

Recommender Systems:

In this module, you will learn about recommender systems. You will be introduced to the main idea behind recommendation engines, then you will gain an understanding of two main types of recommendation engines, namely, content-based and collaborative filtering.

Intro to Recommender Systems

Recommender systems capture the pattern of peoples' behavior and use it **to predict what else they might want or like.**

Applications

- What to buy?
 - E-commerce, books, movies, beer, shoes
- Where to eat?
- Which job to apply to?
- Who you should be friends with?
 - LinkedIn, Facebook...
- Personalize your experience on the web
 - News platforms, news personalization

Advantages of recommender systems

- Broader exposure
- Possibility of continual usage or purchase of products
- Provides better experience

Two types of recommender systems



Implementing recommender systems

- Memory-based
 - Uses the entire user-item dataset to generate a recommendation
 - Uses statistical techniques to approximate users or items
e.g., Pearson Correlation, Cosine Similarity, Euclidean Distance, etc.
- Model-based
 - Develops a model of users in an attempt to learn their preferences
 - Models can be created using Machine Learning techniques like regression, clustering, classification, etc.


Content-based Recommender Systems




Content-based recommender systems






Weighing the genres




Weighing the genres


User Ratings


	2
	10
	8

	Comedy	Adventure	Super Hero	Sci-Fi
	0	1	1	0
	1	1	1	1
	1	0	1	0

Movies Matrix

	Comedy	Adventure	Super Hero	Sci-Fi
	0	2	2	0
	10	10	10	10
	8	0	8	0

Weighted Genre Matrix

	Comedy	Adventure	Super Hero	Sci-Fi
	18	12	20	10










User Profile

\times




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Weighing the genres


Weighing the genres

		Weighted Genre Matrix				
		Comedy	Adventure	Super Hero	Sci-Fi	
 User Ratings	2	 0	 1	 1	 0	
	10					
	8					
		=				
			0	2	2	0
			10	10	10	10
			8	0	8	0
		User Profile				
			0.3	0.2	0.33	0.16




Candidate movies for recommendation

	Comedy	Adventure	Super Hero	Sci-Fi
	1		0	1
	0	0	1	0
	1	0	1	0




Finding the recommendation

	Comedy	Adventure	Super Hero	Sci-Fi
	0.3	0.2	0.33	0.16




User Profile

	Comedy	Adventure	Super Hero	Sci-Fi
	1	1	0	1
	0	0	1	0
	1	0	1	0

Movies Matrix

	Comedy	Adventure	Super Hero	Sci-Fi
	0.3	0.2	0	0.16
	0	0	0.33	0
	0.3	0	0.33	0

Weighted Movies Matrix

	Weighted Average
	0.66
	0.33
	0.63

Recommendation Matrix

Content-based recommender systems



Problem: This can be solved with collaborative-filtering

Content-based recommender systems



Collaborative-filtering

Collaborative filtering

- **User-based collaborative filtering**
 - Based on users' neighborhood
- **Item-based collaborative filtering**
 - Based on items' similarity



Collaborative filtering

- User-based collaborative filtering



Learning the similarity weights

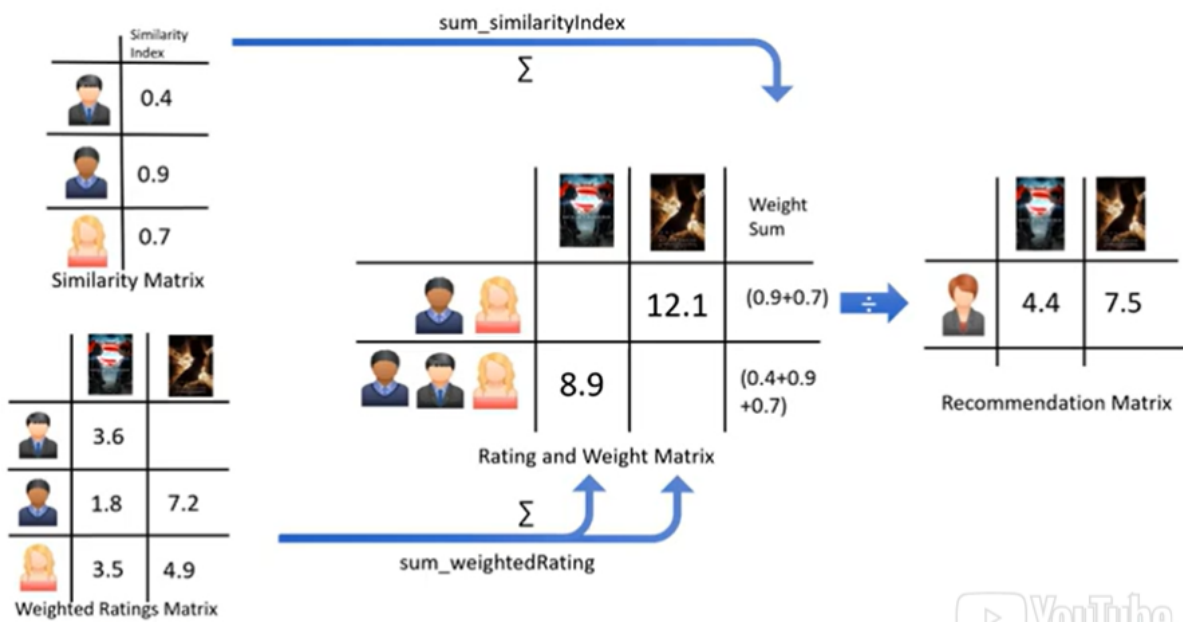
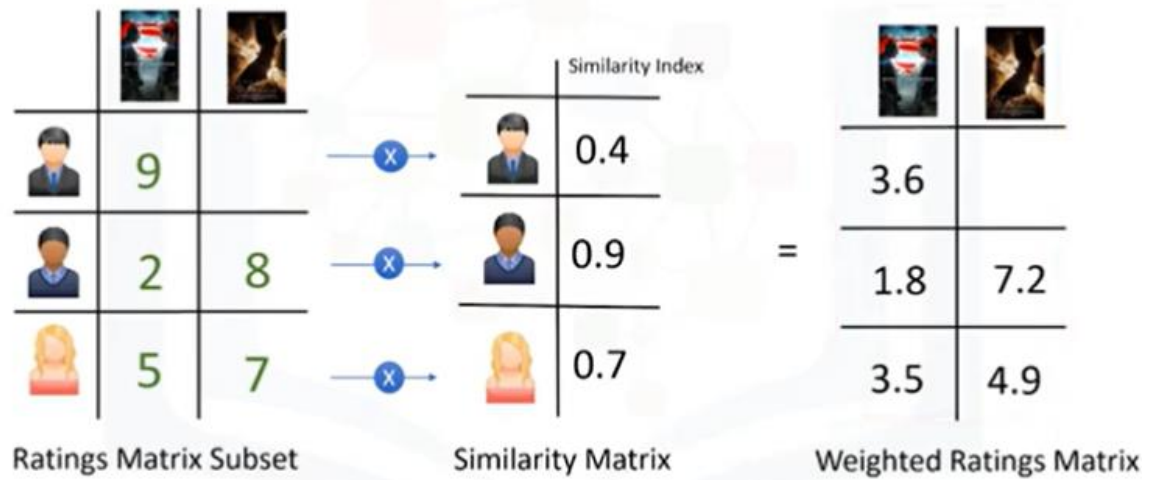
	9	6	8	4	
	2	10	6		8
	5	9		10	7
	?	10	7	8	?

Ratings Matrix

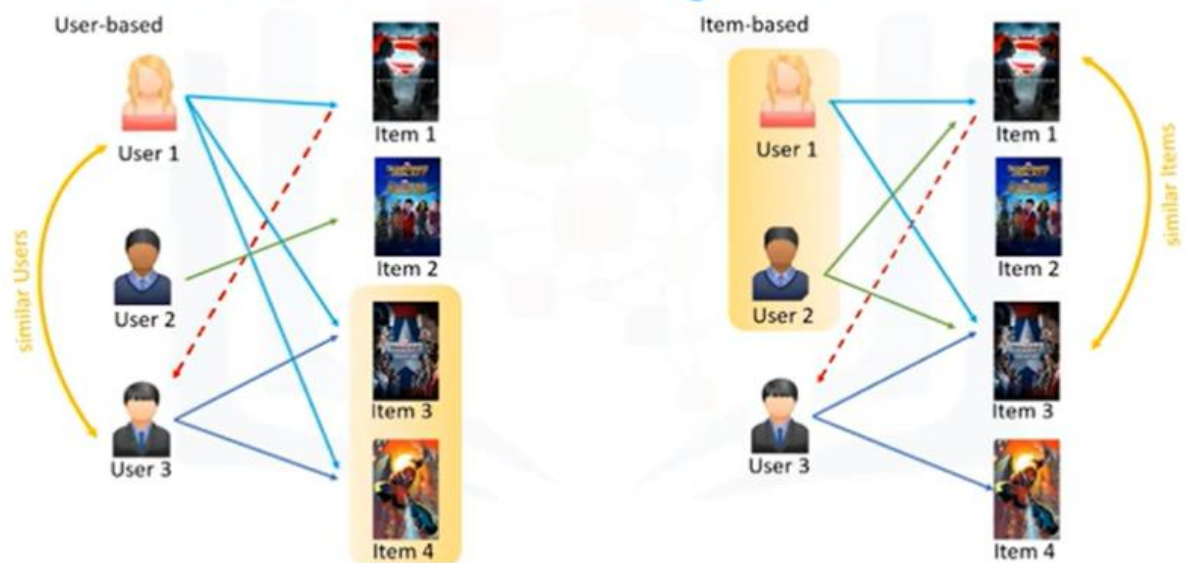
Similarity weights are shown as curved arrows on the right side of the matrix:

- A green arrow from User 3 to User 4 with a weight of 0.7.
- An orange arrow from User 2 to User 4 with a weight of 0.9.
- A yellow arrow from User 1 to User 4 with a weight of 0.4.

Creating the weighted ratings matrix



Collaborative filtering



Challenges of collaborative filtering

- Data sparsity
 - Users in general rate only a limited number of items
- Cold start
 - Difficult in recommendation to new users or new items
- Scalability
 - Increase in number of users or items