

Recommender Systems

Chapter 1. An Introduction to Recommender Systems

1 Introduction

1.1 An important catalyst is the ease with which the Web enables to provide feedback about their likes or dislikes.

1.2 Forms of feedback

1.2.1 Ratings: users select numerical values from a specific evaluation system (e.g., five-star rating system)

1.2.2 An endorsement: To utilize these various sources of data to infer customer interests.

1.3 Based on previous interaction between users and items, because past interests and proclivities(성향) are often good indicators of future choices.

(Exception: Knowledge-based recommender systems, because it suggested on the basis of user-specified requirements rather than the past history of the user.)

1.4 The basic principle of recommendations

1.4.1 Significant dependencies exist between user and item-centric activity.

1.4.2 These dependencies can be learned in a data-driven manner from the ratings matrix, and the resulting model is used to make predictions for target users.

1.4.3 Collaborative filtering: the use of ratings from multiple users in a collaborative way to predict missing ratings.

1.4.4 Content-based recommender systems: the content plays a primary role, in which the ratings of users and the attribute descriptions of items are leveraged in order to make predictions.

1.4.5 Knowledge-based systems: users interactively specify their interests, and the user specification is combined with domain knowledge to provide recommendations.

1.4.6 In advanced models: contextual data, such as temporal information, external knowledge, location information, social information, or network information.

2 Goals of Recommender Systems

2.1 The two primary models

- 2.1.1 Prediction version of problem: To predict the rating value for a user-item combination. (matrix completion problem)
- 2.1.2 Ranking version of problem: Recommend the top-k items for a particular user, or determine the top-k users to target for a particular item. The determination of the top-k items is more common.

2.2 Increasing product sales

- 2.2.1 Relevance: Users are more likely to consume items they find interesting.
- 2.2.2 Novelty: Repeated recommendation of popular items can also lead to reduction in sales diversity.
- 2.2.3 Serendipity: Focus on discovering.
- 2.2.4 Increasing recommendation diversity: Diversity has the benefit of ensuring that the user does not get bored by repeated recommendation of similar items.

2.3 Diversity in the types of products recommended

- 2.3.1 GroupLens Recommender System
- 2.3.2 Amazon.com Recommender System
- 2.3.3 Netflix Movie Recommender System
- 2.3.4 Google News Personalization System
- 2.3.5 Facebook Friend Recommendations

3 Basic Models of Recommender Systems

3.1 Collaborative Filtering Models: The underlying ratings matrices are sparse.

- 3.1.1 Memory-based methods (Neighborhood-based collaborative filtering algorithms)
 - 3.1.1.1 User-based collaborative filtering: To determine users, who are similar to the target user A.
 - 3.1.1.2 Item-based collaborative filtering: The ratings in item set S, which are specified by A, are used to predict whether the user A will like item B.
- 3.1.2 Model-based methods: In case where the model is parameterized, the parameters of this model are learned within the context of an optimization framework.
- 3.1.3 Types of Ratings
 - 3.1.3.1 Interval-based ratings

3.1.3.2 Ordinal ratings

3.1.3.3 Binary ratings

3.1.3.4 Unary ratings

3.1.4 Relationship with Missing Value Analysis

3.1.5 Collaborative Filtering as a Generalization of Classification and Regression Modeling

3.1.5.1 There is no distinction between training and test rows in collaborative filtering because any row might contain missing entries. Therefore, it is more meaningful to speak of training and test entries in collaborative filtering.

3.2 Contest-Based Recommender Systems: The ratings and buying behavior of users are combined with the content information available in the items.

3.2.1 Disadvantages

3.2.1.1 If a user has never consumed an item with a particular set of keywords, such an item has no chance of being recommended.

3.2.1.2 They are not effective at providing recommendations for new users.

3.3 Knowledge-Based Recommender Systems

3.3.1 Constraint-based recommender systems: This search process is interactively repeated until the user arrives at her desired results.

3.3.2 Case-based recommender systems: This interactive process is used to guide the user towards items of interest.

3.3.3 How is the interactivity in knowledge-based recommender systems achieved?

3.3.3.1 Conversational systems

3.3.3.2 Search-based systems

3.3.3.3 Navigation-based recommendation