Design call center management system of e-commerce based on BP neural network and multifractal

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ABSTRACT

Call center is the automatic answering system with the experience of artificial agents, maximize customer satisfaction by means of efficient intelligent program-controlled switches allocation, computer telephony integration. This paper uses PHP technology to achieve call center management system of e-commerce based on B/S model. Call center includes call center platform, seat call center management platform, e-commerce service platform and the platform of knowledge service. The system uses BP neural network to classify the customers and employees queue, traffic forecasting and optimization of call center scheduling using the multi fractal, in order to improve the quality of customer service and reduce operating costs.

Keywords: Call center; BP neural network; Multifractal; E-commerce.
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INTRODUCTION

Call center is also called customer service center (Customer Service Center), customer care centre, customer contact center, it is through telephone, fax and other forms to provide rapid, accurate information and advisory service accepting and complaints and other services, and efficient means of call by intelligent program-controlled switches allocation, computer telephony integration, automatic answering system and the experience of artificial agents, to maximize customer satisfaction, at the same time, nature also makes the relationship between enterprises and customers more closely, is an important means to improve the competitiveness of enterprises.

Customer relationship management is one of the core functions of call center; it can help the enterprise to grasp the demand of customers, strengthening relationships with customers, effectively mining and management of client resources, to obtain the market competition advantage. Customer classification is an important means for enterprises to understand the customer, the enterprise awareness of customer based, divide the customers into different levels of this important, making differential customer service policy, the realization of personalized service through policy [2]. Classification of customer has classification method of two kinds of qualitative and quantitative customer. Qualitative methods in the customer classification is macro according to customers bring value to customer classification, the method relies on the domain knowledge of experts; quantitative classification method is based on some quantitative information from customers as the basis, using data mining techniques such as clustering, decision tree, neural network, association rules, rough set, technology genetic algorithm, a method to classify the customers.

Queuing strategy table is one of the core technologies of Web call center, queuing strategy can improve the service efficiency of the call center, customer call is assigned to the appropriate position, provide better service for customers. The commonly used agent queue strategy: first come first serve, sequential allocation, random allocation, minimum amount of work. Cost sensitive decision of rough set theory in dealing with classification problem into cost sensitive analysis mechanism, on the error classification to distinguish between different results, suitable for processing the misclassification cost sensitive classification problem of non equilibrium. The project use attribute weighted cost sensitive classification method based on rough sets, according to the customer level, customer

records, seats traffic information related to dynamic queuing strategy, Business Hours can prolong the average user, improve service satisfaction, and can improve the efficiency of the new call center.

Traffic data is the estimation of the number of seats and the scheduling of work condition of call center, call center according to the traffic of different arrangements of the corresponding position, so that in the premise of call center service level, to achieve the optimal allocation of human resources in the call center. However, random historical data traffic, the traffic data with chaotic form, therefore, how to accurately predict the call center traffic is an important and urgent problem to be solved. Further study of multi fractal is a fractal theory, can be more convenient to get non stationary time series of the scaling exponent and multiracial spectrum can be effective, multi fractal characteristics of time series analysis, provided it is traffic time series analysis and prediction is an effective path of solution. The paper designs the call center management system of electronic commerce based on BP neural network and multifractal.

EXPERIMENTAL SECTION

1. Key technology analysis of system design
1.1 BP neural network
BP neural network is a kind of multilayer feedforward neural network, BP neural network mapping relationship between input and output a lot of storage and output can be obtained through learning, without the need to provide the mathematical equation of the mapping, BP neural network model using the back propagation algorithm, the learning rule using steepest descent method, the network weights and threshold adjusted by back-propagation, reach the minimum square error and network.

Multilayer BP neural network is a one-way transmission of feedforward neural networks; neural network has three layers or more than three layers of strata. BP neural network hidden layer and multilayer perceptron, which greatly improves the classification ability of neural network, function to arbitrary accuracy to approximate the given, the multilayer perceptron training often uses the error back propagation learning algorithm, as shown in figure 1 [1].
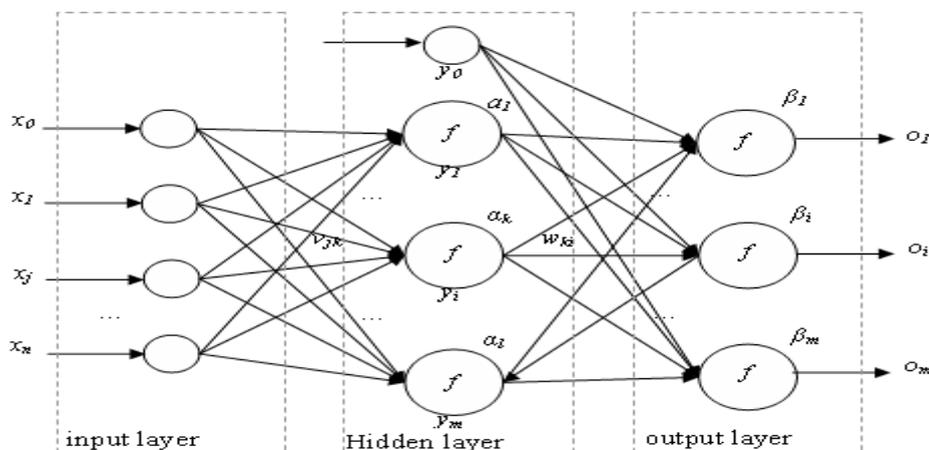

Fig. 1. The topological structure of BP neural network

BP network trainer supervised learning, so training sample set is shaped like a (input vector, the ideal output vector) vector. At the start of training, the weights of nodes in the network by some small random initialization, BP network training process consists of two phases:

(1) Work positive signal propagation: the input signal (training samples) from the input layer to the hidden layer and output layer, generates an output signal at an output end (actual output vector), as is shown by equation (1).

$$E_p = \frac{1}{2} \sum_{k=1}^{l} \left(d_{pk} - o_{pk} \right)^2 \tag{1}$$

(2): the difference between the actual output and the expected output of the network is the calculation of error signal, the error signal started forward propagation layer by layer from the output end, in the reverse process of communication, the network weights continuously through the error feedback for adjusting actual output, the

network closer to the desired output, as is shown by equation (2).

$$v_{ij} = \eta \left(\sum_{k=1}^{l} w_{jk}(d_k - o_k)o_k(1 - o_k) \right) y_j(1 - y_i)x_i \tag{2}$$

The process of network training BP consists of two phases: positive signal propagation and error signal propagation stage. The error between the calculated with the actual output and the desired output value, the weight matrix adjustment of network continuously, so that the actual output of the network is closer to the desired output.

1.2 Multifractal theory
Multifractal also become divided type measure, he is the further study on the fractal theory [2]. The multi fractal to make up for the lack of fractal theory, it can describe the distribution of measures defined in some support. In 2002 Kanethardt proposed the multifractal detrended fluctuation analysis method of it, the method can conveniently be non-stationary time series of the scaling exponent and the multi fractal spectrum; it can multiplex characteristics analysis of time series.

The fractal dimension is a quantitative description of the basic parameters of fractal, it is thatdescribes the. Dimension geometry of Euclidean space is the integer value, and the fractal dimension is divided into numerical.

To F consider the target pattern, subset is R^n, s as a non negative number, for arbitrary $\delta > 0$, definition follow, When $\delta \to 0$ tends to a limit, denoted as

$$H^s(F) = \lim_{\delta \to 0} H_\delta^s(F) \tag{3}$$

If the set F is a subset of these subsets, and have the same structure, but their size is in F accordance with the reduction factor reduced, sub subset of these subsets in turn with the same proportion, and so on [3]. It is assumed that each "mother" a subset, and when each subset of the distance factor increases in accordance with the "mother set are identical". If the initial scale is 1, and the variable length $\varsigma = \gamma^k$, F number of covers the required cube $H_\delta(F) = N^k$, is.

$$D_B = \frac{logN}{-log\dfrac{1}{\gamma}} \tag{4}$$

Multifractal also known as fractal measure, it is the sublimation of fractal theory, the distribution of multi fractal theory to describe the fractal measure defined on a support.

The definition of a metric space is (X, μ), if $X_n = \lim_{n \to \infty} X_n(\alpha)$ is a fractal set, is that it is a fractal subset (X, μ) measure space. If the collection is divided, the fractal set can be expressed as a union of several fractal subsets, and each subset (X, μ) are not fractal dimension, the fractal can be integrated into the multi fractal. Moorhouse Madoff dimension μ_α definitions of fractal subsets X_α of probability measure for the follow equation (5).

$$\vartheta^\gamma(X_\alpha, \eta_\alpha) = \lim_{\gamma \to \infty} \vartheta_\delta^\lambda(X_\alpha, \eta_\alpha) \tag{5}$$

Compared with the definition of fractal dimension can be seen, the physical meaning of fractal dimension is expressed with a subset of the same value, commonly known as the multi fractal spectrum. A complex fractal body, its interior can be divided into subsets of a series of different value that, given a series of fractal characteristics of this subset.

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Many natural phenomena can be described quantitatively by fractal dimension, and the fractal dimension and box dimension, the information dimension of single, correlation dimension and multifractal compared, using a series of index to describe the fractal dimension, the behavior characteristics of spectrum function from multiple time scales reflect the complex system [4]. The characteristics of these systems is to collect a lot of time series data, and the dynamic mechanism of the system is complex, the multifractal detrended fluctuation analysis algorithm, it can be obtained directly from time series of the multifractal spectrum. Project using multifractal detrended fluctuation analysis algorithm to obtain the multifractal spectrum to predict traffic trends, optimize the seating arrangement, and improve work efficiency.

2. The overall design of call center system structure
The call center management system for e-commerce of agricultural products, to provide sales, consulting, customer service, marketing, customer relationship management can function as the agricultural products sales website, help agricultural products e-commerce sites to improve the quality of customer service, the integration of enterprise resources, reduce costs. Call center includes call center platform, seat call center management platform, e-commerce service platform and the platform of knowledge service four big modules. The call center structure is figure2.
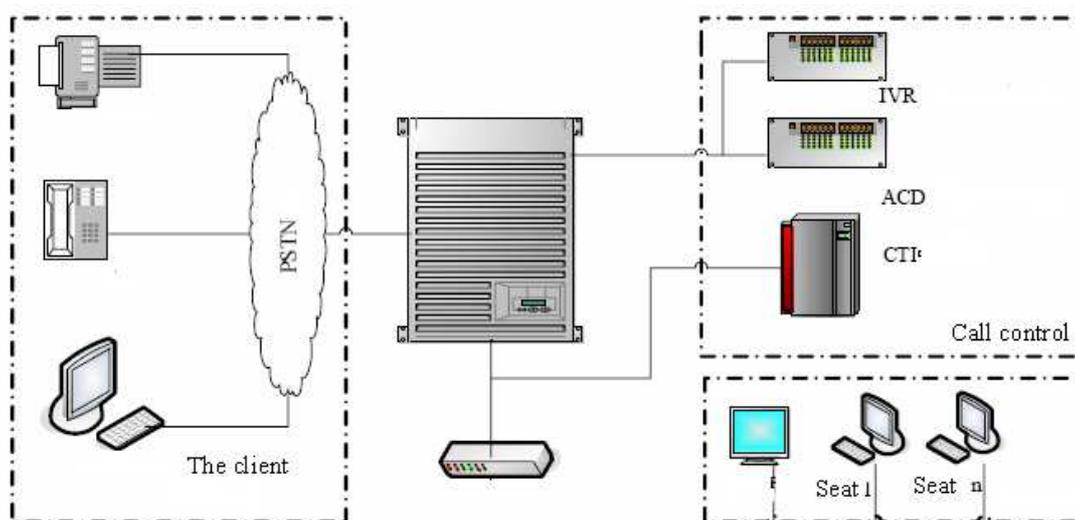

Fig. 2. The call center structure

The system will voice query, self-service, combined with artificial service, put the shopping website sales, distribution of resources, supply chain resources, customer resources are integrated through the network, establish a rapid response mechanism of online shopping, enhance customer groups and shopping sites interaction, resource allocation and utilization. It supports multiple channels including voice, fax and e-mail, image processing, web and e-commerce, arrived at the call from the customer's moment, routing and management from first to last for it.

Call center through telephone, fax and other forms to provide rapid, accurate information and business acceptance and complaints and other services, is an important means to improve the competitiveness of enterprises. The application of call center in the field of agricultural products in electronic commerce, realize all kinds of agricultural products shopping, query, consulting, complaints, business acceptance and other value-added and customer service operations, can greatly improve the customer service level, further enhance the level of agricultural informatization construction, save the expenses, improve work efficiency, promote the development of agricultural product electronic commerce.

3. Development of call center management system of electronic commerce based on BP neural network and multifractal
Combined with the theory of rough set BP neural network to classify the customers and agent based queuing, traffic forecasting and optimization of call center scheduling using the chaos and fractal theory [5]. The system will voice query, self-service, combined with artificial service, put the shopping website sales, distribution of resources, supply chain resources, customer resources are integrated through the network, establish a rapid response mechanism of online shopping, enhance customer groups and shopping sites interaction, resource allocation and utilization, so as to realize the enterprise profit the maximum.

According to the agricultural product electronic commerce website business needs, in the Linux and Asterisk

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platform, design and implement a B/S based structure, use PHP, Javascript, HTML as a development language, using MySQL as database system, ensure the data processing, safety and high efficiency, data access in the process of it.

The system uses PHP language in the Apache environment, HTML and JavaScript language as code, using MySQL as database system, ensure the data processing, data access in the process of high efficiency, safety, adopt three layer architecture to manage code, isolation of the user layer and data layer, provides the reliable safeguard for management and post system [6]. With the popularity of the network, the system wide, convenient application, low requirements of hardware and software, the general agricultural enterprises can be convenient to use. The system is easy to operate, easy popularization, has good application prospects.

The realization of a B/S model based on the "agricultural product electronic commerce VOIP call center management system" based on the PHP technology, the system aims at the field of e-commerce of agricultural products, including the call center system platform module, module function call center agent platform, agricultural product electronic commerce business management module, agricultural knowledge service module. The main functions of the system include.

(1) The call center basic function: two function modules configured for dial up management and call center.

Dial: dial plan management, pre dial, dial the results, speed dial, recording information, route information and statistical function call.

Setting: call center system parameter setting, data import, time setting, grouped settings, queue state, state monitoring function at it.

(2) The call center agent management: basic information management and account management module two.
The basic information management: call records, the dial, schedule management, bulletin management, scheduling management, queue management.

Account management: user management, role management, user identification, and user online statistics.

(3) Electronic commerce business management: including customer management, shopping management.
Customer management: including the analysis of customer information management, customer care, customer records, report management, complaint management, questionnaire, and statistics.

Shopping management: including commodity management and order management.

(4) Knowledge service: provide the knowledge management, information retrieval and intelligent response.

In this paper, the application of call center in the field of agricultural products in electronic commerce, realize all kinds of agricultural products shopping, query, consulting, complaints, business acceptance and other value-added and customer service operations, can greatly improve the customer service level, further enhance the level of agricultural informatization construction, save personnel costs, improve work efficiency, promote the development of agricultural product electronic commerce.

CONCLUSION

The paper designs the call center management system of electronic commerce based on BP neural network and multifractal. According to the agricultural product electronic commerce website, design and implementation of call center management system, the system provides dynamic queuing strategy, customer call is assigned to the appropriate agent, can effectively detect, maintain and retain customers, providing personalized service to customers. Intelligent knowledge module for operator response provides a convenient; system will help to improve the quality of customer service, the integration of enterprise resources, reduce operating costs, and provides a solution for the agricultural product electronic commerce call center. System and agricultural product electronic commerce platform with the use can effectively improve the consumer satisfaction.

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