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Course Content

Collaborative Filtering

Clustering

The first method we saw in the last module was to predict the unknown value of the user-item interaction matrix using the average of all the item ratings assuming all the users are the same. However, this method seems to be very naïve, as it carries an assumption of all users being the same. One of the solutions for this problem is **clustering-based recommendation systems**.

In the clustering-based recommendation systems, we can build clusters based on user-item interactions, and users within each cluster would receive recommendations by applying the averaging method within the individual clusters.

While the clustering-based approach is better than the averaging approach, it is still weak because what we do is identify user groups and recommend each user in this group the same items but the cluster might not be a good representative of the users **that are closer to the 'boundary' of clusters**. Hence, we move to a more personalized approach called collaborative filtering.

Collaborative Filtering

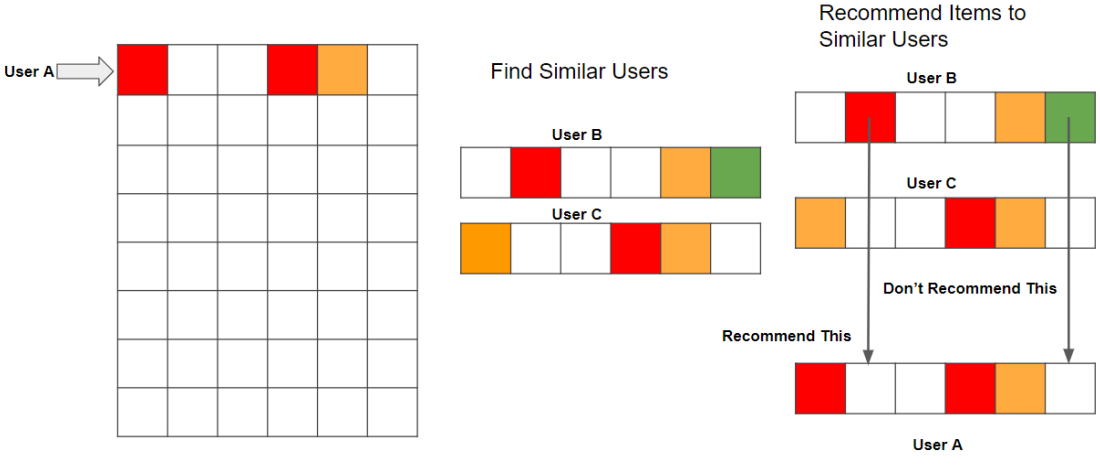
Collaborative filtering, **also known as personalized clustering**, is one of the most popular approaches used in recommendation systems. It helps in providing personalized recommendations to users. In collaborative filtering, the recommendation is done based on the similarity between users or similarity between items.

The set of features acquired by a user is transformed into a user vector and that of an item is transformed into an item vector. Hence for every user, there is a user vector and for every item, there is an item vector. The similarity between the user vectors or item vectors can be calculated by using various distance measurement methods like cosine-similarity, Pearson coefficient, etc.

The two common types of collaborative filtering are user-user and item-item.

User-User Collaborative Filtering: User-User Collaborative Filtering is a technique used to predict the items that a user might like based on the ratings given to items by other users who have similar tastes to the target user.

In the below image, we are trying to illustrate user-user collaborative filtering, where we have 8 users and 6 items, and the colors red, yellow, and green indicate preferred, moderately preferred, and nonpreferred items, respectively.

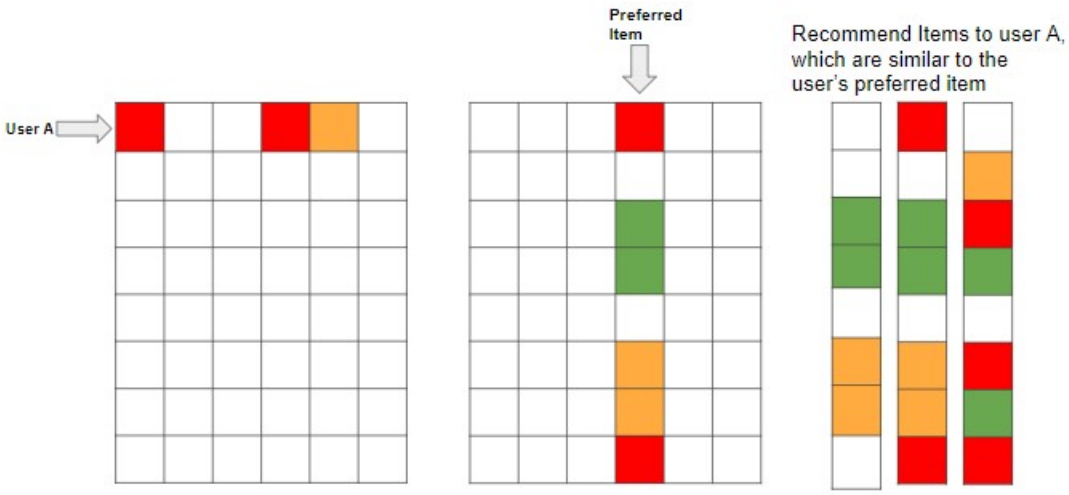


Here, we have the target user A for whom we want to make recommendations. Then, we are selecting users which are similar to the target user, which in this example, are User B and User C. After finding similar users, we are recommending items to user A based on the preference of similar users.

In the above image, we are recommending the second item to User A as it is preferred by User B and not observed by User A. Similarly, we are **not** recommending the sixth item as it is not preferred by User B.

Item-Item Collaborative Filtering: Item-Item Collaborative Filtering is a technique used to predict the items that a user likes based on finding similarities between items that the user had rated and the target item.

Let's consider the same example to understand item-item collaborative filtering as well.



Here, the target user is the same, i.e., User A for whom we want to make recommendations. Now, instead of finding similar users, we are selecting the item that User A preferred (in this example, the fourth item) and finding the items similar to that item. Once we find the similarity between items, we recommend the items similar to the preferred item and not observed by User A.

In the above example, we have 3 items that are not observed by User A, i.e., items 2, 3, and 6. Out of these 3 items, the third item has the highest similarity with the item preferred by User A (all the colors are the same in both vectors) followed by the second item, and hence we can recommend items 2 and 3 to User A.

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