

# Using Social Tags and User Rating Patterns for Collaborative Filtering

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## ABSTRACT

The overwhelming supply of online information on the Web makes finding better ways to separate important information from the noisy data ever more important. Recommender systems may help users deal with the information overloading issue, yet their performance appears to have stalled in currently available approaches. In this study, the authors propose and examine a novel user profiling approach that uses collaborative tagging information to enhance recommendation performance. They evaluate the proposed hybrid approach, illustrated in the context of movie recommendation. The authors also empirically evaluate various existing recommendation approaches (in comparison with the newly proposed approach) using sensitivity analyses to investigate the potential use of varied user rating or tagging patterns to improve recommendations accuracy. The results don't just indicate the effective and competitive performance of the suggested approach, but they also suggest important implications and directions for further research, including the potential associated with applying multiple recommendation approaches within a single system based on the different rating or tagging patterns of the user.

## KEYWORDS

Collaborative Filtering, Collaborative Tagging, Movie Recommendation, Recommender Systems, Social Tag, User Profile

## 1. INTRODUCTION

The Internet represents one of the most important and frequently accessed media in information search and commerce, but the amount of data on the Web has been growing far more rapidly than any consumer can process. In this environment, the advance of information technology has fostered the development and proliferation of various types of services that may assist navigators in separating valuable information from nuisance data, or help potential consumers find their desired products or services among a wealth of options available on the Web. Among the services, recommender systems have become perhaps the most popular and successful aids by selecting the significantly smaller number of options or items that should be of greater interest to users. While search engines

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and portal sites are also widely used by users, they suffer limitations when they attempt to narrow the number of choices or provide prioritized, quality information (Adomavicius & Tuzhilin, 2005; Wei, Shaw, & Easley, 2002).

Among various techniques introduced in prior studies, content-based, collaborative-filtering, and hybrid methods are the three most popular recommendation approaches. The type of a recommender system's approach is determined based on the way that profiles of items or users are created and they are used in the system to generate recommendations. For profiling users, a content-based approach relies on the contents of the items that the given user has previously consumed, and recommends those items whose contents best match with those of the user. A collaborative-filtering approach consults the ratings of other users whose tastes are similar to those of the given user and recommends items that the similar users have liked. When content-based and collaborative-based approaches combine, the resulting approach is categorized as a hybrid approach (Adomavicius & Thzhilin, 2005).

Contents that help create user/item profiles vary depending on the type of recommended items and the relevant features that are available. For example, in their study of movie recommendation systems, Alspector, Kolcz and Karunanithi (1998) use a movie category (e.g., drama), director, movie length, history of winning academy awards, and other such features to develop variants of content-based recommendation systems. On the other hand, Meteren and Someren (2000) use a set of terms gathered from web documents for profiling each web document and recommend those documents with profiles that match better with a user's interests. Besides the aforementioned, item/user profiles can be built based on any relevant content to recommended items such as specifications of products (e.g., MP3 player), descriptions of services (e.g., travel package) or more. Recommendation systems can be applied in many different areas, even outside the e-commerce domain, such as Business Process Modeling where recommendation systems can play a great role in constructing more precise process models by recommending best fitting process fragments to a model (or to its designers) (Koschmider & Oberweis, 2014; Hornung, Koshmider, & Oberweis, 2007).

In prior research, many researchers and practitioners have attempted different approaches to improve the recommender system's performance in their domains, mainly by searching for more efficient use of available item features or developing more effective algorithms. However, many of the studies only raise doubts of the possibility of improving performance over those well-known approaches (e.g., collaborative filtering) with little contribution. Recommendation system's performance may have been stalled for several reasons. For content-based recommender systems, one of the reasons might be that most of the studies attempt to utilize only the easily accessible item features that have already been used exhaustively in the same way in prior studies. Or, for collaborative-filtering based systems, we can probably explain the stalled performance with the limitations that are inherently possessed by user ratings, the data used by most systems, since ratings of similar users or even a single user's rating for an item can be varied or inconsistent by context or time. Different studies support our reasoning and thought on the need for more various sources of data. For example, Ralph and his colleagues (2006) argue that improving heuristics in artificial intelligence may be less useful than increasing the diversity of information. Rajarajan (2008) also agrees that even very simple heuristics that apply more diverse information can improve on the performance of better algorithms. In addition to the studies, there are other studies that also support our thoughts on the limitations of simple user ratings, arguing that different rating patterns of users (or variances in users' expressions of taste for items) lead to the poor performance and sluggish improvement of recommendation systems (Adomavicius, Kamireddy, & Kwon, 2007; Jin, Zhai, & Callan, 2003). In other words, discovering another useful and independent source of information that reflects user preference more accurately by properly considering and interpreting rating patterns of users might be critical for improving recommendations performance. For the reason, researchers have attempted to seek new and effective data sources that better reflect the user tastes, and the collaborative tagging data (or social tags) is one of them. However, although the collaborative tagging has once drawn attention in the IS community (Peng, Zeng, Zhao, & Wang, 2010; Cantador, Bellogin, & Vallet, 2010; Htun & Tar, 2014), the

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