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Product Recommendation based on Category Familiarity using Explicit and Implicit Methods

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Abstract - The Research of social recommendation aims at exploiting social information to improve the quality of a recommender system. It can be further divided into two classes. Explicit social recommendation assumes the existence of not only the users' ratings on items, but also the explicit social connections between users. Implicit social recommendation assumes the availability of only the ratings but not the social connections between users, and attempts to infer implicit social connections between users with the goal to boost recommendation accuracy. This paper proposes a unified framework that is applicable to both explicit and implicit social recommendation. We propose an optimization framework to learn the degree of social correlation and rating prediction jointly, so these two tasks can mutually boost the performance of each other. Furthermore, a well-known challenge for implicit social recommendation is that it takes quadratic time to learn the strength of pairwise connections. This paper further proposes several practical tricks to reduce the complexity of our model to be linear to the observed ratings. The experiments show that the proposed model, with only two parameters, can significantly outperform the state-of-the-art solutions for both explicit and implicit social recommender systems.

1. INTRODUCTION

Social recommendation, a study aiming at incorporating social information of users into a recommender system, has attracted decent attention in recent years. It can further be divided into two tracks: explicit social recommendation and implicit social recommendation. In explicit social recommendation, a variety of models have been developed to exploit the existing social network information to enhance the performance of a recommender system. A common and arguably most successful strategy is to integrate the social information, such as trust or friendship, into a collaborative filtering model in a certain way. Figure 1 describes an explicit social recommendation system given edge strength information is available, while Figure 2 shows another kind of explicit social recommender system where only binary relationship information (e.g., whether two people are friends) is available. Suppose there is a rating dataset including some

ratings of four users fU1; U2;U3;U4g to four items fV1; V2; V3; V4g. Such data can be denoted by a matrix where the"?" entries represent unknown ratings. A social-based recommender system reads the matrix together with a given or inferred user social network as the training examples, and then predicts the unknown ratings.

Note that "social recommendation" in this paper does not refer to recommending links in social networks; instead social networks serve as auxiliary information to improve the quality of recommender systems.

The information of the strength of social relationship can be very useful to a recommender system, as it is reasonable to assume people trust the ratings from their closer friends comparing to those from their acquaintances. Given the rating data along with a binary social network, several works of explicit social recommendation have proposed methods to determine the social connection strength between users to enhance the quality of recommendation.

Unfortunately, such trust or friendship data may not necessarily be available for every recommendation scenario due to the budget or privacy concerns. To address such concern, there emerges another research direction named implicit social recommendation, which aims at mining implicit user social relationship from historical rating data for better recommendation. Without any explicit social data, certain methods have been proposed to generate an implicit social network from given ratings. The pseudo links and/or their strengths can then play as a surrogate of the explicit social network to be incorporated into any explicit social recommendation model.

The goal of this paper is to propose a unified framework to accommodate both scenarios described above. Furthermore, it aims to address the following concerns in the existing social recommender systems.

Concerns for explicit social recommender systems:

The quality of the given social information is sometimes questionable. Since most of the social data are collected from the web or social network services, inevitably they contain noises. For example, past empirical studies have shown that the auxiliary of friendship links is less useful than trust links in boosting the recommendation performance. Furthermore, although it is generally believed trust or friendship are positively correlated with the level of common-taste of people, this study has shown that two users may not have similar rating tastes even they strongly trust each other. Thus, directly utilizing any given social connection may harm the recommendation performance.

PROBLEM STATEMENT

Active users rate many items do not really possess similar rating patterns with their friends since active users do not necessary make friends based on interest sharing. It

violates a common assumption in existing social recommendation works that friends share similar preferences. Consequently, this work concludes that explicit social networks are not always beneficial for recommendation.

OBJECTIVE

We propose a unified framework that can be adopted in either explicit and implicit social recommendation Implicit social recommendation attempts to extract latent social relations between two users from the given rating behaviors for that respective category whereas explicit social recommendation use social relationship between friends and ratings in respective category for recommendation.

2. LITERATURE SURVEY

A Probabilistic Model for Using Social Networks in Personalized Item Recommendation

In this work, we aim to bridge the gap between preference- and social-based recommendations. We develop social Poisson factorization (SPF), a probabilistic model that incorporates social network information into a traditional factorization method; SPF introduces the social aspect to algorithmic recommendation. We develop a scalable algorithm for analyzing data with SPF, and demonstrate that it outperforms competing methods on six real-world datasets; data sources include a social reader and Etsy.

Leveraging Decomposed Trust in Probabilistic Matrix Factorization for Effective Recommendation

In this paper, we try to fill in this gap by decomposing the original single-aspect trust information into four general trust aspects, i.e. benevolence, integrity, competence, and predictability, and further employing the support vector regression technique to incorporate them into the probabilistic matrix factorization model for rating prediction in recommender systems. Experimental results on four datasets demonstrate the superiority of our method over the state-of-the-art approaches.

A matrix factorization technique with trust propagation for recommendation in social networks

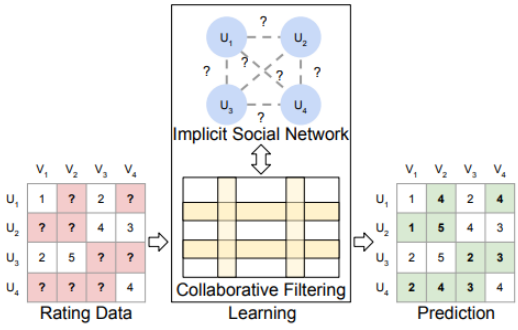
In this paper, we explore a model-based approach for recommendation in social networks, employing matrix factorization techniques. Advancing previous work, we incorporate the mechanism of trust propagation into the model. Trust propagation has been shown to be a crucial phenomenon in the social sciences, in social network analysis and in trust-based recommendation. We have conducted experiments on two real life data sets, the public domain Epinions.com dataset and a much larger dataset that we have recently crawled from Flixster.com. Our experiments demonstrate that modeling trust propagation leads to a substantial increase in

recommendation accuracy, in particular for cold start users.

SoRec: social recommendation using probabilistic matrix factorization

This paper proposes a factor analysis approach based on probabilistic matrix factorization to solve the data sparsity and poor prediction accuracy problems by employing both users' social network information and rating records. The complexity analysis indicates that our approach can be applied to very large datasets since it scales linearly with the number of observations, while the experimental results shows that our method performs much better than the state-of-the-art approaches, especially in the circumstance that users have made few or no ratings.

3. SYSTEM ANALYSIS:



System Architecture

3.1 Existing System

- The quality of the given social information is sometimes questionable. Since most of the social data are collected from the web or social network services, inevitably they contain noises. For example, past empirical studies have shown that the auxiliary of friendship links is less useful than trust links in boosting the recommendation performance. Furthermore, although it is generally believed trust or friendship are positively correlated with the level of common-taste of people, this study has shown that two users may not have similar rating tastes even they strongly trust each other. Thus, directly utilizing any given social connection may harm the recommendation performance.

- However, in the traditional setup, each latent dimension is assumed to contribute equally to the determination of similarity. We argue that this assumption is problematic since the "area of similarity' between every pairs of friends can be very different. For instance, A and B may become friends because they both like watching comedy movies (assuming comedy as one latent dimension), but it does not mean that A and B shall like action movies equally (assuming action represents another latent dimension).

3.1.1 Disadvantages

- Active user's rate many items do not really possess similar rating patterns with their friends since active users does not necessary make friends based on interest sharing. It violates a common assumption in existing social

recommendation works that friends share similar preferences. Consequently, this work concludes that explicit social networks are not always beneficial for recommendation

3.2 Proposed System

- We propose a general social recommender model applicable to the scenarios with or without an explicit social network, as shown in Figure Given an explicit binary social network, our model learns the strength of links from rating data to boost the quality of rating prediction. When the explicit social network is missing, our model learns jointly the existence and strength of social relationships from ratings. Different from most of the previous solutions for implicit social network that treats the learning of the social network and recommendation as two sequential but independent tasks, we propose a Variational Expectation Maximization (VEM) based solution that conducts the learning of social structure and rating prediction together.

- We propose a unified framework that can be adopted in either explicit or implicit social recommendation.

3.2.1 ADVANTAGES

- As will be shown in our experiments later on, efforts spent to determine a common parameter that can be effective in inferring implicit social networks across different datasets are usually futile, thus hinders the effectiveness of such models.

- Experiments show that the proposed solution outperforms the state-of-the-art models in both explicit and implicit scenarios.

MODULES:
Admin:

Admin is main module of application that will check all registered user details of e commerce and OSN users and add products to online shopping site and check product purchase details and recommendation details.

Online Social Network User:
OSN System Construction Module

- In the first module, we develop the Online Social Networking (OSN) system module. We build up the system with the feature of Online Social Networking. Where, this module is used for new user registrations and after registrations the users can login with their authentication.
- Where after the existing users can send messages to privately and publicly, options are built. Users can also share post with others. The user can able to search the other user profiles and public posts. In this module users can also accept and send friend requests.
- With all the basic feature of Online Social Networking System modules is

build up in the initial module, to prove and evaluate our system features.

In this module each user in social network site will have common interested friends who will share similar interests between each user. Given information of
Social structure, we would like to design a collaborative filtering model to automatically learn the underlying pairwise social connections from existing rating data. We hope that such social learning could boost the prediction accuracy of the recommender system.

E-Commerce User:

System Construction Module:

- In the first module, we develop the online shopping website system module. We build up the system with the feature of online shopping. Where, this module is used for new user registrations and after registrations the users can login with their authentication.
- Where after the existing users can send messages to privately and publicly, options are built. Users can view products, purchase products and add to cart. The user can able to search the products.
- With all the basic feature of online shopping modules is build up in the initial module, to prove and evaluate our system features.

User can login in to application either using implicit or explicit manner. In implicit user will login with e commerce details where as in explicit user will login with OSN login details.

Implicit recommendation:
In this recommendation method considering each users purchase details and relating similarity of each user with other user who purchased same product with same rating under same category are considering as profile matched users and based on this recommendations are provided this is inside e commerce there is no social relation between each user.

Explicit recommendation:
In explicit recommendation method social relation between each user in social network is considered as basic feature and relates each users purchase details and based on similarity product recommendation is performed.

4. OUTPUT RESULTS:

Fig 4.1: Home Page

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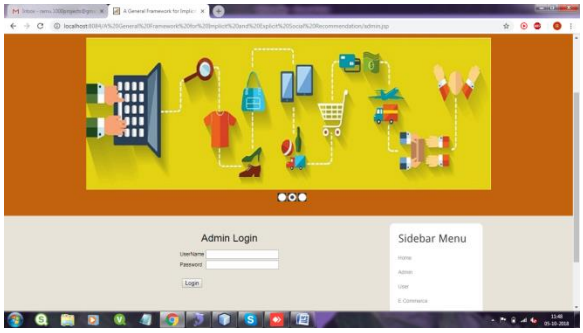

Fig 4.2: Admin Login

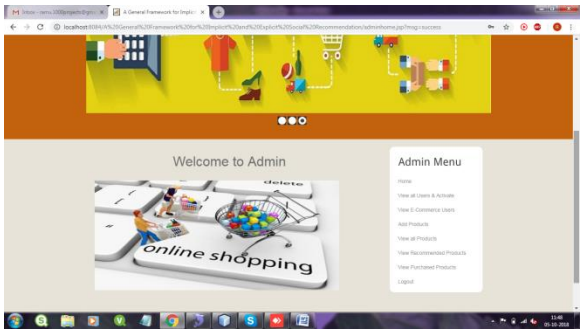

Fig 4.3: Admin Home Page

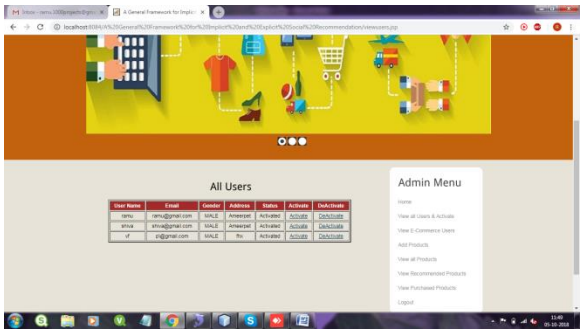

Fig 4.4: View Users page

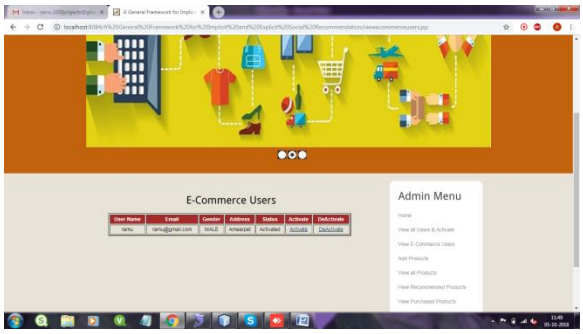

Fig 4.5: View Ecommerce Users

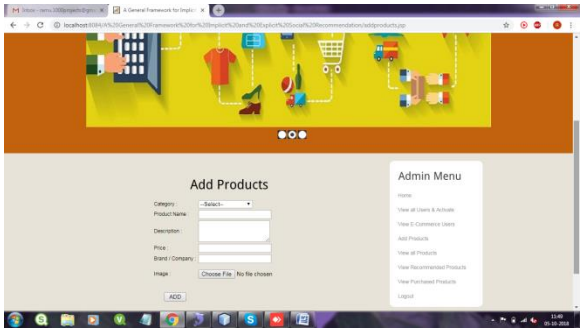

Fig 4.6: Add Products Page

5. CONCLUSION

Probabilistic matrix factorization has been a successful machine learning model toward recommender systems. Based on the social correlation intuition, we propose a new approach to incorporate social network information into probabilistic matrix factorization. We list our contributions again:

Contribution 1: In terms of effectiveness, we successfully build a joint model simultaneously to learn factorized matrices and social network structures. Experiments support that our new approach outperforms previous works that either focus on explicit social recommendation or implement implicit social recommendation in two separate stages.

Contribution 2: Distinct from learning a shared social strength, our work allows learning an individual social strength for each latent factor. We believe that the multi

dimensional social strength learning can benefit the overall recommendation quality.

Contribution 3: In terms of efficiency, to address the scalability problem resulting from fully connected implicit social networks, we propose several practical tricks during the learning process so the complexity can be reduced from quadratic to linear.

Future Enhancements:

Future works consist of two parts. First, we would like to investigate how the content information can be incorporated into the existing model for a hybrid recommender system. Second, we will also consider bringing into our model the temporal information from both social and ratings sides to further boost the performance.

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