A social recommender system with privacy preserving

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Introduction

P2P social networks are presented to give the users more control of their data and relations. This is due to the decentralized underlying architecture. Several architectures were proposed. They had proved the feasibility of implementing basic social networks features (eg. publish, share, comment …) on top of P2P architectures. Advanced features as social information retrieval and particularly the recommender systems are very hard to implement. This is due to the absence of a central server that has a complete view of the social graph, it constitutes a recent challenge. In this paper, we propose a novel recommender system for P2P social network. The principal objective is to help users to discover the most relevant content shared by their friends.

Decentralized Social Network (DOSN) is a system that provides social network functionalities without central service provider [1]. It uses P2P networks to manage the following aspects [2]:

- Profile storage component which describes how profile data is stored in the system,
- Access control component that can be realized either via access policies, via encryption schemes or a combination of both,
- An overlay or federation component to organize the communication between nodes.

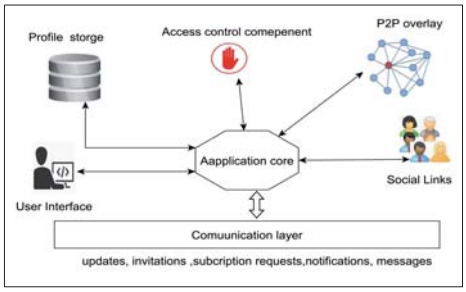


Figure 1. Node functionalities in P2P social network [3]

Recommender systems are the techniques used to propose and recommend relevant content to the users. The recommended content can be a movie, a book, a product in e-commerce platform or a publication in a social network. The recommender systems explore the previous opinions (rating) of users about a given content. They predict a future rating to the new content and suggest the most appropriate to the user.
The recommender systems are classified into: **content based, collaborative filtering and hybrid approaches** [4]
In memory based collaborative filtering: all the ratings are stored in a matrix (Users x Items). The recommender system uses the whole matrix or a part of it to predict new rating. The approaches in this field can be seen as user-based or item-based filtering.

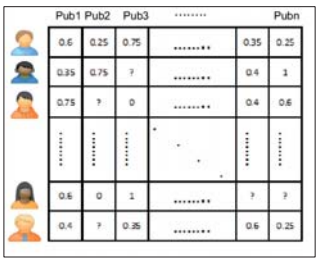


Figure 2. Rating matrix

In P2P social networks, there is no central server to store the rating matrix. The recommendation process is then a big challenge. Our contribution is to design a recommender system in this context.

Proposition

The user who wants to discover the content in his social network, is not obliged to contact all his friends and consults their profiles. The proposed recommender system creates a flow of the most recent and interesting publications posted by the most connected friends.
As shown on figure 3, the user U selects a set of friends and sends to them an update request. Every friend that receives this request will reply with a selected set of publications.
To achieve our goal, we should define some tasks:
-Select a set of friends to the update request.
-Select the suitable publications by the requested friend.

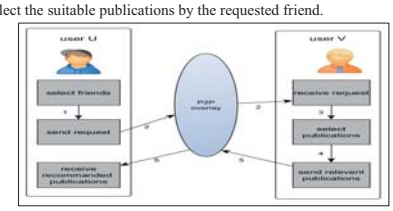
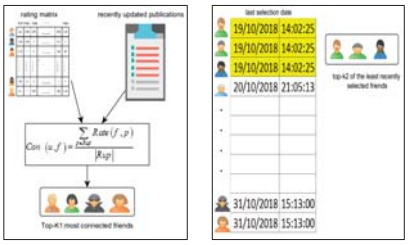


Figure 3. The recommendation process

Friends selection:

- ✓ The users are ordered according to their connection strength . Then, the friends with the strongest connection are chosen (see figure 4.a),
- ✓ For every friend, we store the date of the last selection. Friends are then ordered according to their last selection date (see figure 4.b).
- ✓ The list of the selected friends is the fusion of two lists: top-k1 of the most connected friends and top-k2 of the least recently selected friends.



(a) (b)

Figure 4. Friends selection

Publication selections
The publication are proposed to the user U, if they are well rated by the friends with similar interests to U. So, the first step is to find the most similar friends to U(see figure 5). Then , the opinions of theses friends is considered to find the popular publications (see figure 6, the formula of PopSim)

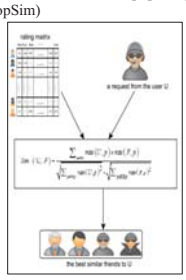


Figure 5. similarity evaluation

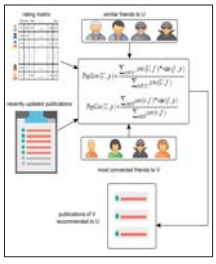


Figure 6. publication selection

Cold start problem: Cold start users have no old rating. Its difficult to find similar friends. We consider the opinion of the most connected friends to find relevant publications(the formula of PopCon in figure 6)

Results

We evaluated the proposed recommender system. Our contribution is the decentralization of the recommendation process. Then, we compare our solution to the central approach.
We observe the following aspects:
-the overlap between the results returned by the compared systems.
-the coverage level: the number of publications covered by the recommender system.

The overlap with centralized algorithm:
It is clear that the decentralized algorithm diverges from the centralized algorithm when the number of friends is important. This is due to the fact that the centralized algorithm recommends publications of all friends and the decentralized use the selected friends only.

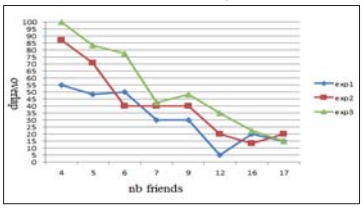


Figure 7. Effect of the friends' number on the overlap level

The coverage level:
The coverage rate is defined as: the number of publications recommended (at least one time) /the total number of publications. It is clear that the decentralized system covers more publications than the centralized one.

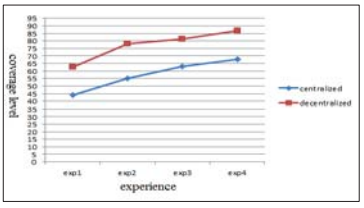


Figure 8. Coverage level

Conclusions

The peer to peer social networks are proposed to improve users' privacy. To achieve this goal, several restrictions were defined. The recommendation quality depends on the information available about users. Our proposition is a trial to design a recommender system without exceeding any privacy constraint.

References

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