Trust Factor Organization for Trust Prediction in Online Social Network

Rajeev Goyal, Arvind K. Upadhyay, Sanjiv Sharma, Pankaj Kumar Mishra

Abstract*: Web 2.0 has provided huge opportunities to human kind that leads the development of social web networks and enables users to communicate and cooperate among each other. Also exchanging their knowledge and experience in an online social environment. In order to identify the trustworthy information source on the social web/network, it is vital to build a trust mechanism. Trust predictions used for the possible trust among the users in an online community. Trust Prediction is used to find trust in future between two users. For a trust prediction mechanism measuring existing trust with the feature that impact on the calculation is crucial. The following study analyses the features of trust to calculate trust for online social network. This increases communication among users and creates a denser trusted network then previous. The study also illustrates how different trust factor can be organize to improve the accuracy and efficiency of trust prediction in online social network.

Index Terms*: Link Prediction algorithm, Trust Prediction, Online Social Networks.

I. INTRODUCTION

One of the major elements of social relationships between human is trust. Trust is the assurance that trusted entity will work in a predicted manner irrespective of the observation and environment in which it works. As the rapid growth of OSN computer science tries to calculate the trust within the user and the product. Several researchers work on different techniques to find the trust and their quantitative factors [1]. Selection and organization of trust factor are very important in the process of trust prediction techniques. Efficiency and accuracy of Trust prediction in OSN is very important in rapid growth of Online Social Network (OSN). User can opt OSN in their life if it provides a trusted environment so they can share their emotion, product and their opinion.

This paper addresses three problems: first what are the factors that can calculate the trust in OSN, Second how to organize these factors to calculate the trust and third how a method of trust prediction can be used in these factors to implement the trust calculation for a certain OSN. The trust factor organization can be transformed into the weight for future trust prediction and network extraction techniques in OSN [2]. This paper uses Facebook trust factors for the study and the opinion dataset for calculation of trust. As the OSN are huge in size and sparse in nature data can be of wide range and diversity. The paper study the factors that are important to trust calculation or have relation with trust prediction.

The paper is organized in the following structure. Section 2 study about several factors that are currently used for trust factor and related study of different type of work done in the area. Section 3 describes the different factor that can be used for the prediction. There are categories where the trust can be internal or external. In section 4 proposed a calculation method for these trust factor and in section 5 conclude the study and talk about the limitation and the techniques that will be used to overcome the limitation.

II. PROPERTIES OF TRUST

Trust is a social phenomenon. To calculate the trust it is important to study the properties of trust and identify the factor of trust that can be used for computation. To the study of trust prediction, these proposed properties are supposed to be remarkable, as they are established on either experimental verification or longstanding examination of human actions, and offer the theoretical basis for the design of numerous trust prediction techniques.

Trust is Subjective. In social science trust is personal. It is subjective for the trustee [3]-[5]. A person having high trust with one can have low trust with another. Trust can be dependent on one's personal view to another person's previous experience, assessment and behavior with each other. The trust of a person can vary drastically. This property is also applicable in OSN such as ecommerce users have personal view for each product some user has high trust rating while other gives low to same product [6]. Several models have been proposed for the calculation of subjectivity of trust, Such as Beta Model [7], Markove chain model [8].

Trust is Asymmetric. This property implies that trust among users does not essentially occur in both directions or to the equal degree. Between two users there are drastic difference in their trust opinion. Different Social status psychology and personal experiences are different for individuals and that is why for each other users trust is totally different. Various studies have been done for hierarchies of "own-way-trust" or asymmetric property [3, 9].

Trust is Propagative.

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Trust propagation is one of the important features in OSN. From source to target user trust propagates. If A trust to B and B trust C then A can also trust C. Transitivity of trust as shown in figure 1.

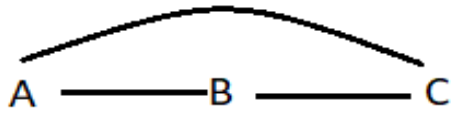

Fig 1: User Trust Transitiveness

So, trust is transitive from one user to another and the path can be built from source to target. Most of the users follow their trusted friends trust tendency for unknown users [10].

Trust is Context Sensitive. Trust can very on different situation. A person can trust a computer science faculty for learning any computer language but cannot have same trust value for learning a game with the same faculty. Researchers study on trust rating on the basis of context [11, 12]. And also study the variation of the trust rating on the basis of context. Every user can have some positive and some negative qualities and based on that user can be trusted on their qualities. Study says that the consideration of trust recommendation can be highly dependent on the context. [13]. Also, social science demonstrates that trust prediction in OSN is drastically dependent on Context [11, 14, 15]. Also, social psychology indicates that trust prediction in OSNs is remarkably influenced by these social contexts and an increasing number of studies have been concentrating on context in trust prediction in recent years [16-18, 8].

Trust is dynamic in nature. Trust is dynamic in nature. A can trust to B at time t1 but the trust rating can change as time changes. Time is one of the main factors for trust rating. Trust can be directly related with time and trust prediction for the users in OSN is highly dynamic. Time-aware trust prediction in OSN can be developed by [19, 20].

III. METHODOLOGY

To extract feature of trust from OSN is first step for predict trust in trusted based recommender system. To organize trust factor, first find the factors that affect Trust in online social network organize these factors such a way that these factors are utilize for next phase of calculation of trust between the users in OSN. Filtering selected factors in predicting Trust in OSN and will create a trust prediction model based on these organized trust factors as shown in figure 2.

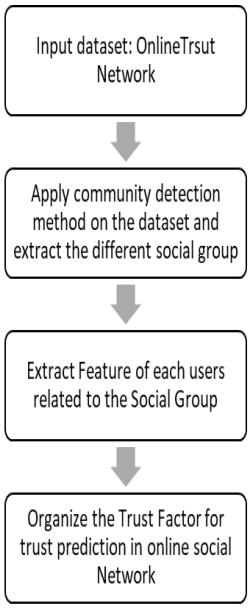

Fig 2: Flow Chart of Organization Trust factor for prediction in OSN

IV. FACTOR AFFECTING TRUST IN OSN

As there is no direct connection between users in OSN, Various factor are affecting users to trust to another user. These factors are utilizing for the computation of the trust. For a Trust prediction model these factors are useful to find the denser and tiny network so one can apply the recommender system on the OSN. Several such trust factor are study and introduced with their relationship.

A. Social status

In a particular context, users trust the person who have a well-defined social status or have an expertise in the particular context. Social position and expertise are the fact that a user have good knowledge of certain domain. The information can be finding the profile and the in degree of the particular user [21].

B. Consistency

Rate of the suggestion that is accepted by the other user is the consistency [22]. A user with high rate of acceptance has high trust. Consistency is the inter-user trust property means it is not dependent on relationship of the users.

C. Geo-Graphic Location

People trust more a person who belongs to same geo-graphic location. Same cities users are more trusted then other cities or other country.

D. Similarity

People who have more similarity have more trust. If people belong same domain or same type user acceptance have more trust in between. [23]. It means people have similarity can impact on the trust for some extent.

E. Communication Frequency

People who have high frequency of the communication in between have high trust [24].

F. Previous Experience

Previous Experience also influence the trust. If previous experience is bed it result low trust if previous experience high then trust is high.

V. ORGANIZATION OF TRUST FACTOR

All these above trust factors are divided in to two parts Inter user Trust and intra User Trust. Inter user trust is not dependent on the relation between two users it's an individual trust rating while intra user trust is dependent on the user's relationship. In Intra user trust rating can be different for the both the source and target users. Such as user A can have high trust on user B but User B not trusted by user A. table 1 and 2 shows the features of the trust that are intra dependent relationship and Intra dependent Relationship.

Table 1: Factor of Inter Activity for Trust

S No.	Fields
1	From User
2	To User
3	Geo graphic Location
4	Communication Frequency
5	Current Trust
6	Similarity

Table 2: Factor of Intra Activity/Independent for Trust

S No.	Fields
1	User ID
2	Profile
3	Consistency

So, user Importance of the node for a user I with respect to given source and target user is formulated as shown in equation 1.

$$c_i = W1_i * C_i(SS_i) + W2_i * C_i(Con_i) + W3_i * C_i(GL_{s,i}) + W4_i * C_i(Sim_{s,i}) + W5_i * C_i(Cf_{s,i}) + W6_i * C_i(Pe_{s,i}) + W7_i * C_i(GL_{i,t}) + W8_i * C_i(Sim_{i,t}) + W9_i * C_i(Cf_{i,t}) + W10_i * C_i(Pe_{i,t}) \quad (1)$$

Here SS_i is social status, Con_i is consistency, GL is Geographic's location, Sim is Similarity, Cf is Communication Frequency and pe is Previous Experience. Here Social Status and Consistency is intra relationship trust feature that is not dependent on the relationship between user i and Source or target user. All other such as Geographic's location, Similarity, Communication Frequency and Previous Experience are intra relationship trust feature. These Feature are dependent on the relationship between user i and Source or target user. And $W1$ to $W10$ are the coefficient or the weight of the feature. By this we can get the user Importance which can be used to predict trust by recommender system. Table 3 shows the user importance of the user required to calculate trust prediction.

Table 3: User Importance Table

S. No.	Fields
1	User ID
2	User Cost (Importance)
3	Density

In this study, we used extended epinions dataset for trust rating organization. The Data Set represents the rating of the online social network users. OSN can be represented as a directed graph A (N, E) where N denotes the node [26] i.e. a set of online Social network users and E denotes trust relationship between them. Epinions dataset statistics are as shown in table 4.

Table 4: Epinions Dataset Statistics

Total no of participants	~132,000
Total no of Statements	841,372
Total No Of trust statement	717,667
Total no of distrust Statement	123,705
Total no of participants received no less than one statement	~85,000

For trust prediction several researchers use the dataset and extract feature set [25]. Features used for Trust organization is as shown in table 5.

Table 5: Feature set of Trust Organization

S No	Feature
1	Total no of trust Statement read by user
2	Total no of Trust Statement written by user for communication frequency
3	In degree of the user for Social status
4	Out degree of user Social status
5	Page rank of user for Consistency
6	Previous trust

VI. RESULTS AND DISCUSSION

Based on the Factor which Affects Trust in OSN of proposed idea, divide total number of users in the social groups .These are based on effective factors of Social Network For the evaluation of the proposed model, we divided all users into the Feature Extraction application in three groups, based on the how much they are closer for different types of permission given at the time of accept the friend request. All the

persons are granted based on the individual and its personality. There are different types of groups for the particular user. For the idea of implementation, evaluate idea based on the subject and its objective. In subject evaluation, user 'choice for his or her ego, to get more effective output then the existing ones and in the objective evaluation, precision measure is done through the mathematical formulas to get best weight set. These all will use evaluation metrics which are given by Recommender Systems.

As a result a distribution chart is given in figure 3. Factors such as Social status, Consistency, Geo-graphic location, similarity, Communication frequency and previous experience. Figure shows the relative distribution of the factors for organization of trust network.

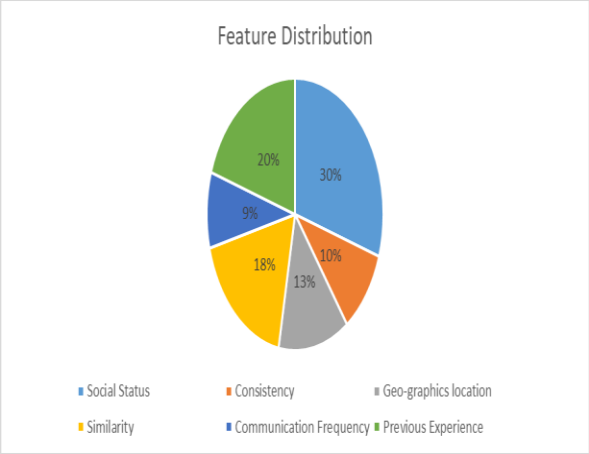

Fig 3: Distribution of factors for Trust in OSN.

VII. CONCLUSION

Online Social Network is rapidly growing and trust between the online users is becoming highly significant. Prediction of trusted user is one of the most important technique in the rapid development of OSN. First task for the trust prediction is organization of trust. This confirms the trust factor and their organization. In this paper, several specified trust factors are used for the trust prediction. This paper analyzed the trust factor and classify them into the inter-relationship trust factor and intra-relationship trust factor. These factors and their organization are used to get more accurate and more efficient trust prediction rate.

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