Abstract

Recommender systems (RS) play a key role in various sectors of the digital economy. Over the past decade, along with the rapid expansion of online services, many e-commerce, e-tourism, e-resource, social media, and retail companies have begun leveraging the power of data to enhance their profits. They achieve this by helping customers discover interesting items or products within the vast expanse of online data. To achieve this goal, the implementation of a recommender system is necessary, and as a result, the demand for recommender systems has increased more than ever before. The dissertation introduces selected recommender algorithms and outlines their widely recognized taxonomy. Additionally, it delves into the significant challenges and limitations inherent in these methods, offering a comprehensive discussion of various evaluation techniques.

The growing demand for generating more relevant recommendations has led to the emergence of numerous innovative recommendation systems, such as Context-aware Recommender System (CARS), which incorporates contextual information into recommendation systems. A primary objective of my doctoral research is to introduce a novel recommender system that utilizes contextual information to provide more relevant recommendations.

Although several approaches have been proposed over the last decade to build recommender systems, most of them suffer from the cold-start problem. This problem arises when a new item is introduced to the system or a new user signs up. Handling cold users and items is widely acknowledged as a crucial success factor for any new recommender algorithm. In this dissertation, we introduce a frequent pattern mining framework for recommender systems (FPRS), a novel approach to address this challenging task. Furthermore, we propose a Clustering-based Frequent Pattern mining framework for Recommender Systems (Clustering-based FPRS), a platform comprising several recommendation strategies that significantly mitigate the cold-start problem. In this framework, we tackle the sparsity issue by operating on a more granular representation of similar users and items. Instead of working with the very sparse user-item matrix, we derive an intermediate data representation by grouping similar users and items together.

On the other hand, there is an urgent demand for finding more efficient techniques to generate recommendations. In many recommender systems, the time required to generate recommendations is crucial. This means that recommendations may become useless if there is a delay in generating and presenting them to the user. Therefore, a novel recommender system based on Factorization Machines and Association Rules (FMAR) is proposed. This framework is designed to speed up recommender systems without impacting accuracy. All the novel methods proposed in the dissertation were subjected to experimental verification on real-life problems and data.

Keywords: recommender systems, collaborative filtering, content-based filtering, hybrid filtering, cold-start problem, machine learning, frequent pattern mining, association rules, factorization machines