

An effective recommendation framework for personal learning environment using learner preference tree and GA

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Abstract— Personalized recommendations are used to support activity of learners in the personal learning environments and this technology can deliver suitable learning resources to learners. This paper models dynamic and multi-preference of learners using multi-dimensional attributes of resource and learner' rating by data mining technology to alleviate the sparsity and cold start problems and increase the diversity of recommendation list. The presented approach has two main modules: explicit attribute-based recommender and implicit attribute-based recommender. In the first module, learner preference tree (LPT) is introduced to model interests of learner based on explicit multi-dimensional attributes of resource and historical rating of accessed resources. Then, recommendations are generated by nearest neighborhood collaborative filtering (NNCF). In the second module, weights of implicit or latent attributes of resource for learners are considered as chromosomes in the genetic algorithm, and then this algorithm optimizes the weights according to historical rating. Then, recommendations are generated by NNCF using the optimized weight vectors of implicit attributes. The experimental results show that the proposed method outperforms current algorithms on accuracy measures and can alleviate cold-start and sparsity problems and also generate a more diverse recommendation list.

Index Terms— Collaborative filtering, learning environment, sparsity, personalized recommender, genetic algorithm, explicit attribute, implicit attribute.

1 INTRODUCTION

WEB-based education has undergone rapid development in recent years. With growth of many online learning systems, a huge amount of e-learning resources have been generated which are highly heterogeneous and in various media formats [1]. The task of delivering personalized learning resource is often framed in terms of a recommendation task in which a system recommends items to an active user [2]. To address information overload and personalization problems in e-learning environments, recommender systems have been proposed by many researchers. This research also proposes an effective recommendation framework for personal learning environment based on attributes of learners and resources. Using this approach, tutors can improve the performance of the teaching process and learners can find their suitable online resources.

1.1 Motivation

With the explosion of e-learning resources and digitalization a lot of conventional learning resources, it is difficult for learners to discover the most appropriate resources according to keyword searching method. On the other hand, several researches have addressed the need

for personalization in the web-based learning environment. Researchers utilize recommendation techniques to resolve information overload in the new learning environment. By this means, there are still several challenging problems.

The first important problem relates to the sparsity and cold start problems in the e-learning environment. The sparsity problem occurs when rating data are insufficient for identifying similar users (neighbors). In practice recommender systems are used to evaluate very large data sets and since each user only rates a small amount of items, the number of ratings given by the users is very small in comparison with the total number of (user; item) pairs in the system. Cold-start refers to the situation in which an item cannot be recommended unless it has been rated by a substantial number of users. This problem is particularly detrimental to users. Likewise, a new user has to rate a sufficient number of items before the recommendation algorithm be able to provide reliable and accurate recommendations [3]. In the e-learning environment, since various learners have different knowledge and different preferences, the common used items (resources) between them are few and therefore the similarity value between users will be unreliable. This leads to the sparsity and also the cold start problem.

The second important problem refers to the overspecialized recommendation results that occur when recommended items are very similar to each other and the recommendation list isn't diverse. The goal of recommendation diversification is to identify a list of items that are dissimilar, but nonetheless relevant to the user's interests.

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