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The Prediction Model and System of Stock Rise and Fall Based on BP Neural Network

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Abstract: *The purpose of forecasting the rise and fall of the stock market is for investors to analyze the future stock price trends, trends and other information, and combine the characteristics of the stocks to choose appropriate methods to make trading decisions. The purpose of this paper to study the stock price prediction model is to improve the preventive measures against stock risks. This article mainly uses the experimental method and the comparative method to conduct an experimental research on the stock price fluctuation forecast model. Experimental results show that the accuracy of BP neural network algorithm in stock prediction can reach 91.5%. This means that the stock price prediction model based on BP neural network has certain feasibility, and its research value is also relatively large.*

Keywords: *BP neural network, Stock rise and fall, Forecast model, System design*

1. Introduction

The stock rise and fall forecast refers to the analysis and comparison of indicators such as stock price trends and accumulated trading volume in the future for a period of time by investors. The stock market is a complex system that not only includes a large amount of data, but also has many parameters. Based on the BP neural network algorithm, a new system is constructed that combines the qualitative and quantitative analysis in traditional market risk assessment.

There are a lot of theoretical results in the study of stock price prediction models and systems based on BP neural network. For example, in order to reduce the investment risk of investors, Ma Jian uses BP neural network complex value to enhance the error function to create a prediction model to predict stock prices [1]. Some people believe that predicting stock prices is a hot spot for investors, and the use of artificial intelligence to predict stock prices has become a very popular method of predicting stocks in recent years [2, 3]. Others say that the stock market plays an indispensable role in the entire national economic system. BP neural network has advantages in processing multi-dimensional data [4, 5]. Therefore, this paper proposes a stock price prediction model and system based on BP neural network, which has theoretical basis and research significance.

This article first studies the BP neural network and expounds its basic theory. Secondly, the stock market and risks are studied in detail. Then it discusses the stock analysis method and proposes the application of neural network. Afterwards, the stock prediction system is described in detail. Finally, through the realization of the system, the algorithm and error are analyzed, and the result is obtained.

2. The Stock Price Rise and Fall Forecast Model Based on BP Neural Network

2.1. BP Neural Network

BP neural network is a new research method, which is mainly used in system identification, data mining and machine learning. Many problems applied in real life are processed and analyzed by artificial neurons. After the input vector is trained by this algorithm, a functional relationship is obtained to represent the value of the output variable. This function is called the initial weight coefficient or standard deviation sequence. Then establish the corresponding model according to the obtained parameters, and bring these parameters into the next layer of neural network to calculate the number and weight of stocks corresponding to all data points on the corresponding data set. The basic principle is to use a large number of training sets as an output set with self-learning and response functions, and to modify all points to

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varying degrees by imitating neurons, so as to make it a kind of strong generalization ability, high precision and stability adjustable parameters [6, 7].

For the three-layer BP neural network training algorithm, if the actual output of the network does not match the expected output, there will be a W output error.

$$W = \frac{1}{2}(C-P)^2 = \frac{1}{2}\sum_{i=1}^{n}(c_i - p_i)^2 \tag{1}$$

W is a function of weight connection between g_{kl} and h_{li}, so the error W can be changed by adjusting the weight of each layer of the neural network, so that W is continuously reduced, and the adjustment of the weight is proportional to the negative gradient of the error.

$$\Delta g_{kl} = -\alpha \frac{\partial W}{\partial g_{kl}} \tag{2}$$

$$\Delta h_{li} = -\alpha \frac{\partial W}{\partial h_{li}} \tag{3}$$

The error signal starts from the output and propagates back layer by layer. In order to speed up the convergence speed of the BP algorithm, impulse terms can be added to adaptively adjust the learning rate. Adding the impulse term means that the weight adjustment from the previous iteration is included in the weight adjustment. The neural network training problem can be reduced by finding the weight space to find the weight that can make the objective function reach the overall minimum. The main disadvantage of the gradient descent method is that it is easy to fall into a local minimum [8, 9].

2.2. Stock Market

The stock market is like a capital game. In the stock market, due to the existence of factors such as information security, speculators' divergence in understanding, the complexity of various analysis techniques, and the randomness of stock price changes, the actual investment results are often mismatched or inconsistent. Obviously, the vast majority of investors have not yet fully understood the market, and cannot flexibly use certain laws of the stock market. Most investors still cannot remember some shortcomings of their nature [10, 11].

2.2.1. Method of Predicting Stock Price

The stock price forecasting method is generally based on the length of forecasting time, selecting an index closest to the actual situation from historical data as the basis for adjustment and then introducing new parameters. This article will use the BP neural network algorithm to calculate the corresponding value of the stock real-time trend and historical daily index respectively and analyze its changing law. First, use the training set to judge the latest or recent closing prices, price trends and other information in a certain period of the current period, determine the prediction method, and then input it into the system model. According to the data obtained by the forecasting method, a mathematical function is established to simulate the operation process of the actual time series. Because the BP neural network has strong learning ability and fault tolerance, it can adjust the training set or select the weight parameters according to the actual situation. And it can also take advantage of its own good generalization performance and robustness and adaptive processing characteristics to reduce the dependence on data to a certain extent [12].

Regression analysis method can solve the existing or possible problems in traditional technology to a certain extent, but it cannot accurately reflect the current state of the market due to large stock price fluctuations or possible abnormal values. Therefore, it is necessary to use statistical methods to deal with the impact of these changing factors in order to achieve the desired effect.

Historical average method. The algorithm calculates stock price changes based on indicators such as dividends, bonuses, and the difference between the corresponding annual or monthly total price ratio and the number of years to determine the price change, and then uses the result as one of the most basic parameters in the stock prediction model to obtain the final The analysis of the price fluctuation curve and trend chart of the company leads to the final prediction model.

2.2.2. The Process of Stock Price Prediction

The process of stock price prediction is that investors analyze the acquired data, make a comparison based on the history of the time series, and then select a suitable discourse and indicator as the target of

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prediction. What needs to be noted in this process is to have correct, effective, timely and reliable information. The stock price forecast is based on time, through the collection of historical data, combined with statistical analysis and expert systems to complete the forecast. Before starting the research, you must first determine the required parameters and related technical indicators (such as: length of time, etc.). Then establish the corresponding model according to these indexes. Finally, input the data after selecting the value of each variable in the model into the MATLAB software to process and generate the final result and carry out the simulation test. So as to verify the correctness of the conjecture and hypothesis, and make an evaluation of the prediction effect.

2.3. Stock Prediction System

2.3.1. Demand Analysis

The function of the execution system is to execute the basic business processes and operations of several stocks such as wholesale bidding, market opening, continuous bidding, liquidation and entrusted purchase processes, selling and withdrawal operations on the computer, and to provide convenience for future functions.

The availability, reliability, simplicity and confidentiality of the system must be guaranteed. Since the system must be used for real-time activities, the reliability requirements are naturally quite high. It is not only necessary to ensure that the activity has no major problems, but also that there are problems, the system must have good continuity, and the system can continue to work after reopening the system, so as to ensure the smooth progress of the activity. Because the system adopts C/S structure design, multiple people can work on different computers at the same time. This requires timely checking, comparison and updating of their own data to prevent others from tampering with their own data. Module independence and unity The system adopts C/S structure development. The stock simulation module of the system can be opened and closed at will, requiring strong module independence; because the inventory simulation system is only a part of China's financial and banking system, the others are deposits and loans, Insurance system.

2.3.2. Design of Stock Forecasting Model

The purpose of this article is to design and implement a neural network-based inventory forecasting model. The model can automatically extract features from the data to represent the current state of the inventory. The current inventory status is used as the input of the model, and the output is the result of the inventory forecast. And by adapting the optimization model, it has higher prediction accuracy and better convergence effect. Aiming at the goals proposed in this article, the model should have two functions: data feature extraction and stock price prediction. These two functions are implemented in two different models. The overall structure of the model designed in this paper is shown in Figure 1:

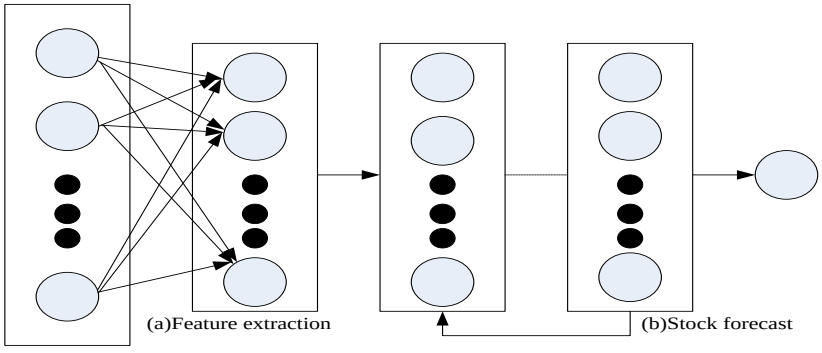

Figure 1: Stock prediction model architecture

The first part of the model is used for dimensionality reduction and feature extraction from inventory data. A small number of features are extracted from a large amount of inventory data to represent the current state of the inventory. The second part is the inventory prediction model; the model uses the state retrieved from the first part as input. Exit is the expected price of the stock, and there is a feedback loop in the model, indicating that the forecast takes into account the impact of historical conditions on current conditions.

Stock index data contains a lot of redundant data. These multicollinearity indicators do not have much practical significance in the calculation of neural networks, so they should be removed from the data to

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remove these redundant information and extract the main functions.

Inventory data is a kind of sequence data, and there is a strong correlation between the data. Traditional machine learning models and predictive neural networks can only process fixed-length sequences due to fixed input and output patterns. Inventory data in different time periods often have different periodicities and short cycle times, making it difficult to assign laws to understanding. Therefore, traditional regression models perform poorly on inventory data.

The model designed in this paper is composed of a feature extraction model and an inventory prediction model. Therefore, these two parts must be formed separately during training. According to the order in which the data is passed into the model, the feature extraction model is trained first, and then the feature extraction model is used. The generated data trains the inventory prediction model. First, use the greedy layered training method to pre-train the weights of each layer, and then input the pre-trained weights into the corresponding layer of the deep autoencoder. In the fine-tuning step, a global optimization algorithm is used to fine-tune the pre-trained weights to obtain the final weights of the automatic depth encoder.

The securities market has a large amount of historical data, including the opening price, closing price, high and low and trading volume of stocks. The input and output variables of the neural network are determined by principal component analysis combined with Dow theory. If the data value of the input layer is too large, the neural network will be paralyzed, so the data must be preprocessed. The preprocessing should retain the attributes of the original data, usually using a linear normalization method. Determining the number of hidden layer nodes is a very important step to determine the topological structure of the BP neural network model. Careful selection of the number of hidden layer nodes can effectively avoid the phenomenon of "overfitting".

3. The Realization of the System

3.1. Stock Trend Forecast

The main trend in this part is trend forecasting. The main methods of trend prediction include operations such as peak and falling signals, continuous falling signals, bottom and rising signals. The creation of the inventory trend prediction model is divided into setting training parameters, inputting sample data for network training and inputting data for prediction.

3.2. Stock Trend Simulation

There are two methods for stock forecasting, one is short-term forecasting, and the other is long-term forecasting. In the case of short-term forecasting, that is, forecasting market price values such as several days, the actual value is usually used to replace the value determined by this forecasting method. The other is long-distance scanning: the long-distance scanning is not replaced by the actual value, because the error of the long-distance scanning is relatively large. When measuring equity risk, it may be evaluated based on factors such as the type and nature of various risks. With price prediction, you can select a specific value of the closing price or the value of the stock price as the forecast target. For different prediction targets, the system prediction accuracy requirements are also different. The selection of samples is considered in many ways. The first is that the number of selected training samples cannot be too large. Too large sample data makes the calculation very complicated, which is not conducive to the operation of the subsequent algorithm, so it is impossible to get a good prediction result. The second is that the number of samples cannot be too small. Too few samples will lead to poor fitting and no good prediction effect at all.

3.3. Experimental Data

Use the selected training samples to train the network. After training with different numbers of samples, different predicted value and true value curves of Shanghai Composite Index closing numbers and predicted absolute error curves are obtained. In this paper, 300, 500, 700 and 900 training samples are selected for testing. And use BP neural network algorithm for data processing and prediction.

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4. Simulation Experiment Results

(1) The Prediction Error of different Training Samples

In order to test the role of BP neural network algorithm in the stock price prediction model, this paper selects some samples to test the data, compares it with the actual situation, and obtains the error result. The details are shown in Table 1:

Table 1: Prediction error for the different training samples

	Actual value	Predictive value	Error
300	2950	3280	330
500	2940	3210	270
700	2945	3205	260
900	2940	3190	250

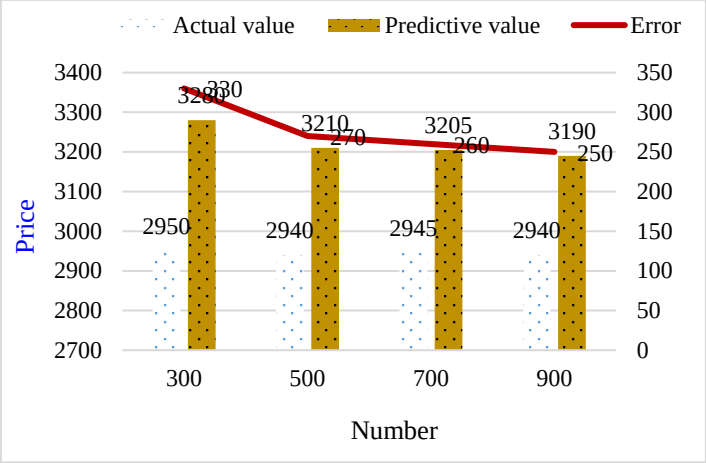

Figure 2: Prediction error for the different training samples

As shown in Figure 2, we can see that, in the actual value and the predicted value, the error of the sample first increases with the increase of the sample size, and then decreases with the change of the number. Among them, the size of the error is kept below 100, that is, the error rate is kept between 8.5% and 11.2%. This data is enough to show the effect of the BP neural network algorithm.

5. Conclusion

The stock price forecast refers to the analysis of historical data based on statistical methods to find out the inherent relationship between the trend and the range of changes. Then use an algorithm to calculate that the stock price has one or more values within a certain period of time. There are many kinds of forecasting techniques, including various forms based on mathematical models, gray systems, neural networks, and so on. The main function of stock price prediction is to analyze the data, find anomalies, and determine the next trading direction and adjust the strategy according to the actual situation. Through research, it is found that the stock price prediction model of BP neural network has a high accuracy rate. Therefore, it is necessary to conduct in-depth research on the BP neural network algorithm.

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