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Implementing Trading Strategies for Gold and Bchain Based on Neural Networks and Apriori Algorithms

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Abstract: *Market traders often buy and sell volatile assets with the goal of maximizing total returns. In order to provide traders with the optimal trading strategy, this paper establishes a trading model based on neural network and Apriori algorithm. Firstly, a neural network model is established according to the given data to predict the price data on the trading day. The Apriori algorithm is then used to obtain the frequent term set, which complements the neural network model to obtain the trading strategy to determine whether to add or close a position and the size of the trade. The model is then further optimized to obtain a stable trading strategy considering the risk and cost of trading.*

Keywords: *Neural network algorithm; Apriori algorithm; Frequent itemset; Trading strategy*

1. Introduction

Market traders often buy and sell volatile assets with the goal of maximizing total returns. Usually there is a commission for each purchase or sale. Two of these assets are gold and bchain. An investment strategy is a combination of strategies that investors adopt to avoid risk and obtain optimal returns in their securities investment activities. Investments are made to both reduce or avoid risky losses and to ensure liquidity and returns.

Determining a scientific investment strategy and strengthening the analysis of securities investment are of key importance for new joint-stock companies, investors into shares, and institutional investors using assets. Therefore, it is necessary to build models to get trading strategies and optimize trading strategies to improve the profitability of market traders as well as the safety of assets. In this paper, we establish a trading model based on neural network and Apriori algorithm.

2. Model Establishment and Solution

2.1. Nerual networks

The data will be loaded to create an autoregressive coefficient of 4 to establish a neural network. Set the number of neurons to 16. To avoid overfitting set the training set, test set and validation set of 70 percent、10 percent and 20 percent respectively. By training the neural network, so that the neural network to meet the expected requirements. By training the model, the original data is used to predict the corresponding date data, we divide the overall data into three segments, each segment to take 500 data for prediction (the number of bchains is 500 and the number of golds is 400) through the previous segment of each date data to predict the data of the day. The prediction is done for 20 consecutive days and compared with the original data to verify the accuracy of the model.

The R-values of the neural networks for bchain and gold are analyzed separately. The correlation between the predicted output and the target is very close to 1, which means that the prediction data of this neural network is very accurate.

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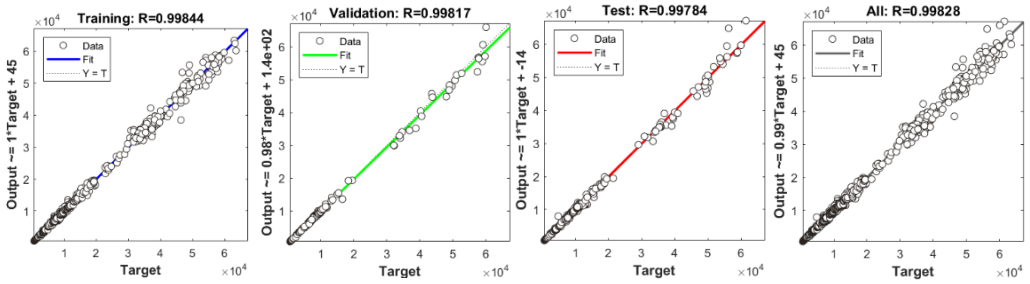

Figure 1: R value of Bchain

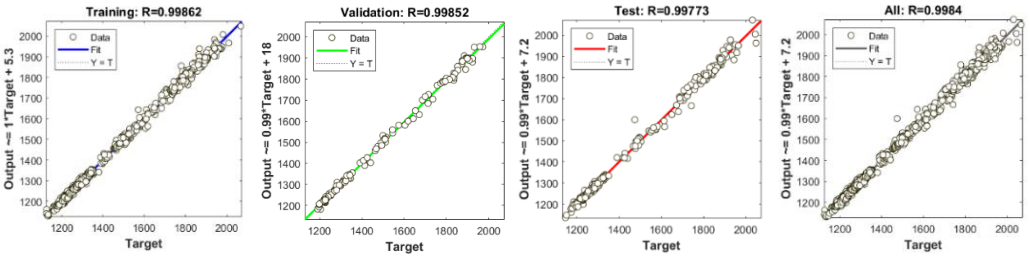

Figure 2: R value of Gold

The overall trend predicted by the neural network almost overlaps with the original data, and the error value interval is reasonable, the sub-model has been able to predict the price trend very well.

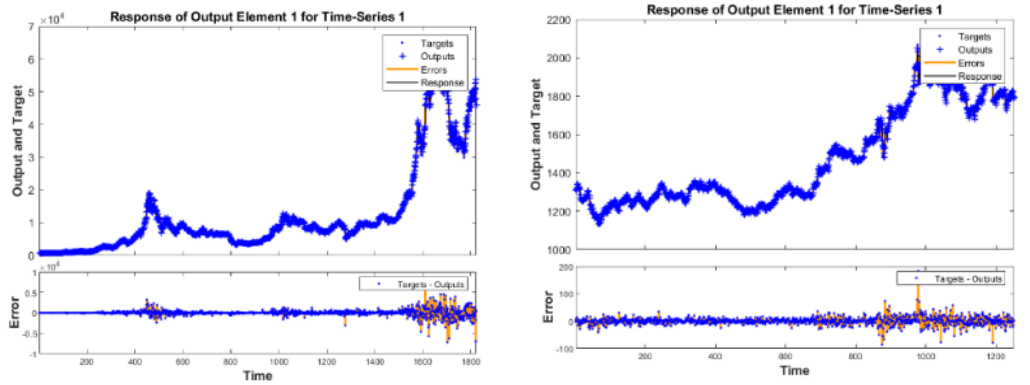

Figure 3: Predicted and original trends for Bchain and Gold

Since the neural network model can only predict the trend and determine the general investment direction, but fails to react whether to make a trade, much less determine the specific trade amount. Therefore, the following Apriori algorithm is used to determine when to make a trade and the specific amount of the trade.

2.2. The Apriori algorithm

Apriori algorithm is a frequent itemset algorithm for mining association rules, and its core idea is to mine frequent itemsets through two stages of candidate set generation and downward closure detection of episodes. According to the above prediction model, we can get the price of a future trading day, but the price can only judge the direction of the future trading day, cannot reflect the specific trading strategy, so if you want to develop a scientific and reasonable strategy is needed through the known historical data respectively statistics corresponding to the law of the distribution of the rise and fall, continuous rise and fall distribution law, so as to develop a scientific investment strategy.

According to the investment rules of the financial market, when the value of financial products in the financial market falls, it is necessary to buy; when the market rises, it is necessary to sell. In order to clarify the specific amount of buying and selling, it is necessary to study the laws of each financial product, and then develop a strategy corresponding to it.

Take gold as an example, use Matlab software to calculate the data given in the question. The operation is as follows: According to the investment rules of the financial market, when the value of

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financial products in the financial market falls, it is necessary to buy appropriately; when the market rises, it is necessary to sell, in order to clarify the specific amount of buying and selling, it is necessary to study the laws of each financial product itself, and then develop its corresponding strategy.

Take gold as an example, use Matlab software to calculate the data given in the question. The specific operations are as follows:

1) Calculate the actual rise and fall of financial products for each trading day.

2) Find all the increases in $IC_{0.5}$.

3) Find all the drop in $DC_{0.5}$.

4) Introduce the association rule algorithm to count the number of subsets with 2, 3, 4, 5, and 6 consecutive rises or falls, $m_2,m_3,m_4,m_5,m_6,n_2,n_3,n_4,n_5$, respectively.

5) The number of consecutive rises over 90% is $SUI_{0.9}$, and the number of consecutive falls over 90% is $SUD_{0.9}$.

6) The $IC_{0.5}$ of all rises and $DC_{0.5}$ of all falls are obtained for each U time up or down in the historical data.

The construction of the investment model: let the number of consecutive up or down is X_1, and the number of consecutive up or down of the product is U_1, the maximum cumulative up is IC_{MIN}, and the maximum down is DC_{MAX}.

The data of the next day can be predicted and judged by the neural network model, and the rise of multiple consecutive days can be further predicted based on a large amount of predicted data. If there is a continuous increase or continuous decrease, the amount of the first position addition can be increased or reduced appropriately P_1.

The first does not take into account the transaction costs when considering the position increase, and for the accuracy of the calculated values, commission costs are deducted in one time after adding positions, namely:

Let the first position increase amount be P_1.

The second position addition amount is P_2:

$$P_2 \times DC_{0.5} + P_1 \times \left(\frac{DC_{MAX}}{SUD_{0.9}}\right) IC_{0.5} = 0$$

The third position addition amount is P_3:

$$P_3 \times DC_{0.5} + P_2 \times \left(\frac{DC_{MAX}}{SUD_{0.9}}\right) IC_{0.5} + P_1 \times \left(\frac{DC_{MAX}}{SUD_{0.9}}\right)^2 IC_{0.5} = 0$$

The n-th position addition amount is P_3:

$$P_n \times DC_{0.5} + P_{n-1} \times \left(\frac{DC_{MAX}}{SUD_{0.9}}\right) IC_{0.5} + P_1 \times \left(\frac{DC_{MAX}}{SUD_{0.9}}\right)^{n-1} IC_{0.5} = 0$$

A linear regression model is introduced to fit its parameters to obtain:

$$y = a \cdot e^t$$

For the position management model obtained on this basis under normal conditions, if the cumulative increase or decrease in the number of consecutive rises or falls X times is W.

$$y_{IC} = ae\left(\frac{W}{DC_{MAX}} \cdot SU_{D0.9}\right)$$

$$y_{DC} = ae\left(\frac{W}{IC_{MAX}} \cdot SUD_{0.9}\right)$$

In summary, the above strategy of adding and subtracting positions, combined with the trend prediction mentioned in the first part, makes the investment strategy more stable.

Similarly, to solve for the bchain investment strategy, the size of the initial investment amount of both.

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$$P_{GOLD} = \frac{P_{SUM}}{SUD_{0.9}} \times \frac{1}{2}$$

$$P_{GOLD} = \frac{P_{SUM}}{SUI_{0.9}} \times \frac{1}{2}$$

The final time to add and subtract positions as well as the steady change in returns are verified by using the above model in the data provided in the question, respectively. For the analysis of the time to add and subtract positions, the model trades are obtained by substituting the data for the simulation.

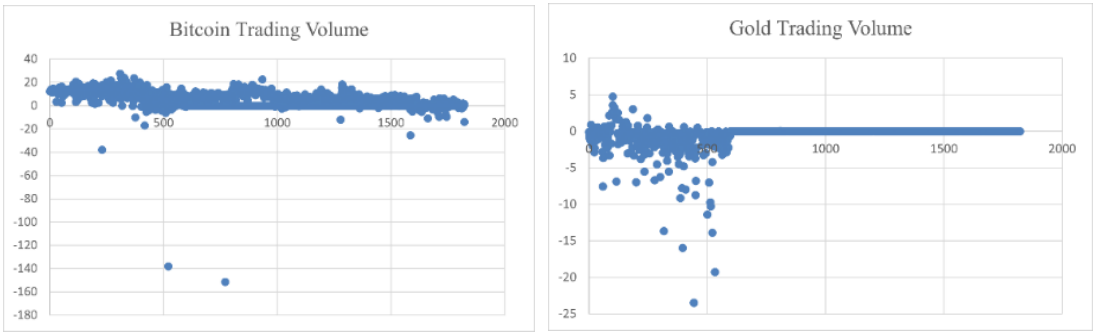

Figure 4: The transaction volume of Bchain and Gold

The return curve obtained by simulating the above developed strategy using historical data is shown below.

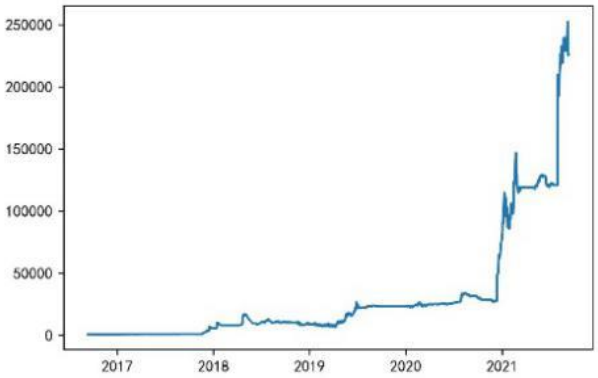

Figure 5: Yield curve

The analysis allows the stability of the proposed model to hedge certain risks compared to the optimal strategy that can be given in the trading strategy to match the general environment of the short-term financial markets.

3. Conclusion

This paper proposes a trading model based on neural network and Apriori algorithm. Firstly, a neural network model is established according to the given data to predict the price data on the trading day. Then the Apriori algorithm is used to obtain the frequent term set, which complements the neural network model to obtain the trading strategy to determine whether to add or close a position and the size of the trade. Finally, the model is further optimized to obtain a stable trading strategy considering the risk and cost of trading. The model can provide investors or companies with the optimal trading strategy, so as to maximize the benefits.

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