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E-commerce Mobile Payment Risk Trend Prediction

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Abstract

The risk of e-commerce mobile payment is relatively volatile, and traditional methods cannot predict the changing trend of e-commerce mobile payment risks, which makes the accuracy of e-commerce mobile payment risk prediction low. Based on analyzing the characteristics of e-commerce mobile payment risks, data mining technology is introduced to model and predict e-commerce mobile payment risks, and to conduct comparative experiments with other e-commerce mobile payment risk prediction models. It can be seen from the results of simulation comparison experiments that the e-commerce mobile payment risk prediction value of this method has a small deviation from the true value, and the e-commerce mobile payment risk prediction accuracy is very high, which effectively reduces the e-commerce mobile payment risk prediction error. The risk prediction accuracy of business mobile payment is lower than the model in this paper, and the model of e-commerce mobile payment risk prediction in this paper takes less time. The comparison results show that the model in this paper can predict more accurately, faster, and more reliably the risks of e-commerce mobile payment, and it is an effective e-commerce mobile payment risk prediction model.

Keywords: *Electronic transaction, Mobile payment, Risk management, Data mining, Time series, Risk prediction model*

1. Introduction

With the continuous development of e-commerce technology, more and more people begin to conduct transactions on the Internet [1][2][3]. In the process of online transactions, there are many risks. Among them, mobile payment risks are the most common, and network frauds often occur. Therefore, how to predict the risks of e-commerce mobile payment, reduce the probability of e-commerce mobile payment risks, and become the current e-commerce mobile payment risk. A hot spot in the field of business research [4][5][6].

In response to the problem of e-commerce mobile payment risk prediction, many current research institutions have conducted in-depth analysis, and many e-commerce mobile payment risk prediction methods have emerged [7][8]. Currently, there is an e-commerce mobile payment risk prediction model based on the time series method, which combines the historical data of e-commerce mobile payment risk to generate time-series data. There is a strong time-series correlation between these data, and then according to the correlation, The establishment of an e-commerce mobile payment risk prediction model can only model the linear change characteristics of e-commerce mobile payment risk. Therefore, the error of e-commerce mobile payment risk prediction is relatively large [10][11][12]; subsequently, artificial neural network-

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based E-commerce mobile payment risk prediction models. They can model the nonlinear change characteristics of e-commerce mobile payment risks. However, because of the chaotic nature of e-commerce mobile payment risks, they ignore the chaos and have disadvantages such as low efficiency and large deviations. [13][14][15].

To improve the accuracy of e-commerce mobile payment risk prediction, this paper proposes a data mining technology e-commerce mobile payment risk prediction model and compares experiments with other e-commerce mobile payment risk prediction models to verify the feasibility of the e-commerce mobile payment risk prediction model in this paper.

2. Basic theory

2.1. Chaos processing technology of time series data

The risk of e-commerce mobile payment is related to network security, the quality of Internet users, and the improvement of relevant laws. These influences also interfere with each other and affect each other. This makes the changes of e-commerce mobile payment risks complex, including certain periodic changes. It is random, non-stationary, and chaotic. This leads to the e-commerce mobile payment risk on the surface that there is no change rule to follow. It has a certain regularity from the deep analysis. Through chaos analysis of e-commerce mobile payment risk data, its changing law is reflected, which provides help for subsequent e-commerce mobile payment risk prediction modeling. For an e-commerce mobile payment risk historical data collection, it can be described as $x(t), t = 1，\ 2, \cdots, N$, where N represents the number of e-commerce mobile payment risk historical data, using mutual information method and correlation dimension The algorithm determines its embedding dimension m and delay time τ. According to the embedding dimension m and delay time τ, a multi-dimensional e-commerce mobile payment risk history data set can be generated, which can be described as:

$$X(t) = \{x(t), x(t+\tau), \cdots, x[t+(m-1)\tau]\}$$

2.2. BP neural network

BP neural network is a process data mining technology. Compared with other data mining technologies, its modeling process is simpler and easier to implement, and its modeling performance is very good. Therefore, this article introduces it to the construction of e-commerce mobile payment risk prediction. In the process of molding. The structure diagram of the BP neural network is shown in [Figure 1].

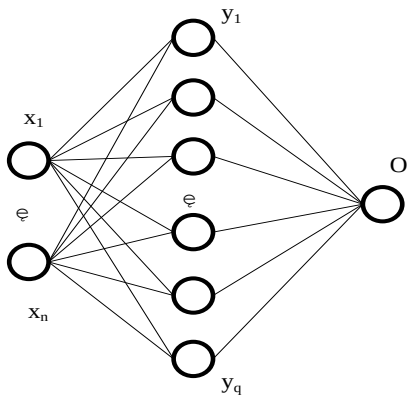

Figure 1. The structure diagram of the BP neural network

The working principle of the BP neural network is as follows: First, the number of nodes in the input layer and the output layer are respectively determined through the e-commerce mobile payment risk data, and the number of nodes in the hidden layer is determined according to the number of nodes in the input layer. Then initialize the relevant parameters, perform forward learning, and calculate the e-commerce mobile payment risk prediction error. Finally, reverse learning is performed according to the prediction error until the e-commerce mobile payment risk prediction error reaches the requirements of practical applications.

3. Working steps of e-commerce mobile payment risk prediction model

Collect e-commerce mobile payment risk data, taking into account the influence factors of e-commerce mobile payment risk that have been reflected in the changes in data values. This article only collects the risk value of e-commerce mobile payment, and the size of the risk value is determined by the expert, to obtain a one-dimensional e-commerce mobile payment risk time series data sample set.

Use mutual information method and correlation dimension algorithm to determine the embedding dimension and delay time of one-dimensional e-commerce mobile payment risk time series data samples.

According to the embedded dimension and delay time, a multi-dimensional e-commerce mobile payment risk time series data sample is obtained.

Use BP neural network to learn multi-dimensional e-commerce mobile payment risk time series data samples, and establish an e-commerce mobile payment risk prediction model.

In summary, the e-commerce mobile payment risk prediction process based on data mining technology is shown in [Figure 2].

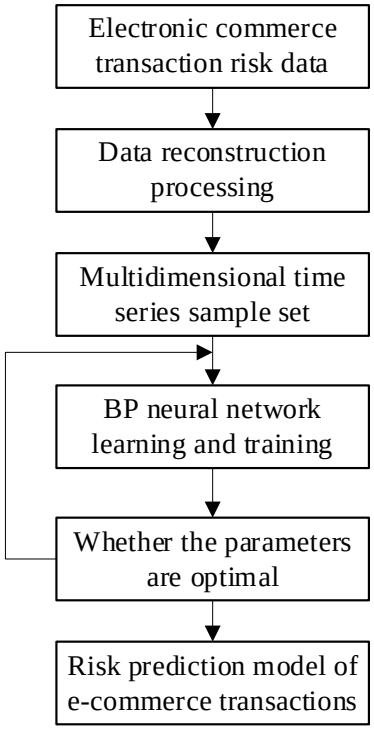

Figure 2. E-commerce mobile payment risk prediction process based on data mining

4. E-commerce mobile payment risk prediction results and analysis

4.1. Test environment and comparison model

The hardware environment of the e-commerce mobile payment risk prediction test is: AMD Ryzen 3 3300X CPU, Kingston Fury DDR3 1866 8 GB, GALAXY HOF PRO 1TB M.2 SSD; the software environment is: the programming tool is Matlab 2019, and the platform is Linux. In the same test environment, the time series analysis method and BP neural network are selected for the comparative test of e-commerce mobile payment risk prediction.

4.2. Time series data of e-commerce mobile payment risks

Using an e-commerce system and a period of mobile payment risk as to the research object, a total of 100 e-commerce mobile payment risk historical data are obtained, which form a one-dimensional time series, as shown in [Figure 3].

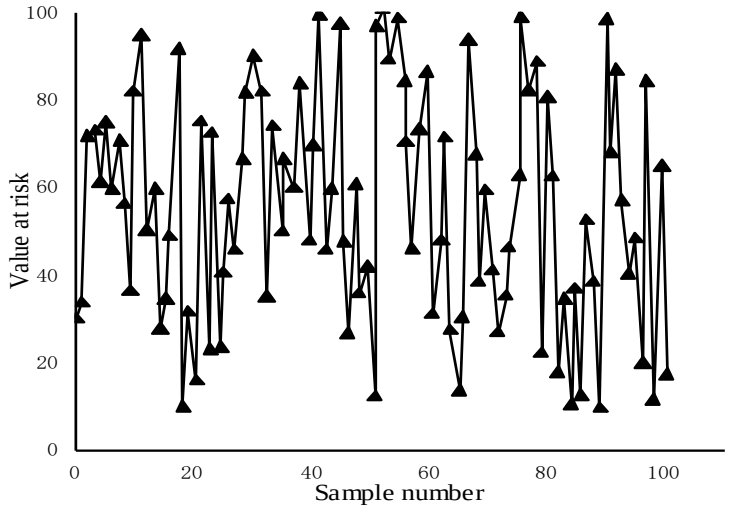

Figure 3. Time series data of e-commerce mobile payment risks

4.3. Determining the delay time of the embedding dimension

For the time-series data of e-commerce mobile payment risk in [Figure 2], the embedding dimension and delay time are determined, and their change curves are shown in [Figure 4].

It can be seen from [Figure 4] that the embedding dimension and delay time of the time series data of e-commerce mobile payment risk are 5 and 5ms, respectively, and then reconstruct the multi-dimensional e-commerce mobile payment risk time series data based on them, and use them as a data mining technology of learning sample data.

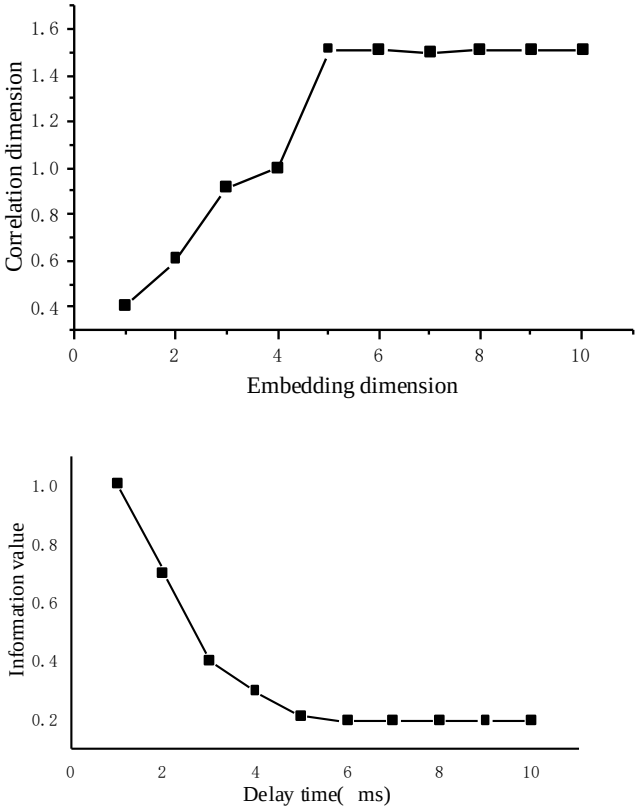

Figure 4. Embedding dimension and delay time of e-commerce mobile payment risk time-series data

4.4. Single-step prediction results of e-commerce mobile payment risks

Three e-commerce mobile payment risk prediction models are used for modeling and analysis, and their single-step e-commerce mobile payment risk prediction accuracy is calculated. The results are shown in [Figure 5].

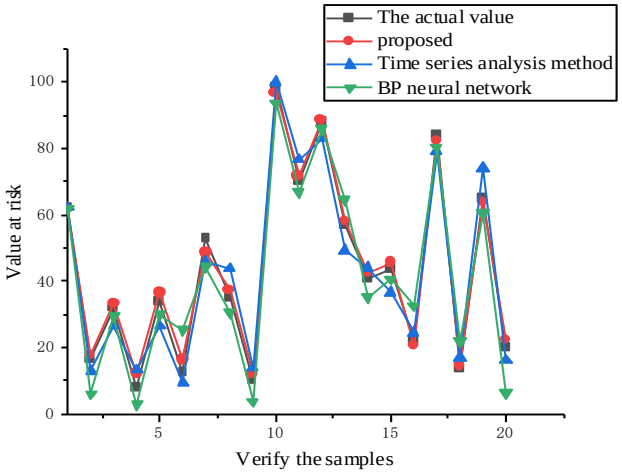

Figure 5. Comparison of single-step e-commerce mobile payment risk prediction results

From the single-step e-commerce mobile payment risk prediction accuracy in [Figure 5], the following conclusions can be drawn:

1）The single-step e-commerce mobile payment risk prediction result of the traditional time series analysis method is the worst, and the obtained e-commerce mobile payment risk prediction error is the largest. This is because it does not consider the nonlinearity of the e-commerce mobile payment risk, but only describes the simple changing law of the e-commerce mobile payment risk, so that the ideal e-commerce mobile payment risk prediction result cannot be obtained.

2) The single-step e-commerce mobile payment risk prediction result of the BP neural network is higher than that of the traditional time series analysis method because its nonlinear modeling ability is better than the traditional time series analysis method. However, because the chaotic characteristics of the e-commerce mobile payment risk are not considered, the predicted value and the actual value have a large deviation, so that the e-commerce mobile payment risk prediction effect cannot be optimal

3) The e-commerce mobile payment risk prediction value of this model has a little deviation from the true value, and the e-commerce mobile payment risk prediction effect is better than the traditional time series analysis method and BP neural network. This is because the method in this paper has the good predictive ability of the BP neural network. At the same time, considering the chaotic nature of e-commerce mobile payment risks, the original e-commerce mobile payment risk data is reconstructed into a multi-dimensional e-commerce mobile payment risk data, which can better discover the changing laws from the e-commerce mobile payment risk data and get the most Excellent prediction effect, and the comparison result proves the superiority of the model in this paper.

4.5. Multi-step prediction results of e-commerce mobile payment risks

Since the goal of e-commerce mobile payment risk prevention is to reduce the probability of payment risk, the single-step e-commerce mobile payment risk prediction result has little practical application value for ensuring the safety of e-commerce mobile payment. Therefore, a multi-step prediction experiment of e-commerce mobile payment risk is required, and their prediction results are shown in [Figure 6].

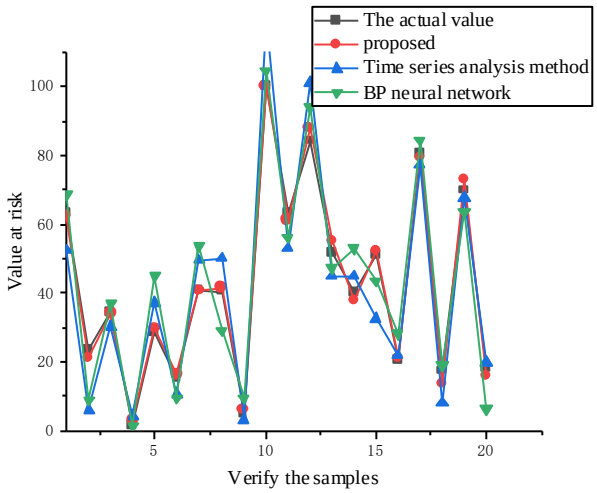

Figure 6. Comparison of multi-step prediction results of e-commerce mobile payment risks

It can be seen from Figure 6 that the multi-step e-commerce mobile payment risk prediction result is worse than the single-step e-commerce mobile payment risk prediction result. This is because the multi-step prediction has a certain error accumulation result, but the e-commerce mobile payment risk prediction result can still meet the actual requirements. At the same time, the e-commerce mobile payment risk prediction result of this model is better than traditional time series analysis and BP neural network, which once again verifies the superiority of this model.

4.6 Analysis of prediction results

To better reflect the feasibility of the e-commerce mobile payment risk prediction model in this paper, the model is used to model and predict 10 types of e-commerce mobile payment risk time series sample data. First, determine the embedding dimension and delay time of 10 kinds of e-commerce mobile payment risk time series sample data reconstruction, as shown in [Table 1].

Table 1. Values of embedding dimension and delay time

Time series data number	Embedded dimension	Delay time/ms	Time series data number	Embedded dimension	Delay time/ms
1	10	6	6	4	4
2	13	11	7	5	12
3	5	12	8	5	11
4	13	7	9	11	12
5	8	4	10	12	5

It also counts the prediction accuracy of 10 types of e-commerce mobile payment risk time series sample data, as shown in [Table 2].

Table 2. Comparison of prediction accuracy of multiple e-commerce mobile payment risks%

Time series sample number	Single-step prediction			Multi-step prediction		
	Paper model	Traditional time series analysis	BP neural network	Paper model	Traditional time series analysis	BP neural network
1	97.82	90.44	93.46	92.01	80.75	89.88
2	98.42	91.72	93.47	93.24	80.55	89.57
3	97.67	91.2	92.77	92.2	80.19	89.71
4	97.32	90.55	93.21	93.8	81.43	88.45
5	98.75	90.56	93.02	92.62	80.21	88.14
6	98.91	91.01	93.16	93.21	80.14	88.55
7	98.42	90.79	92.84	92.6	81.72	88
8	98.87	90.37	93.07	93.48	81.15	88.63
9	98.55	91.46	93.47	93.64	80.28	88.78
10	97.4	90.97	92.44	93.05	81.54	88.05

Analyzing the prediction accuracy of the 10 types of e-commerce mobile payment risk time series sample data in [Table 2], it can be found that the single-step prediction accuracy of the model in this paper exceeds 97%. The e-commerce mobile payment risk prediction error is very small, and the prediction accuracy is very stable. There is no significant volatility. It shows that the risk prediction results of e-commerce mobile payment in this paper are very reliable and can be applied to actual e-commerce mobile payment risk management. The comparison model's e-commerce mobile payment risk prediction accuracy is lower than 94%, the prediction effect is significantly worse than the model in this paper, and the prediction accuracy fluctuates

greatly and is unstable. From the multi-step prediction accuracy, it can be seen that the e-commerce mobile payment risk prediction of the model in this paper is also better, indicating that the model in this paper has better versatility.

4.7. Comparison of the efficiency of e-commerce mobile payment risk prediction

Calculate the single-step prediction time of e-commerce mobile payment risk prediction, and the results are shown in [Table 3]. It can be seen from [Table 3] that the prediction time of the model in this paper is shorter than the traditional time series analysis method and BP neural network, which improves the efficiency of e-commerce mobile payment risk prediction.

Table 3. Comparison of risk prediction time of e-commerce mobile payment ms

Time series data number	Paper model	Traditional time series analysis	BP neural network
1	13.79	21.05	16.23
2	13.28	21.16	15.65
3	13.96	20.8	15.41
4	12.16	21.25	16.67
5	12.46	21.57	15.72
6	12.61	21.21	16.04
7	13.58	21.65	16.81
8	13.99	20.78	16.57
9	13.62	21.34	16.37
10	13.63	20.94	15.07

5. Conclusion

Aiming at the disadvantages of current e-commerce mobile payment risk prediction methods such as low efficiency and large deviations, to improve the accuracy of e-commerce mobile payment risk prediction, a data mining technology e-commerce mobile payment risk prediction model is proposed. First, collect one-dimensional time series data of e-commerce mobile payment risk, and reconstruct it into a multi-dimensional e-commerce mobile payment risk time series. Then, using data mining techniques to analyze the multi-dimensional e-commerce mobile payment risk time series, and construct the e-commerce mobile payment risk prediction model. Finally, use the Matlab 2019 platform to conduct comparative experiments with other e-commerce mobile payment risk prediction models. The results show that the e-commerce mobile payment risk prediction bias of the method in this paper is very small, can track the characteristics of e-commerce mobile payment risks with high precision, and the efficiency of e-commerce mobile payment risk prediction is very high. The prediction effect is significantly better than other e-commerce mobile payment risk prediction models, which verifies the feasibility of the e-commerce mobile payment risk prediction model.

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