Original Research Article

Research on Trust Evaluation Model Based on Statistical Data in E-Commerce

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Abstract: Both the level of science and technology and people's economic level have been significantly improved in the present social background. With the application and popularization of computers and networks in people's homes, online shopping, which is of high flexibility and convenience, has emerged and gradually become an important choice to shop. In e-commerce activities, the trust between the two parties often directly affects the results of online transactions, which is even a very critical influencing factor. Therefore, an effective trust evaluation model will make a positive impact on the healthy and sustainable development of e-commerce activities. Based on the trust evaluation model of reputation that has been applied in practice, this article will integrate D-S evidence fusion algorithm into the new evaluation model and try to analyze its unique value in application.

Keywords: Statistical Data; Trust Evaluation Model; E-Commerce Activities

The Internet is so widely popularized at present that almost everyone can connect with it through intelligent mobile devices or computers. Accordingly, with the accelerated pace of people's life, online shopping, an e-commerce activity, has emerged and become a very common way of business activities in a short time. Similar to the traditional trading form, there are trust issues in online shopping, which has always been an important factor affecting both parties. Although a large number of scholars have made extensive research on the "trust" and "evaluation model" in e-commerce transactions, the numerous results they achieved generally cannot fully meet the differences among users. In practice, it is difficult for those online evaluation systems to meet the expectations of consumers in e-commerce activities.

1. Analysis of "trust"

1.1 Classification

First, it is necessary to clarify the identity of an entity and its corresponding permitted scope, and then effectively monitor and manage its behavior. On this basis, a trust level should be built. According to the differences in the scope of trust, trust can usually be divided into two categories, namely identity trust and behavior trust. The former refers to co-operating with related technologies (such as access control, information encryption, data hiding, and protocol) on the basis of the entity identity and authorized behavior. The system belongs to the research content of distributed network. Some traditional network information technologies can be well applied to solve problems in identity trust. The latter refers to the related issues of trustworthiness, which is broader in scope, wider and more realistic in meaning. It often reflects the substantiated and specific behavior trust, and then the application ability can be judged. Generally speaking, identity trust helps people to determine the target entity of a transaction. However, it cannot be effectively

guaranteed whether the entity can act according to the expectations, such as the quality of its service, the quality of products, and the perfection of after-sales service. At this time, entity's behavior trust is needed to make clear whether transactions can be conducted. Behavior trust plays an important role in modern P2P business practice[1].

In a modern society, a natural person will generally have trust in a specific person or entity, which comes from others' recommendation or his own direct experience. So is the trust in the network formed. Generally speaking, the entity trust can be divided into three types: recommendation, direct and indirect. Direct trust is generally formed from the previous transaction experience between the two parties. As for indirect trust, the trust relationship is constructed by the recommendation of other entities, because there is no transaction or little transaction experience between the two parties. The reputation value is often obtained through the evaluation result or direct experience of the third-party. In general, the reputation value is calculated with reference to the third party with higher reliability, or it may be completed by centralized calculation, and in some cases, it is calculated independently under specific circumstances. The recommendation trust is obtained by taking the credibility of the trust provided by recommended nodes into full consideration and judging the trust degree according to the feedback opinions[2].

1.2 Characters

In sociology, trust is a social phenomenon, while in the field of information science, the concept of trust in human society is often the important foundation of trust model. Generally, the characters of trust can be divided into the following aspects. First, trust usually exists between two nodes. Second, trust can be divided into different levels, such as fuzzy semantic variables and a probability expression. Third, trust should be constructed through achievement of certain conditions. For example, natural persons trust the services of medical institutions, but they cannot trust their mechanical maintenance services. Fourth, trust should be constructed with reference to the old experience. The entity will complete the evaluation of trust according to the proximity conditions. Fifth, with the help of recommendation, it can improve the degree of trust to a certain extent and help other nodes to make decisions. Sixth, trust transfer needs to be completed under specific conditions, and it is necessary to evaluate and consider the source of trust recommendation. Seventh, trust is often subjective, that means the trust values for the same nodes can be different and cannot be measured by the same standards. Eighth, trust is generally asymmetric. Ninth, trust is dynamic, and the trust of each node will be affected by time, behavior and other factors, and will change at any time[3].

2. Analysis of trust evaluation model based on statistical data

2.1 D-S evidence fusion algorithm

Compared with the related theories of probabilistic reasoning, D-S theory contains more direct and easy data collection and data acquisition, which is widely applied in practice. In the process of actual calculation operation, as D-S can better deal with data from different sources, it has a more significant advantage in the synthesis processing of data with the characteristics of fuzziness and uncertainty. When designing the evaluation model, it is necessary to synthesize the data of different evidence sources so as to obtain reliable information. This is one of the issues that need to be considered in this study[4].

First, take Θ as the set of all possible solutions for the problems to be determined, and set it as recognition framework. The basic probability distribution function $m(A)$ (mass function) can be used to show the trust degree of all possible solutions of Θ. At the same time, make it to meet

$$\sum_{A \subseteq \Theta} m(A) = 1$$

in which $m(A)$ refers to the trust degree for possible solution A. The larger the value of $m(A)$, the higher the trust degree[5].

Dempster synthesis refers to setting the set of basic probability distribution functions of data with independent relationship to a complete basic probability distribution function. As $\forall A \subseteq \Theta$, in the mass function of Θ, namely m_1 and

m_2, the rules of Dempster synthesis are as follows:

$$m_1 \oplus m_2(A) = \frac{1}{1-k} \sum_{B \cap C = A} m_1(B) \cdot m_2(C)$$

K is a normalized constant,

$$K = \sum_{B \cap C \neq \Phi} m_1(B) \cdot m_2(C)$$

$$= 1 - \sum_{B \cap C \neq \Phi} m_1(B) \cdot m_2(C)$$

As $\forall A \subseteq \Theta$, in the mass function of Θ with limited number (m_1, m_2, ..., m_n), the rules of Dempster synthesis are as follows:

$$(m_1 \oplus m_2 \oplus \ldots\ldots \oplus m_n)(A)$$

$$= \frac{1}{1-K} \sum_{A_1 \cap A_2 \cap \ldots\ldots \cap A_n = A} m_1(A_1) \cdot m_2(A_2) \ldots\ldots m_n(A_n)$$

Among which:

$$K = \sum_{A_1 \cap \ldots\ldots \cap A_n \neq \Phi} m_1(A_1) \cdot m_2(A_2) \ldots\ldots m_n(A_n)$$

$$= 1 - \sum_{A_1 \cap \ldots\ldots \cap A_n = \Phi} m_1(A_1) \cdot m_2(A_2) \ldots\ldots m_n(A_n)$$

The value of K reflects the matching degree of evidence source data, and the larger it is, the lower the matching degree is. Otherwise, the matching degree is higher. In the process of actual operation, it is necessary to limit the value range of K, so that the results obtained after evidence fusion can be closer to the reality[6].

2.2 Trust evaluation model based on statistical data

Trust evaluation is usually based on the characteristics of transaction behavior. Referring to the trust evaluation model based on reputation and integrating D-S evidence fusion theory, this article puts forward a new trust evaluation model, which is mainly based on statistical data.

After the completion of the transaction, the trade was evaluated. In this study, there were 10 indexes in the specific evaluation of the trade and five different evaluation levels, namely "fully satisfactory with 5 points", "almost satisfactory with 4 points", "moderately satisfactory with 3 points", "unsatisfactory with 2 points" and "unsatisfactory with 1 point", which were expressed by A1-A5 respectively. In the calculation of evidence fusion, the score of A1 is defined as a_1 (95 points), followed by $A_2 = 85$, $A_3 = 75$, $A_4 = 65$ and $A_5 = 55$. In this study, for the sake of simplifying the calculation, the weights of different factors are set under the same standard. For different indexes, evaluation in the range of grade A_i includes a_{i1}, a_{i2} and ... a_{in}. At this time, the probability of the basic probability distribution function of trust evaluation in grade A_i is:

$$p_i = \frac{\sum_{k=1}^{n} a_{ik}}{\sum_{k=1}^{10} a_k}$$

(p_i is the probability that the trust evaluation of this consumer is in grade A_i)

Online shopping, as an e-commerce activity, has a very significant impact on people's daily life. It has become a very common way of business activities in a short time. Similar to the traditional trading form, there are trust issues in online shopping, which has always been an important factor affecting both parties of the transaction. The trust evaluation model of this article has been appropriately improved based on the reputation trust evaluation model. After obtaining the comprehensive evaluation information of users, it can select the evaluation information of users with relatively close geographical and basically close age range and combine with D-S evidence fusion algorithm to analyze the evaluation data of different users, so as to obtain evaluation. For different users, it is necessary to choose different evaluation models for evidence fusion. Because the system can search for the basic elements such as region, age and gender by itself during the trading activities between the two parties, this study conducts effective evidence fusion on users with

similar element for the sake of simplifying the calculation, which is helpful to accurately complete the trust evaluation[7].

3. Conclusion

To sum up, e-commerce is still in the development stage at present. The trust evaluation model based on statistical data can meet the needs of social development. The advantages of this model are that it can analyze the characteristics of individual differences, and select user information to compare and calculate when setting key information for different commodities, thus improving the evaluation accuracy. In addition, by combining with D-S algorithm, it takes the fusion of incomplete information into consideration, and optimizes the evaluation data appropriately, which effectively improves the evaluation value.

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