RTrust, A simple trust inference method for memory-based CF recommenders (/trust based similarity)

## Introduction

Most recommendation system employs Collaborative Filtering method to make predictions. The preferences of the similar users are aggregated to predict a personalized recommendation [huang]. The intuition is that users who had similar preference would have a similar presence in the future. Most common form similarity measure used in recommender system is Pearson correlation. In addition to the use of rating similarity, incorporating various aspects of social relationship among the users have proven to increase the performance of the recommender.

Most common problems that effect performance of recommender systems include cold-start, data sparsity. Cold start refers to the problem where recommender fails to make a prediction for a user since user has not rated any/enough items [huang, Schein et al. 2002

]. In most real-world data set users only rate few items. The sparseness makes it difficult for making prediction with items with very few or no rating. In order to alleviate the problem, CF researches often use the trust relationship among the users.

Unfortunately, not many real-world data sets provide trust information. In this paper, we aim to tackle the trust inference problem in simple star rating data. The rest of the paper is organized as follow. The related work section explores the background of incorporating trust in recommenders found in the literature. Next, we propose details the problem and discusses our model. In the experiment and result section, we compare the performance of the proposed with the baseline method. We have chosen, O’dnonvan’s item-trust-profile as baseline method, since we draw motivation for the proposed model from his model.

Related Work

Similar to traditional brick-and-mortar businesses, trust plays a vital role in the success e-commerce business [Trust worthiness in ecommerce 4, 5, 13]. Incorporation of trust

Most CF literature assumes the implicit meaning of trust without a definition, thus, there is no room for argument. In this work, we borrow the definition of trust form sociology research. Gamabata[1982] states *Trust as the subjective probability by which an individual,* A*, expects that another individual,* B*, performs a given action on which its welfare depends*

Odnovan [] proposed a method based on recommender’s contribution to prediction accuracy. Higher contribution to the accuracy, trust between two users are higher. Similar to our approach, Resnick formula is used to calculate the predictions. The algorithm defines [alpha] contribution threshold to filter the (closest users). Similar to many other similarity measures, [alpha] does not accounts for the degree of agreement, it’s merely a distance measure of trust. In contrast, our model measures the degree of agreeableness using a similar method.

Li et. al [Yung-Ming Li] improvised O’dnovan’s model by including preference similarity, recommendation trust, and social relations into the recommendation algorithm. In their recommendation trust analysis module, trust is calculated exactly as O’dnovan proposed model. Therefore, we argue that replacing their trust module with ours would increase the performance of the recommender.

Preliminaries and Model

Let be users and be the item and the rating represents ’s evaluation on . The predictions are calculated using Resnick formula as in Eq.1

where is the predicted rating of item j for the user u. and are the mean ratings of user u and v respectively. The similarity between u and v is using the Pearson correlation given by:

Trust between user u and user v can be calculated as the ratio of agreements in co-rated items as in the following equation

where , k is the upper bound of the rating value (often 5), Ia and Ib are user a and b’s rating vector respectively. Trust value is in the range of [0,1] where 0 means no trust and 1 is completely trust worthy. In contrast to using predication accuracy most trust inference methods that uses rating as primary source trust [odnovan], this method takes into account of expectation drawn from past agreement. However, this trust inference method counts the non-co-rated items. If any two users have no common item, then the trust between them is 0, and it is very common to find user pairs who do not have common item ratings.

We address this issue by searching the trust matrix for common user of user’s immediate friends. Take the most reliable friend and assign new trust value by discounting the friends trust value. If there is more than one max value, one is chosen randomly. Similar to Film trust, a breadth search first can be utilized to fill the rest of the trust matrix. Since the trust values are in the range of 0-1, the values can be multiplied along the path.

algorithm 1

Get number the co-rated item positively co-rated items and negatively co-rated items

Experiment and Result

We use publicly available movielense one million data set and .. to test the performance of the propsed method. We compare our results with two baseline method HUI [Quasi] and Odvan’s method.

Huang, Applying Associative Retrieval Techniques to Alleviate the Sparsity Problem in Collaborative Filtering

Quasi, An effective recommender system by unifying user and item trust information for B2B applications

Yung-Ming Li ⁎, Chun-Te Wu, Cheng-Yang Lai , A social recommender mechanism for e-commerce: Combining similarity, trust, and relationship