



Risk Identification Model of Enterprise Strategic Financing Based on Online Learning

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Abstract. The current financing risk identification model only identifies according to the financial situation of enterprises. The limitations of risk indicators affect the accuracy of identification, and have great limitations for enterprises in different industries. In view of the above problems, this paper will study and build an enterprise strategic financing risk identification model based on online learning. After analyzing the causes of enterprise strategic financing risk, the financing risk identification index system is designed. Based on the structure of impulse neural network, the risk identification model is constructed by using online learning algorithm. The model test results show that the minimum identification accuracy of the model is 92.4%, which has a good risk identification effect for enterprises in different industries.

Keywords: Online learning · Enterprise strategic financing · Financing risk · Risk identification · Risk matrix · Impulse neural network

1 Introduction

The competitive pressure of domestic enterprises from all aspects has further increased. In order to remain invincible in the fierce competition, enterprises must have strong financial management ability. The core of financial management is fund management. The important link of fund management is how to finance and how to control the financing risk. In recent years, the financing scale and number of events of enterprises have shown an explosive growth trend. Due to different economic environments, different development stages and different industry development characteristics, enterprises have a variety of financing needs and financing purposes, and they also face different financing risks [1]. In the early stage of development, enterprises will generally face considerable capital pressure. In the early stage of development, their profitability is weak, their investment is large, and their R & D cycle is long, which will lead to a considerable degree of financing risk. In the context of the new normal of economic growth slowdown and development structure transformation, the capital market, as an important support for

economic transformation and innovation, provides a huge amount of financial support for the sustainable development of enterprises, and the active financing activities provide a strong driving force for the development and growth of enterprises.

Scholars at home and abroad have not studied the strategic financing risk of enterprises for a long time. Most developed countries mainly control and solve the financing problems of cultural enterprises through the appropriate guidance and support of the government and the self-regulation of market mechanism. Risk identification is a process in which economic units judge, classify and sort out the faced and potential risks, and identify the nature of risks. Japan has also set up special departments for small and medium-sized enterprises, set up branches everywhere, and created a more perfect environment for enterprise development through the introduction of a number of policies, regulations and financial schemes [2]. In Europe, where the world economy is very active, it is generally direct government subsidies or direct financial support, which is simpler and more direct than other countries and regions. Most scholars believe that the enterprise financing risk is caused by the increase of liabilities. In the process of enterprise financing, the capital structure is unbalanced. For example, if the proportion of debt financing is too large, the enterprise's ability to pay will be weakened and the financing risk will increase. Scholars have concluded that the factors affecting financing risk include asset liability ratio, total asset profit ratio, profitability, solvency, liquidity and growth ability. Scholars also explored the interaction between corporate value and enterprise risk management. According to different research methods, foreign financing risk identification methods are mainly divided into univariate analysis, multivariate statistical analysis and artificial intelligence analysis. Risk identification methods are mainly divided into qualitative identification and quantitative identification. Qualitative identification methods are widely used in matrix analysis, ANP network analysis, Delphi method, etc., but qualitative identification methods have certain subjectivity and obvious limitations in the identification of risk matters [3, 4].

Online learning can adjust the model in real time and quickly according to the online feedback data, so that the model can reflect the online changes in time and improve the accuracy of online prediction [5]. The process of online learning includes: presenting the prediction results of the model to users, then collecting the feedback data of users, and then training the model to form a closed-loop system. The enterprise's business strategy is constantly adjusted to adapt to the changes of the market, and the enterprise financing risk is also changing with the business situation, resulting in a certain timeliness of the enterprise's strategic financing risk, and higher requirements for the speed and accuracy of risk identification. Therefore, based on the above analysis, in order to reduce the losses caused by financing risks in enterprise operation, this paper will study and build an enterprise strategic financing risk identification model based on online learning, which is of great significance for improving enterprise financing risk control, optimizing enterprise financing structure and mode, and exploring enterprise sustainable development.

2 Construction of Enterprise Strategic Financing Risk Identification Model Based on Online Learning

Enterprise strategic financing has effectively alleviated the bottleneck problems such as lack of financial resources and shortage of funds in different periods of enterprise development, promoted the flow of capital, activated the capital market, effectively promoted the improvement of enterprise capital operation efficiency and the expansion and strengthening of scale, and played an important role in ensuring steady economic growth and smooth adjustment of economic structure. The risk of enterprise strategic financing may be caused by policy change, interest rate change, low management level, lack of integrity and so on. The problems existing in enterprise financing risk management include: backward risk management technology and means, imperfect legal basis for risk management, poor implementation of foreign exchange control policies, increased foreign exchange risk, objective conditions of risk management hinder its development, cumbersome financing procedures and poor financing channels, which increase financing risk [6]. Enterprise financing risk identification should establish a comprehensive risk management system that covers all business processes and operation links and can continuously monitor, regularly evaluate and accurately warn risks. In the process of enterprise strategic financing risk identification, we should adhere to the four principles of comprehensive identification, key identification, dynamic identification and objective identification. Therefore, this paper will build a financing risk identification model after analyzing the causes of enterprise strategic financing risk.

2.1 Cause Analysis of Enterprise Strategic Financing Risk

The financing risk cannot be completely eliminated, and because of the instability of the value determination of intangible assets and income acquisition of enterprises, the changing factors affecting financing activities will only increase, and the financing risk of enterprises must exist objectively. It is precisely because of the objective existence of risk that determines the objectivity and necessity of financing risk. This paper analyzes the causes of enterprise strategic financing risk from the external and internal environment of enterprise operation. Figure 1 is the schematic diagram of financing risk classification of enterprise business strategy.

Enterprise external environmental factors refer to the analysis of the impact from the outside of the enterprise from the perspective of politics, economy and society. From the development of enterprises in different industries in China, there are still deficiencies in China's market. As for the financing mode of enterprises, there are few financing tools available. As a traditional financing institution, commercial banks can play a limited role in the current situation, and some emerging financing methods still lack a relatively mature capital market to give full play to their greatest advantages. This kind of financing means is more restricted by enterprises. With the rapid development of China's economic market, although the financial financing channels in the market are constantly enriched, the relevant laws are not perfect. In the process of implementation, there will still be some problems such as weak operability of laws and regulations, which will affect the process of enterprise strategic financing. In addition, the overall credit level of some enterprises is low, and all kinds of fraud are prohibited repeatedly. The reasons for

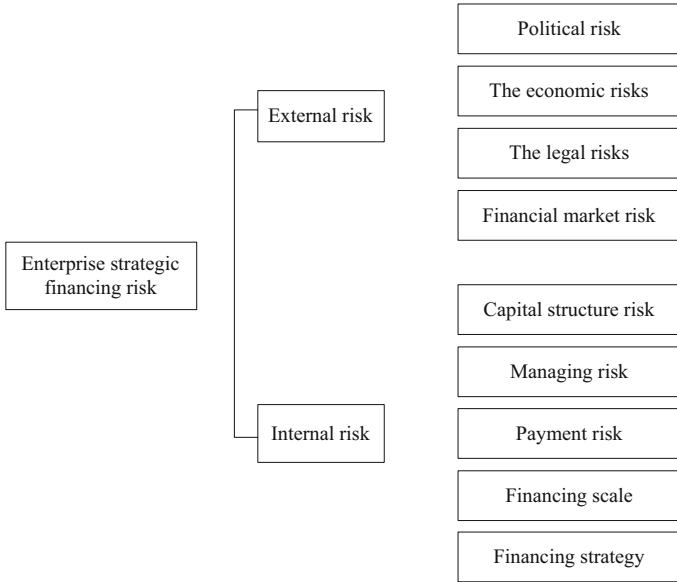


Fig. 1. Classification of enterprise strategic financing risks

the formation of enterprise financing risk are the confusion of internal operation and management and the unreasonable formulation of strategy. There is a large gap in the strength of enterprises in different industries in China, and there are a large number of enterprises. These enterprises usually lack strong operation capacity and efficient financing strength, so they can not form enterprises with economies of scale [7]. These enterprises are still very backward in the concept of operation and management, lack of Zhuoyuan development strategic planning, and can not gather excellent management talents to plan for them, which makes them more blind in the financing process, and do not clearly identify and evaluate the potential financing risks of enterprises, laying hidden dangers for the subsequent sustainable development of enterprises.

The main factors causing financing risks within enterprises are enterprise financing scale, financing structure, financing strategy and so on. The excessive debt financing scale of enterprises will also increase the financing risk. It greatly increases the possibility of insufficient solvency or eventual bankruptcy of enterprises due to the lack of guarantee of income. At the same time, the interest rate of debt financing is too high, so that enterprises will pay more and more interest, which further increases the risk of enterprise strategic financing. The debt financing structure is unreasonable. The short-term or long-term financing under different business strategies will have varying degrees of impact on the business situation of enterprises, which will lead to the change of enterprise financing risk. In addition, although the financing methods and Strategies of enterprises in different periods of strategic financing need to be adjusted, the financing opportunity is also very important. If the enterprise misses the financing opportunity and the financing cost. Moreover, under different debt financing methods, enterprises are also different in the difficulty of obtaining funds and restrictive terms for enterprises, and their corresponding

debt financing costs and potential financing risks are also quite different. In addition, there is also a certain correlation between the enterprise's own capital and the financing anti risk ability. The strong accumulation ability of the enterprise's own capital will enhance the enterprise's ability to resist the financing risk. The imperfection of enterprise capital structure increases the difficulty of enterprise financing; At the same time, if the enterprise cannot recover the sales money in time, it will cause trouble to the enterprise's capital chain, resulting in a greater crisis. According to the causes of enterprise strategic financing risk analyzed above, the enterprise strategic financing risk identification index system is designed.

2.2 Design of Enterprise Strategic Financing Risk Identification Index System

Enterprise financing risk evaluation is the process of determining the risk level of financing risk factors of enterprises in different industries. According to the above analysis of financing risk causes, select the indicators that comply with the principles of authenticity, integrity, independence, logic and operability, and design the enterprise strategic financing risk identification index system. In the comprehensive evaluation of enterprise financing risk, too few evaluation indicators can not reflect the actual risk, and too many indicators are not convenient for practical operation. The key lies in the role of the selected evaluation indicators in risk identification. Table 1 shows the financing risk identification index system designed according to the causes of strategic financing risk analyzed above.

After designing the enterprise strategic financing risk identification index system shown in Table 1, according to its identification and judgment criteria, use the risk matrix to analyze and determine the level of each risk factor. It is an evaluation method to judge the degree of risk by constructing the risk rating table and risk index and arranging experts to score the risk factors. Experts estimate based on reasonable judgment, information available at that time and their own accumulated experience. Therefore, the experience and knowledge of experts determine the quality of risk assessment. The occurrence probability and risk impact of enterprise strategic financing risk are integrated to obtain the financing risk comparison table shown in Table 2.

In the constructed risk identification indicators, some indicators may belong to "very large", "very small", "medium" and "interval". The larger the index value, the better the index, which is called very large index; The smaller the index value, the better the index, which is called very small index; For some indicators, it is expected that the more centered the indicator value is, the better, which is called the centered indicator; The expected value of some indicators falls within a certain interval, which is called interval indicators. In order to facilitate the data processing of indicators, various types of indicators are transformed into very large indicators j . For very large indexes, linear transformation is carried out according to the following formula:

$$q_{ij} = \frac{p_{ij}}{p_j^{\max}} \quad (1)$$

Table 1. Enterprise strategic financing risk identification index system

Risk type	Risk causes	Risk factor
Market risk	Market competition	Low barriers to entry
		Market competition intensity
		The degree of difficulty of enterprise elimination
		Enterprises exit high threshold
	Level of enterprise competitiveness	Companies have difficulty meeting consumer demand for their products
		The market share of the enterprise is unstable and there are no fixed customers
Product marketing ability		
Production and operation risk	Technology research and development risk	The difficulty and complexity of technology are high
		Uncertainty of technology life cycle
		Conformity of production capacity with market demand
	Manage risk	Imperfect internal structure of the enterprise
		Weak management ability of managers
Environmental risk	Macroeconomic environment	Changes in interest rate, exchange rate and inflation rate
	Government policy	Government support and policy changes
Financial risk	Financial market risk	Enterprises are punished for trading in the market
		The enterprise industry is impacted by the international market
	The credit risk	Decline in corporate credit rating
		Insufficient repayment ability of enterprises
	Operational risk of flow	Inactive market transactions make financing limited

(continued)

Table 1. (continued)

Risk type	Risk causes	Risk factor
		Problems in financing operation calculation

Table 2. Comparison of risk levels

Risk probability range (%) / risk impact	Negligible	Small	Moderate	Serious	Crux
0–10	Low	Low	Low	Intermediate	In
11–35	Low	Low	Intermediate	Intermediate	High
36–55	Low	Intermediate	Intermediate	Intermediate	High
56–85	Intermediate	Intermediate	Intermediate	Intermediate	High
85–100	Intermediate	High	High	High	High

For the very small index j , carry out linear transformation according to the following formula:

$$q_{ij} = \frac{1 - p_{ij}}{p_j^{\max}} \tag{2}$$

Then, the index value is transformed from 0 to 1:

$$q_{ij} = \frac{p_{ij} - p_j^{\min}}{p_j^{\max} - p_j^{\min}} \tag{3}$$

After the preliminary processing of the indicators in the enterprise strategic financing risk identification index system, based on the pulse neural network structure, the online learning algorithm is used to improve and optimize, and the enterprise strategic financing risk online identification model is constructed.

2.3 Realize the Construction of Online Identification Model of Enterprise Strategic Financing Risk

The financing risk of enterprises is positively correlated with financing cost, financing structure, financing scale and the proportion of intangible assets in total assets. According to the analysis of MM capital structure theory, the higher the financing cost, the smaller the proportion of financing income relative to financing cost, the greater the possibility of financing interruption or failure and the greater the financing risk. In addition, the higher the debt financing ratio of enterprises, that is, the higher the asset liability ratio, the greater the financing risk. Before using impulse neural network to identify financing risk, establish the correlation coefficient matrix between each point through the relevant

data of each risk index, find out the factors with large relative connection degree, and then connect them with edges according to the relevant principles.

The enterprise strategic financing risk network can be represented by $G = (V, E)$. Let the network have N nodes, M edges, $V = \{v_1, v_2, \dots, v_n\}$ represents the set of nodes, nodes represent the risk identification index, $E = \{e_1, e_2, \dots, e_m\}$ represents the set of edges, edges represent the relationship between nodes, and the small weight represents the relationship between nodes. The degree of correlation between each node indicates the degree of correlation between the enterprise's strategic financing risk indicators. The higher the degree of node aggregation, the closer the correlation between the enterprise and its risk factors. After determining the weight of each risk index according to the expert evaluation results, the network structure of enterprise strategic financing risk is determined. According to the correlation between enterprise financing risk indicators reflected in enterprise strategic financing risk network, a pulse neural network is established. In order to facilitate the subsequent derivation of spatiotemporal back propagation learning algorithm based on discrete time steps, the explicit iterative representation of pulse neurons with known sampling time will be used to ensure the traceability of pulse calculation and facilitate the calculation of chain rules. The combination of equations describing the specific dynamic characteristics of neurons is as follows:

$$I_i^n[t] = \sum_{j=1}^{l(n-1)} w_{ij} s_j^{n-1}[t] + \beta \quad (4)$$

$$K_i^n[t] = K_i^n[t-1] + \frac{I_i^n[t] - K_i^n[t-1]}{\tau} + \alpha s_j^{n-1}[t] \quad (5)$$

$$s_j^n[t] = g[K_i^n[t] - \alpha] \quad (6)$$

$$g[K_i^n[t] - \alpha] = \begin{cases} 1, & K_i^n[t] \geq \alpha \\ 0, & K_i^n[t] < \alpha \end{cases} \quad (7)$$

In the above equation, the superscript n , subscript i and square brackets t of each variable represent various internal states of the FF pulse neuron located in the n layer of the network at time n . K , I and s respectively represent the network parameters, total input vector and its own pulse issuing state of pulsed neurons (1 indicates issuing pulses and 0 indicates keeping silent). τ Value represents the membrane time constant, $l(n)$ represents the total number of neurons in layer n , w_{ij} is the weight value between presynaptic pulse neuron j and postsynaptic pulse neuron i , and β represents the constant input of pulse neuron i at each time. - once the K value of pulse neuron i reaches or exceeds the threshold 0, the neuron will generate and send out pulses and reset the K value at the same time. The output pulse activity of pulse neurons is controlled by gate function $g[]$ to generate or not generate pulses (1 means to generate pulses and 0 means not to generate pulses).

The input of the pulse neuron i located in the hidden layer of layer n will also affect its own output pulses in time t and $t + 1$, and then affect the final number of pulses by affecting the total input of the pulse neuron in the postsynaptic layer $t + 1$. The parameter

update formula of pulse neural network output bias is as follows:

$$\delta_j^n[t] = c \sum \delta_j^{n+1}[t] w_{ij}^{n+1}[t+1] \frac{\partial s_j^n[t+1]}{\partial K_i^n[t+1]} \quad (8)$$

The above formula is a component of the weight update value in the hidden layer. It is necessary to understand the accurate symmetrical weight information to complete the calculation. However, this demand is considered impossible in the brain. At the same time, the back-propagation process in the time dimension requires the neuron to understand the input data information of time $t+1$ at time t , which makes the multi-layer SNN unable to learn the time characteristics in the data in real time. Due to the internal state of the pulse neuron i at time t , the idle update rule needs to know the accurate symmetrical weight information at time t and $t+1$. However, it is unlikely to meet such strong architectural constraints in the actual network connection. In order to avoid this problem, this paper uses the fixed weight of random initialization in the network to replace the weight of connecting the same two neurons at different times, so as to realize faster and simpler learning rules. After the input pulse neuron sends out a pulse, the neuron transmits the pulse to the postsynaptic pulse nerve; At time t , if the state of postsynaptic neurons issuing pulses is inconsistent with their expected value, the value of δ will change, which will affect the state of. In addition, because it is also related to time, its change curve will be smoother relative to the change curve of δ value. The updated value of the weight will finally be determined by the value of c and the state of the input pulse. In the process of implementation, the online learning algorithm only needs the pulse neuron to update its internal variables iteratively, without storing all the intermediate data generated by the input data in a period of time. Taking the index of financing risk identification system as the node vector of neural network, the relevant enterprise data are input to the neural network. After the iterative processing of neural network, the enterprise financing risk identification results are obtained.

According to the above process, the construction of enterprise strategic financing risk identification model based on online learning is completed. Using this model can help enterprises identify financing risks timely and effectively in the process of strategic financing, facilitate enterprises to adjust strategic financing strategies in time, take corresponding risk prevention measures, and reduce the losses caused by enterprise financing risks.

3 Model Test

3.1 Test Preparation

Test Scheme Design

The performance of the above-mentioned enterprise strategic financing risk identification model based on online learning will be compared and tested. Before the model test, actual enterprise data will be extracted to form a sample data set for model identification accuracy and efficiency. Compare the enterprise strategic financing risk identification model constructed in this paper with the financing risk identification model based on

fuzzy fmea-vikor and the financing risk identification model based on sample weighted support vector machine. The identification model deals with the financing risks of enterprises in different industries respectively. Compare the model identification results with the results of professional institutions, and get the corresponding test data. The performance of the risk identification model is comprehensively evaluated by comparing the risk identification accuracy and risk identification time of the identification model.

Selection of Test Data

This paper selects 36 companies in different cities and industries as the research objects. These enterprises can be divided into large-scale manufacturing, Internet and FMCG enterprises. Among them, the risks of each enterprise in strategic financing are known, and all enterprise financing risks are measured by professional institutions. The samples are divided into two groups: training samples and test samples. There are 12 enterprises in the modeling samples and 24 enterprises in the test samples. This test collected the financial data of the first 20 quarters of each company.

3.2 Test Results

Tables 3, 4, and 5 respectively show the test data of strategic financing risk identification of three risk identification models for large manufacturing, Internet and FMCG enterprises.

Table 3. Comparison of strategic financing risk identification test data of large manufacturing enterprises

Number	Risk identification model based on online learning		Risk identification model based on fuzzy fmea-vikor		Risk identification model based on sample weighted support vector machine	
	Accuracy/%	Recognitiontime/s	Accuracy/%	Recognition time/s	Accuracy/%	Recognition time/s
1	96.9	14.25	92.4	18.11	89.4	26.36
2	95.8	11.37	92.2	19.18	89.7	25.80
3	97.6	12.56	94.7	18.17	87.4	26.18
4	95.1	14.38	92.5	18.47	89.7	26.27
5	95.3	13.83	91.9	19.58	86.8	26.11
6	97.4	14.83	94.8	18.32	87.1	26.14
7	96.7	13.84	94.6	18.51	88.6	26.22
8	96.8	14.68	91.1	19.38	89.2	26.34
9	97.2	13.61	94.6	18.36	89.5	25.73
10	97.5	10.82	91.8	18.62	87.7	26.56

By analyzing the data in Table 3, it can be seen that when identifying the strategic financing risk of large manufacturing enterprises, the identification accuracy of the

identification model in this paper is higher than 95%, while the highest identification accuracy of the risk identification model based on fuzzy fmea-vikor is only 94.8%, and the highest identification accuracy of the risk identification model based on sample weighted support vector machine is only 89.7%. The recognition time of the recognition model in this paper is significantly less than that of the other two recognition models.

Table 4. Comparison of test data of strategic financing risk identification of Internet enterprises

Number	Risk identification model based on online learning		Risk identification model based on fuzzy fmea-vikor		Risk identification model based on sample weighted support vector machine	
	Accuracy/%	Recognition time/s	Accuracy/%	Recognition time/s	Accuracy/%	Recognition time/s
1	93.9	15.76	88.8	23.48	83.2	29.66
2	92.6	14.25	89.4	23.51	82.4	29.14
3	93.3	13.83	87.2	25.64	83.6	29.52
4	93.9	12.27	87.7	23.80	80.5	28.97
5	95.2	14.03	86.9	23.97	82.1	30.38
6	92.4	15.41	88.5	23.61	81.4	29.26
7	92.7	13.32	89.9	23.78	83.9	29.46
8	94.2	14.54	89.1	24.73	82.3	29.53
9	94.3	15.39	88.6	25.24	81.6	29.82
10	94.8	13.82	89.3	24.41	83.7	29.50

By analyzing the data in Table 4, we can see that when identifying the strategic financing risk of Internet enterprises, the lowest identification accuracy of this model is 92.4%, which is higher than the highest identification accuracy of the other two models. The recognition time is also much shorter than the other two recognition models.

By analyzing the data in Table 5, it can be seen that the recognition accuracy of the model in this paper is higher than 93.9%, and the recognition accuracy is higher than 91.7% of the risk recognition model based on fuzzy fmea-vikor and 89.3% of the risk recognition model based on sample weighted support vector machine.

To sum up, for the financing risk identification of enterprises in highly variable industries, the identification accuracy of this model is significantly higher than the other two models, and the identification time of this method is far less than the other two identification models. It shows that this model has better recognition effect and reliability for different industries. Summarizing the analysis of the test data of the above three tables, the identification accuracy and efficiency of the enterprise strategic financing risk identification model based on online learning constructed in this paper are significantly improved when identifying the enterprise financing risk, and the practical application effect is better.

Table 5. Comparison of strategic financing risk identification test data of FMCG enterprises

Number	Risk identification model based on online learning		Risk identification model based on fuzzy finea-vikor		Risk identification model based on sample weighted support vector machine	
	Accuracy/%	Recognition time/s	Accuracy/%	Recognition time/s	Accuracy/%	Recognition time/s
1	94.6	15.68	89.2	20.92	88.4	27.66
2	93.9	15.36	91.3	21.58	88.9	27.53
3	94.2	13.78	89.8	20.07	88.7	27.42
4	94.6	14.93	90.5	22.78	88.2	27.03
5	94.7	14.77	91.7	23.78	87.6	26.64
6	95.4	15.02	90.9	20.49	89.3	27.38
7	95.2	15.21	89.1	21.32	87.1	27.45
8	95.1	14.48	90.0	22.94	88	27.53
9	95.2	13.79	89.6	23.07	87.4	26.71
10	94.8	13.76	89.4	20.36	86.8	27.16

4 Conclusion

After the financial crisis, with the development of Internet technology, Internet of things technology, blockchain technology and the improvement of risk management level, the research on enterprise financing business transformation has also become mature. Enterprises carry out strategic financing related operations according to the development strategy and capital management needs of enterprises at different operating stages. In this process, many organizational elements forming strategic financing present a systematic change. However, there are usually different degrees of risks in enterprise financing operations. Although they cannot be eliminated in the financing process, risk management can be strengthened through various ways and means such as risk transfer and dispersion, so that the high risks of financing activities can be controlled within the scope that all stakeholders are willing to bear. This is also the key to enterprise strategic financing. Therefore, accurately identifying the strategic financing risks of enterprises is very important for actively building a security system for effectively managing financing risks and forming the unique competitiveness of enterprises. The risk response of financing risk is an indispensable part of risk management. This paper constructs an enterprise strategic financing risk identification model based on online learning. Through research, the following conclusions are reached:

- (1) By virtue of the good training characteristics of online learning, this model makes the risk identification model adjust in time according to the changes of the enterprise's business strategy, and improves the accuracy of financing risk identification.

- (2) The risk identification model constructed in this paper can help business decision-makers to make rational induction and summary of financing risk management methods and measures, reveal the mechanism of financing risk formation and change, guide financial practice, and implement more effective management of enterprise financing risk after it is actually applied to enterprise operation.

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