Establishment of Genetic Hybrid Neurotourism Algorithm

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Abstract: In order to grasp the changing trend of customer churn and improve the prediction accuracy of customer churn, a prediction method of tourism customer churn based on Hybrid Neural Genetics is proposed. The mixed neural genetic algorithm is used to model and predict the customer turnover, estimate the tourism customer value calculation.

Keywords: Mixed Neurogenetics; Tourist Customers; Customer

Introduction

With the continuous expansion of information management, the tourism industry is developing faster and faster, and customers have become an important basis and guarantee for the profits of the tourism industry. However, the fierce market competition has intensified the frequency of customer loss. The problem of customer churn prediction has attracted extensive attention in the tourism industry[1]. Therefore, data mining of customer behavior and accurate prediction of customer churn have important practical value.

1. Calculation of tourism customer value

It is pointed out that the latest purchase time is the time interval from the last purchase to the current one. The smaller the value, the more likely the customer will buy again γ is larger; Purchase frequency S_i It refers to the total purchase times of customers in a certain period of time. The higher the purchase frequency, the more loyal the customers are; The purchase amount is the total consumption of customers in a certain period of time. The greater the value, the greater the contribution of customers to the company's profits η bigger the company is, the more it should pay attention to the customer. RFM model measures the customer value with the above three indicators (the indicators of the third customer are R, F and m), and mines the system law of the indicators (the weight coefficients are respectively A , B and C), thus, the calculation expression of customer value is obtained:

$$V_i = \prod \mu \mathrm{A} T_i + \eta B F_i + \gamma C S_i \quad (1)$$

Set the collected original data of customer turnover as:

$$a^{(0)} = \left\{ a^{(0)}(1), a^{(0)}(2), \cdots, a^{(0)}(n) \right\} \quad (2)$$

Accumulate the original data line of customer churn once, and get:

$$a^{(n)} = \left\{ a^{(n)}(1), a^{(n)}(2), \cdots, a^{(n)}(i) \right\} \quad (3)$$

And there are:

$$a^{(n)}(i) = k \sum_{i=1}^{k} a^{(0)}(i) \qquad (k = 1, 2, \cdots, n) \quad (4)$$

Then the characteristic attribute matrix of the training sample set is:

$$A_{ij}=\begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix} \quad (5)$$

Establish a first-order differential equation for the data after the accumulation operation:

$$\frac{a^{(n)}-1}{\sum V_i(x+y)}+A_{ij}a^{(n)}(i)=U \quad (6)$$

Among them x and y are the parameter to be evaluated Convert the above formula into matrix form, and:

$$y_n=\bigcap Ux_n-ka^{(0)} \quad (7)$$

Among them :

$$x_n=\left[x^{(0)}(2),x^{(0)}(3),\cdots,x^{(0)}(n)\right]^T \quad (8)$$

The objective function can be expressed as:

$$\min\left\{s(i,k)\right\}=\sum_{j=1}^{n}A_{ij}a^{(n)}(i)\sum_{h=1}^{c}\left[Z_{hj}\left\|r_{ij}-s_{ih}\right\|\right]^2 \quad (9)$$

Attract information Z_{hj} is from h to the candidate representative point j, r_{ij} reflects the evidence accumulated that I is suitable to be the representative point of J; Attribution information s_{ih} is from the candidate representative point I to H. In the iteration, the two information are updated alternately: let the number of nodes in the input layer, the hidden layer and the output layer be E,P,N , the number of samples is D , then the hidden layer input of the neural network is:

$$net_j=D\sum_{i=1}^{I}\frac{\left(E-P-N\right)}{\min\left\{s(i,k)\right\}}-Z_{hj} \quad (10)$$

Set the collected customer churn data ϖ consists of linear part and random part $\hat{L}_t$ and $\overline{G_t}$ The specific steps of customer churn data mining based on hybrid neural genetic principle are: using neural network model to analyze customer churn data pairs ϖ modeling and prediction, its linear part can be v . Accurately describe and get the corresponding prediction results m . Using BPNN to analyze customer churn data ϖ nonlinear part can be modeled and predicted N accurately describe and get the corresponding prediction results S_r linear prediction results Q and nonlinear prediction results P Input support vector machine for learning, and get the customer value weight coefficient is, then:

$$\hat{y}_t=\varpi S_r N\times\hat{L}_t\overline{G_t}+Qvm\times Pnet_j \quad (11)$$

The above customer value calculation models are based on RFM models[8]. In order to facilitate the analysis of the value of different customers, a customer value calculation model is constructed based on the relationship between different models.

In the implementation process, the way of space transfer and movement is adopted, using a coordinate point to represent the scenic spot that the customer will travel, and using a line to represent the tourist route that the customer will

pass. Different scenic spots will show different differential behaviors when carrying out tourism activities.

2. Customer interest sample processing based on hybrid neurogenetics

When doing the classification task, the voting method is used to get the prediction results, and when doing the regression task, the average method is used to get the prediction result. Therefore, hybrid neural genetic algorithm has high accuracy and generalization ability.

The hybrid neural genetic algorithm is used to deal with the training samples of the prediction of customer churn in the tourism industry, and some irrelevant samples are deleted to reduce the size of the training sample set. The training samples processed by the hybrid neural genetic algorithm are used for learning, and the prediction accuracy of customer churn in the tourism industry is calculated by the 10 fold cross validation method. The optimal parameters are determined according to the accuracy, so as to establish the prediction model of customer churn in the tourism industry .the prediction accuracy of tourism industry customer churn is analyzed

From the perspective of customers in different life cycles, the research of customer value calculation theory focuses on four different stages: the stage of identifying and acquiring potential customers, With the in-depth study of customer value, in addition to considering the life characteristics of customers, such as dividing customers into potential customers, new customers, old customers and lost customers, some scholars assume that the customer life cycle obeys the exponential distribution, that is, the loss time of customers may occur at any time. Some scholars, in order to simplify the calculation, assume that customers lose or have high quality after each purchase, and the loss rate obeys the geometric distribution.

Table 1 stability analysis of loss rate

ID	Purchase times	Average loss rate	Loss rate variance	Ratio of variance to mean value
T1242	4	0.6734	0.1134	0.1323
T1452	3	0.6342	0.1211	0.1212
T1343	2	0.6422	0.1435	0.1333
T1256	5	0.6788	0.1211	0.1253
T1542	1	0.6235	0.1245	0.1452
T1435	2	0.6545	0.1113	0.1378

According to the statistical results of the churn rate of customers per purchase, not only the absolute value of the standard deviation is relatively small, but also its relative value (the ratio of standardization to mean value) is very small, that is, the churn rate of customers after each purchase is stable.

3. Conclusion

Customer churn prediction is an important research content in the field of tourism. Because the influencing factors of customer churn are complex, its changes have both definite regularity and randomness Because the prediction accuracy of customer churn obtained by traditional clustering method is low, based on the combinatorial optimization theory, aiming at the regularity and randomness of customer churn, this paper uses grey neural network modeling, adopts the nonlinear fitting ability of Hybrid Neural Genetics, and carries out nonlinear weighting on their prediction results.Here, we currently only propose one theoretical idea and need to continue in-depth research to achieve the goals of the model.

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