

# System to Facilitate Trust for Personalized Recommendations on Social Network

Padmane Chetana<sup>1</sup>, Jadhav Priyanka<sup>2</sup>, Kor Priyanka<sup>3</sup>

<sup>1,2,3</sup> Dept. Of IT., MET's Institute of Engineering, Bhujbal Knowledge City, Adgaon, Nashik (Ms), India

**Abstract**— Now a days, social networking applications becomes more popular and gained a lot of interest because of social media such as blogs, customer review sites etc. Here trust is very important part of social networking from security point of view. In this paper, we introduce a framework for handling a trust for personalized recommendations on social network. This framework is based on reputation mechanism that takes the implicit and explicit connections between the users and gives the personalized recommendations to the users. It provides the positive recommendations for trustworthy users and negative recommendations for untrustworthy users. In order to compute the reputation of each user we use trust properties. Trust is generally calculated based on the users posts rating, likes or dislikes of other users those can be communicated to each other.

**Keywords**—Social Network, Trust, Reputation, Recommendation

## I. INTRODUCTION

Now a days, many people uses Social networking websites or social networking applications[1]. Using this websites many people communicate to each other, share their thoughts, experiences, personal information etc. Because of this, social networking websites gained a lot of interest and use of social networking sites gets increase a lot. That's why social networking applications such as social media, blogs, customer review sites becomes more popular into users and number of users of social applications gets increased day by day. Each social application or social networking websites have their own and unique features in terms of privacy[4], communication forms, tagging or posting something, connections between the users etc[7]. These characteristics should give the information about the user's interactions. For identifying the interactions between the users some analysis techniques are used, such as identification of communities of users, identification of content and collaborative filtering[3]. Users of similar interest are finding out using the identification of communities of users analysis technique[2]. In identification of content technique the contents like a product review, blog, tweet, and post are analyzed. And the last analysis technique is Collaborative filtering which is used for predicting the future items rating based on the users behavior and ratings of other similar users. When users communicate to each other sometimes it may happen that they don't know each other in real life they can't meet each other[6]. They only know each other through websites and network. When they communicate to each other personal information may get exchange between them, this is secure or not that's the main question. So trust becomes more important here.

In general Trust is multifaceted concept. It may be subjective and non-symmetric, dynamic and context-specific. By differentiating the initial work on the user recommender systems for social network do not includes the trust. This paper is focused on the calculating trust and distrust between the peoples to make the decisions about the community members.

In the recommender system our contribution is for providing the trust for the personalized user recommendations in the social networking system. Proposed system makes the use of Explicit and Implicit user connections and captures the users common interest desired from these connections. It is based on the reputation mechanism that rates the user's posts and other user's opinions. For computing the reputation of the members different properties of trust are used such as

transitivity of trust, local rating, collaborative rating, and personalized user recommendations. In social Networking trust is not perfectly transitive but here it is calculated using the communication between peoples [5].

## II. LITERATURE SURVEY

Now a days, social media is become a more popular. So there is a need of social network analysis. Analysis is performed on the basis of contents and links of the users. Trust is handled on the basis of reputation mechanism as well as the implicit and explicit connections between the members of network. According to the results of the trust personalized user recommendations are given to the network members [1].

Relations between the members of network are varies from person to person and community to community. Personalized recommendations of social network includes the consideration of the contents item published by the users and also considers relationship among them which has led to mixed results. Research can be understood on the underlying process of the networks and those processes are affect the preferences of the members [2].

Social recommendations are generated on the basis of collaborative filtering. Collaborative rating considers the personal belief of the user as well as the overall witnesses interacted within the network. Credibility of the witnesses are also considered[3].

Trust is facilitated in E-learning environment to find out most similar as well as trustworthy co-learner. It helps learners to successfully identify good helpers or collaborators. Privacy of the learners is protected using the identity management. Reputation is an important factor to measure trust in e-learning environment. Reputation management, reputation assessment and reputation transformation is also handled in this environment [4].

Make a new friend and keep an old one scenario is considered. Peoples are recommended according to the ranking of the contents. It mostly focuses on the item recommendations. Top ranked items such as reviews, comments, posts etc. positive and negative links are predicted in social network by using the machine learning framework and sociology [5].

Trust is often considered as the belief of the one user in the compassion of the other user to act honestly in opposition to distrust. This trust survey determines the various definition of trust for internet application. It determines the initial trust and also observes the behavior of trustee's. It also updates trust accordingly trustee's behavior [6].

Trust is not faultlessly transitive in social network, it declines along the transition path and it can be communicated between people. It can be generated according to the personal beliefs as well as the related to the members of social network. Social axioms are also considered to form positive and negative edges. Social axioms such as enemy of my enemy are my friend. Slashdot Zoo network is studied which containing the negative links. It showed that the network reveals multiplicative transitivity. Also performs social network analysis on graphs with negative edge weights [7].

## III. PROPOSED SYSTEM

This paper proposes a System to Facilitate Trust for Personalized Recommendations on Social Network. For finding the trust between users the connection between different users in the system is considered, Connections can be Explicit or Implicit. The proposed system is mainly based on three phases which are (Phase 1) User connection formation, (Phase 2) reputation rating estimations and (Phase 3) recommendations generation.

### 1. User connection formation:

Connection is established between the members of the network. Connection is formatted implicitly or explicitly, it can be differentiated as explicit trust between the users that brings the strong trust semantics and implicit trust forms the momentary user connection in network. Trust connection may be categorized in different four categories explicit user to user connection, explicit user to item connection, implicit user to item connection and implicit user to user connection.

**Explicit user-to-user connection:** This type of connection represents permanent bonds between users, in which users form the trust connections by relating another user. Members in the network can maintain and update two lists as friend list and enemy list. Friend list contains trusted users and Enemy list contains untrusted users.

**Explicit user-to-item connection:** In this type of connection users of the network give likes or dislikes or comment to specific item, published by another user. The comments can be thumbs-up or thumbs-down tags or positive or negative ratings and it carries the non-textual contents.

**Implicit user-to-item connection:** In this type of connection item published by user and having unique identifier. It also has one or more hyperlinks that point to other content item.

**Implicit user-to-user connection:** In this type of connection user to user level information is mapped from user to item information and it provides single implicit user to user connection.

The main thing in our system is that we consider the distrust connection yet that are not supported in all social networks.

## **2. Reputation Rating Estimation:**

The reputation rating estimation mechanism measures the trust connection identified in the social network and provides personalized rating. Reputation ratings are collectively formed combining the evaluator's own view on the target user as well as the opinion of number of other members on social network.

There are four reputation rating systems such as local rating, collaborative rating, transitivity of trust and trust aware personalized recommendations.

## **3. Recommendation generation:**

Based on the overall reputation ratings of members as evaluated by the users. The proposed system generates personalized positive and negative user recommendations that form the trust and distrust connections. Positive recommendations are used for connecting to the new users, subscribe the new blogs and share resources in social networking applications. And negative recommendations are used for identifying the untrustworthy users. Both types of recommendations are used in order to update the trust and distrust connections of the users in the social network.

### **A. Architecture**

Trust aware system works on two main components as shown in Figure 1, first is trust and reputation management and another is friend/enemy list recommendations. Reputation is considered according to the posts. Trust is handled based on the reputation as well as three types of rating such as local rating, collaborative rating and transitivity of trust. The second component contains the recommendations, friend list and enemy list. Local recommendations are calculated on the basis of local rating and collaborative recommendations are calculated on the basis of collaborative rating. Enemy list and friend list are generated using the results of ratings.

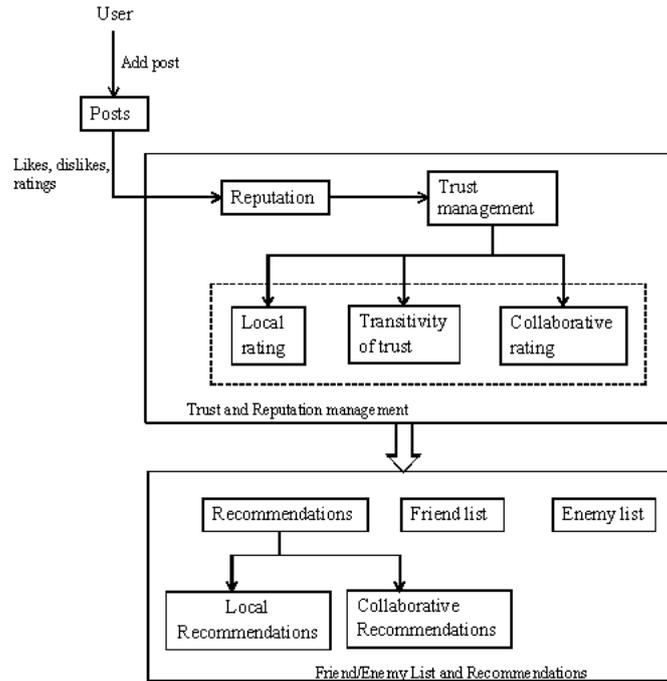


Figure 1: Architecture of System to facilitate trust

### B. User Reputation Rating System Formulation:

Here we assume the presence of  $N$  users  $U=\{U_1, U_2, U_3, \dots, U_N\}$  in network.  $F(u_j)$  and  $E(u_j)$  are respectively denote friend list and enemy list.

Local rating:

Local rating estimation is performed in equally distributed time intervals. The reputation rating from user  $u_j$  to  $u_i$  at the time interval  $t_k$  is given by following formula:

$$\begin{aligned} Rating(u_j \rightarrow u_i, t_k) &= w_{user} \cdot UserConn(u_j \rightarrow u_i, t_k) \\ &+ w_{expl} \cdot ExplConn(u_j \rightarrow u_i, t_k) \\ &+ w_{impl} \cdot ImplConn(u_j \rightarrow u_i, t_k) \end{aligned}$$

As discussed above local rating is estimated by the combination of three factors.

First factor deals with the explicit user to user trust distrust connection. It is lies within the  $[-1, 1]$  range, where a value nearest to 1 shows trust and -1 shows distrust.

Second factor deals with the explicit user to item connections. Rating is calculated on the basis of content items published by the user and total number of opinion expressed by another user. The rating calculated using this type of connection is given by following formula:

$$ExplConn(u_j \rightarrow u_i, t_k) = \frac{PosExpl(u_j \rightarrow u_i, t_k) - NegExpl(u_j \rightarrow u_i, t_k)}{PosExpl(u_j, t_k) + NegExpl(u_j, t_k)}$$

(2)

Third factor deals with the implicit user to item connections and depends on number of links from the content items published by  $u_j$  on the content item published by user  $u_i$ . This type of rating is given by formula:

$$ImplConn(u_j \rightarrow u_i, t_k) = \frac{PosImpl(u_j \rightarrow u_i, t_k) - NegImpl(u_j \rightarrow u_i, t_k)}{PosImpl(u_j, t_k) + NegImpl(u_j, t_k)} \quad (3)$$

Collaborative filtering:

Local rating is performed on the personal belief of the user but in the collaborative rating witnesses of the users is also considered. The overall collaborative rating of user  $u_j$  to  $u_i$  at the time interval  $t_c$  is evaluated using the following formula:

$$CollRating(u_j \rightarrow u_i, t_c) = cred(u_j \rightarrow u_j, t_c) \cdot LocalRating(u_j \rightarrow u_i, t_c) + \sum_{q=1, q \neq i, j}^Q cred(u_j \rightarrow u_q, t_c) \cdot LocalRating(u_q \rightarrow u_i, t_c) \quad (4)$$

In the above formula there is combination of two summands. First is based on direct experiences of the user  $u_j$  and the second represent rating of  $u_i$  as contributed by the Q witnesses.

Transitivity of trust:

Witnesses considered into the collaborative rating are categorized in four categories, namely friends of friends, enemies of friends, friends of enemies, enemies of enemies. Credibility of users are also considered in the transitivity of trust.

Assume that there are P distinct paths having depth d to connect  $u_j$  to  $u_q$  through the witnesses  $u_q$ . The credibility of user  $u_j$  to  $u_q$  at the time interval  $t_c$  having P path is given as follows:

$$cred(u_j \rightarrow u_q, t_c, p) = \frac{1}{n} \cdot cred(u_j \rightarrow u_q(1), t_c) \cdot cred(u_q(1) \rightarrow u_q(2), t_c) \cdot \dots \cdot cred(u_q(n-1) \rightarrow u_q(n), t_c) \quad (5)$$

Trust aware personalized recommendations:

Personalized recommendations are generated on the basis of local rating and collaborative rating. Trustworthy users are added into the friend list and Distrust worthy users are added into the enemy list.

#### IV. CONCLUSION

The previous work done mainly focused on user and item recommendation without studying the trust relationship between them. Due to this, the security of user connection might be disturbed.

Therefore, we recommend a trust aware user recommender system to make connection of social network trustworthy by giving positive or negative recommendation to the users. So that, positive recommendation will help in connecting trustworthy people and negative recommendations will aware users not to connect distrust worthy users. Trust will be calculated using local rating, collaborative rating. Transitivity of trust will be calculated using different formulas.

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