Marketing Risk Assessment Method of Industrial and Commercial Enterprises Based on Convolutional Neural Network

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Abstract. As a part of the whole enterprise system function, marketing management always runs through the beginning and end of the enterprise operation process. Its running status determines whether the whole enterprise system operates effectively. With the increasingly complex and changeable internal and external business environment, enterprises are facing more and more uncertain factors and more marketing risk events. Facing the increasingly prominent marketing risk problems, enterprises lack enough attention and effective preventive measures and means, which makes many enterprises fall into the dilemma of loss or even bankruptcy. Therefore, it is of great practical significance to strengthen the research on enterprise marketing risk management in complex environment. Therefore, a new marketing risk assessment method for industrial and commercial enterprises is designed based on convolutional neural network. Firstly, the marketing risk management objectives of industrial and commercial enterprises are analyzed. Secondly, the risk index system is constructed based on convolutional neural network, so as to realize the marketing risk assessment of industrial and commercial enterprises. The results show that the evaluation effect of the designed marketing risk assessment method is good, It has certain application value.

Keywords: Convolutional neural network · Industrial and commercial enterprises · Marketing · Risk assessment

1 Introduction

With the continuous deepening of China's economic system reform, the gradual development and improvement of the market economic system and the gradual integration of the domestic market with the international market [1], the institutional environment and business environment of Chinese enterprises have also undergone extensive and profound changes, such as the increasingly fierce market competition, the acceleration of the pace of industrial structure adjustment, the fast-paced change of market demand, the continuous emergence of new technologies and products [2–4], the change of public

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consumption habits, etc. All these make the internal and external environment of the enterprise more complex and uncertain. This complex and uncertain business environment not only brings unlimited market opportunities to enterprises, but also brings huge risks [5]. The first is that the marketing management of enterprises will face great risks and challenges. Because, as a part of the whole enterprise system function, marketing always runs through the beginning and end of the enterprise operation process, and is contained in the enterprise functions such as strategy, brand, quality, advertising planning, public relations image, channel, after-sales service and so on [6]. The function of marketing management not only highlights the importance of its position, but also shows the risk and complexity of marketing management. Looking back on the development process of Chinese enterprises in recent ten years, behind the abnormal marketing phenomena such as price war, advertising war, brand extension war and diversification war that once prevailed in the market, how many once brilliant enterprises fell down overnight and even withdrew from the historical stage [7]. The painful market outcome tells us that the marketing management of Chinese enterprises generally lacks the awareness of risk prevention. This not only directly caused the confusion of market competition and irreparable huge losses to enterprises, but also had an adverse impact on the development of the whole national economy.

Marketing risk is a common phenomenon in market economy, and it is the possibility of causing damage to enterprises randomly due to the influence of various factors in enterprise marketing activities. Enterprises in market economy, as market subjects [8–10], should participate in market activities independently in the fierce market competition, fully capture market opportunities and avoid market risks. However, due to various reasons, many enterprises are often unable to effectively evaluate, analyze and even make decisions when facing marketing risks. For example, the enterprise risk avoidance management organization is not perfect, the operation procedures are not standardized, the implementation of the system is not strict, the management of loopholes. Marketing personnel lack the ability to analyze and identify risks, lack of awareness of risk prevention, enterprise marketing risk prevention measures ineffective, marketing behavior does not adapt to the rapidly changing market demand. How to avoid marketing risk has become an important factor for the development of enterprises. Chinese enterprises should first have a deeper understanding of marketing theory, and then establish a set of advanced theoretical system of marketing risk analysis, prediction and prevention, and also need a set of standardized, practical and efficient technical means and methods. Gradually establish the corresponding close to the market, flexible operation of the marketing system, so as to avoid marketing risks. At present, Chinese enterprises are generally in a complicated marketing environment with high risks and many opportunities. However, enterprises lack sufficient understanding of the increasingly serious risk problems, and lack of effective preventive measures and means, resulting in many enterprises facing losses and even bankruptcy.

Therefore, it is necessary to deeply reflect on the marketing management links of enterprises under the new environment and further analyze the marketing management mechanism of enterprises. Based on this, this paper designs a new marketing risk assessment method for industrial and commercial enterprises. This paper analyzes the marketing risk management objectives of industrial and commercial enterprises, constructs the

risk index system based on convolutional neural network, and realizes the marketing risk assessment of industrial and commercial enterprises. The experimental results show that the designed marketing risk assessment method has good evaluation effect and certain application value.

2 Design of Marketing Risk Assessment Method for Industrial and Commercial Enterprises Based on Convolutional Neural Network

2.1 Analyze the Marketing Risk Management Objectives of Industrial and Commercial Enterprises

Risk is a kind of uncertainty, which is manifested in that it may bring losses to the people facing risks and huge benefits. Marketing risk means that in the process of enterprise marketing, due to the influence of various unpredictable uncertain factors, the actual income of enterprise marketing deviates from the expected income, so that there is the opportunity or possibility to suffer losses and obtain additional income. The meaning of marketing risk is similar to that of risk. The difference is that he emphasizes that the subject of risk is the participants and competitors of marketing activities. Its loss is the punishment suffered due to violation of market laws or their own mistakes, mainly refers to the reduction or loss of economic interests. Most of its risks arise from marketing activities or related aspects, The risk condition is the uncertain event caused by the market behavior or marketing event of the business entity.

Marketing risk is a kind of complex risk form, which has many contents and forms. According to the different degree of risk, marketing risk can be divided into several levels. The first level is fatal marketing risk, which refers to the risk of large loss and serious consequences. The direct consequences of such risks often threaten the survival of marketing subjects and lead to heavy losses, which means that they can not recover or suffer bankruptcy for a time. For example, major changes have taken place in the market situation, and the enterprise fails to fully predict, resulting in major market behavior mistakes. This makes the frustrated enterprise products have no market and no further development, so that the enterprise falls into serious difficulties. The second level is the general marketing risk, which is all kinds of risks with moderate loss and obvious consequences but does not pose a fatal threat. The direct consequences of such risks have certain sequelae. If part of the enterprise's accounts receivable cannot be recovered on time, the enterprise still has a large amount of bad debt losses after efforts and invalid legal procedures, and the enterprise suffers economic losses, which makes it difficult to turnover working capital. The third level is the slight enterprise risk, which makes the loss small, the consequences are not obvious, and does not have an important impact on the marketing activities of the marketing subject. Generally, such risks do not affect the overall situation and only cause local and minor harm to the marketing subject. For example, the enterprise caused some product losses during transportation due to packaging problems, resulting in events affecting customer distribution and customer claims, which had an adverse impact on the enterprise. The division of these three levels of risk is not absolute. Under certain conditions, general marketing risk and slight

marketing risk will be transformed into special fatal risk, especially after a certain period of accumulation, there will be qualitative changes. If the accounts receivable cannot be recovered for a long time and are illegally occupied by other enterprises for a long time, the consequences will be disastrous for the enterprise, and the general risk and minor risk will be transformed into fatal risk. Therefore, the understanding, analysis, prediction and control of marketing risk is mainly aimed at fatal marketing risk and general marketing risk, because this is the main aspect of the contradiction and the main task of marketing risk management. At the same time, it is also necessary to pay attention to minor marketing risk and prevent it.

In economic activities, in addition to the irregular changes in the natural and social environment, the complexity of marketing activities, and the continuous changes in consumer demand and power, but also due to the limitations of the experience and ability of marketing subjects, they do not fully understand and grasp the generation, development and consequences of risks, or fail to take timely and effective measures to prevent them, And cause all kinds of losses. The most common is the marketing staff's own mistakes, that is, the risks and losses caused by the marketing staff's sense of responsibility and work quality problems. Under what circumstances should marketers take the initiative to bear part of the risk losses and avoid some risk losses, which risks must be borne by marketers, which can and should be avoided, and whether the avoidance is due to cost considerations or strategic and strategic considerations, correct decisions and arrangements should be made, otherwise improper bearing or avoidance will lead to new risk losses, The actual loss will be much greater than expected, that is, a risk will lead to a new risk, and a small risk will lead to a large risk. For example, if the enterprise plans to sell at a lower price and make profits, that is, it will first make some financial sacrifices to defeat its competitors. However, due to improper deployment and implementation, the enterprise has suffered significant economic losses and not only failed to occupy the expected market. However, they were caught by their opponents, denounced as unfair competition and sued in court. The enterprise was not prepared enough to lose the lawsuit, and new economic losses occurred. In the communication between enterprises and other business entities or competitors in the market, if they are careless, they will be used by the other party, forming the risk of their own loss, which is common in the complex market economy.

After the marketing loss of an enterprise, a problem that marketing managers are very concerned about is the impact of the loss event on the profitability of the enterprise. Generally speaking, an enterprise will have a minimum reward string. It is not only the standard to judge whether a marketing activity is feasible, but also the standard to formulate the marketing risk management plan. Marketing risk managers must control the loss within a certain range, in which the profitability of the enterprise will not be lower than the minimum rate of return. The stability of income is very important for enterprises, because it can help enterprises establish a good image of normal development and enhance the investment confidence of investors. For most investors, an enterprise with stable income is more attractive than an enterprise with high income and high risk. Stable income means the normal development of enterprise marketing; In order to achieve the goal of stable income, enterprises must increase risk management expenditure.

The production and operation of the enterprise is like "sailing against the current, if you don't advance, you will fall back". With the increasing competition in modern society, enterprises can firmly attract customers only by constantly introducing newer and higher quality products. Only by constantly exploring new markets can enterprises occupy a leading position in the market. If the enterprise stagnates and lingers on the original performance, the competitors will ruthlessly take away its customers and squeeze it out of the market through strength expansion. Therefore, the enterprise must continue to develop in order to obtain permanent survival. However, the existence of risk has become a potential resistance to the development of enterprises, because the losses caused by risk accidents will have a great impact on the development of enterprises. In order to achieve the development goal, the marketing risk manager must establish a high-quality marketing risk management plan to deal with all kinds of loss results timely and effectively, so that the enterprise can survive the loss. It can quickly obtain compensation and create good conditions for the continuous development of the enterprise. As stated in the pre loss goal, the enterprise can timely and effectively deal with the losses caused by marketing risk accidents and reduce the adverse impact of losses, which can reduce the impact on the national economy and protect the interests of personnel and economic organizations related to the enterprise, which is conducive to the enterprise to bear social responsibility and establish a good social image.

There is a certain connection between all these pre loss goals and post loss goals. For example, in order to achieve the safety factor goal, the marketing risk should be transferred before loss, so as to reduce the loss and make up for the loss to a certain extent, so as to reduce the impact on enterprise marketing. However, it is difficult to achieve all pre loss and post loss goals at the same time. Because there are various conflicts between pre loss objectives and post loss objectives, the realization of any post loss objective requires a certain amount of capital investment. Moreover, with the improvement of the post loss target level, the amount of funds required is also rising, which obviously conflicts with the economic target in the pre loss target. In addition, the safety factor goal in the pre loss goal also conflicts with the economic goal. In order to obtain greater security, marketing risk managers need to make more use of some high-cost marketing risk treatment technologies and increase marketing managers' measures to control risks and risk guarantee, so as to reduce losses and obtain timely and sufficient economic compensation after losses, which will inevitably lead to a sharp rise in marketing risk management costs. Marketing risk managers should properly handle the conflict between objectives, take the overall objective of the enterprise as the commander, widely solicit the opinions of relevant departments, and formulate a marketing risk management objective suitable for the specific situation of the enterprise.

2.2 Risk Index System is Constructed Based on Convolutional Neural Network

Convolutional neural network is generated on the basis of modern neuroscience, biology, psychology and other scientific research achievements, reflecting the basic characteristics of biological nervous system, is a kind of abstraction, simplification and simulation of biological nervous system. The convolutional neural network is composed of many parallel interconnected same neuron models, and the signal processing of the network is realized by the interaction between neurons. The neuron model and structure of a

convolutional neural network describe how a network transforms its input vector into output vector [11]. This transformation process is a computational process from a mathematical point of view, that is to say, the essence of convolutional neural network reflects a functional relationship between network input and its output. By selecting different model structures and activation functions, different convolutional neural networks can be formed to obtain different input/output relations, and achieve different design objectives and complete different tasks. Therefore, before using convolutional neural network to solve practical application problems, it is necessary to first master the model structure and characteristics of convolutional neural network as well as the calculation of its output vector. Therefore, it is necessary to design the neuron model when constructing the risk indicator system, as shown in Fig. 1.

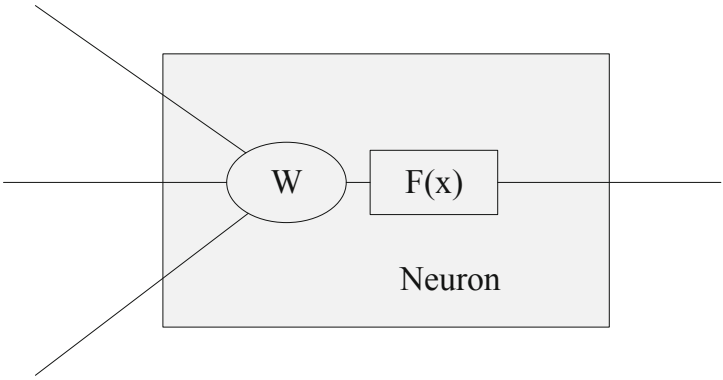

Fig. 1. Schematic diagram of neuron model

It can be seen from Fig. 1 that the model is generally a multi input and output nonlinear element. The neuron output is not only affected by the input signal, but also affected by other factors inside the neuron. Therefore, in the modeling of artificial neuron, an additional input signal is often added, which is called deviation, sometimes called threshold. At this time, it is necessary to calculate the column vectors of different matrices, As shown in formulas (1) and (2).

$$W = [w_1 w_2 ... w_r] \tag{1}$$

$$P = \left[p_1 p_2 ... p_r\right]^r \tag{2}$$

In formulas (1) and (2), $w_1 w_2 ... w_r$ and $p_1 p_2 ... p_r$ represent the array vector set, which need to be integrated to build the neuron model and output the vector, as shown in formula (3).

$$A = f(W \times P + b) \tag{3}$$

In formula (3), B represents the deviation. Activation function is the core of a neuron and network. In addition to the network structure, the problem-solving ability and efficacy of the network depend largely on the activation function adopted by the network.

At this time, the relationship between the activation function and neurons is shown in formula (4).

$$A = \begin{cases} 1 \; W \times P + b \geq 0 \\ 0 \; W \times P + b \leq 0 \end{cases} \tag{4}$$

At this time, the neuron relationship meets the risk assessment criteria, that is, the constructed index is shown in formula (5).

$$f = \frac{1}{1 + \exp[-(n + b)]} \tag{5}$$

In formula (5), n represents the number of indicators. Using this index, we can accurately carry out risk assessment and reduce the difficulty of risk assessment.

2.3 Realize Marketing Risk Assessment of Industrial and Commercial Enterprises

Convolutional neural network has a very outstanding performance in the image classification data set. Due to the large normal image information, a large number of weights need to be set if the fully connected neural network is used, and the neural network evaluation model needs to be built to realize the marketing risk assessment of industrial and commercial enterprises, as shown in Fig. 2.

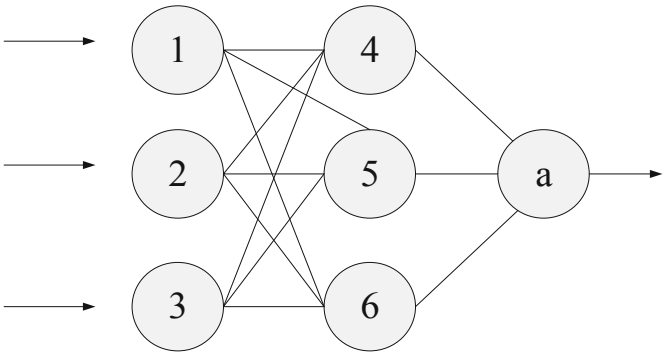

Fig. 2. Neural network evaluation model

According to the neural network evaluation model in Fig. 2, marketing risk evaluation can be further carried out. Due to the complexity of the marketing system, the indicators reflecting the marketing risk of enterprises are also quite complex. Therefore, we should follow certain principles to select early warning indicators. It is not only the goal of risk early warning management, but also can comprehensively and truly reflect the operation effect and existing problems of the early warning system, and really play the role of early warning. This is especially reflected in the definition and calculation method of indicators.

Sensitivity of indicators to system changes. That is, the indicators are required to not only quickly reflect the subtle changes of the system, but also advance the actual fluctuations, sensitively predict and reflect the generation and development of enterprise marketing activities, and timely reflect the real state of enterprise marketing, which is pioneering or universal.

The more indicators are not the better. The main, basic and representative comprehensive indicators should be selected as quantitative calculation indicators to facilitate horizontal and vertical comparison. At the same time, the quantification of indicators and the difficulty and reliability of data acquisition should be considered; The evaluation model and method shall be easy to master, the required data shall be easy to statistics, and the existing statistical data shall be used as much as possible. Relevance requires that each index included in the index system can correctly reflect the content and status of marketing risk from a certain angle, so as to make the index and index become an organic whole connected with each other; Independence means that the overlapping area between indicators should be minimized when designing indicators. At the same time, the relationship between indicators is not contradictory, but dialectical and unified.

Independence makes the interrelated indicators have their own characteristics, and relevance makes the independent indicators become a whole and serve the marketing risk early warning system. In the long run, the internal and external environment of the enterprise is developing and changing. Specifically, marketing risk early warning management is not only a goal, but also a process. This determines that the index system should have dynamic characteristics. That is, with the development of enterprises, the index system should be amended correspondingly, and the contents of new monitoring should be supplemented to ensure the advanced nature of the risk early warning monitoring system. Meanwhile, the contents of the index system should not be changed frequently, and should be relatively stable in a certain period.

In addition to quantitative indicators, some indicators can not be measured by accurate data, but can only be described and evaluated qualitatively. However, they are very important for marketing risk early warning management, so they must be used in order to comprehensively reflect the current situation and trend of enterprise marketing. The establishment of the rating index system should conform to the objective facts and correctly reflect the real appearance of the rating object. The index system and calculation method shall not be biased towards any party of the rating object or rating subject. Rating agencies and rating personnel must be fair, objective and based on facts, and must not arbitrarily change the index items, calculation methods and evaluation standards according to personal preferences. Credit rating must comply with relevant national policies, laws and regulations. The index system should reflect the guidance of national macro policies. Some economic benefit indicators and risk supervision indicators should reflect the specified requirements if the government stipulates standard values. In the determined evaluation indicators, it is mainly divided into objective quantitative indicators and subjective qualitative indicators.

Enterprise external marketing risk is determined according to four major indexes: market risk, customer risk, supplier risk and competitor risk. The range of index range can be determined according to the general situation of Chinese enterprises, relevant data and the results of marketing questionnaire survey. In the specific evaluation, we should

adjust these indicators according to the marketing situation of enterprises, and set the weight of specific enterprises. Some objective indicators that are difficult to obtain can be regarded as qualitative indicators to evaluate. Therefore, the establishment of indicators is for external risks, and according to the competition risk, customer risk, supplier risk, competitor risk four modules. The determination of index range can be based on the current general situation of Chinese enterprises, relevant data and the results of marketing questionnaire survey as the demonstration of setting index range. In the specific evaluation, these indicators should be adjusted according to the marketing situation of enterprises, and the weight of specific enterprises should be set. Some objective indexes that are difficult to obtain can be evaluated as subjective fuzzy indexes.

3 Case Analysis

3.1 Overview

An industrial and commercial enterprise is selected for marketing risk assessment. It has been proved theoretically that the BP neural network with only one hidden layer using sigmoid function can approach any rational function. Considering that the scale, training time and complexity of the system are reduced as much as possible, a three-layer BP network structure is adopted in this example, that is, a hidden layer is adopted. According to the basic principle of neuron selection and common empirical formula, combined with the specific situation, the number of neurons in the hidden layer is determined through trial calculation. The output layer establishes the neural network model according to the classification of marketing risk level. At this time, the initial data of risk indicators are shown in Table 1.

Table 1. Initial data of risk indicators

Indicators	x1	x2	x3
1	0.55	0.27	0.95
2	0.47	0.22	1.0
3	0.43	0.13	0.75
4	0.40	0.18	0.11
5	0.42	0.10	0.06
6	0.45	0.15	0.26
7	0.44	0.12	0.76
8	0.37	0.09	0.87
9	0.40	0.04	0.88
10	0.60	0.09	0.74

(*continued*)

Table 1. (*continued*)

Indicators	x1	x2	x3
11	0.60	0.14	0.69
12	0.75	0.19	0.92
13	0.65	0.36	0.90
14	0.52	0.25	0.95
15	0.63	0.20	0.83

It can be seen from Table 1 that there are differences among various risk indicators at this time, which meets the subsequent evaluation needs, and the risk evaluation test can be carried out.

3.2 Application Effect Analysis

The enterprise marketing risk assessment method designed in this paper and the traditional enterprise marketing risk assessment method are used for risk assessment respectively. The application effect is shown in Table 2.

Table 2. Application effect

Index	Accurate strength	This paper designs a risk assessment method to assess the intensity	The assessment intensity of traditional risk assessment methods
1	3	3	3
2	2	2	1
3	1	1	1
4	1	1	1
5	2	2	2
6	3	3	3
7	2	2	2
8	1	1	1
9	3	3	2
10	2	2	1
11	1	1	1
12	3	3	2

(*continued*)

Table 2. (*continued*)

Index	Accurate strength	This paper designs a risk assessment method to assess the intensity	The assessment intensity of traditional risk assessment methods
13	2	2	1
14	1	1	2
15	2	2	2

Among them, 3 indicates high accuracy intensity of marketing risk grade, 2 indicates medium accuracy intensity of marketing risk grade, and 1 indicates low accuracy intensity of marketing risk grade.

It can be seen from Table 2 that the marketing risk level evaluated by the method designed in this paper is more accurate, which proves that the evaluation effect of the designed method is good and has certain application value.

4 Conclusion

By designing the marketing risk evaluation index system, the marketing risk evaluation model based on BP neural network is designed according to the theoretical knowledge of neural network. Among them, the marketing risk model based on neural network established in this paper has the function of self-adaptation and self-learning. Therefore, it has practical and extensive application in the monitoring and prevention of enterprise marketing risk. The evaluation result of this method is good and has certain application value.

Marketing risk management is a complex system engineering, limited by knowledge and theoretical foundation, the study of this paper is only a preliminary theoretical framework, and only provides a research perspective and method. The requirements and operation methods in practical application still need to be further improved in practice. In addition, there are still many deficiencies in this paper, such as the effectiveness of the enterprise marketing index system and the relevance and independence of each index, whether the scope of grade division meets the requirements of practice, the established index system and model has not been effective practice test, etc., all these need to be further studied and discussed.

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