Group Recommender System using Matrix Factorization Technique for Book Domain

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Abstract− A recommender system helps users to select the desired items by analyzing the user's habit of interacting with the system. Recommender system also help the group of users for selecting items due to information overloads. Group Recommender System (GRS) is designed to identify all preferences within a group. An aggregation strategy is needed to accommodate all user preferences in a group. GRS is required in many cases, for example in the book domain, a bookstore recommends a list of books through a display for a group of visitors. We design a GRS for the book domain using Matrix Factorization technique. We utilize three methods to design GRS, such as After Factorization (AF), Before Factorization (BF), and Weighted Before Factorization (WBF). These three approaches were applied to three different group categories, i.e., small groups, medium groups, and large groups. We aim to find the best approach for each group category in this research. The evaluation metrics used are precision and recall in building this GRS. The results of this research indicate that a small group is suitable for using all three approaches, AF methods is the best approach methods for medium groups, and the best approach method for large groups is WBF.

Keywords: Group Recommender System, Matrix Factorization, After Factorization, Before Factorization, Weighted Before Factorization

1. INTRODUCTION

Data on the internet is huge and continues to increase along with the number of internet users [1]. However, not all data available on the internet can be used or provide satisfactory results for the user [1]. To overcome this problem, a recommender system has been developed to assist users for selecting required items, where the recommended items are retrieved from a database that contains a very large set of items [2]. A recommender system is a type of information filtering system that is used to predict the rating or preference a user will give to an item [3]. Recommender systems are applied to various products and services on the internet, for example movies, videos, music, and social media [2][4]. The recommender system provides personalized item recommendations by analyzing the user's habits of interacting with the system [5]. However, there are conditions where a recommender system is needed to recommend an item to a group of users who have different preferences, so that a recommender system for groups is also an issue that is equally important to address [6].

Many e-commerce platforms utilize recommender systems to optimize their operations, and one of the most commonly employed paradigms for constructing these systems is Collaborative Filtering (CF) [7][8]. CF recommendations are founded on the principle that a user is likely to appreciate items favored by another user who shares similar preferences. This approach leverages the (implicit or explicit) feedback provided by each individual user to suggest items that are popular among users with comparable tastes [9][10]. The widespread adoption of these implementations has propelled the field of recommender systems, resulting in the development of faster and more precise recommender systems [11]. Numerous conventional CF techniques rely on the foundation of Matrix Factorization (MF) [12].

Group Recommender System (GRS) is a model that integrates all preferences of group members [6][13]. To design the model, an aggregation strategy is used that fits the needs of the group [6]. GRS is more complicated than individual recommender systems [14]. Some examples of problems that require GRS include watching movies together, choosing tourist destinations together, choosing radio stations together, and choosing music together [8]. Many studies discuss the recommender system for the book domain. One of these studies utilizes the Convolutional Neural Network (CNN) algorithm in building a recommender system [15]. This algorithm is used because it can overcome the problem of data sparsity. GRS is also needed in the book domain, for example, a bookstore increases sales by displaying book recommendations on the LCD by looking at nearby customer preferences. Based on these problems, we created a GRS with a book domain. We designed the GRS using the Collaborative Filtering (CF) paradigm with the Matrix Factorization (MF) method.

Collaborative filtering plays a crucial role in enhancing the recommendation environment through the utilization of matrix factorization (MF) decomposition technology, which has been proven to be one of the most effective recommendation strategies. However, despite its success as a method employed in recommendation systems, SVD-based methods encounter the issue of data sparsity, resulting in inaccurate prediction of ratings. R.Barathy., et al. [16] built a recommendation system using the CF paradigm with the MF method optimized using the SVD method.

We conducted this research with the aim of building an accurate GRS to recommend an item using the MF paradigm CF method with three approaches, i.e., After Factorization (AF), Before Factorization (BF), Weighted Before Factorization (WBF) to be applied in various group categories. In this study, we specifically focus on the