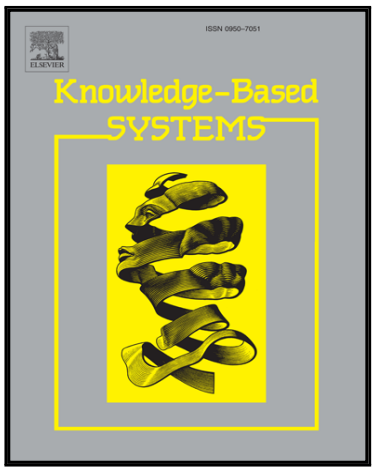

Utilizing Transfer Learning for In-Domain Collaborative Filtering

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ABSTRACT

In recent years, transfer learning has been used successfully to improve the predictive performance of collaborative filtering (CF) for sparse data by transferring patterns across domains. In this work, we advance transfer learning (TL) in recommendation systems (RSs), facilitating improvement within a domain rather than across domains. Specifically, we utilize TL for in-domain usage. This reduces the need to obtain information from additional domains, while achieving stronger single domain results than other state-of-the-art CF methods. We present two new algorithms; the first utilizes different event data within the same domain and boosts recommendations of the target event (e.g., the buy event), and the second algorithm transfers patterns from dense subspaces of the dataset to sparse subspaces. Experiments on real-life and publically available datasets reveal that the proposed methods outperform existing state-of-the-art CF methods.

Keywords: Recommender Systems, Transfer Learning, Collaborative Filtering, Implicit Ratings, Explicit Ratings, Sparsity.

1. INTRODUCTION

The sparsity problem is one of recommendation systems' (RSs) most well-known problems [1]. In recent years, the use of cross-domain RSs has increased and these systems have become a common and a well-known solution to alleviate the data sparsity problem [50]. Cross-domain RSs use different domains in order to improve prediction in a selected target domain. These systems recommend products and/or services from different domains while sharing knowledge. The shared knowledge can be derived from the users, items, ratings, context data, and so on.

Prior studies have emphasized the benefits of applying cross-domain recommendations and proposed some techniques to achieve improvements over single domain recommenders [3, 9, 11]. Knowledge aggregation of user-model strategies [4-7, 42-43] represents one type of RS cross-domain technique. This technique combines user model data from other domains to enrich the user's data; user model (UM) data is the data that the RS collects about the user in order to provide personalized services to him/her. The UM approach requires overlapping users between domains which is not always available. A different type of cross-domain technique that has become increasingly common is transfer learning (TL) [2]. TL, which is the base technique for this paper, does not necessarily require overlapping users or items between domains.