

An intelligent movie recommendation system through group-level sentiment analysis in microblogs

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ABSTRACT

The emergence of the online media sharing sites (e.g. Youtube, Youku, and Hulu) have introduced new challenges in program recommendation in online networks. However, there is a bottleneck that the amount of available viewing logs and user friendship networks are too limited to design effective recommendation algorithms. Thus, carrying out an intelligent program recommendation system is important for these sites. In this work, we propose a novel model which turns to the social networks and mine user preferences information expressed in microblogs for evaluating the similarity between online movies and TV episodes. To the best of our knowledge, it is the first effort to bridge the gap between movie and TV watchers domain with social network activities. Moreover, it is the first approach that can solve the “cold-start” problem in movie and TV recommendation system. Series of data mining approaches and social computing models have been adopted in this work. Similar programs found from the social network are further used to suggest programs in other media devices. This work can be easily applied in online media streaming sites in order that intelligent recommendations of programs can be made to the customers through mining microblogs.

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1. Introduction

The development of Web 2.0 technique and ubiquity of user generated content (UGC) within the web has enriched the available information we can acquire from the Internet, which in turn makes it possible for us to mine from the web series of valuable knowledge, which is unavailable before Web 2.0 era, for many industries. Especially, online movie and TV episodes streaming site is one representative field among them. Recently, the rapid development of media streaming, storing techniques has turned the online movie/TV program streaming system an alternative media towards traditional TV sets, where viewers can select to watch a program from a huge database including traditional TV channels as well as huge amount of online video streams at unprecedented level. Although it provides users much more choices to watch, it brings many challenges [1].

Firstly, the development of film industry and the huge amount of UGC have brought these online movie streaming sites large

amount of programs including pay-per-view movies, TV episodes, etc. With these techniques, users have the opportunity to choose what to watch from a program warehouse at unprecedented level. However, the explosion in number of TV episodes and movie programs has led to a great difficulty for each individual watcher in choosing a favorite program (resp., TV episodes¹) [1]. To remember or choose a channel from numerous options has become a challenging task. In such background, personalized suggestion of program in these sites [2–7] has become an appealing research direction.

Secondly, traditional recommendation systems such as collaborative filtering technique, which is popular in recent e-commerce websites, is based on two factors: plenty of historical records where user preferences can be learned from, and user friendship networks where recommendations can be made by learning from the viewing logs of their friends who share similar interests. However, as online movie streaming sites may suffer from both limited user friendship networks and viewing logs, state-of-the-art collaborative filtering technique cannot be applied in this setting.

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¹ <http://www.nielsen.com/us/en/insights/news/2014/changing-channels-americans-view-just-17-channels-despite-record-number-to-choose-from.html>

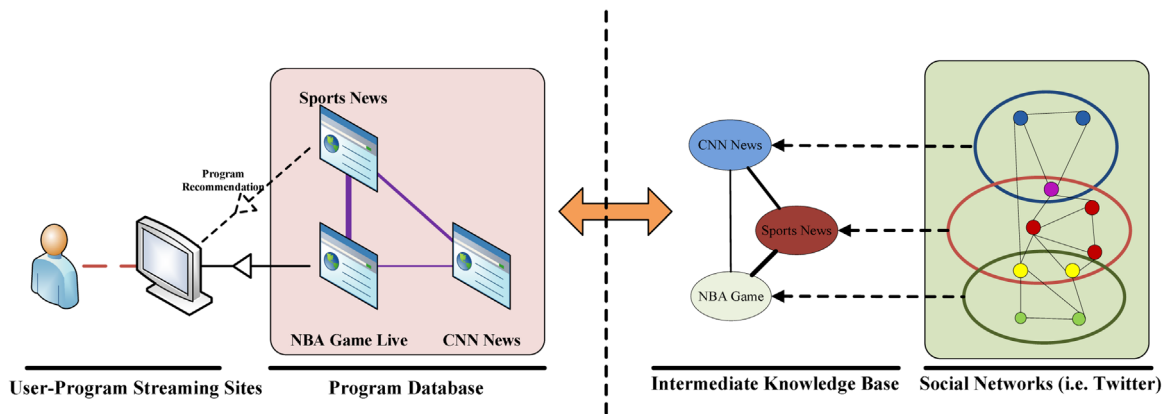


Fig. 1. Motivating scenario of KBridge.

Fig. 1 shows a motivating scenario. Assume that John is watching NBA live game when suddenly it comes to a break or half-time. The online movie streaming system may decide to recommend him to see something else during the break. There are two other programs in the program warehouse, which one should be recommended? The system has limited knowledge about the relationship between the contexts of different programs. They cannot accomplish this task alone. In fact, traditional TV and movie watching is known and understood to be an intensely social activity, which is shown in the following senses. On the one hand, people watch programs together, commonly but not exclusively in the same room. On the other hand, people talk about TV episodes, discussing and recommending programs via many communication channels such as face-to-face, phone conversation, messaging, posting, and etc. To discover which channel a user may be interested in as well as what their friends are watching have caught attentions from many researchers.

With the ubiquity and popularity of online social networks, there are an increasing number of opportunities for people to discuss their offline watching behavior with others through these new online media. For instance, users may explicitly or implicitly express what they have watched, enjoyed, or bought through social networks such as Twitter [8–11], Facebook [12,13] and Youtube [14–17]. These social networks have provided us enough information about user preferences and their interests which can be used to solve the aforementioned challenges [18,19]. In order to help people choose what program to watch in the light of enormous movies and TV episodes, we propose a new model, namely KBridge (Knowledge Bridge between movie/TV programs and social computing), which exploits the connections between people involved in movie/TV programs using knowledge from social networks. However, there exist several main challenges in the task. Firstly, intelligent program recommendation system is still in a “cold-start” stage, thus identification of user and extraction of user group on program watching domain are required. Secondly, due to the privacy issue social network communication data are always anonymous that we cannot identify the exact identification of each user in social network domain. Finally, user communication in social network domain contains heterogeneous unstructured information (i.e., plain text, video, and image), which makes the data mining efforts more challenging.

In this paper, we turn to some other knowledge base such as Social Networks (i.e., Twitter and Youtube) where people form different communities, each one of which represents a group of fans for a specific program. Hence, it is possible to identify and evaluate the communication and distance between such communities. In this way, the relationship between different programs in social network domain can be found as shown in the right part of Fig. 1, based on which we may further make recommendations in movie/TV programs domain.

For instance, we may suggest John to watch Sports News during the break. KBridge explores the in-depth connection among contents, thus can be used in the following usage scenarios:

- From a specific program, find other similar program according to the program-wise association rules.
- For specific user group, find the best program to recommend.

To the best of our knowledge, this is the first approach that matches the user communication in social network domain with that in online movie streaming system domain, and utilizes social network information and social computing models in movie/TV program recommendation task. To be more specific, our contributions in this work can be summarized as follows.

- We propose a model to identify discussion groups in microblog that are correlated with a given topic (i.e., a specific TV episode or movie).
- By investigating the correlation between groups of users in microblog, we propose a novel sentiment-aware association rule mining algorithm, which utilizes the sentiments expressed in microblogs to identify frequent program patterns and deduce the association rule of movie/TV programs. Through this way, we can overcome the second limitation, namely “cold-start” problem. To the best of our knowledge, this is the first effort that bridges the gap between user activity in program watching domain and social network domain.
- Moreover, our proposed model is generic in the aspect that, not only plain text, but also other unstructured information within social networks can be utilized.
- We propose a prediction model utilizing a series of prior information, such as program view logs, program metadata similarity, and social-aware frequent program patterns, to predict the future view logs for an arbitrary program. Through this model, we address the first limitation proposed in the beginning of this section.

The rest of this paper is organized as follows. We present a brief review towards the related work in Section 2. In Section 3 we present the overview about the system. Following that, Section 4 describes the problem formulation and the solutions. Exhaustive experiments conducted over real-world networks in Section 5 demonstrates superiority of our model comparing with series of baseline algorithms. In the final section, the conclusion is made and more discussions are put together for future efforts.²

² To facilitate our discussion, we refer to movie and TV episodes as program in the followings.

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