

Trust Prediction Framework for Social Networking

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Abstract

In today's hyper-connected society, understanding the mechanisms of trust is crucial. Trust issues are critical to solving problems. Trust phenomenon has been extensively explored by a variety of disciplines across the social sciences, including economics, social psychology, and political science. Trust is a concept with many facets and dimensions. In this paper, Prediction Trust Framework based on the evaluation of trust value and Improved PageRank Algorithm will propose for evaluation trust in OSNs (Online Social Networks). This evaluation framework designs to integrate theoretical concepts from the trust literature, social network and helps to other different trust-related problems in OSNs.

Keywords: OSNs, trust Evaluation, Improved PageRank Algorithm, Machine Learning

1. Introduction

With the development in social technology, communication has grown. It is now connect with people across all over the world become easier and cheap to communicate. The distance issue is no longer an excuse for lack of communication. Communication systems have grown from wired devices to wireless devices. The internet has also brought adverse changes in the forms of communications that are available and currently being used. It has led the rise of social networks.

Trust can be very valuable thing in social communication. In society, trust is needed for not only important for people, but also institutions and systems. There is a general wish among contemporary social scientists that social trust is important, for both social and political reasons. Unusually in the increasingly fragmented and specialized academic world, the interest in trust extends across many different disciplines, including sociology, political science, economics, psychology, history, political theory and philosophy, management and organization studies, and anthropology.

However, important to emphasis that concerned with social trust that is interpersonal or horizontal trust between citizens, rather than vertical or political trust between citizens and political elites, or citizen confidence in political institutions. Here, the focus is on relationship patterns and structures of social networks and not on processes through which trust is built. The goal of this framework is to find the ways to utilize the structure of social networks for trust relationships within them and that allows the integration of different trust evaluations type analysis of various aspects of trust in OSNs. If two individuals are not directly connected, a trust inference mechanism makes use of the paths that connect them in the social network, and the trust values along those paths, to come up with a recommendation about how much two persons who are not directly connected might trust one another.

The remainder of this paper is organized as follows: describe the literature review in section 2. Then discuss the concepts of social networks and trust in section 3. Trust evaluation framework is presented in Section 4. At, Section 5 calculate trust prediction. Section 6 also explains results and discussions. At last, section 7 describes conclusion.

2. Literature Review

Nowadays various trust computation methods are available. Many trust evaluation methods have been proposed from different perspectives; however, most of them just quantify certain trust related factors and integrate them into a trust value by setting a weight for each factor. There exist many works on the issue of trust evaluation (some may interpret it as trust inference or trust computing).

A social context-aware trust sub-network extraction model computes to search near-optimal solutions effectively and efficiently using Ant colony algorithm (ACA) heuristic methods [13]. The goal of this result is extracted sub-networks within the same execution time. An improved direct trust evaluation method based on the Leader-Follower clustering algorithm for context-aware trust model [14]. It is tried to solve the problem of data sparsity problem

caused by the diversity of services and contexts. A collaborative filtering algorithm based on matrix factorization and multi-path trust degree fusion that used a method combined the matrix decomposition technique with bias and the trust model in social networks [15]. They were considering the problem of trust computing of multiple paths and non-adjacent case. The main work is the problem of low recommendation accuracy caused by the high dimensionality of data. We-Intention, Moral Trust and Self-Motivation [3] is based on motivational factors. It has been checked Cronbach's α , squared multiple correlations (SMC). Cronbach's α estimates the proportion of the variance in the test score that can be attributed to true score variance. The main work is to examine and analyze the major factors influencing knowledge sharing activity in social collaboration. Dijkstra's algorithm [7], it takes up the most trusted as well as the shortest path for trust inference. Their target is to find the most trusted path in as minimum time of trust calculation.

Trust in OSNs is an important issue and thus is widely studied and implemented. Various methods predict the trust score of source user on target user by propagating trust along trust edges. Needed to find many algorithms to calculate the most trusted path in as minimum time – weight and credit evaluation. In this framework an Improved PageRank algorithm will propose based on time-weight and credit evaluation. This system analysis also suggests that more trusted over trust individuals will give more accurate information than the others.

3. The Concepts of Social Networks and Trust

Social media makes human interaction much more convenient and much faster than real life human interaction, it makes globalization a reality, it gives a chance for introverted people to express themselves, and it also benefit develop international relationships whether its business or social. Social media is any website that allows social interaction. Social media is growing rapidly throughout the world. More adults and teenagers are joining sites such as Facebook, MySpace, and Twitter to interact with friends, family, and strangers. When looking at social media and relationships, there are plenty of people who get upset that their significant other doesn't post about them often enough. There are also those who feel social media is a downfall to their relationship, as it causes distrust between the couple.

"Trust is one of the most important synthetic forces within society". In social science theory as in practical daily life, including life satisfaction and happiness, optimism, well-being, health, economic prosperity, educational attainment, welfare, participation, community, civil society, and democracy, trust is also the center of a cluster. For example, trusting people are healthier and happier in their life and live longer than distrusting people do. And, of course, social trust is a core component of social capital, and is normally used as a key indicator of it, sometimes as the best or only single indicator. If trust is indeed as important as this, then it should be extremely interesting to know more about the origins of social trust.

In Fig.1 describes the four portions of the trust relationships. Trust Information Source, level of Trust in professional relationships, type of trust relationship and properties of trust.

A. Trust Information Source

Trust information in social network contains three main sources.

Attitudes

Like or dislike is an individual's degree for something are represented by attitudes. They have positive, negative or neutral view of some entity. User's interactions are basic for attitudes.

Experiences

Member's perception in people interactions with each other is described by experiences. In peer-to-peer networks, information sources while evaluating trust between nodes in the network are often used for experiences. That is usually quality of rating peer's interactions with other.

Behaviors

Patterns of interactions identify is behaviors and interaction is a main source of behaviors. Trust facets, frequency or change of interaction can be depended on it. Classify and compute trust between members in network can be used these behaviors.

B. Level of Trust in Professional Relationships

There are three basic levels of trust relationships in social network.

Deterrence-based trust

Consistent behavior is depended on Deterrence-based trust and the threat of punishment. Deterrence a step further is taken by Calculus-based trust. This form is based not only in the fear of

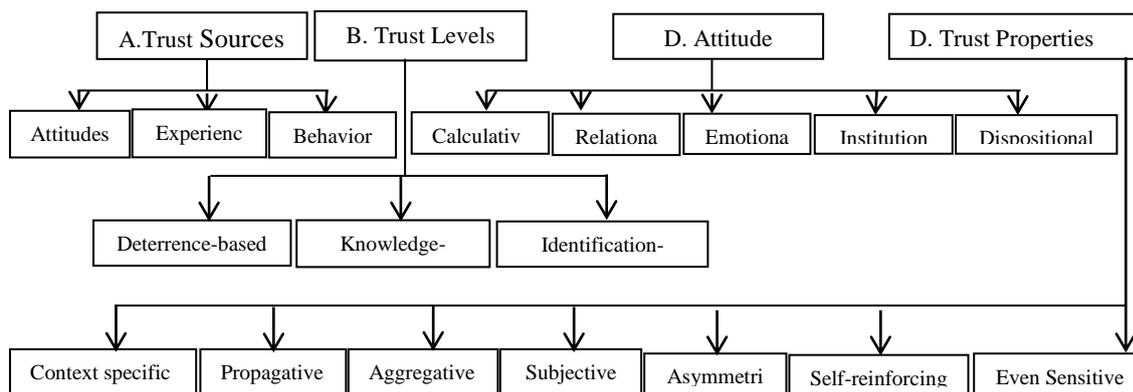


Fig1. Trust Relationships

punishment for violating trust, but also in the rewards for preserving it. Trust is based on a calculation.

Knowledge-based trust

When an individual has enough information and understanding about another person to predict that person's behavior can be occurred by knowledge-based trust. Accurate prediction depends on understanding each other, which develops from repeated interactions, communication, and building a relationship between each other.

Identification-based trust

Based on knowing and predicting another person's needs and preferences are built by Identification-based trust (IBT); Sharing is also need and preferences for IBT. Identification enables users to think, feel and respond like the other person.

C. Types of Trust Relationships

There are many different aspects of trust.

Calculative aspect of trust

In economics, trust can mainly found where the trust is described as a ratio of gain chance to loss chance with the amount of the loss of potential to the amount of the gain of potential is calculative aspect of trust [11].

Relational aspect of trust

This is a repeated interaction between the member and trustee. In computer science, it is also called direct trust because trust is based on direct communications between two others.

Emotional aspect of trust

Security and comfort in relying on a trustee. Between member and a trustee, emotional is an outcome of direct interpersonal relationships is an outcome in psychology.

Institutional aspect of trust

Institution aspect of trust is providing environment, which improves cooperation between users and penalizes misbehaviors. Organizational level and societal level as legal systems are supported that can exist.

Dispositional aspect of trust

A generalized expectation about the trust of other people is developed. That aspect will be developing relational aspect of trust and how the communications between member and trustee on online social network.

D. Properties of Trust

There are different properties in trust. Trust can change with time or be subjective. What kind of trust is being researched and modeled are great influence in determined by this aspect. [11].

Context specific

Scope can context specific in trust. If user A trusts user B as his driver, he will not trust her as his son teacher. User A is trustworthy towards user B in the context of seeing a driver, but not in the context of teacher. It is considered when modeling trust among Facebook user. In that work, there will be considerations about contexts in which trust is found on Facebook. Therefore since this trust is evaluated by interactions on Facebook, that it has Facebook context.

Dynamic

Trust can be changed increase or decrease with time and new experiences, interactions or observations. New experiences are more important than the old ones, which experiences may become irrelevant with time. Modeling dynamicity of trust used difference techniques in computer science. Communication on Facebook calculates trust in a

period of time without tracking its changeability with time.

Propagative

Propagative is a very important property of trust and several works are explored that. Trust is usually propagative for example, user A trusts user B and user B trusts user C, then user A, who does not know user C, can get some amount of trust on user C based on how much user C trusts user B and how much user B trusts user C. Trust information can be passed from one member to another in social network, creating trust chains. That can be explored peer-to-peer algorithms for determining trust among Facebook users, which is one of the most important properties of trust for this system.

Aggregative

One member can have some trust on other member that is not directly connected to it and does not know how to behave when it has several trust change recommending different amount of trusts towards trustee. This information gets from composed to form final trust calculation.

Subjective

In general trust can be subjective. If B is given opinion by A and then subjective is computed from that opinion. The subjective trust nature leads to trust personalization computation, where the user has a direct impact on the computed trust review. This work will not be computing trust from subjective reviews of the users because the trust is interactions between users. However, there will be conclusions about the correspondence of the trust calculated from user interactions of Facebook and user subjective preferences toward other users.

Asymmetric

Trust is typically asymmetric. One member may trust another more than other is trusted back. Differences in people perceptions, opinions and beliefs are occurred asymmetry.

Self-reinforcing

Trust is also usually self-reinforcing. People trust other people usually act positively. Also, if the lowery trust between people it is that they will lead to even less trust on each other will interacting highly unlikely with each other.

Event sensitive

Trust is not only taken a long time to create, but also a one impact event may destroy it completely. That means that trust has event sensitive.

4. Trust Evaluation Framework

Trust is even to see it is not as rather as individuals as a property of society. A core personality trait of individuals, which is not so much trust but individuals participate in, contribute to, or benefit from a trusting culture, or from social and political institutions that encourage the development of trusting attitudes and behavior. According to this system, there is a need for a trust evaluation framework at a network level.

In this paper, a general trust evaluation framework is presented for large scale online social networks, which obtains the overall trust level of the original social network by using Improved PageRank Algorithm.

Fig. 2 depicts the overall structure of our framework, where there are mainly five modules, namely, data collection, extraction, compute Count like, Share, and weight link and then compute rating, calculate Trust and Trust prediction. Data collection module retrieves necessary data records from the target social network and extraction module generate a trust feature for each record. It is served as the data preparation and preprocessing components of the framework.

Compute Count like, Share and compute rating module compute the count for like, share and then compute weight link using Improved PageRank algorithm and compute rating calculate the rating from users.

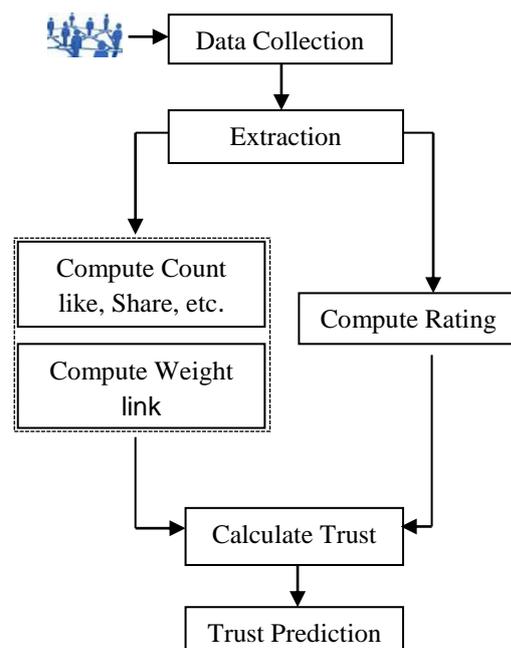


Fig. 2. Trust evaluation framework structure

4.1 Simplified PageRank Algorithm

Compute count for like, and share and weight link by using Simplified PageRank Algorithm.

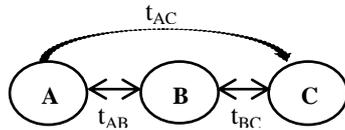


Fig. 3 Trust Relationship between friends A, B and C

In Fig.3, A is direct trust on B and B trust on C because A and B are friends and then B and C are also friends. Moreover, A is indirect trust on C because A and C are not direct friends but A and B are friends and also B and C.

Table 1. Result of link structure

Friends	A	B	C	no. of out links
A	0	1	1	2
B	1	0	1	2
C	0	1	0	1
no. of in links	1	2	2	5

In table 1, show in links and out links from Fig 3. A has in link from B and out link to B and C and also B has two in links and out links to A and C. C has two in links from A and B, one out links to B. The number of out-going links is an important parameter.

4.2 Calculation of Improved PageRank Algorithm

$$PR_j^{(0)} = \frac{2(2I_j + O_j)}{\sum_{k \in R(P_j)} (I_k + O_k)}$$

Where PR = PageRank, I_j = Number of in links, O_j = Number of out links, O_k = total number of in links, O_k = total number of out links. After calculation with Simple PageRank results are below.

$$PR_A = \frac{2(2*1+2)}{1+2+2+2+2+1} = \frac{8}{10} = 0.8$$

$$PR_B = \frac{2(2*2+2)}{1+2+2+2+2+1} = \frac{12}{10} = 1.2$$

$$PR_C = \frac{2(2*2+1)}{1+2+2+2+2+1} = \frac{10}{10} = 1$$

Continuing calculate with Improved PageRank Algorithm after the calculation of Simplified PageRank result.

4.3 Improved PageRank Algorithm

Improved PageRank, a trust network inference algorithm, is used as the basic for generating predictive ratings personalized for each user.

Algorithm1. Pseudocode for Improved PageRank

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Pseudocode for pageRank (G)
Input : let G represent set of nodes
Output : An n element array of PR which represent PageRank
for each web page
1. For i ← 0 to n - 1 do
2. Let A be an array of n elements
3. A[i] ← 1/n
4. d ← some value 0 <d<1, e.g 0.85
5. Repeat
6. For i ← 0 to n - 1 do
7. Let PR be a n-elements of array
8. PR[i] ← 1-d
9. For all pages I such that I links to PR[i] do
10. Let O be the number of outgoing edge of I
11. PR[i] ← PR[i]+d * A[I]/O
12. If difference between J and PR is small do
13. Return PR
14. For i ← 0 to n-1 do
15. A[i] ← PR[i]
    
```

4.4 Calculation of Improved PageRank Algorithm

$$PR_i = (1 - d) + d \left[\sum_{j \in Li} \frac{PR_j}{O_j} \right]$$

d= Damping Factor (0.85)

Table 2. Improved PageRank Result

Iteration	Friend A	Friend B	Friend C
1	0.800	1.200	1
2	0.660	1.281	0.975
3	0.694	1.274	0.986
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10	0.700	1.296	0.998
11	0.701	1.296	0.999
12	0.701	1.297	0.999

Table 2. describe the output results are show descending order for relevance trusted users after the calculation. In this calculation, using Improved PageRank and calculate with above Simple PageRank result. Finally the iteration will be finished when the iterating results are the same.

5. Calculate Trust Prediction

Table 3. Trust prediction result for each user

Friends	PR_{fi}	R_{fi}	$PR_{fi}R_{fi}$
A	1.297	3	3.891
B	0.701	5	3.505
C	0.999	4	3.996

Table 3 described result for individuals user calculated with above weighted result by using Improve PageRank method and rating result, which are given rate from individual user.

6. Results and Discussions

Finally output the trust decision making using with above table 3 result and user rating.

$$R = \frac{\sum_{i \in f} PR_{fi} R_{fi}}{\sum_{i \in f} PR_{fi}}$$

Where R = recommended rating, PR_{fi} = weighted by the trust value from to each friend, R_{fi} = rating from each user.

$$R = \frac{1.297*3+0.701*5+0.999*4}{1.297+0.701+0.999} = 8.72933$$

This value becomes the "Recommended Rating" that is personalized for each user. Aforementioned empirical investigations show asymmetric and also based on knowledge-based trust and dispositional aspect of trust that enough information and understanding to predict about another person, who is how the communications between member and trustee on online social network.

Various methods have been proposed prediction the trust score of source user on target user by propagating trust along trust edges. In those computational settings, trust metrics are emerging as a powerful technique and calculate a recursive search with weighted averages. Computing trust is then ranked based on the rating given by "trustable users", weighted by their trust score. This framework target is to find the most trusted path in as minimum time more possible than other and output trust prediction sorting lists.

7. Conclusion

In this paper, we developed a trust framework that aims to provide an intuitive way to represent the calculated trust. A general trust evaluation framework is also presented for trust evaluation at the network level, which provides the trust network buildup for a given social network. The prototype of framework in real online social network shows the feasibility and high accuracy of trust calculation. This framework will propose for use in all applications where human trust, including difference types of social networks. It is easier to find the most trusted path than other and at the time of trust calculation by using this evaluation framework.

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