

# Customer Behavior Analysis in the Environment of "Internet+"

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**Abstract.** In the era of rapid development of Internet information technology, enterprises to achieve efficient management of customer behavior is the key to improving competitiveness. This paper innovatively combines customer behavior characteristics in the environment of "Internet+" and traditional customer behavior to build a customer classification indicator system based on customer value. From the three dimensions of customer characteristics in the environment of "Internet+", current value and potential value, there are fourteen secondary indicators, using BP neural network algorithm, combined with G company customer data to measure, the customers are divided into four categories from high to low customer value, and the effectiveness of the model is proved by simulation tests.

**Keywords:** "Internet+"; customer value; customer classification; BP neural network.

## 1. Introduction

Since the government work report of Premier Li Keqiang at the Third Session of the 12th National People's Congress, the "Internet+" plan has been proposed. "Internet+" as a national strategy has pointed out the direction for the development of various fields in the future. On the one hand, "Internet+" is the realization of the combination of the Internet and traditional industries, to optimize production factors, update business systems, and reconstruct business models to complete economic transformation and upgrading; On the other hand, "Internet+" as a whole concept, through the Internet of traditional industries to complete industrial upgrading. At the same time, the Internet era is an era of knowledge economy based on big data. it is a network value era in which customer value is paramount and human capital value is prioritized. Achieving the integrated development of the Internet and traditional retail, agriculture, education, and government affairs is conducive to industrial upgrading to enhance economic productivity, thereby promoting the healthy and orderly development of the national economy.

When traditional industries rely on the development of Internet information technology, the entire social economy gradually shifts from the seller's market to the buyer's market, and customers can find a wide variety of products or services on the network platform. To maintain their competitive advantage, enterprises must adhere to the "customer-centric" strategy, strengthen customer relationship management, and timely understand customer needs. The realization of customer value is manifested by customer behavior. Therefore, this paper combines the characteristics of customer behavior in the Internet environment to construct a customer classification indicator system based on customer value. Based on the indicator system, the BP neural network is used to determine the customer classification under the "Internet+" environment, and the characteristics of each type of customer and the corresponding marketing strategies are analyzed.

## 2. Review of Related Research Literature

### 2.1 Customer Classification Research based on Customer Value

Customer value is very important for the company. Yang Yongli (2015) summarizes the theoretical research of customer value from three perspectives: The first is the customer's value perception subject, which measures the remaining size of the consumer that the company provides to the customer; The second is to regard the enterprise as the subject of value perception and measure the relative importance of customers to the enterprise; The third is to study the value of the subject and

the object of the value of the enterprise and the customer. Customer classification is more common from the perspective of customer lifecycle management, current value and potential value, and ranking by value. The classification idea is currently applied to a variety of industries, such as electricity, gas stations, insurance companies, and so on. Wang Zhuxia (2018) established a customer's current value model and long-term value model based on the telecom customer's life cycle management thinking, established a customer value analysis strategy. Yu Yue (2018) research shows that the customer base classification tree model of the gas station plays an active role in the customer value positioning of the gas station. Zheng Pingbiao (2014) established an evaluation system based on the current value, potential value and loyalty of customers, and classified research on railway customers to provide reference for railway customer relationship management. Fan Jingjun (2014) builds customer classification indicators based on the current value and potential value of customers, conducts customer classification case studies with B2C e-commerce enterprise data.

In summary, the classification based on customer value can more fully reflect the contribution of customers to the enterprise, it is beneficial to develop a reasonable differentiated service strategy. However, the classification indicator system of customer value is difficult to construct, especially the rapid development of Internet information technology. Compared with the previous customer behavior in this environment, the customer classification standard is more complicated.

## **2.2 Customer Behavior Characteristics in the Environment of “Internet+”**

With the rapid development of computer and Internet technologies, diversifying meaningful and valuable information in large-scale online customer behavior has become the focus of attention of Internet people and major Internet companies. Xiang Jianchi(2010) puts forward the value of customer interaction in the context of the Internet, that is the customer's suggestion information to the company, the information of the competitors brought to the enterprise, etc., is important for the company to find its own shortcomings and deficiencies, improve products and services, make decisions and further development. Jia Yingli (2018) proposed to classify and manage customers of e-commerce enterprises with demographic characteristics, length of stay, number of visits, and customer value information. Huoston (2019) believes that the data generated in digital media is growing exponentially in the Internet era, and it is critical for companies to assess customer satisfaction with their products or services.

The above can be seen that some scholars have combined the characteristics of the Internet era to study customer behavior, but there are still deficiencies. Rarely explore the idea of customer classification management based on customer value by combining the behavior characteristics of online platform customers with traditional customer behavior, and lack of systematic evaluation system of customer value in the environment of “Internet+”.

## **2.3 Customer Classification Technology Methodology**

Enterprises can choose different technical methods according to their conditions, including K-means algorithm, rough set, self-organizing map neural network, BP neural network and so on. Liu Zhiyi (2014) proposed an initial clustering center selection strategy based on maximum distance aliquots. The RFAT model and K-means improved algorithm were used to cluster the existing customer data of an enterprise, and the marketing strategy for different customer groups was given. Wan Yinghong (2011) proposed a customer consumption classification model based on rough neural network, conducted empirical research on telecommunications customer management in a certain region. Sun Ming (2018) uses SOM neural network clustering method to rationally classify 546 household gas customers of a large natural gas production enterprise according to the characteristics of natural gas products. Qiao Fei (2015) builds an effective data analysis model with BP neural network model, which helps college employment managers to make customer-level predictions for school recruitment companies.

Research on customer classification based on customer value has two advantages: First, through the grasp of customer value, it can more fully reflect the contribution of customers to corporate income; Second, it can help enterprises to develop differentiated service strategies more rationally

and effectively, thus optimizing resource allocation. With the emerging development of "Internet+", Internet information technology has many characteristics such as convenience, privacy, timeliness and efficiency. The customer behavior in this environment is different from traditional customer behavior. The expression of customer value has the characteristics of the times. This paper combines customer behavior characteristics in the environment of "Internet+" and traditional customer behavior to build a customer classification indicator system based on customer value.

### 3. Customer Classification Indicator System Construction based on Customer Value

According to the literature, this article discusses the importance of customer value from the perspective of the enterprise. The customer classification model based on customer value in the "Internet+" environment will be constructed from the three dimensions of customer characteristics in the environment of "Internet+", current value and potential value. The customer classification model established from the above dimensions can more accurately reflect the value of customers in the "Internet+" environment.

After sorting out the various classification indicators, the customer classification indicator system based on customer value under the environment of "Internet+" constructed in this paper is shown in Table 1 below.

Table 1. Customer Classification Indicator System Based on Customer Value in the Environment of "Internet+"

Target layer	Firstly indicator	Secondary indicators
Customer value	Customer characteristics in the environment of "Internet+"	Customer basic properties
		Number of times customers visit the site
		The time customer logged into the network and stayed
		Customer interaction value
	Current value	The last time the customer purchased online shopping time
		The number of online purchases by customers in the last year
		The total amount of money the customer spent on online shopping in the last year
	Potential value	The number of times a customer repeatedly purchases an enterprise product or service
		Customer cross purchases
		Persistence of customer-to-business relationships
		Customer perception of enterprise brand image
		Is the customer willing to recommend others to buy
		Customer rating
Customer's willingness to register a member		

## 4. Customer Classification Research in the Environment of "Internet+".

### 4.1 Customer Value Data Collection and Processing

With the rapid development of the Internet and data analysis technology, data analysis enterprises and departments are gradually specialized, and through a series of data collection channels, all-round collection of customer data can be realized. In this paper, some customers of G Company were selected to collect data through questionnaires. The number of issues was 600, and 548 of valid questionnaires were received. The effective rate of questionnaire recovery was 91.33%. Due to the wide range of data involved, and the classification indicators are qualitative and quantitative, before the calculation of customer value, the collected data needs to be processed, so that it is within the same calculation standard. This paper will use the idea of the five-point system in the Likert scale, score it according to the different characteristics of each indicator, and score all the indicators with different attributes within 1 to 5 points.

### 4.2 Pre-classification based on Customer's Current Value

Customer pre-sorting can not only help to have a preliminary understanding of customers, but also because many customers have the same value characteristics, pre-sorting can pave the way for subsequent classification sampling, thus greatly improving the effectiveness and representativeness of sampling.

The weight set is a set corresponding to the classification indicator,  $a = \{a_1, a_2, \dots, a_3\}$ , and  $\sum a_i = 1$ . In view of the different situations of enterprises in the "Internet+" environment, the development environment is changing, and so on. The expert scoring method can be comprehensively considered to a certain extent, and then scored, so that a relatively more accurate weight setting can be obtained. Therefore, in the determination of weights, this paper chooses the expert scoring method, selects 10 G company managers and professional research scholars to assign weights to the indicators. The results are shown in Figure 1.

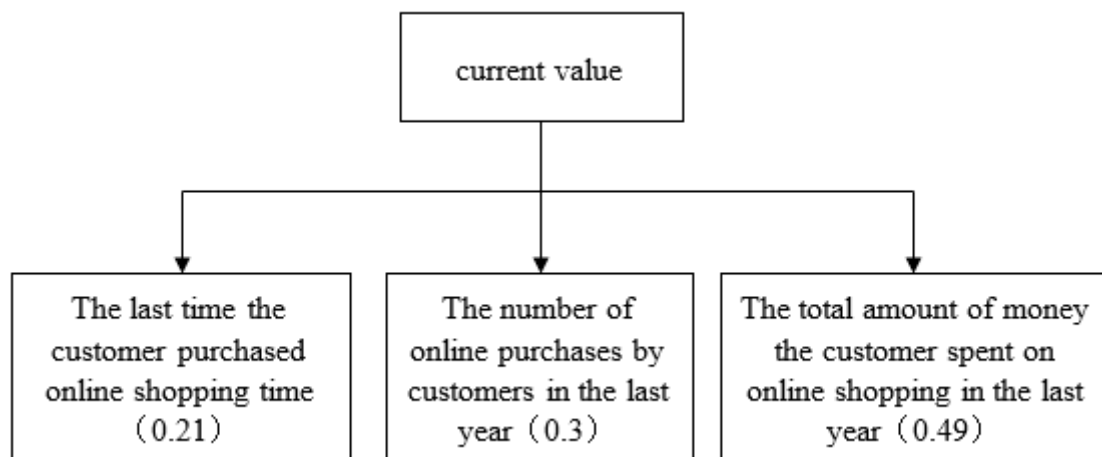


Figure 1. Customer current value weight

In the indicator processing, each indicator of the current value is scored in the five-point range, and each score is multiplied by the weight, and the three indicator scores are added to obtain the current value score of the customer. The specific algorithm formula is as follows:

$$C_i = R_i * W_R + F_i * W_F + M_i * W_M \quad (1)$$

$C_i$  Current value of each customer,  $R_i, F_i, M_i$  represents the customer's score in the three indicators of current value, and  $W_R, W_F, W_M$  represents the proportion of each of the three indicators of current value.

The customer is pre-classified into five categories by calculating the current value of the G company's customers. The specific classification results are shown in Table 2.

Table 2. Customers Current Value Classification in the Environment of “Internet+”

Number	Current value	Number of people	Proportion
1	$1 \leq C < 2$	102	18.61%
2	$2 \leq C < 3$	150	27.37%
3	$3 \leq C < 4$	110	20.07%
4	$4 \leq C < 5$	105	19.16%
5	$C = 5$	81	14.78%

### 4.3 Customer Classification based on BP Neural Network

The BP neural network is called Back-Propagation Network, it is often used in the fields of function approximation, information classification and pattern analysis. The training process is that the input information from the input layer is transmitted to the output layer through the hidden layer. If the actual output obtained at the output layer is inconsistent with the expected output, it is transferred to the back propagation, and the error signal (The difference between the actual output and the expected output) Returning along the original path, learning to modify the connection weight between the neurons in each layer, and finally making the error within the allowable range. The structure of a common BP neural network model is shown in Figure 2.

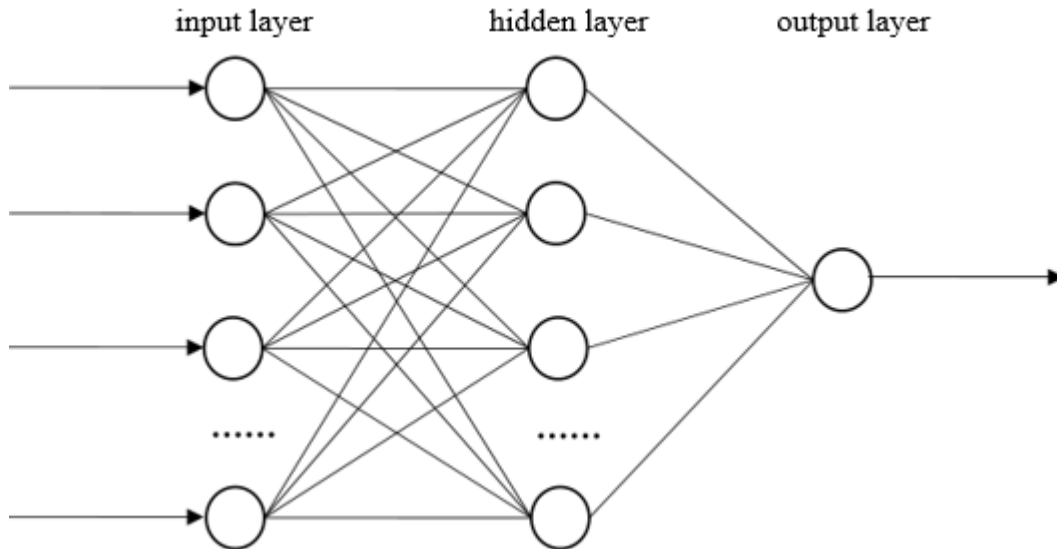


Figure 2. BP neural network model diagram for customer value evaluation

#### (1) Normalized data

According to the results of the pre-classification process, 50% of the customers from each category are randomly selected to form a sample with 274 capacities for research. Normalize all sample data using the minimum and maximum normalization methods. The normalized data matrix can improve the calculation speed of the model data and effectively solve the problem of numerical difficulties in calculation. The specific processing methods are as follows:

$$X'_i = \frac{X_i - \text{MIN}(X)}{\text{MAX}(X) - \text{MIN}(X)} \quad (2)$$

$X_i$  is a single individual in the sample,  $\text{MIN}(X)$  and  $\text{MAX}(X)$  are the minimum and maximum values in the sample.  $X'_i$  is the processed sample individual. After processing the data in this way, the data can be normalized to a value between  $[0, 1]$ , which facilitates subsequent research and analysis.

#### (2) Structure selection of BP neural network

According to Kolmogorov's theorem, we can know that BP neural networks with three-layer Sigmoid neurons can approximate any continuous function as long as there are enough hidden layer nodes. Therefore, in the calculation of customer value, this paper chooses BP neural network model with input layer, single hidden layer and output layer. The number of nodes in the input layer should be equal to the number of input variables, corresponding to the number of customer classification indicators based on customer value, so the number of input layer nodes is 14. Since the output result is to be classified to the customer, the number of output layer nodes is set to 1, that is customer value, represented by "K". The determination of the number of neurons in the hidden layer is more complicated, and generally the more complex the problem, the more the number of neurons in the hidden layer are required. According to Kolmogorov's theorem, in the three-layer BP neural network, there is the following approximate relationship between the number of neurons in the hidden layer and the number of neurons in the input layer:

$$n_2 = 2n_1 + 1 \quad (3)$$

$n_2$ : number of neurons in the hidden layer,  $n_1$ : number of neurons in the input layer.

According to the above formula, the number of neurons in the input layer, output layer and hidden layer in the BP neural network model are: 14, 1 and 29.

#### (3) Function selection

In the MATLAB environment, the BP neural network toolbox mainly provides S-type logarithms, tangent functions and linear functions as transfer functions. Since the value of the data after normalization is between 0-1, the transfer functions from the input layer to the hidden layer and the hidden layer to the output layer are `tansig` and `logsig` respectively. The calling formats are:

$$\begin{aligned} A &= \text{tansig}(N) \\ \text{Info} &= \text{tansig}(\text{code}) \end{aligned}$$

N: Q S-dimensional input column vectors; A: Function return value, located between intervals (-1, 1)

$$\begin{aligned} A &= \text{logsig}(N) \\ \text{Info} &= \text{logsig}(\text{code}) \end{aligned}$$

N: Q S-dimensional input column vectors; A: Function return value, located between intervals (0, 1)

The training function is determined by the learning algorithm, and different learning algorithms correspond to different training functions. In this paper, when training the network, select `train` as the training function, and the calling format is:

$$\begin{aligned} [\text{net}, \text{tr}, Y, E, \text{Pf}, \text{Af}] &= \text{train}(\text{NET}, \text{P}, \text{T}, \text{Pi}, \text{Ai}) \\ [\text{net}, \text{tr}, Y, E, \text{Pf}, \text{Af}] &= \text{train}(\text{NET}, \text{P}, \text{T}, \text{Pi}, \text{Ai}, \text{VV}, \text{TV}) \end{aligned}$$

#### (4) Construction of BP neural network model

A  $14 \times 29 \times 1$  BP neural network was generated using Matlab's BP neural network toolbox. In order to meet the model validity and reliability test, the numbers 1-229 are used as training samples, and the numbers 230-274 are used as simulation test samples. Specific steps are as follows:

① Data entry, the data that needs to be trained in the network is entered the workspace operation window in MATLAB7.0.



② Create a neural network, Open the BP Neural Network Toolbox, enter the data into the corresponding fields, and create a new neural network.

③ Set related parameters and functions, Set the initial values of weights and thresholds before training the BP neural network. The network auto-initialization the weight and threshold, default value is 0. Correlation function selection: Logsig, the transfer function used by the input layer to the hidden layer is a logarithmic function of the S type. This function maps the input of each neuron to [0,1]; Traingdx, momentum and adaptive learning rate BP gradient decrement training function, commonly used in neural network weights and threshold training; Learngdm, a gradient descent momentum learning algorithm that represents weights and thresholds, It works by calculating the rate of change of the weight or threshold by a combination of the input and error of the neuron, the momentum constant, and the learning rate of the weight or threshold; Mse is the BP network mean squared performance function, which can achieve the purpose of evaluating network performance through mean square error.

④ Network training, click on training after parameter setting, MATLAB automatic training sample. Through the training of the sample data, it can be found that the error of the test sample reaches 0.01, and the neural network training can be ended. Then, based on the network model constructed by the training sample, the result of the simulation is close to the expected output. Therefore, the model evaluation results are consistent with the actual basics, and the trained BP neural network model can be used to analyze and calculate the customer value in the environment of "Internet+". G company customers are divided into four categories based on customer value size, as shown in Table 3.

Table 3. Customer Classification Results

Number	Customer value(K)	Customer types
1	$0.75 \leq K \leq 1$	A
2	$0.5 \leq K < 0.75$	B
3	$0.25 \leq K < 0.5$	C
4	$0 \leq K < 0.25$	D

From the above results, there are four customer types: Class A customers, that is, the value output is in the range of  $0.75 \leq K \leq 1$ . These customers have frequent purchases and high consumption, which is the most important customer of the company; Class B customers, that is, the value output is  $0.5 \leq K < 0.75$ . Such customers are also the major contributors to corporate profits. Enterprises should focus on investing resources and transform them into Class A customers as much as possible; Class C customers, that is, the value output is  $0.25 \leq K < 0.5$ . The company should selectively maintain customers to ensure that customers can still make profits for the company in the future; Class D customers, that is, the value output is  $0 \leq K < 0.25$ . G companies can adopt a relatively cool attitude and let them lose.

## 5. Conclusion and Suggestion

Pre-classification based on the current value of customers can greatly improve the validity and representativeness of sampling, which is the starting point for customer classification using BP neural network algorithm. By constructing a customer classification indicator system based on the customer characteristics in the environment of "Internet+" combined with the current value and potential value of the customer, the customer behavior in the current network era can be more systematically evaluated. The new customer value indicator system and classification method are applied to G company to form an effective customer classification, which is beneficial to the enterprise to achieve dynamic management of customers. There are many differences in the consumption behavior of different value customers under the Internet background. In order to better promote the management of enterprise customers, this paper puts forward three suggestions:

(1) From the perspective of customer management, companies not only pay attention to the current value and potential value of customers, but also combine the characteristics of customer behavior in the environment of "Internet+" to develop a reasonable marketing strategy. Classifying customers and implementing differentiated services not only saves corporate marketing costs, but also improves the return on investment of enterprises.

(2) From the perspective of business management, with the rapid development of computer technology and Internet information, enterprises should keep pace with the times, realize the informationization of business management, and establish a 360-degree relationship between customers and enterprises. Pay attention to the important role of big data in the field of customer management, actively build a big data management system, further realize the visualization of analysis results, and improve the decision-making efficiency of enterprises in customer management.

(3) From a marketing perspective, the consumer-oriented 4C theory is more suitable for enterprises in the Internet environment than the traditional 4P theory. 4C theory mainly emphasizes customer-centric and puts customer satisfaction first. The social behavior of customers in the Internet era is increasing day by day. Enterprises can use customer reviews to promote word-of-mouth marketing and fully exploit the potential value of customers.

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