

## *Retraction*

# **Retracted: Analysis of Comprehensive Artificial Neural Network Computer Media Aided Construction of Economic Forecasting Model**

### **Journal of Electrical and Computer Engineering**

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

### **References**

- [1] T. Li, "Analysis of Comprehensive Artificial Neural Network Computer Media Aided Construction of Economic Forecasting Model," *Journal of Electrical and Computer Engineering*, vol. 2022, Article ID 7981393, 8 pages, 2022.

## Research Article

# Analysis of Comprehensive Artificial Neural Network Computer Media Aided Construction of Economic Forecasting Model

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As a complex system engineering, economic forecasting involves many fields and disciplines, and its accuracy largely depends on the selected forecasting method and forecasting model. The construction of the traditional economic prediction model mainly depends on the theories of economic statistics and metrology, which cannot meet the prediction needs of the new era. ANN model has a more flexible nonlinear quality and learning mode so that it can effectively adapt to the prediction scenario of a nonlinear economic system. ANN is an abstract model of the human brain neuronal network based on the information-processing perspective and composed of different networks to achieve a specific representation of logical strategies. ANN's self-learning function, associative storage function, and the ability to find optimal solutions at high speed have led to its in-depth application and research in an increasing number of fields. In addition, ANN research work has continued to advance, has made great progress in many fields represented by economic forecasting, has successfully solved many practical problems, showing a more intelligent adaptation in the field of economics, and therefore has an important research value. Based on this, this paper first analyzes the economic system prediction, then studies the ANN medium model and learning algorithm, and finally verifies the effectiveness of the ANN economic prediction model integrating computer medium.

## 1. Introduction

After years of in-depth integration and development of the global economy, economic integration and trade diversification have made remarkable achievements in the past few decades. However, in recent years, the development of the global economy is very unstable [1]. On the other hand, in order to maintain the steady development of the social economy, it is inseparable from the prediction and planning of economic info, so as to provide scientific and objective decision-making basis and data support for economic development [2]. In this context, through the collection and analysis of various indicators of economic operation, the establishment of economic prediction model is of great value for reasonably predicting the trend of economic development in a certain period of time.

In order to ensure the healthy development of their macro-economy, governments will inevitably formulate some economic decisions and intervention measures. The

formulation of these economic control policies and intervention measures depends on the prediction of the future economic situation, which requires relevant institutions and personnel to adopt scientific means and strategies to make an accurate prediction of the economic situation. The accuracy of economic forecasting largely depends on the selected forecasting method and forecasting model [3]. The construction of the traditional economic forecasting model mainly depends on the theories of economic statistics and metrology. With the iterative progress and utilization of modern info tech such as artificial intelligence, IoT, and cloud computing, the construction of economic forecasting model has been supported by new tech, which has laid a solid technical premise for the regulation of economic activities and the formulation of strategies [4].

As a complex system engineering, economic forecasting involves many fields and disciplines. On the one hand, it is determined by the complexity of macro- and microeconomic activities; on the other hand, it is also determined by

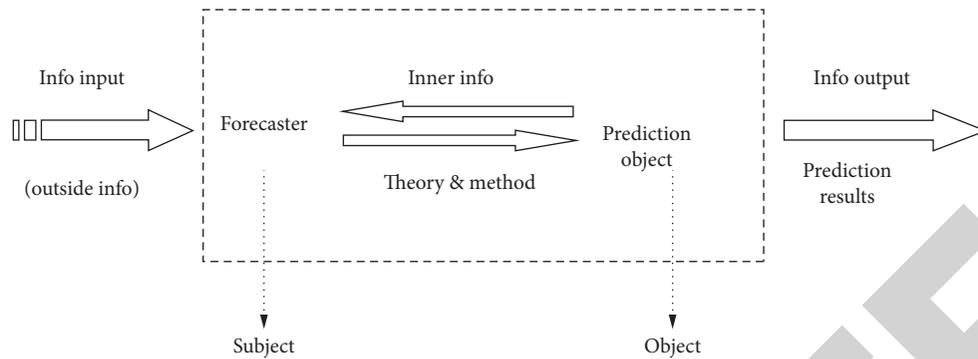


FIGURE 1: Elements of economic system prediction.

the nonlinearity and uncertainty of the economic system [5]. These inherent characteristics make economic prediction very difficult. Facing the serious challenge of economic prediction modeling, economic prediction research increasingly depends on quantitative data support. In this process, many kinds of prediction models and algorithms have emerged, such as time series analysis, econometrics, and VAR methods. Among them, as a mainstream prediction model method, VAR is a large-scale structure prediction model, which is composed of many variables [6]. However, whether econometric models, time series analysis, or VAR models belong to the category of linear models, which are difficult to predict nonlinear economic systems, resulting in a large optimization space for the prediction accuracy of these models, which is difficult to effectively meet the prediction needs of macroeconomy.

Traditional economic forecasting models either put forward many unrealistic presuppositions for the economic system or rely on the data generated by historical economic activities, so as to predict a very small number of economic quantities [7]. Due to the nonlinear and uncertain characteristics of the economic system, it is difficult to accurately realize the evolution prediction modeling of the economic system, resulting in great limitations of the traditional economic prediction model [8]. This requires breaking through the limitations of traditional prediction theory and practical models, finding new economic prediction methods to deal with the complex and diversified economic environment, reducing the risk of economic decision-making, and improving the prediction accuracy of economic system, so as to provide technical support for corresponding institutions to specify correct economic regulation policies and carry out corresponding response measures, so as to accelerate economic activities to better achieve the predetermined objectives.

In the info age, various computer media have made rapid progress. The computing medium represented by the ANN model has gained in-depth attention and research in the construction of economic prediction model because of its prediction accuracy advantage in the field of multivariable time series. The development of ANN theory provides a new opportunity for economic forecasting. ANN model has a more flexible nonlinear quality and learning mode. Thanks to its concise constituent units and flexible learning

simulation mode and ability, it can be effectively applied to nonlinear economic system forecasting [9]. There is a certain inevitable trend behind a large number of disordered activities in the economic system. Through the analysis and calculation of economic data, it could study the law of economic development and predict economic activities. ANN model has the ability of self-study, association, and storage, so it can quickly guide the complex relationships and laws between nonlinear things. Therefore, it has good adaptability and matching in economic model prediction.

In short, under the background of the rapid development of computer medium, the economic system is more complex, diverse, and visual. As a continuous pursuit of human activities, economic growth is an important indicator to measure social development. Due to the complexity of the economic system, its healthy and orderly development is inseparable from the competent intervention and regulation of economic acquisition, and these adjustment and intervention measures are inseparable from the effective prediction of the economic system [10]. With the help of the ANN model, an advanced medium, it can effectively predict the impact of economic regulation measures on the whole economic system, so as to provide technical support for relevant institutions to make corresponding decisions and plans. Therefore, it is of great practical value to study the construction of ANN economic prediction model integrating computer medium.

## 2. Research on the Economic Forecasting System

The prediction of the economic system is the result of using known knowledge and means to deduce and judge the development trend and situation of the economic system in a certain period of time in the future. The constituent elements of economic system prediction are shown in Figure 1, mainly including input info, prediction object, prediction theory, and model adopted, as well as output prediction results and info. The prediction of economic system should follow the principles of continuity, correlation, similarity, variability, and randomness. At the continuity level, it is mainly because the past activities of the economic system will have an impact on the current and future behavior [11]. At the relevance level, it is mainly because the economic system, as an open system, is dependent on external factors. At the level of

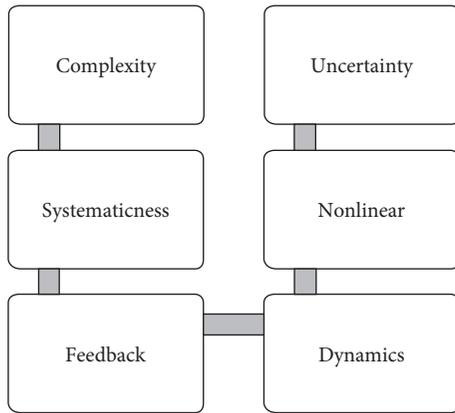


FIGURE 2: Typical characteristics of economic system.

similarity, variability, and randomness, it means that the relevant prediction activities should follow the change law of the economic system and find out the relevant influencing factors.

At the level of forecasting characteristics of economic system, because economic phenomena can be recognized and utilized, it has a certain regularity to carry out economic forecasting. The accuracy of economic forecast also has the typical characteristics of relativity and limitation, because the economic system will inevitably be affected by factors that cannot be mastered. When the results of economic prediction are inconsistent with the actual economic operation, it cannot explain that the prediction of the economic system is failed, because there are many human active interventions in economic activities, which affect the operation results of the economic system. The economic system has several typical characteristics as shown in Figure 2.

At the level of economic prediction test, common prediction test methods include relative error, average prediction error, average absolute error, mean square error, and average absolute percentage error. These different economic forecast test methods can effectively verify the consistency between the forecast results and the actual situation.

**2.1. Classification Method.** The methods of economic system prediction include qualitative prediction, quantitative prediction, and comprehensive prediction. Among them, the qualitative prediction of economic system is mainly based on subjective judgment, so it can only roughly estimate the development trend of things. Secondly, at the level of quantitative prediction, a targeted quantitative model is established through the collection of data and info of the economic system, so as to calculate the development trend of the economic system [12]. The comprehensive prediction organically integrates the advantages of the first two prediction methods to ensure that the prediction results are as accurate as possible. The forecast of typical fields can generally be divided into short-term forecast, medium-term forecast, and long-term forecast according to their duration, as shown in Table 1. In addition, according to the scope of prediction, it can be divided into macro- and microprediction, in which the prediction of economic system belongs to typical macroprediction.

TABLE 1: Classification of forecast periods in typical domains.

Forecast periods (years)	Tech	Industry	Economics
Short term	1-3	1-10	1-5
Medium term	3.5	10-20	5-10
Long term	5-10	>20	>15

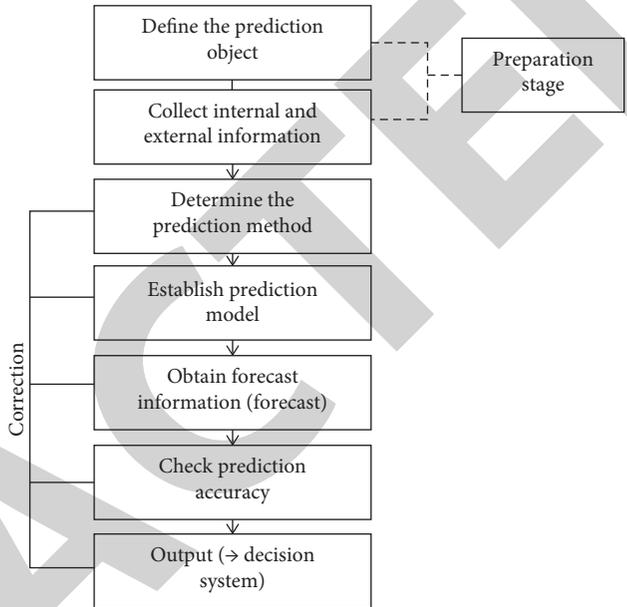


FIGURE 3: Typical process of marketing service in power supply enterprises.

In the process of economic system prediction, it should first clarify the prediction object and collect internal and external info of the economic system. After completing the preparation stage, it is necessary to further determine the prediction method and model, obtain the prediction info, check the prediction accuracy until the prediction info is output, and ensure the accuracy of the prediction results through continuous iterative optimization. The typical process of economic system prediction is shown in Figure 3.

In addition, in the process of economic system prediction, it is inevitable to receive the interference of many factors, which will adversely affect the accuracy of prediction. Generally speaking, the development of economic system prediction is mainly limited by objective factors, the role of randomness and mutation factors, and the accuracy of the selected prediction models and methods, social factors, and intelligent structure.

### 3. ANN Computer Medium

In recent years, the computer medium has made remarkable progress, and its in-depth utilization in many fields has significantly accelerated the development of all walks of life. However, with the in-depth utilization of computer medium, the disadvantages of traditional computer medium have gradually emerged [13]. Firstly, the info processing flow of a typical computer medium is shown in Figure 4.

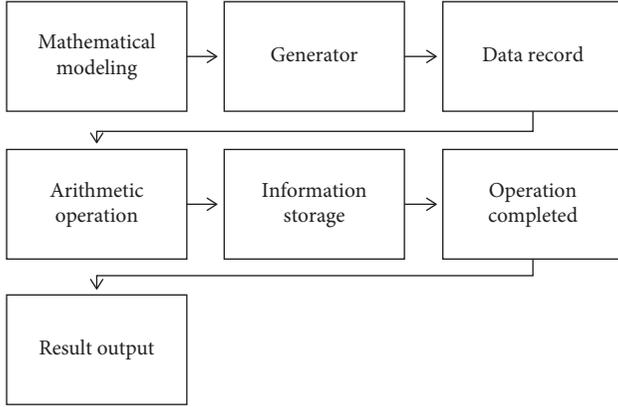


FIGURE 4: Typical info processing flow of computer medium.

It can be seen from Figure 4 that this flow depends on the set program steps, and the info processing mode is more centralized and serial, which has great limitations in the processing of intelligent info and other scenarios. Therefore, it is necessary to find a new medium, expand the mechanism of info processing and storage, and realize the efficient solution of related matters. As a top-down method, ANN medium is suitable for low-level mode processing. ANN medium simulates brain neural function by simulating human brain neural structure, so as to quickly process a large number of neuronal info and dynamic behavior. ANN medium can better solve and deal with the problems faced by traditional computer medium, especially its advantages in spatio-temporal info storage, parallel search, self-organizing association, spatio-temporal data statistics, and so on [14].

At present, ANN medium mainly aims to solve the problems of global, structural, and programmability and realize the overall stability. The artificial neural network medium uses the connection mechanism to model the cognitive information processing process and replaces the algorithm by establishing neural computing. Secondly, at the level of intelligent info processing, the utilization of ANN medium includes optimization control, signal processing, and sensor info processing. In addition, at the level of software simulation and hardware implementation, software simulation is carried out on the traditional computer medium to form an ANN simulator, so as to verify the new model and complex network characteristics [15]. At the realization level of neural network computer medium, biological simulation and digital-analog interconnection are realized.

In terms of storage capacity, the storage capacity of the ANN medium is greatly related to the network. The upper and lower limits of info expression capacity of ANN medium with  $n$  neurons are shown as follows:

$$C < \log_2 \left( 2^{(n-1)2^n} \right)^n, \quad (1)$$

$$C \geq \log_2 \left( 2^{(0.33[n/2]^2)} \right)^{[n/2]}. \quad (2)$$

Secondly, at the level of computing power, ANN medium can mainly realize mathematical approximate mapping, estimation of probability density function, and

formation of topological continuity and statistical isomorphic mapping and extract relevant knowledge from binary database. It can also realize nearest neighbor pattern classification and data clustering and solve optimization problems. ANN medium can better solve the problems of feature extraction, pattern classification, associative memory, low-level perception, and adaptive control. With the deepening of the utilization of ANN medium, its integration with traditional computer medium can effectively give full play to their advantages and accelerate the specified connection between target nodes.

The utilization of ANN prediction model media in economic system prediction further enriches the theory and practice of economic growth prediction and brings a new innovative perspective for the prediction of economic system operation. Secondly, the utilization of ANN prediction model can provide new decision-making tools and intellectual support for macroeconomic departments and can accurately predict the operation situation and trend of economic system in a certain period of time. In addition, by establishing the growth model based on ANN medium technology, the fitting ability of the economic prediction model is ameliorated.

**3.1. ANN Medium Model.** The basic composition of the ANN medium is shown in Figure 5. This medium is mainly used to strengthen the competition between neurons in the layer.

The relationship between each element node is shown in equations (3) and (4). Where  $w_{ji}$  is the connection weight between neuron  $i$  and neuron  $j$ ;  $u_i$  is the neuron state of neuron  $i$ ;  $v_j$  is the output of neuron  $j$ , that is, an input of neuron  $i$ ;  $\theta_i$  is the threshold of neuron  $i$ . Function  $f$  expresses the input-output characteristics of neurons.

$$u_i = \sum_{j=1}^n w_{ji} v_j - \theta_i, \quad (3)$$

$$v_i = f(u_i). \quad (4)$$

If the threshold  $\theta_i$  as a special weight, the output of neuron  $i$  can be expressed as the state shown in (5), in which  $w_{0i} = -\theta_i$ ,  $v_0 = 1$ .

$$v_i = f \left( \sum_{j=0}^n w_{ji} v_j \right). \quad (5)$$

In order to express the nonlinear transformation ability of neurons with continuous functions, S-type functions are often used.

$$f(u_i) = \frac{1}{1 + e^{-u_i}}. \quad (6)$$

At the level of connection mode, there are mainly intralayer connection, circular connection, and interlayer connection. Among them, intralayer connection is an intraregional connection, circular connection is used to continuously strengthen its own activation value, and

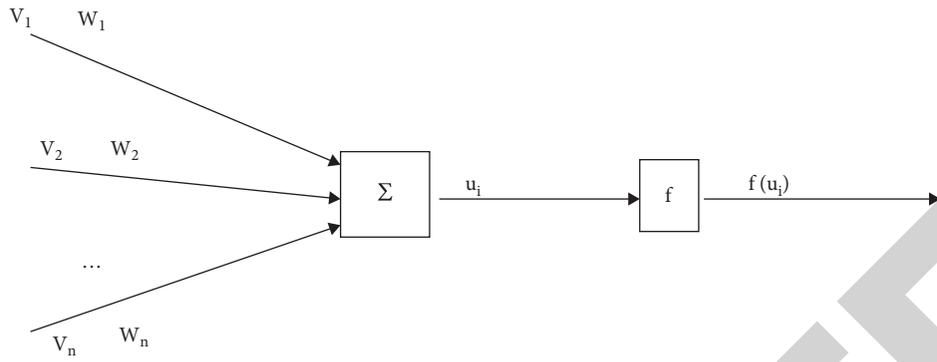


FIGURE 5: The basic composition of ANN medium.

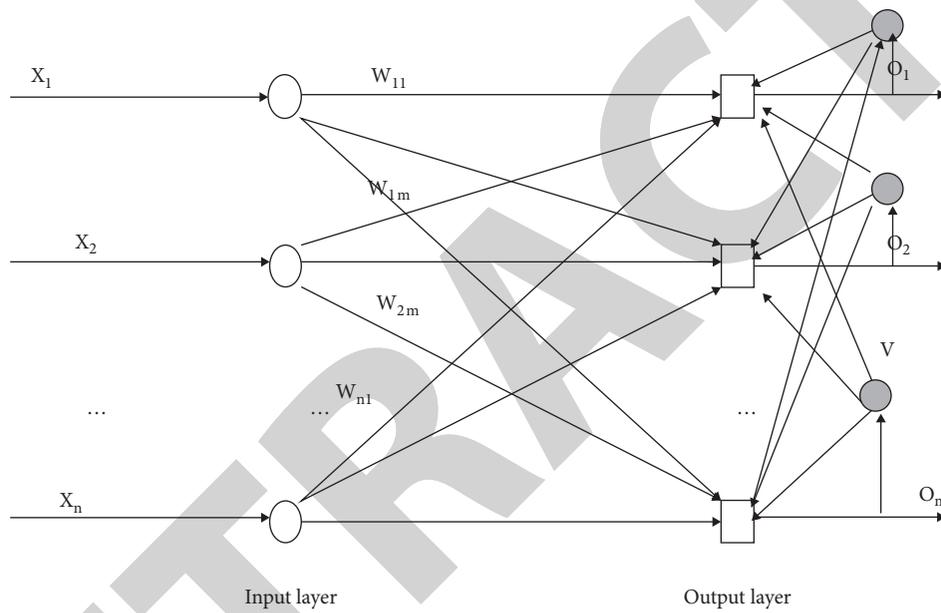


FIGURE 6: Simple single-stage horizontal feedback network architecture.

interlayer connection is the connections between neurons in different layers, so as to realize interlayer signal transmission. At the level of network info flow type, it mainly includes feedforward network and feedback network. Among them, the former is carried out layer by layer from the input layer to each hidden layer and then to the output layer; in the latter, each node can not only receive input from the outside but also output to the outside. In addition, the layered structure of ANN medium is divided into horizontal feedback, layer feedforward, and layer feedback. The simple single-stage horizontal feedback network is shown in Figure 6.

3.2. ANN Medium Model and Learning Algorithm. The processing of single output perceptron is applied to the neurons in the output layer of multioutput perceptron one by one. Firstly, the weight matrix is initialized, and then, the cycle number control method is used for cycle control to perform the specified number of iterations on the sample set. Or the precision control method or comprehensive control method

shall be selected according to the actual problems. In the initial test stage, the accuracy requirements are low. After the test is completed, the actual accuracy requirements are given. The mathematical model of the perceptron is shown as follows:

$$\text{net}_j = \sum_{i=1}^n w_{ij}x_i, \tag{7}$$

$$\begin{aligned} o_j &= \text{sgn}(\text{net}_j - T_j) = \text{sgn}\left(\sum_{i=0}^n w_{ij}x_i\right) \\ &= \text{sgn}(\mathbf{W}_j^T \mathbf{X}), \end{aligned} \tag{8}$$

$$\mathbf{W}_j = (w_{1j}, w_{2j}, \dots, w_{ij}, \dots, w_{nj})^T, \tag{9}$$

where  $o_j$  is the output and  $\mathbf{W}_j$  is the input.

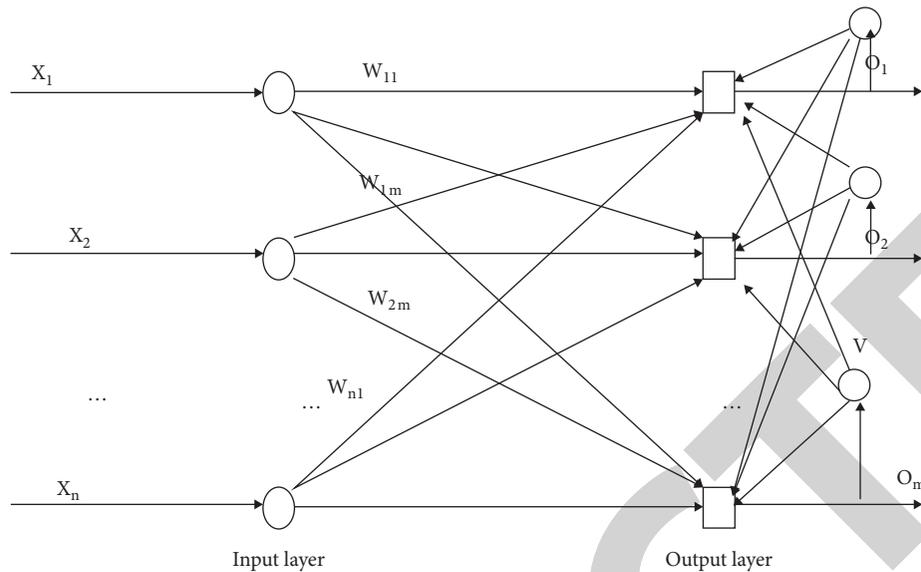


FIGURE 7: Topology of BP network medium.

For the problem of linear indivisibility, the closed or open convex domain is divided by a two-level network, and the nonconvex domain is identified by a multilevel network, and special attention should be paid to the adjustment of the connection weight of the hidden layer. By combining multiple single-level networks and fusing the network group with other single-level network groups, a two-level network can be formed. The network can be used to divide a closed or open convex domain on the plane, and a nonconvex domain can be divided into multiple convex domains. The three-level network can be used to identify nonconvex regions. The XOR problem is realized by constructing a two-level network with two neurons in the first layer and one neuron in the second layer.

Because the learning rules of perceptron neural network can only train single-layer neural network, while single-layer neural network can only solve linear separable classification problems, and multilayer neural network can be used for nonlinear classification problems, it is necessary to find a learning algorithm for training multilayer network. BP algorithm can be better applied to the learning of multilayer network and has wide applicability and effectiveness, which is also the main reason why most ANN medium adopts the form of BP network. The topology of the BP network medium is shown in Figure 7. In the BP network structure, the dimension of its input/output vector, the number of layers of the network hidden layer, and the number of neurons are directly related to the problem.

**3.3. Training Process.** The training samples of the BP network medium are input vector and ideal output vector. The weight is initialized, a sample  $(X_j, Y_j)$  is taken from the sample set in the forward propagation stage, and  $X_j$  is inputted into the network and calculated the corresponding actual output  $O_j$ . In the error propagation stage, the difference between the actual output  $O_j$  and the corresponding ideal output  $Y_j$  is calculated, and the weight matrix is

adjusted in the way of minimizing the error. The error measure of the network with respect to the  $j$ th sample is shown as follows:

$$E_j = \frac{1}{2} \sum_{k=1}^m (y_{jk} - o_{jk})^2. \quad (10)$$

The error of the output layer is used to adjust the weight matrix of the output layer, and the error of the direct leading layer of the output layer is estimated with this error, and then, the error of the leading layer of the output layer is used to estimate the error of the previous layer. In this way, the error estimates of all other layers are obtained, and these estimates are used to modify the weight matrix, so as to establish the process of transmitting the error shown by the output to the input step by step in the direction opposite to the input signal.

The order of receiving samples in the BP network medium has a great impact on the training results. It is easier to accept later samples. Generally speaking, it is difficult to arrange an appropriate order for the samples in the set, and the sample order will affect the results, so it is necessary to eliminate the influence of sample order. The input, output, precision control parameters, and learning rate are initialized with different small pseudo-random numbers. Secondly, the cycle control parameter is set as the precision control parameter plus one; the maximum number of cycles, cycle number control parameter equal to zero; for each sample, the weight modification amount and output error of output layer and hidden layer are calculated, and then, the weight matrix of output layer and hidden layer is modified. The ameliorated measure can effectively solve the accuracy problem caused by the sequence of samples and the jitter problem of training.

## 4. Model Construction Method and Results

At the microeconomic level, the cost prediction model constructed by ANN medium can predict the future

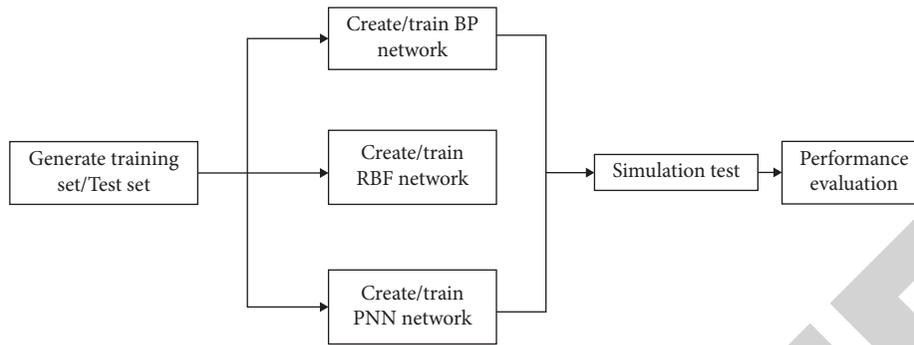


FIGURE 8: Simulation and prediction process based on BP network.

operating costs of enterprises in various industries and conduct simulation experiments on sales, so as to accurately predict future sales. In the field of macroeconomic system, ANN medium can be used to predict and warn the budget, inflation, and economic development cycle, and macro operation situation of the economic system. At the economic market level, the ANN model can accurately predict the profitability and future trend of the economic market. In addition, in the financial field, the use of the ANN model can establish a scientific and objective credit evaluation model, so as to evaluate the credit rating, financial status, risk rating, and expected benefits of relevant institutions and individuals. At the level of operation evaluation and decision-making assistance of the socio-economic system, the ANN model can objectively evaluate relevant industries, sustainable development, industrial planning, and economic strategy and truly reflect the actual situation of economic system.

**4.1. Construction Method.** The trained BP network is used for simulation prediction, and its process is shown in Figure 8. Firstly, the training and test sets are generated, and the samples are divided into training set and test set. The training samples are used for network training, and the test samples are used to test the generalization ability of the network. Secondly, the simulation is tested, and the final results are evaluated by creating training BP network, RBF network, and PNN network. After the network is created and trained, the input variables of the test set are sent to the network, and the output of the network is the prediction result. By calculating and comparing the error between the predicted value and the real value of the test set, the performance of the network can be evaluated according to the error results: the smaller the relative error is, the better the performance of the ANN prediction model is.

In addition, through sample collection, normalization, and random selection of training samples and test samples, the prediction error is calculated by test samples to evaluate the generalization ability of the network. If the generalization ability meets the requirements, the trained BP neural network can predict/classify. Otherwise, the network parameters need to be adjusted to continue learning until the generalization ability meets the requirements.

TABLE 2: The economic system parameters selected.

Parameters	Periods (values), unit: 100 million CNY				
Training samples	2005	2006	2007	2008	2009
	183085.8	219438.5	270092.3	319244.6	348517.7
Test samples	2010	2011	2012	2013	2014
	412119.3	487940.2	538580.0	592963.2	643563.1
Prediction samples	2015	2016	2017	2018	2019
	688858.2	746395.1	832035.9	919281.1	986515.2

TABLE 3: ANN model prediction output results.

Year	Comparison results, unit: 100 million CNY		
	PV	AV	Error (%)
2020	1014868.6	1015986.2	0.11

**4.2. Results Analysis.** At the level of economic system index selection and data processing, it is mainly based on macroeconomic theory. Therefore, the input variables of the ANN prediction model in this paper come from the production function. The economic system parameters selected in this paper are shown in Table 2. Secondly, the input indexes need to be preprocessed to speed up the learning and convergence efficiency of the ANN prediction model. In the process of forecasting the economic system, the actual time series observation data are input into the ANN economic forecasting model network, so as to obtain the prediction output at the next time, and carry out continuous iteration until the final result is obtained.

In order to verify the effectiveness of ANN economic prediction model integrated with computer medium, it is necessary to train, simulate, and verify the network model with the help of a computer software medium. This paper chooses MATLAB software medium to form the BP network model. After setting the training parameters, the train function is called in the software to train the BP model. The input variables of the economic system selected in Table 2 are predicted by the BP model, in which the data from 2005 to 2009 are used as training samples, the data from 2010 to 2014 are used as test samples, and the data from 2015 to 2019 are used as prediction samples. The forecast samples are inputted into the model to obtain the economic forecast value of 2020, and the results are shown in Table 3. It can be seen from the

prediction results that the ANN economic prediction model integrated with computer medium has high accuracy and small error and can meet the needs of economic prediction in specific scenarios.

## 5. Conclusion

In summary, there is a certain inevitable trend behind a large number of disordered activities in the economic system. Through the analysis and calculation of economic data, it could study the law of economic development and predict economic activities. By analyzing the concept and characteristics of economic forecasting, this paper studies the constituent elements, principles, methods, and classification of economic system forecasting. By studying the main contents of the research and utilization of ANN medium, the topological characteristics and model algorithms of ANN medium are analyzed. Finally, by analyzing the construction of ANN network economic prediction model integrating computer medium, this paper studies the utilization of ANN economic prediction model in economic prediction, analyzes the prediction results, and verifies the effectiveness of ANN economic prediction model. The self-learning features of the ANN economic forecasting modeling system incorporating computer media enable comprehensive analysis of data samples and historical data to make sound, scientific economic forecasts. Economic forecasting involves many industries and all aspects of society and requires a large amount of computation to find optimal solutions to complex forecasting processes. ANNs incorporating computer media not only effectively utilize the high-speed computing power of computers but also efficiently find optimal solutions and therefore have a high practicality in the field of economic forecasting. However, ANN in the field of economic forecasting still faces the real problems of data acquisition, data processing and analysis, and economic analysis methods. The integration mechanism and channels of artificial neural network and big data resources, and the processing and analysis of economic big data need to be further expanded and deepened by follow-up research.

## Data Availability

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

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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