

RecExp: A Semantic Recommender System with Explanation Based on Heterogeneous Information Network

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ABSTRACT

In recent years, there is a surge of research on recommender system to alleviate the information overload. Many recommendation techniques have been proposed and they have achieved great successes in many applications. However, the explanation of recommendation results is an important but seldom addressed problem. In this paper, we organize the objects and relations in a recommender system with a heterogeneous information network, which integrates more informations and contains rich semantics. Then we employ a semantic meta path based personalized recommendation model and design a recommender system with explanation, called RecExp. The RecExp system has two unique features. (1) Semantic recommendation. RecExp provides different recommendation models to comply with users' requirements through setting of meta paths. (2) Interpretive recommendation. Under a hybrid recommendation model, RecExp provides the explanations for the recommendation results.

Keywords

Recommender Systems; Heterogeneous information network; Recommendation explanation

1. INTRODUCTION

Recently, recommender systems have attracted much attention from multiple disciplines, and many techniques have been proposed to build recommender systems. However, these techniques only focus on the accuracy metrics, they seldom care about the explanation of recommendation results. As we all known, good explanations could help inspire user trust and loyalty, and increase satisfaction. Recommen-

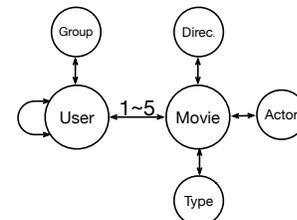


Figure 1: Network schema of HIN constituted by douban movie recommendation.

dation explanation makes it quicker and easier for users to find what they want, and persuade them to try or purchase a recommended item [4].

In this paper, we develop a **Recommender** system with **Explanation** (called RecExp). Inspired by the recent surge of heterogeneous information network (HIN) [1], we organized the objects and relations in a recommender system as a HIN. Fig. 1 shows such an example in movie recommendation. The HIN not only contains different types of objects in movie recommendation (e.g., users and movies) but also illustrates all kinds of relations among objects, such as viewing information, social relations, and attribute information. Moreover, two objects in a HIN can be connected via different paths, called meta path [3], and different meta paths have different meanings. So we can find the similar users of a user through different meta paths connecting these two users, and then we can combine the recommendation results of different similar users under different meta paths. Based on this idea, we design the semantic recommender system, RecExp, with explanation, which has the following two significant features:

- Semantic recommendation. Utilizing different meta paths, RecExp can find different similar users, and thus generate different recommendation results according to these similar users. Moreover, these meta paths correspond to different recommendation models, so RecExp can realize semantic recommendation through selecting proper meta paths.
- Recommendation explanation. RecExp utilizes semantics and weights of meta paths to present personalized recommendation explanation, which can reveal user preferences and make explanation more persuasive.

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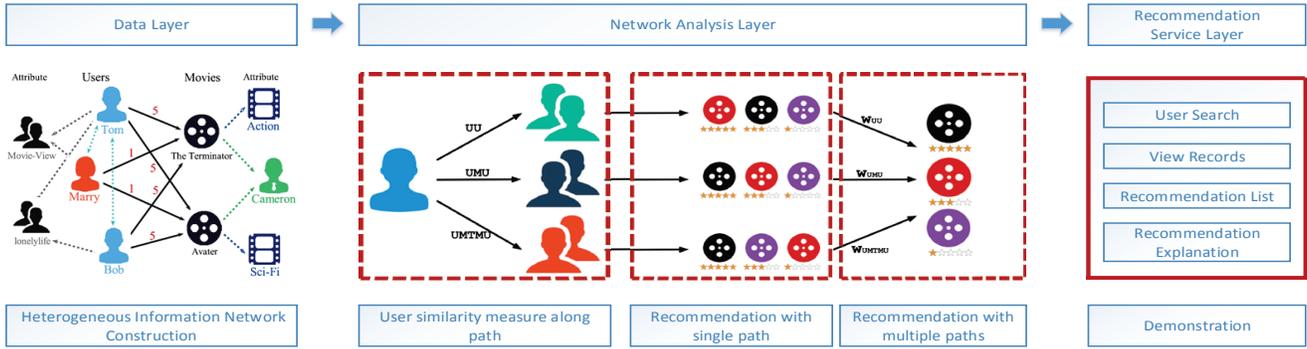


Figure 2: The architecture of *RecExp* system.

2. SYSTEM FRAMEWORK

Fig. 2 shows the system architecture. The three main components are detailed as follows.

- Data layer: it extracts data from different data sources (e.g., database and web) to construct a HIN.
- Network analysis layer: it analyzes the HIN and provides the recommendation services. It first computes the similarities between users along different meta paths, such as “User-Movie-User”. And then, based on similarity of users, we find the similar users of a target user under a given path, and the predicted rating score of the target user on a movie can be inferred from the rating scores of these similar users on the movie. Under different meta paths, there are different predicted rating scores. Through the weight learning method, we assign each meta path with a preference weight for each user, and the final predicted rating under all meta paths can be the weighted average of predicted rating under each meta path. More technique details can be found in our work[2].
- Recommendation service layer: it provides the succinct and friendly web interface of recommendation services. The recommendation services include five kinds of semantic recommendations, hybrid recommendation with explanation, and the view record for the searched user.

3. DEMONSTRATION

In this part, we will show the two major components of the *RecExp* system. For more details, please visit our introduction video at <https://youtu.be/-AjdS7vedAI>.

- Recommendation functions: there are six recommendation function buttons in Fig. 3. Each function button represents a typical recommendation model through selecting a meta path. For example, the collaborative filtering corresponds to the UMU path. The description of the selected recommendation model is detailed under the button box. For example, if you press the “Hybrid recommendation” button, the below panel will show “Recommendation based on hybrid information, such as movie content and social relation”.
- Recommendation explanation: the function will be invoked when the “Hybrid recommendation” function is selected. Fig. 4 shows the details of the explanation. Since the hybrid recommendation generates the results through multiple meta paths, the fan chart shows the weights of each meta path which can represent the user preference on these paths. The larger the weight is, the more the user prefers to get recommendation from the correspond-

ing meta path. On the right of the fan chart, it shows three most important meta paths and corresponding explanations. In each explanation, we display the three most similar users with the target user based on corresponding meta path.

- Hybrid recommendation
 - Collaborative recommendation
 - Content recommendation
 - Member recommendation
 - Location-based recommendation
 - Social recommendation
- Recommendation based on the users who have the same view records with you

Figure 3: Recommendation Functions.



Figure 4: Recommendation Explanation.

4. CONCLUSION

Based on the heterogeneous network, we designed a novel recommendation system: *RecExp*. The *RecExp* system has two unique properties: semantic recommendation and interpretable recommendation. The demonstration on the real-world movie data set validates its effectiveness.

5. ACKNOWLEDGMENTS

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