論　文　の　要　旨

題　目　　　　　Personalized Recommendation Algorithms with Collaborative Filtering
　　　　　　　　（協調フィルタ方式による個人への物件推薦アルゴリズム）

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An explosive growth of information on the web, converted universe into a global village. While searching, getting the relevant information from the internet may not be possible for several times. The large growth in the amount of available information, the growing number of visitors to World Wide Web and the limitations of search engines create many challenges for recommendation systems. Personalized Recommendation Systems may be used to get relevant information from the internet. Recommender System is to generate significant recommendations to a collection of users for items or products that might interest them. This is a powerful new technology for extracting additional value for a business from its user databases and help users find items they want to buy from a business. Recommender systems real world examples are amazon.com (for books) and netflix.com (for movies). Thus the objective of Recommender System is to generate recommendations. Collaborative Filtering uses the known preferences of a group of users to make recommendations or predictions of the unknown preferences for other users. The fundamental assumption of Collaborative filtering is that if two different users rate 'n' items similarly, or have similar behaviors and hence will rate or act on other items similarly. Collaborative filtering is a widely used technique for information filtering in personalized recommendation systems and one of the important techniques which predicts the interests of a user by collecting preference information from many users.

The Collaborative Filtering models can also hold with the situations where user

profiles are supplied by observing user interactions with a system and dealt with user profiles that are obtained by requesting users to rate information items. Broadly, they are classified into (i) Memory-based Collaborative Filtering techniques such as the user-based, item-based and neighborhood-based Collaborative filtering algorithm; (ii) Model-based Collaborative Filtering techniques such as Bayesian belief nets, Clustering, Singular Value Decomposition (SVD) and MDP-based Collaborative filtering and (iii) Hybrid Collaborative filtering techniques such as the Content-boosted Collaborative Filtering and Personality Diagnosis.

In memory-based CF technique, User-based collaborative filtering systems depend on item rating predictions. The process of considering items to a user is based upon the opinions of people with similar likes or dislikes. Recommender systems helps to users to overcome information overload by providing personalized suggestions based on a history of a user's likes and dislikes. Memory-based CF techniques such as the User-based, Item-based CF techniques, Neighborhood-based CF computes similarity between users or items, and then uses the weighted sum of ratings or simple weighted average to make predictions based on the similarity values. Pearson correlation and vector cosine similarity are commonly used similarity calculations, which are usually conducted between co-rated items by a certain user or both users that have co-rated a certain item. To make top- N recommendations, neighborhood-based methods can be used according to the similarity values. Memory-based CF algorithms are easy to implement and have good performances for dense datasets. Memory-based CF algorithms drawbacks are dependence on user ratings, decreased performance when data are sparse, new users and items problems, and limited scalability for large datasets.

Model-based CF on imputed rating data and on dimensionality-reduced rating data will produce more accurate predictions than on the original sparse rating data. The development of models can allow the system to learn to recognize complex patterns based on the training data, and then make intelligent predictions for the collaborative filtering tasks for test data or real-world data, based on the learned models. Usually, classification algorithms can be used as CF models if the user ratings are categorical, and regression models and Singular Value Decomposition methods and be used for numerical ratings. Model-based CF techniques need to train algorithmic models, such as Bayesian belief nets, clustering techniques, Singular Value Decomposition or MDP-based ones to make predictions for CF tasks.

Hybrid CF techniques combine CF methods with other recommender systems to alleviate shortcomings of either system and to improve prediction and recommendation performance. Every prediction technique has its own strengths and weaknesses; there is a need to combine different prediction techniques to increase the accuracy of recommender systems. The idea behind hybrid prediction techniques is that a combination of algorithms can provide more accurate recommendations than a single algorithm as disadvantages of one algorithm can be overcome by other algorithms.

Most recommender systems use Collaborative Filtering methods to predict new items of interest for a user. While both methods have their own advantages, individually they fail to provide good recommendations in many situations. Incorporating components from both methods, a hybrid recommender system can overcome these shortcomings by Combine the information.