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Collaborative filtering via sparse Markov random fields

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Abstract

Recommender systems play a central role in providing individualized access to information and services. This paper focuses on collaborative filtering, an approach that exploits the shared structure among mind-liked users and similar items. In particular, we focus on a formal probabilistic framework known as Markov random fields (MRF). We address the open problem of structure learning and introduce a sparsity-inducing algorithm to automatically estimate the interaction structures between users and between items. Item-item and user-user correlation networks are obtained as a by-product. Large-scale experiments on movie recommendation and date matching datasets demonstrate the power of the proposed method.

Keywords: Recommender systems, collaborative filtering, Markov random field, sparse graph learning, movie recommendation, dating recommendation

1. Introduction

Learning to recommend is powerful. It offers targeted access to information and services without requiring users to formulate explicit queries. As the recommender system observes the users, it gradually acquires users tastes and preferences to make recommendation. Yet its recommendation can be accurate and sometimes surprising. Recommender systems are now pervasive at every corner of digital life, offering diverse recommendations from books [14], learning courses [7], TV programs [2], news [4], and many others (see [17] for an up-to-date survey on applications).

An important direction to recommendation is collaborative filtering (CF). CF is based on the premise that people are interested in common items, and thus there exists a *shared structure* that enables transferring one's preference to like-minded users. A highly interpretable approach is correlation-based, in that our future preference will be predicted based on either similar users who share the rating history [24], or correlated items that share the previous raters [27]. For example, the popular line "people who

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