intelligence algorithms are enumerated. This paper introduces the source of artificial fish swarm algorithm, basic theory, behavior description, influence parameters, etc.

(3) The neural network is easy to fall into the local extreme value, and the iteration time is long, and the convergence speed is slow. Because the selection of the initial weight and threshold of the network has a direct relationship with the prediction effect of the entire prediction model, the artificial fish swarm algorithm which is simple in parallel and can jump out of the local optimization is selected to optimize the initial value.The artificial fish swarm neural network prediction model is established, and the steps of modeling and the process of network training and prediction are described in detail.

(4) The determinants, model structure and neural network model of the nonlinear dynamic model of fund net value prediction are analyzed.Through the empirical analysis show that the selected economic indicators which influence the fund performance and the established neural network dynamic model can reflect the market operation rule, over a period of time can accurately predict the change trend of fund net worth every week and the turning point of rise and fall, for next week's market change prediction accuracy is higher, and the fund net value of the short-term forecast has certain reference value for investors. How to make the network have better predictive power in network selection or learning algorithm selection remains to be further discussed.

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