

Chapter 131

The Study on the Credit Risk Assessment of Borrower in P2P Network of China

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Abstract On account of the rapid development of modern network technology, more and more online financial services come to being. Take P2P network as an example. Now, such financial services model in our country is taking great risk. This is mainly a study on credit risk. Based on BP neural network, P2P network platform credit risk evaluation model were built to train and simulate. The results show that the final data generated by these models are of practical value. It is capable of using P2P network platform on personal credit risk evaluation scientifically. At the end of the article, some valuable suggestions are put forward in regard to P2P network loan personal credit risk evaluation system.

Keywords P2P network · BP neural network · Credit Risk

131.1 Introduction

P2P network, by means of network, is a new lending mode essentially and it is an innovation in terms of the traditional way of private lending terms. Compared with the past lending mode, this online financial service contains much more merits with low financing requirement; easy operation and low risk. The borrowers can raise money in a relatively short period of time, while the loaner can lend the money to more than one borrower to have the risk decentralized at the most extent. With the development of Internet technology, P2P microfinance has gradually evolved into P2P network. P2P network platform has extremely attracted people's eyes. Since 2005, a well-known P2P network platform in Britain, named Zopa.com, after four years of reform and progress, has constantly expanded their business scope. And its market has spread to Spain, Japan and other regions. In 2014, the sums of loan project involved about 270 million pounds. Although this kind of network financial

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service in our country develops relatively late, affected by the rapid development of the social financial industry, it is in a quick speed now. In June 2007, the first P2P network platform established—ppdai.com, and since then become popular in our country. According to the data related P2P focus, by the end of April 2015, the network financial service platform of this kind is about 1819. Its rapid development has received more and more attention from borrowers. According to a report in the home of net, the lending in the first half of this year, lending projects involved in the transaction reached 300.619 billion yuan.

P2P network platform is developing so quickly because of its incomparable advantages that traditional finance cannot be compared with it. P2P network not only speeds up the disintermediation but improves the utilization of idle funds [8]. Compared with the traditional bank loans, P2P network can reduce the financing costs [1] and bring convenience to personal finance, which makes the banking system come true [5]. Under such social background that most small scale enterprises usually have financing difficulties, this kind of Internet banking services can cut the financial charges of these enterprises, so that micro and small business can get rid of their trouble and get better development [3].

However, investors will still face higher credit risk in such network financial service. Firstly, most parts of Internet lending have not required borrowers to use pledge, so if the borrowers break their promise, the investors can hardly redeem most of their loss; Secondly, the investors can only make investment decision according to the borrowers' information from P2P network platform, which exists a phenomenon of converse choice; Thirdly, without the professional knowledge of diversified investment, it is difficult for individual investors to make optimal investment decision in practice. Thus, after exploration and analysis, the borrowers' credit risk are of great value significance in this kind of network financial service.

131.2 Literature Review

Zhu and Lei [12] argued that such a network of financial services companies tend to focus on controlling the internal risk, and exploring a lot in the credit risk prevention mechanism of exploration. However, many problems still exist in the actual development process. To further standardize the P2P network platform development, they put forward ideas to reform from the policy environment, regulation and the platform level aspects and continuously improve self perfection.

Wu and Cao [9] proposed to divide the network financial service into the scope of regulation, and then to design the regulation principle, content and so on, in order to the guarantee the development of stable for a long time.

Miao [4] pointed out that “peer-to-peer lender” continuous innovation aims to face the risk of gradually highlighted, the risk of industry development formed the negative effect is very outstanding. To some extent, it also formed certain threat to the country's financial security. If you want to completely solve the problem of

peer-to-peer lender, the country and the regulatory net lending industry must form as a whole and make it develop healthily.

These studies have emphasized the risk which was caused by the P2P network platform must introduce the corresponding laws and regulations. But these studies neglected the P2P network itself lacks the borrowers credit risk evaluation model. Of course, except this perspective analysis, there are many scholars thinking that net credit operation mode for P2P network platform are equally important. Greiner and Wang' [2] research shows that Prosper are relatively perfect credit system. In Prosper platform, the borrower should not only provide your basic information (such as marital status, income level, the condition of basic assets, etc.), but also submit the social security number, driving license number and other information effectively.

Wang, Yuan and Zhong [7] summed up that the operation mode has two characteristics: the first is, based on the reference of risk prevention system of Zopa, to require loaners who raise funds on network platform to repay the debt in a specific time; Followed by using audit credit way, specifically is residence booklet of loans through the network platform to raise funds and other relevant certificates, etc. should be included in credit audit system.

Credit Ease, the mainstream P2P network platform in China, provides customers with unsecured and unsecured small loans. Its main customer base is the workers, college students, the private owners and farmers. Zhang [10] argued that Credit Ease reflected a distinct feature of running patterns is to design a new "P2P credit to help farmers platform" to increase farmers' income, and farmers' interest and management fee charges is less. In this way it unites the commonweal and commercial integration, and lays a more solid foundation the company's business expansion. Of course, to some extent, these studies still play a role in evaluating P2P network borrowers' credit risk in our country. But these studies are insufficient. Few scholars make further researches to P2P network from the aspect of the evaluation metrics of Internet finance credit and in combination with online behavior and the evaluation metrics of P2P network credit. Compared with some small and micro-sized enterprises and common personal clients, banks are more willing to provide loans for state-owned enterprises or government-financed platforms. Even though they agree to provide loans for these groups, collateral are required. With the great impact that Internet finance have caused to the financing activities of traditional financial institutions, traditional financial institutions have started to expand a new financing method, i.e. unsecured loans. However, Beibu Gulf Bank in Guangxi has released a new financial product to individual businesses and small-sized enterprises. The requirements are low that any Chinese legal citizens who have lived in Nanning for some time can make applications to it. This makes it more convenient for them to make a loan. Obviously, it is of significance to put forward the model of evaluating personal credit risk. When the evaluation of one's credit is good, not only the impossibility of the cash withdrawing because of the excessive frequency of transactions can be avoided, but also P2P network can encourage traditional financial industry to seek innovations. Thus, domestic bond market yields are rising and funds are circulating all around. And domestic demand and consumption are expanded [6]. As a result, from the angle

131.3.2 Data Acquisition

From P2P network platform transactions of PPDAL, peer-to-peer lender, CreditEase, LUFAX, the paper selected 70 borrowers' information record without default and 30 borrowers' information record with default, with a total of 100 P2P group information, as the samples of this P2P credit risk evaluation. According to the result of the borrower's information value and the result given by P2Pplatform, the credit risk rating is divided into 5 levels, specific sample data in the Tables 131.2 and 131.3:

131.3.3 Normalization Processing

The seven variables and one output variable values were showed in this paper. Ready input neural network model, the samples of neural network input values are generally needed to have normalized processing; the input amount of normalized to $[0, 1]$. This method of normalization which is used in the article is maximum minimum value method; its function is as follows:

$$f(u) = \begin{cases} 1 & u \leq a, \\ \frac{u-a}{b-a} & a < u < b, \\ 0 & u \geq b. \end{cases} \quad (131.1)$$

Then through maximum minimum value method-normalized function and data collection, and use the following formula to normalize:

$$u_i^* = \frac{u - \min(u)}{\max(u) - \min(u)}. \quad (131.2)$$

Because maximum minimum value method for data normalization processing is a kind of linear transformation, it can better retain its original meaning without the loss of too much information.

131.3.4 The Construction of the Model

This paper uses the three layers of neural network to simulate P2P network borrower credit risk evaluation process, the input layer node number is 6, such as age, literacy, marital status, income level, housing situation, the frequency of default. The actual amount of hidden layer nodes is 10, the corresponding output node for a total

Table 131.2 P2P individual credit risk evaluation index value (1)

Order number	Age	Literacy	Marital status	Income level	Housing situation	Default number	Credit risk rank
1	0.8	0.3	1	0.5	0.8	0.6	0.6
2	0.9	0.3	1	0.5	0.2	0.6	0.4
3	1	0.1	1	0.5	0.2	0.2	0.2
4	0.9	1	1	1	0.6	0	0.4
5	1	0.5	1	1	0.6	0.2	0.6
6	0.8	0.7	0	0.1	0.6	1	0.8
7	0.9	0.3	0.5	0.5	0.8	1	0.8
8	0.8	0.7	1	0.5	0.2	1	0.8
9	1	0	1	0.5	0.2	1	0.6
10	0.8	0.5	1	1	0.6	1	1
11	0.9	0	1	0.7	1	1	0.8
12	1	0.3	1	0.5	0.4	1	0.8
13	0.9	0.5	1	1	0.6	1	1
14	0.8	0.5	0.5	0.7	0.2	1	0.8
15	0.8	0.3	1	0.5	0.6	1	0.8
16	1	1	0.7	1	0.2	0.2	0.4
17	0.9	0.3	0	0.5	0.2	0.4	0.2
18	0.9	1	1	0.5	0.6	1	0.8
19	0.8	0.3	1	0.7	1	0.6	0.8
20	0.9	0.7	1	0.7	0.2	0.2	0.4
21	1	0.3	1	0.5	0.2	0.2	0.4
22	0.9	0.7	0	0.7	0.8	0.4	0.4
23	1	1	0	1	0.8	0.4	0.4
24	0.9	0.5	0	0.5	0.4	0.4	0.4
25	1	0.5	0.5	0.7	0.2	1	0.8
26	0.9	1	0.5	0.7	0.2	0.6	0.6
27	0.9	0.5	0.5	1	0.2	0.4	0.4
28	0.8	0.5	1	0.5	0.8	0	0.4
29	0.9	0.3	1	0.7	0.2	0.2	0.4
30	0.9	1	1	0.5	0.6	0.6	0.6
31	0.8	0.5	1	0.5	0.4	0.6	0.6
32	1	0.5	1	1	0.6	0.2	0.6
33	0.9	0.7	1	1	0.4	0.6	0.8
34	0.7	0.7	1	1	1	0.6	0.8
35	0.8	0.3	1	0.5	0.8	0	0.4
36	0.8	0.3	0	0.7	1	0.6	0.6
37	0.9	0.3	0.5	0.5	0.2	0	0.2
38	0.9	1	1	0.7	1	1	1
39	0.9	0.7	0.5	0.7	0.2	1	0.8

(continued)

Table 131.2 (continued)

Order number	Age	Literacy	Marital status	Income level	Housing situation	Default number	Credit risk rank
40	0.8	0.3	1	1	0.4	1	0.8
41	1	0.7	1	0.7	0.8	1	1
42	1	1	1	0.5	0.6	1	0.8
43	0.9	0.3	1	0.5	0.2	1	0.8
44	0.8	0.7	0.5	1	0.4	1	0.8
45	0.6	0.3	1	1	0.8	1	1
46	0.6	1	1	0.5	0.8	0.2	0.4

Table 131.3 P2P individual credit risk evaluation index value (2)

Order number	Age	Literacy	Marital status	Income level	Housing situation	Default number	Credit risk rank
47	0.9	0.5	1	1	0.4	0.2	0.4
48	0.8	0.7	1	1	0.6	1	1
49	0.7	0.3	0	0.5	0.8	1	0.8
50	0.9	0.3	1	0.5	0.2	1	0.8
51	1	1	1	0.5	0.6	1	0.8
52	1	0.7	1	0.5	0.6	1	0.8
53	0.8	0.3	1	1	0.6	1	1
54	0.9	0.7	1	0.7	0.4	1	0.8
55	1	0.3	1	0.5	0.6	1	0.8
56	0.9	0.3	0	0.5	0.6	1	0.8
57	0.9	1	1	0.5	0.6	1	0.8
58	1	0.5	0.5	0.5	0.4	1	0.8
59	1	0.7	1	1	0.6	1	1
60	0.9	1	0.5	1	0.6	1	1
61	0.9	0.5	1	0.5	0.2	1	0.8
62	0.8	0.5	1	1	0.8	1	1
63	0.9	0.7	0.5	0.7	0.2	1	0.8
64	0.9	1	1	0.5	0.4	1	0.8
65	0.9	0.5	0.5	1	0.8	1	1
66	1	1	1	1	0.6	1	1
67	0.9	0.7	1	1	0.8	1	1
68	0.7	0.3	1	1	1	1	1
69	0.8	0.3	1	1	0.8	1	1
70	0.9	1	1	1	0.6	1	1
71	1	1	1	1	0.6	1	0.8

(continued)

Table 131.3 (continued)

Order number	Age	Literacy	Marital status	Income level	Housing situation	Default number	Credit risk rank
72	1	0.3	1	0.5	0.4	1	0.8
73	0.8	0.3	1	0.5	0.8	1	0.8
74	0.9	0.7	1	1	0.8	1	1
75	1	0.3	1	0.5	0.4	1	0.8
76	1	0.1	0	0.5	0.2	0.4	0.2
77	1	0.7	1	1	0.4	0.6	0.8
78	0.7	0.3	1	0.5	1	1	0.8
79	0.6	0.7	1	1	0.6	1	1
80	0.8	0.5	0.5	0.5	0.2	1	0.6
81	0.9	1	0	1	0.6	1	0.8
82	0.9	0.1	0	0.5	0.6	1	0.6
83	1	0.5	0	0.5	0.6	1	0.8
84	1	0.7	1	1	1	1	1
85	0.9	1	0.5	1	0.8	1	1
86	0.9	0.5	1	0.5	0.6	1	0.8
87	0.8	0.5	1	0.7	1	1	1
88	0.9	0.3	1	0.7	0.6	1	0.8
89	0.9	0.1	0	0.5	0.4	1	0.6
90	1	0.5	0	0.7	0.2	1	0.6
91	0.9	0.7	1	0.7	1	1	1
92	0.9	1	1	1	0.6	1	1
93	0.9	1	1	1	0.6	1	1
94	0.8	0.7	1	1	0.6	1	1
95	1	0.5	0	0.7	0.4	1	0.8
96	1	0.7	1	1	0.6	1	1
97	0.9	0.1	1	0.7	0.6	1	1
98	0.7	0.5	1	0.5	0.2	1	0.8
99	0.8	0.7	1	0.5	0.6	0.2	0.4
100	0.9	0.3	0	0.7	0.4	1	0.8

amount is 1. Because both the input vector and output vector is not in conformity with the linear relationship, single polarity Sigmoid is used as transfer function; the corresponding mathematical type as follows:

$$f(u) = \frac{1}{1 + e^{-u}}.$$

131.4 Model Simulations

The author has made corresponding training and simulation operations by Mat lab in this article. After repeated experiments, to extract the ideal level training error, he started to train the neural network and thus obtained the specific weights and thresholds, and then established the corresponding evaluation model. The mode was set up and then analyzed carefully and forecasted data validation at last. The credit risk evaluation of the accuracy was predicted at the time of lacking such financial services network information.

131.4.1 Training Process and Results

In the process of simulation, the former 95 data among the 100 data as training data, and fitting, contains 29 borrowers who have default record and 66 borrowers who have no default record. The total amount of the borrowers who have default record is one and the borrowers who have no default record are 4 in the first 96–100 of information extraction, Using “train” function to train the BP neural network,

```
net = newff(pn_train,tn_train,10)
Net.trainParam.epcohs = 1000
Net.trainParam.goal = 1e - 3
Net.trainParam.show = 10
Net.trainParam.lr = 0.1.
```

The “ p ” is the input matrix after pretreatment, “ t ” is the output results. When the network step length is 1000, the expected targets error is 0.001, 10 cycles show a convergence curve changes, learning step length is 0.1.

As shown in Fig. 131.1, BP neural network model can meet the target requirements of precision after four iterations. As a result, the model is practical and accurate. As shown in Fig. 131.2, network output risk is similar to actual assessment level, being in a good condition.

131.4.2 Simulation Process and Results

After the training and fitting, the corresponding predictions unfold careful verification.

```
t_final = sim(net, p_test).
```

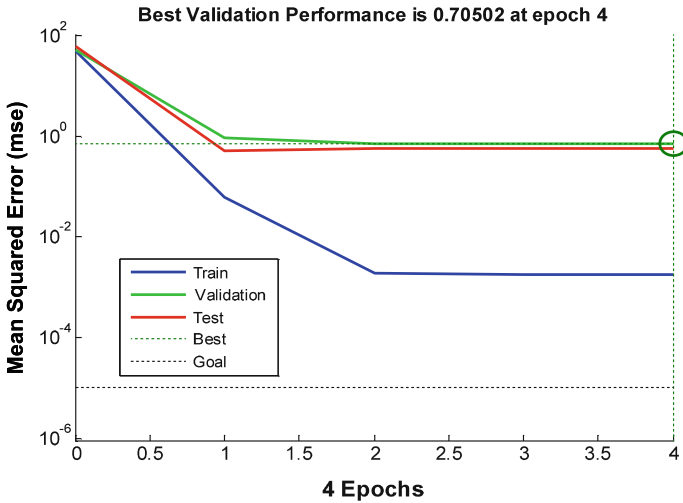


Fig. 131.1 Training Results

Fig. 131.2 Comparison diagram

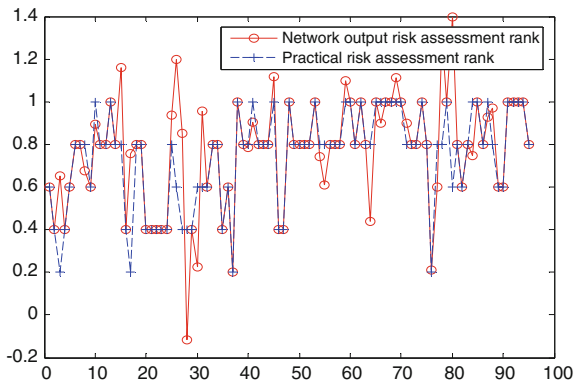


Table 131.4 The target output compared with model output

	Borrower 96	Borrower 97	Borrower 98	Borrower 99	Borrower 100
Target output	1	1	0.8	0.4	0.8
Model output	0.987213	0.998456	0.809303	0.409453	0.759145

Among them, the function Simis a simulation function, and P_test is a data which needs forecast after pretreatment. After the validation data input from 95 to 100 results, the target output compared with model output are as follows: As shown in Table 131.4, according to the 95 data of borrowers for training and simulation, model output and target output are basically identical. It is obvious that such evaluation model accuracy is very good.

Table 131.5 Three types of output

	Borrower 96	Borrower 97	Borrower 98	Borrower 99	Borrower 100
Target output	1	1	0.8	0.4	0.8
Model output	0.987213	0.998456	0.809003	0.409454	0.759145
Model output of lack of education level	0.968452	0.957345	0.744924	0.388231	0.721295

131.4.3 Simulation Results of Lack of Data Validation

Because the network financial service data is collected by the entry of the borrowers, there will be a shortage of information, resulting in the financial services platform to validate personal information, there is a certain number of invalid information. And on the premise of insufficient information, the new evaluation system can still be with the help of the training effect, obtain accurate results. In this paper, eliminating cultural degree index from 96 to 100 data, and verify the prediction results of model. In the lack of information about cultural degree, the target outputs compared with the model output are as follows: As shown in Table 131.5, under lack of information of education level, compared with complete information model output, there are some differences, but the overall model output and target output basically remains the same. Thus, it can be seen that in the case of lack of information of education level, the BP neural network model can forecast credit evaluation of the borrower in P2P network, and it is in a higher accuracy of these valuation.

131.5 Conclusions

The risk assessment model discussed in this article, through the training of the borrower credit information, rectify and reform all the neural unit specific connection weights in the corrective model, clear input and output of actual connection and obtain accurate measurement results. But defects still exist in the process of evaluation, for example, training can't leave plenty of data; the network structure has certain difficulty in construction. However, in view of these shortcomings, the partial derivative of error functions can strengthen the explanatory ability of the neural network method by introducing fuzzy logic. Using the model analyzes the individual credit situation, Ali small loans has done better in this respect. In Berger and Udell model analysis framework, Ali small loans use Ali cloud, Alipay and Taobao and Alibaba website that wrap the huge amounts of data. Using huge customer resources, trading and credit data, and the analysis of the data mining for customer credit rating,

finally, get the conclusion of “small amount, short time limit and increases with the increasing borrow also” of unsecured small loans and mortgages [11].

For the research results above all and the requirements of objective environment for credit risk assessment, the following views are put forward: first of all, the relevant legal system about this kind of lending model must be improved. P2P network in our country is lack of legislation and regulation. In order to better standardize legal financing and personal loan, CBRC should enact the law about P2P network as soon as possible; next, strengthening personal moral cultivation. Personal credit is closely linked with moral cultivation. The promotion of moral cultivation can also make personal credit improve. Individuals can learn excellent traditional culture or follow the example of moral model to strengthen the personal moral accomplishment and enhance personal credit. Besides these, the government should increase the popularize strength of moral cultivation. At last, make the best of executive’s coordination and optimize level of management. The management methods for credit industry in our country’s industry and trade ministry are closely related to reformation and progress of this profession. Accordingly, China’s industry and trade ministry should give due attention to the development of P2P network platform and take reasonable measures to scientifically manage it.

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