

# Comparison of B2C E-commerce Websites Trust Assessment Models

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**Abstract**—Trust is a very important factor in any social relationship. In the current trend when physical marketplace are also establishing themselves on Internet, where they go online and where commerce transaction takes place online, trust becomes one of the major critical issue for any customer. Similarly it also becomes important for the vendor to know how much customer rely on in them. Trust being the base of any relationship, needs to be analyzed properly. By analyzing trust, customer can make decision for commerce transactions, whereas vendor can get to know about the loopholes in their system. This paper provides the important factors comprising the major trust issues and with the help of those factors, three different models namely Text Analysis, MLPNN and ANFIS are compared. In addition to comparative analysis, their individual applications are also suggested.

**Keywords**—Trust, E-commerce, Neural Network, ANFIS, Text Analysis.

## I. INTRODUCTION

Commerce is a basic economic activity which involves buying and selling of any types of goods. Gone are the days of traditional way of buying and selling goods. In today's world of modernization, everything is going online. Today, from accounts to customer relationship management, from supply chain to demands forecasting makes use of advanced technology. With the advent Internet technologies, today physical marketplaces like Croma (A TATA enterprise) and Shoppers Stop are also going online [1]. This depicts the current trend of market and the increasing importance of World Wide Web. The whole new shift from traditional way to the modern way is to decrease the competence deficiency among the key players in those business areas. In this electronic age, the major concern is whether the business functions applied or any business transactions carried out are trustworthy or not? The answer lies in one's perception created towards the business owners and also in the trust factor created by those business owners in this competitive market.

Trust with all of its implications has been studied in numerous different verticals, and this helps in increasing options for research opportunities and its applications. If trust factor can be understood and enriched by reputable online marketplaces, then there would be substantial amount of growth in general e-commerce transactions [2]. Manifestations of trust are easy to identify because we experience and rely on it every day, but at the same time it is quite challenging to define because it exhibits itself in many different forms. The term trust is also quite confusing because

the term trust is used in many different forms with variety of meanings [3][4].

As described, Trust can be explained in many different contexts, the focus in the paper would be more over E-commerce transactions. E-commerce is such a huge concept, that it is classified into four different categories. Each type categorized, depends on the nature of supplier and client. Classifications are as follows—

- Business to Consumer (B2C)
- Consumer to Consumer (C2C)
- Business to Business (B2B)
- Consumer to Business (C2B)

The major chunk of E-commerce applications lies in B2C domain where an individual business owner comes in direct contact with the consumer. Despite of exponential growth of internet users, the rate of online shoppers is still lacking behind. As discussed, the most often cited reason is lack of trust. As a step towards analyzing trustworthiness, this paper compares three different models of website trust assessment.

## II. RELATED WORK

Trust is the most important element in any communal association and especially in e-commerce applications and transactions [5]. The less ability of creating mutual trust in e-commerce business practices is just because of lack of personal touch. Though, to shape a good business relation there is no necessity for face to face interaction, consumers still fear an aspect of perspective risk factor in e-commerce transactions. Although there are many different advance technologies like e-signatures, e-certificates or even trust badges are used to assist users or rather consumers more specifically. Generally this trust governing factors are called online relationship quality (ORQ) [6]. Instead these factors are only part of this online relationship quality. With these factors we can actually analyze trust factor and understand how it relates to customer purchase behavior in any online context. This online relationship quality is further divided into three different sectors those are a) System Quality, b) Information quality, c) Service Quality. These are most prominent quality factors influencing internet shopping value [7].

There are few approaches where evaluation of trust is focused and hence coming up with different trust models. Starting with Zuhang, he stated that trust is dependent upon price of the product and credit history of the customer [8]. Similarly, Akhter proposes a model in which trust is dependent on security, familiarity and design of the website [9]. Authors in paper [10], state that trust can be evaluated using four factors: existence, affiliation, policy and fulfillment. Although, they have come with the better model, it is still not a cost effective model as price is an important facet on which trust depends [11] [12].

The nomenclature of final trust value is divided into two categories: direct trust and indirect trust [13] which is shown in figure 1. Direct trust has two dependencies, price of the product and past experience. The price of the product is an important feature and it is further reliant on pricing scheme of the organization, promotional discounts and personal discounts. Similarly past experience relates to the experience of the user based on the previous transactions from the websites. Three attributes contribute to this facet of direct trust i.e. behavior of the organization towards consumers, quality of the product and delivery time.

Indirect trust depends on following three things: recommendations, policies and website design. Recommendations for a websites bank on word of mouth, trust certification and feedbacks. Policies of the organization rely on security policy, privacy policy and satisfaction policy. Last and one of the most important factors for indirect trust is website design which relies on interactive GUI of the website, categories of the product and navigation system of the website.

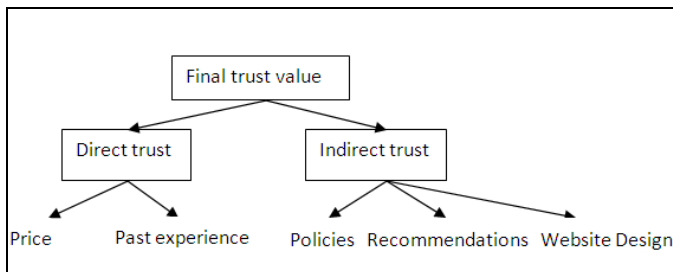


Fig.1. Nomenclature of Trust Evaluation

### III. PROPOSED SYSTEM

As seen in literature survey, there are many different parameters which contribute to trust. The most important parameters contribute to trust factor are as stated: Words of mouth, certifications, feedbacks, security, privacy, satisfaction, interactive GUI, categories, navigation, pricing schemes, promotional discounts, personal discounts, behavior, quality, delivery. These parameters are clubbed into five groups those are: recommendations, policies, website design, pricing schemes, past experience.

Trust being the vague term, can be defined in different context, but with respect to e-commerce business functions trust can be defined as— “A confidence or faith gained by a business owner from their consumer”

As discussed in literature survey, there are many different models for the purpose of trust evaluation. Here, three different models are compared namely Text Analysis, MLPNN and ANFIS.

**Text Analysis**— in this method websites are analyzed in terms of text and layout. Website pages are retrieved and stored in web repository. The second step is about feature extraction and pre-processing where html tags and unnecessary words are eliminated. The third step is analysis step where text and layout are compared to the data set which is predefined [14].

For the next two methods, survey was taken from different set of people. Questionnaire was prepared keeping in mind of different profession like IT professionals, Engineering Students and Banking professionals. The scale used for the survey was from 1 to 10, and it was scale down to 0 to 1. In all total 2049 entries of survey was taken, out of which 75% of data was used in training and rest was used for testing.

**ANFIS**—in this method there were five inputs given namely price, past experience, recommendations, policies, and website design. All the inputs are from 0 to 1. With the help of grid clustering method 243 different rules are generated.

**MLPNN**—in this method all 15 parameters are considered as an input to multi-layer perceptron neural network system (MLPNN). All the inputs are from 0 to 1. It has 2 hidden layers with 5 and 2 nodes respectively. The feedback is given to the system by error back propagation training algorithm (EBPTA).

### IV. EXPERIMENTAL RESULTS

The comparisons of these three methods are done on the basis of mean square error, execution time and their applications.

#### A. Input Parameters

The input to the system is given in two different ways, considering all 15 parameters discussed in proposed system.

For text analysis approach web crawler was used and 100 links were stored in web repository. After storing these links, each link was scanned and compared to predefined data set of positive and negative words written. It also checks for different algorithms used for security purposes like https, X509, RSA, SSL handshake algorithm. System also checks for pricing scheme offered and website design. Accordingly the trust score is given to the website.

For ANFIS and MLPNN approach questionnaire was prepared of 16 questions. This questionnaire was circulated between engineering graduate students, IT Professionals and banking professionals. Survey of 2049 person was conducted to capture their opinion about trustworthiness in e-commerce websites. They were asked to give their opinion on the scale of 1 to 10. These inputs were then scaled down to 0 to 1 as required.

**B. Mean Square Error(MSE)**

Mean Square error is very commonly used comparative parameter and was preferred dimension. With the help of mean square error it can be said that how better the system predicts the output, and hence better the system is.

$$mse = \frac{(y_1 - \hat{y}_1)^2 + \dots + (y_n - \hat{y}_n)^2}{n} \quad (1)$$

Where  $y_1$  stands for desired output for the 1<sup>st</sup> survey report and  $\hat{y}_1$  stands for actual output that gets from the system. The difference is then squared and all this squared difference are then added and finally divided by the total dataset value.

For ANFIS method the whole data set was given for 100 epochs and finally the error line graph for mean square error for 100 epochs was as in figure 2. From epoch no 24 the error rate becomes constant.

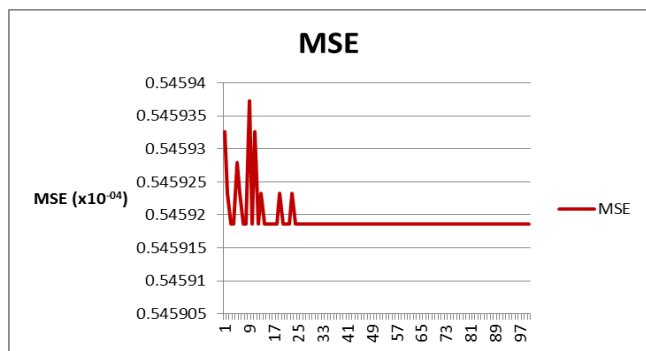


Fig.2. MSE graph for ANFIS

The final mean square error value for ANFIS came out to be 5.0496e-04.

Similarly for MLPNN the setup was made and ran for 100 epochs again. Results were as given in figure 3.

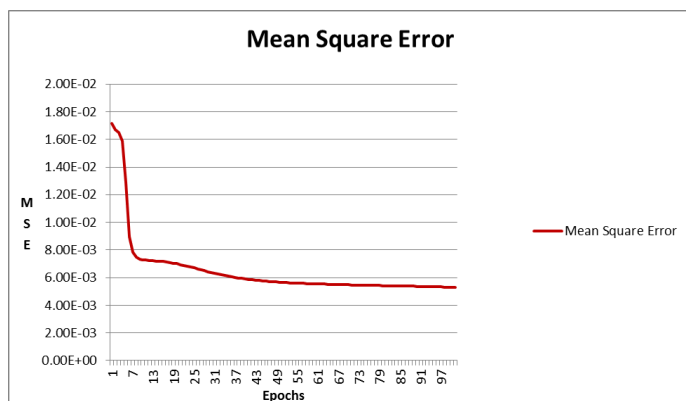


Fig.3. MSE graph for MLPNN

The final Mean Square error value for MLPNN came out to be 6.199301e-03

The comparison of mean square error for three different methods is as shown in figure 4.

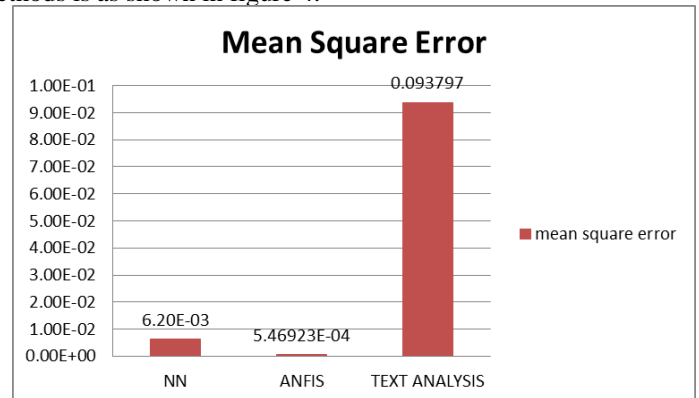


Fig.4. MSE Comparison

Text Analysis method has much higher error rate compared to MLPNN and ANFIS because during the retrieval of webpages there was some time limit given. If it exceeds the time limit it used to give error and this limit was major connection timeout or read timeout. ANFIS has much better accuracy than other systems.

**C. Execution time**

Execution time is actually the total time taken by the system to get trained and tested. So it is the addition of training time/crawling time and testing time/retrieval time.

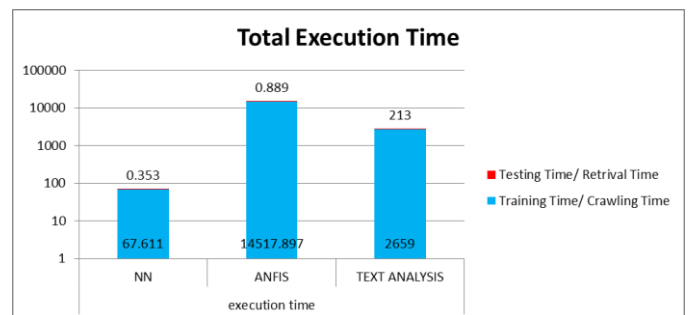


Fig.5. Comparison of Execution Time

As seen in the above figure 5 the execution time of each approach is compared. The graph chosen is a logarithmic graph because of huge difference between the execution time of the methods. As seen in the graph MLPNN takes least time with 67.611 sec for training and 0.353 sec for testing, while ANFIS takes the highest time for training.

**D. Applications**

With above results of mean square error and execution time some applications of each model can be suggested. They are as follows:

ANFIS—as this system have high accuracy with very high execution time, this model is suggested for business owners who can analyze their own business functions and can know what consumers feel for them. They can analyze the trust they have gained from their customers.

## REFERENCES

Text Analysis—as this method involves text and layout analysis, with not so good accuracy and execution time. This model is suggested for the prediction of the business owners their applications or may be even the product they are banking on.

MLPNN—as this method has very less execution time with quite good accuracy, this model is suggested for the first time customers who want to trust the business owner but are hesitating to do so. So this model will help them to know what other consumers think about the business owners and can then take their decisions.

## V. CONCLUSION

Trust is really important in any relationship, but when it comes to commerce transactions it becomes matter of concern. So three different models those are compared on the basis of mean square error and execution time also have applications in their own specific way. No model can be said to be the best one but applied in the best way they can. For future work these models can be applied in the field of applications suggested and can be compared with other approaches for better results determination.

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