Lesson 16

Recommenders

Recommender Definition and Need

- Refers to a machine learning (ML) tool that enables recommendations after extractions of features in the item sets from the multiple datasets

- A recommender's need arises because a customer finds it difficult to search the right product due to information overload.
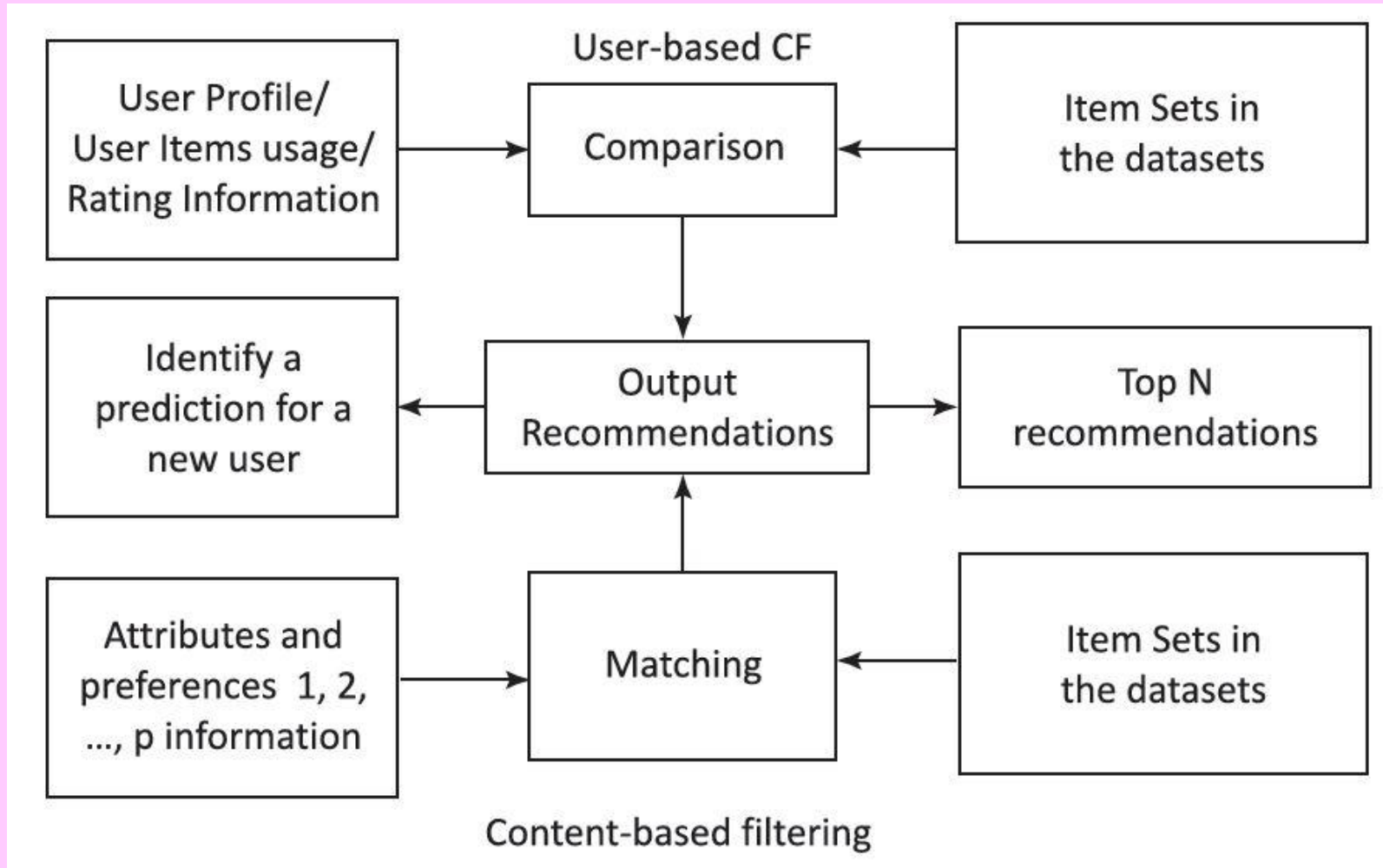
Recommender Examples

- A product recommender, such as book recommender
- Enabler for the selection of the right product among the high recommendation products.

Recommenders

- User-based collaborative filtering (CF)
- Content-based filtering (CBF) recommenders)

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Recommender CF and CBF Methods

User-based CF

| User Profile/ User Items usage/ Rating Information | → | Comparison | ← | Item Sets in the datasets |

| Identify a prediction for a new user | ← | Output Recommendations | → | Top N recommendations |

| Attributes and preferences 1, 2, ..., p information | → | Matching | ← | Item Sets in the datasets |

Content-based filtering

CF Algorithm

- Makes recommendations by calculating the similarities in item sets in-between different items in the datasets

- Algorithm predicts the likeliness of an item that it has not rated based on a set of historical preference judgments from a community of users

- Relies on the behavior of users

Recommending Method using the CF

- Group forms for similar users which means in neighbourhoods

- Similar means not distant

- Recommender is an application of near-neighbour search method

Recommending Method using the CF

- The already rated items are significant in searching for a neighbour

- Once a neighbour of a user is found, different algorithms used

- Combine the preference of neighbours to generate recommendations

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Top-N Recommendations

- Recommends a set of N top-ranked items that will be of interest to a certain user

- Techniques analyze the user-item matrix to discover relations between different users or items and make Top-N recommendations

User-Item Matrix Input Data Example

- Input Data: User, Item, Rating

- For example, (1, 206, 4.0), (2, 256, 5.0), (3, 106, 3.0), (4, 56, 2.0), (5, 206, 4.5), (1, 206, 4.0), (1, 206, 4.0), …

- Data dynamically built ups the Matrix and updates the rating in the existing matrix

CF Recommendation Approaches

- Model-based collaborative filtering – Based on ML techniques (Section 6.8.2)

- Memory-based collaborative filtering – Based on similarity between users and items

S

s= 1

User-Based CF Algorithm for Top-N Recommendations

- Identify the k most similar users (nearest neighbours) to the active user using the Pearson correlation or vector space model

- User as a vector in the v-dimensional item space

Item-based Collaborative Filtering

- Item-based similarity between items is more static compared to dynamic Users based CF

- Enables pre-computation which improves online performance

- An item-based similarity is more meaningful

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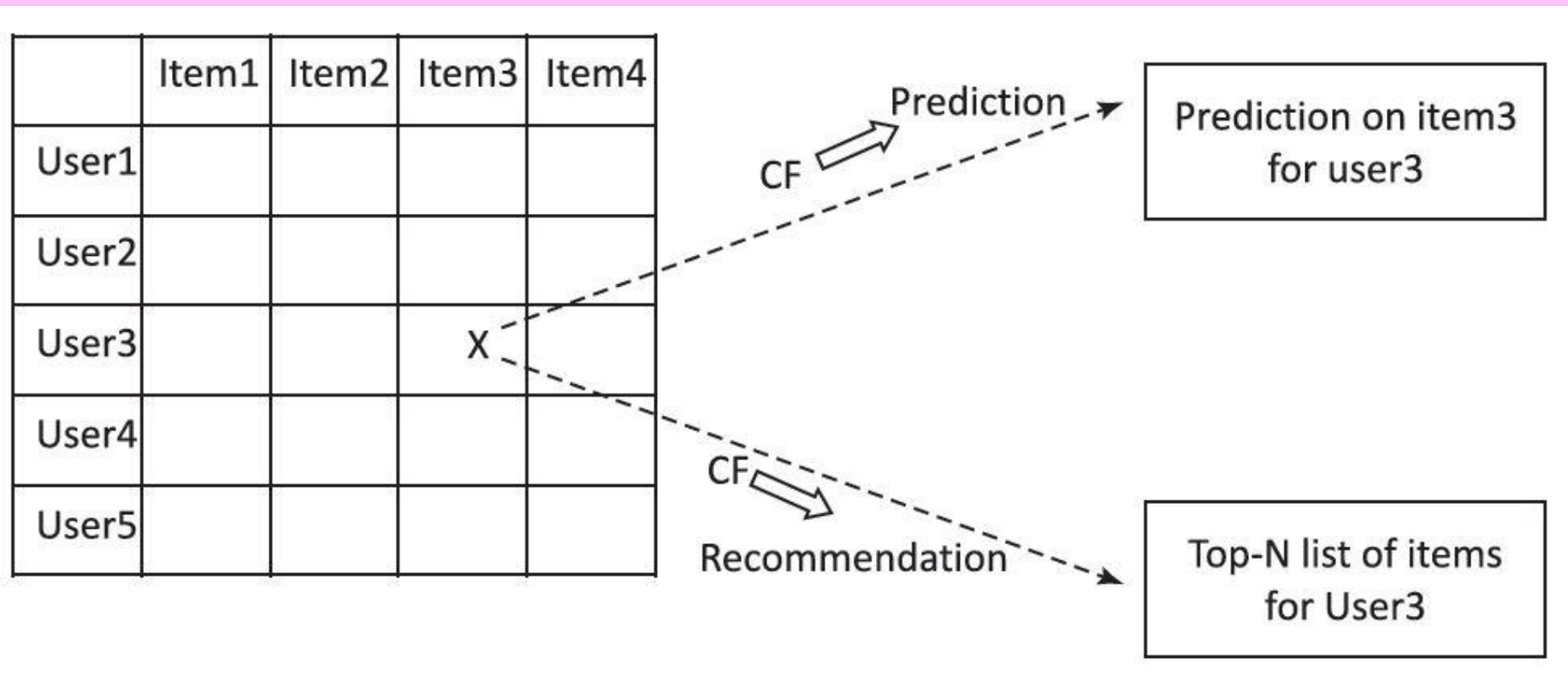
The similarity between two users of items

- Measured by treating each user as a vector of rating frequencies and computing the cosine of the angle formed by the frequency vectors

Using **an m × n user-item matrix, P**

- Similarity between two items j and i defined as the cosine of the angles between v-dimensional vectors corresponding to the i-th and j-th columns of matrix P.

- [Equation (6.23b)]

Figure 6.20 Prediction on an item and top 10 recommendation list from a user-item matrix

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Model building for recommender approach

- A machine learning approach

- Recommend a set of items using pre-computed models

- Use the association rules, regression, clustering, neural network, Bayesian classifiers, decision trees and matrix completion techniques

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Content Based Filtering (CBF) Recommendation

- Built around the attributes and preferences of a given item

- Evaluates the contents or items on the preferences of others with a similar point of view (Figure 6.19)

Content Based Filtering (CBF) Recommendation

- When anyone buys a product online, most websites automatically recommend other products that she/he may be interested to buy

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Knowledge-based Filtering (KBF) Recommender

- Built on explicit knowledge about user preferences, the number of items of specific attributes and a criterion function for the recommendation

- Positive recommendation criterion for the given context.

KBF Advantage

- Advantage of KBF recommender is that it applies in scenarios where CF and CBF have difficulties in uses, for example, due to cold start problem

- Applies in complex domains, such as house recommender

KBF Disadvantage

- Problem associated with acquiring difficulties for knowledge

- A definitive recommendation in explicit form difficult with partial knowledge

Hybrid Filtering

- Refers to combination of the CF and CBF

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Recommender Applications

- E-commerce, Product recommender – Amazon

- Digital Libraries, Pages/ documents/ books recommendation

- Enterprise Activity Intelligence

- Domain expert recommender, …

- Personal Assistance, for example, for Museum guidance, …

Summary

We learnt:

- Collaborative filtering Recommender

- Content based recommender

- User-Item Matrix for predicting

- Top-N recommendations

- Knowledge based Recommender

- Applications

End of Lesson 16 on
Recommenders