# Control Model Design for Monitoring the Trust of E-logistics Merchants

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**Abstract.** In order to improve the subjectivity bias of the traditional autocorrelation function analysis method, this paper tries to introduce the mutual correlation criterion to establish the asymptotic control model in the e-logistics trust degree control application. By pre-constructing the resource database structure model of e-logistics, we adopt the DOI mutual correlation criterion to describe the user's trust degree evaluation of resources, and then form the user trust Simulation experiments show that the model has a good asymptotic control performance on the trust degree of e-logistics with accurate trust evaluation and high estimation accuracy. The decision making approach based on the mutual correlation criterion, in which two or more users jointly make the normalized evaluation of the mutual trust value model, can effectively improve the traditional model autocorrelation active selection bias. The new model realizes the progressive control of e-logistics trust degree based on the mutual correlation criterion, which can significantly improve the supervision of e-logistics enterprises.

**Keywords:** Electronic logistics · Cloud computing · Control model

## 1 Introduction

With the strong development of network transactions and e-commerce logistics industry, the information and data of users of network transactions of e-commerce logistics are expanding, along with the expanding information field of e-commerce logistics and the expanding information space, how to extract the information that users care from the massive information and improve the evaluation performance of merchants has become a research topic of concern [1]. The problem of accurate and effective evaluation algorithms for trust in online transactions is studied. In the open and complex network environment, factors such as randomness and ambiguity in the transaction process through the network are unpredictable, and the traditional evaluation mechanism does not make accurate judgment and quantitative assessment of them. In an open and complex network environment, buyers and sellers choose each other through a virtual network platform. For example, in Taobao, where the number of online transactions is powerful, buyers choose whether a merchant can fulfill their promises based on their needs and the reputation of similar merchants. Likewise, sellers evaluate buyers who have chosen their goods based on their trustworthiness. It is necessary to control and evaluate the trust


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degree of each other, and to improve the quantitative assessment performance of merchants by designing a logistic trust degree progressive control model for e-commerce and conducting trust degree ratings of online physical objects [2].

Traditional models have solved the trust assessment methods and evaluation degree calculation of buyers and sellers in online transactions to varying degrees under certain application conditions, but with the popularity of the Internet, the increase in online users, and the increase in user satisfaction, many shortcomings have emerged in the specific application of these models [3]. For example, in the open and complex online environment, the randomness of the communication between buyers and sellers in the process of purchasing products and the unpredictability of whether the transaction between merchants and buyers can be carried out smoothly are uncertainties that cannot be accurately predicted when using the knowledge of probability theory for estimation, and if there are malicious buyers or sellers who deliberately break the trust degree by making false evaluations, the evaluation mechanism cannot If there are malicious buyers or sellers who deliberately break the trust, the evaluation mechanism cannot make a definite judgment and eliminate them. At the same time, the above model does not give different trust degree evaluation mechanisms according to the different characteristics of entities, and lacks some flexibility [4, 5]. It can be seen that the traditional e-logistics trust degree control model adopts the model design method of autocorrelation function analysis, and the evaluation effect is not good due to the large subjectivity of autocorrelation feature analysis [6–8]. In response to the above problems, this paper proposes a progressive control model of trust degree of e-logistics based on inter-correlation criterion. Firstly, the resource database structure model of e-logistics is constructed, and based on the mutual correlation criterion, the e-logistics user recommendation model construction and network trust degree control model are carried out to realize the algorithm improvement, and the simulation experiment is carried out to demonstrate its superior performance by performance test.

## 2 Resource Database Structure Model and Trust Influence Parameters for E-logistics

### 2.1 Resource Database Structure Model for E-logistics

Design the resource database structure model of e-logistics based on cloud computing, and set the query history of e-logistics resource database users as $W = \{w_1, \ldots, w_p\}$.The query pattern $\sigma(W)$ is a two-dimensional matrix of $p \times p$. For $1 \leq i, j \leq p$, the cascade layer depth is $N_k (k = 0, 1, ..., L)$, denotes the number of k-layer data connections data target position location state estimation vector is

$$\alpha = (\alpha_1, \alpha_2, \ldots, \alpha_n) \neq 0 \tag{1}$$

Denote by $W_{ij}^{(k)}$, the connection weight of the jth layer of k, $x_i^{(k)}$ is the $i$ ($i = 1, 2, ..., N_k$) input vector of the hidden data set in the e-logistics database. Denote the linear input and reversible invariant output of the e-logistics trustworthiness evaluation system by $s_j^{(k)}$ and $y_j^{(k)}$, Expressed as an eigenvector as:

$$x^k = \left[x_1^{(k)}, x_2^{(k)}, \ldots x_{N_{k-1}}^{(k)}\right]^T \tag{2}$$

$$s^{(k)} = \left[s_1^{(k)}, s_2^{(k)}, \ldots s_{N_k}^{(k)}\right]^T \tag{3}$$

$$y^{(k)} = \left[y_1^{(k)}, y_2^{(k)}, y_{N_k}^{(k)}\right]^T \tag{4}$$

The power spectrum optimized allocation probability density function of the resource database obtained by grid assignment (Pr):

$$\left|\Pr\left(\mathrm{Re}al_{\sum,A}(k) = 1\right) - \Pr\left(Simulator_{\sum,A,Sim}(k) = 1\right)\right| \le negl(k) \tag{5}$$

In e-commerce transactions, if both parties agree, the transaction can be carried out smoothly, and the buyer evaluates the seller according to the merchant's various service attitudes, and the evaluation can be converted into the merchant's reputation to facilitate the smooth conduct of the next transaction. The above process shows that only the mutual trust mechanism between buyers and sellers can ensure the smooth transaction in the virtual network environment. The above process realizes the construction of the resource database structure model of e-logistics and lays the foundation for the progressive control of trust degree.

### 2.2 E-logistics Trust Influence Parameters and Cloud Preprocessing

The main parameters influencing the trust in e-logistics are: the credibility of the evaluator, the historical evaluation value accumulated by the merchant, and the price of the transacting entity. Due to the unpredictability factors such as randomness and ambiguity of the buyer and seller in conducting the transaction process, and also if there is a deliberate breaking of trust by the user, the existing evaluation mechanism does not make an exact judgment on it. Trust between subjects includes both direct trust and indirect trust. Direct trust is obtained by the subject based on his own experience, assuming the existence of n evaluations of the evaluated goods, corresponding to m characteristic attributes. If each evaluation is considered as a cloud factor, then m trust attribute clouds are obtained using the trust attribute inverse growth cloud algorithm. The data set contains n samples for n uncorrelated independent vectors, let the range e-logistics data value domain for N discrete points $A = \{a_1, \ldots, a_N\}$, and meet $a_1 < a_2 < \ldots < a_N$.The set $X$ is divided into class c and the set of subscripts is assigned:

1) $V_1 = \{> a_1, > a_2, \ldots, > a_{N-1}\}$
2) $V_2 = \{\ge a_1, \ge a_2, \ldots, \ge a_N\}$
3) $V_3 = \{< a_1, < a_2, \ldots, < a_N\}$
4) $V_4 = \{\le a_1, \le a_2, \ldots, \le a_N\}$
5) $V_5 = \{= a_1, = a_2, \ldots, = a_N\}$

Suppose U is a quantitative domain and C is a qualitative concept in U. When the quantitative value x is a random realization in the qualitative concept C and the degree of certainty $\mu(\mathrm{x}) \in [0, 1]$ of x with respect to C is a stable random number, then the distribution of x over the quantitative domain U is called a cloud, denoted as $C(X)$. Each x is called a cloud droplet. Where the cloud droplet is described quantitatively by a standard normal function. The cloud model is described by a large number of quantitative values with certainty for qualitative quantities, and it mainly utilizes forward and inverse cloud generators for interconversion of qualitative and quantitative concepts. Suppose that U is a topological quantitative domain of trust data of God's network and C is a qualitative concept in U. When the quantitative value x is a random realization of the qualitative concept C in, The determinacy of x with respect to C, $\mu(x) \in [0, 1]$ is a stable random number. Through the above processing, the correlation analysis and cloud pre-processing of the parameters influencing the trust degree of e-logistics are realized to provide an accurate data base for conducting the trust degree of e-logistics.

## 3 Improvement of Trust Degree Asymptotic Control Model Based on Mutual Correlation Criterion

On the basis of the above model design, algorithm improvement is carried out, and the superior traditional e-logistics trust degree control model adopts the model design method of autocorrelation function analysis, which is more subjective in autocorrelation feature analysis and has poor evaluation effect. In this regard, this paper proposes a progressive control model of trust degree of e-logistics based on the inter-correlation criterion.

The DOI (Degree of Interest) intercorrelation criterion is used to describe the user's trust evaluation of the resource, and the posterior probability of successful negotiation between two subjects for the n + 1th time follows a Beta distribution.

$$P_{a+1} = E(Beta(P|a+1, n-a+1)) = \frac{a+1}{n+2} \tag{6}$$

Let the mutual correlation function weight function be U, where $\sum u = 1$. The trust relationship model between e-logistics user A and user B, where $I_a$ is the resource identifier of user A. The following must be satisfied by network users for e-logistics A products:

$$v - p_1 + \rho_1 A_1 \geq 0 \tag{7}$$

$$v - p_1 + \rho_1 A_1 \geq \delta \cdot v - p_2 + \rho_2 A_2 \tag{8}$$

$$U = \begin{cases} v \geq p_1 - \rho_1 A_1 \\ v \geq \frac{p_1 - p_2 + \rho_2 A_2 - \rho_1 A_1}{1-\delta} \end{cases} \tag{9}$$

Based on the mutuality criterion, a consumer who chooses logistics product B must satisfy:

$$\delta \cdot v - p_2 + \rho_2 A_2 \geq 0 \tag{10}$$

The above equation tabulates the rating of resource i by users A, B in the user trust network control system. The indirect trust relationship between users is obtained denoted as $A \to B, B \to C$. Launching:

$$MSD_{a \to b} = 1 - \frac{\sum_{i=1}^{|I_{a,b}|} \sqrt{(d_{a,i} - \overline{d}_a)^2 + (d_{b,i} - \overline{d}_b)^2}}{|I_{a,b}| \times \sum_{i=1}^{|I_{a,b}|} \left[ \sqrt{(d_{a,i} - \overline{d}_a)^2} + \sqrt{(d_{b,i} - \overline{d}_b)^2} \right]} \tag{11}$$

The randomness of buyers in the process of shopping for goods and communication with sellers, merchants and buyers to conduct transactions between them meet the following constraints:

$$v - p_1 + \rho_1 A_1 < \delta \cdot v - p_2 + \rho_2 A_2 \tag{12}$$

That is:

$$U = \begin{cases} v \geq \frac{p_2 - \rho_2 A_2}{\delta} \\ v < \frac{p_1 - p_2 + \rho_2 A_2 - \rho_1 A_1}{1 - \delta} \end{cases} \tag{13}$$

Users trust the rating of resource i by users A, B in the network control system, and if there are malicious buyers or sellers who make false ratings to deliberately break the trust level, there are:

$$p_2 - \rho_2 A_2 \geq \delta \cdot (p_1 - \rho_1 A_1) \tag{14}$$

At this point, the market only has demand for product A; when the following inequality is satisfied:

$$p_2 - \rho_2 A_2 \leq p_1 - \rho_1 A_1 - Q(1 - \delta) \tag{15}$$

In the above equation, $\boldsymbol{w}(k) \in R^n$ the expert rating results in an unknown perturbation in the finite energy local range. When:

$$\delta \cdot (p_1 - \rho_1 A_1) \leq p_2 - \rho_2 A_2 \leq p_1 - \rho_1 A_1 - Q(1 - \delta) \tag{16}$$

The asymptotic coefficients of user trust evaluation $\gamma > 0$, if there exist positive definite symmetric matrices $Q$, $S$, $M$, the asymptotic control solutions of e-logistics trust degree are:

$$\frac{p_1 - p_2 + \rho_2 A_2 - \rho_1 A_1}{1 - \delta} \leq v \leq Q \tag{17}$$

$$\frac{p_2 - \rho_2 A_2}{\delta} \leq v \leq \frac{p_1 - p_2 + \rho_2 A_2 - \rho_1 A_1}{1 - \delta} \tag{18}$$

In the above equation, $Trust_{a \to b}$ represents the trust weight value of target user A to user neighbor B. The use of using $TW$ to increase the number of similar users in the traditional collaborative filtering recommendation method produces an uncertain time lag due to the high number of similar users in the trust network model, At this time, two users jointly make a normalized evaluation of each other's trust value model and construct a user trust assessment mechanism and network control model. This realizes the progressive control of e-logistics trust based on the mutual correlation criterion and improves the management and control benefits for e-logistics merchants.

## 4 Simulation Experiments and Results Analysis

In order to test the performance of the algorithm in this paper in achieving the progressive control of trust in e-logistics, simulation experiments are conducted. Experimental environment: Myeclipse 8.0 experimental simulation platform and Java platform development language and combined with swarm program package. According to the analysis, the e-logistics network trading merchants receive customer orders, through the multi-subject negotiation, the subject respectively in accordance with their role in the merchant and the sector in which they are synergistically play their role, together to serve the business objectives. The trust level of network information is modeled according to the index system described in the previous section and divided into five levels, A, B, C, D and E. The user trust perception model uses the trust level evaluation of network information on C2C websites as the index system. Suppose there are trust attribute clouds $TPC_1$, $TPC_2$ and their mathematical properties are $Ex_1$, $En_1$, $He_1$, $Ex_2$, $En_2$, $He_2$ respectively. using the algorithm of this paper, the response output of the mutual correlation function of e-logistics users is calculated as shown in Fig. 1.

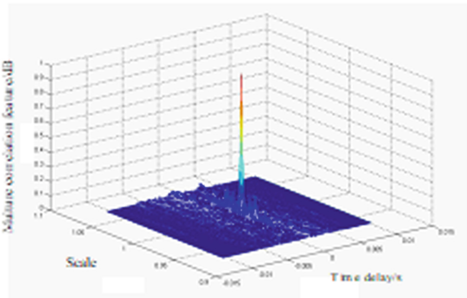


**Fig. 1.** e-Logistics user correlation function response output

As seen in Fig. 1, the algorithm of this paper is used for the mutual correlation function feature analysis, based on the mutual correlation criterion, the feature extraction accuracy is high, and the estimation performance of the trust degree of e-logistics is superior, for the trust attribute cloud TPC1 generates a normal random number $W_1$ with $En_1$, ${He_1}^2$ as variance, and the trust value is calculated as 6.2 by the division of the trust interval with low confidence as [3.5–6.5]. In order to compare the performance of the algorithm, the simulation experiment of the progressive control accuracy of the trust degree of e-logistics is carried out using the algorithm of this paper and the traditional algorithm, and the results are obtained as shown in Fig. 2.

In Fig. 2, assuming that the historical trust degree and the current trust degree are weighted half each, since the trust degree of the previous evaluation is 6, then the trust degree of the network transaction of this e-logistics merchant is $6 \times 50\% + 6.2 \times 50\% = 6.1$. Comparing the control accuracy of this paper's algorithm and the traditional algorithm, we get that this paper's algorithm has better asymptotic control performance, accurate evaluation and higher estimation accuracy.

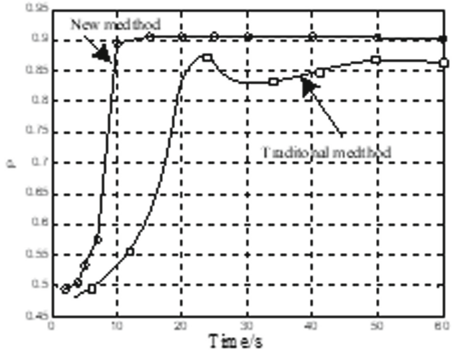


**Fig. 2.** Progressive control accuracy of e-logistics trust degree

## 5 Conclusion

The design of the logistic trust degree progressive control model for e-commerce is used to carry out the trust degree rating of network entity objects and improve the quantitative evaluation performance of merchants. The traditional e-logistics trust degree control model uses the model design method of autocorrelation function analysis, which is not effective in evaluation due to the large subjectivity of autocorrelation feature analysis. A progressive control model of trust degree of e-logistics based on inter-correlation criterion is proposed. Firstly, the resource database structure model of e-logistics is constructed, and based on the mutual correlation criterion, the e-logistics user recommendation model is constructed and the network trust degree control model is implemented to improve the algorithm, and the simulation experiments show that the algorithm in this paper has good asymptotic control performance, accurate evaluation and high estimation accuracy. The asymptotic control of e-logistics trust degree based on the mutual correlation criterion is realized to improve the management and control benefits of e-logistics merchants.

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