

Recommender System

Overview

- **Introduction.**
- **Recommender System Algorithm**
- **Examples**
- **Goals and benefits of Recommender Systems**
- **Recommendation techniques**
- **Collaborative filtering**
- **Content-based filtering**

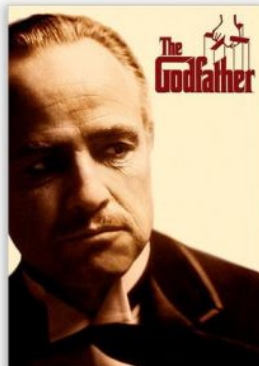
Introduction

Recommender System:

“Recommender Systems (RS) are software agents that elicit the interests and preferences of individual consumers and make recommendations accordingly. They have the potential to support and improve the quality of the decisions consumers make while searching for and selecting products online”



Examples(Netflix movies)



The Godfather

1972 R 177 minutes



When organized-crime family patriarch Vito Corleone barely survives an attempt on his life, his youngest son steps in to take care of the would-be killers, launching a campaign of bloody revenge in this Oscar-winning epic.

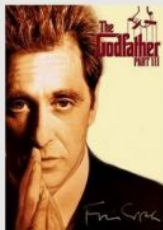
Cast: Marlon Brando, Al Pacino, James Caan, more...

Rent unlimited DVDs, including *The Godfather*, for only \$7.99 a month.

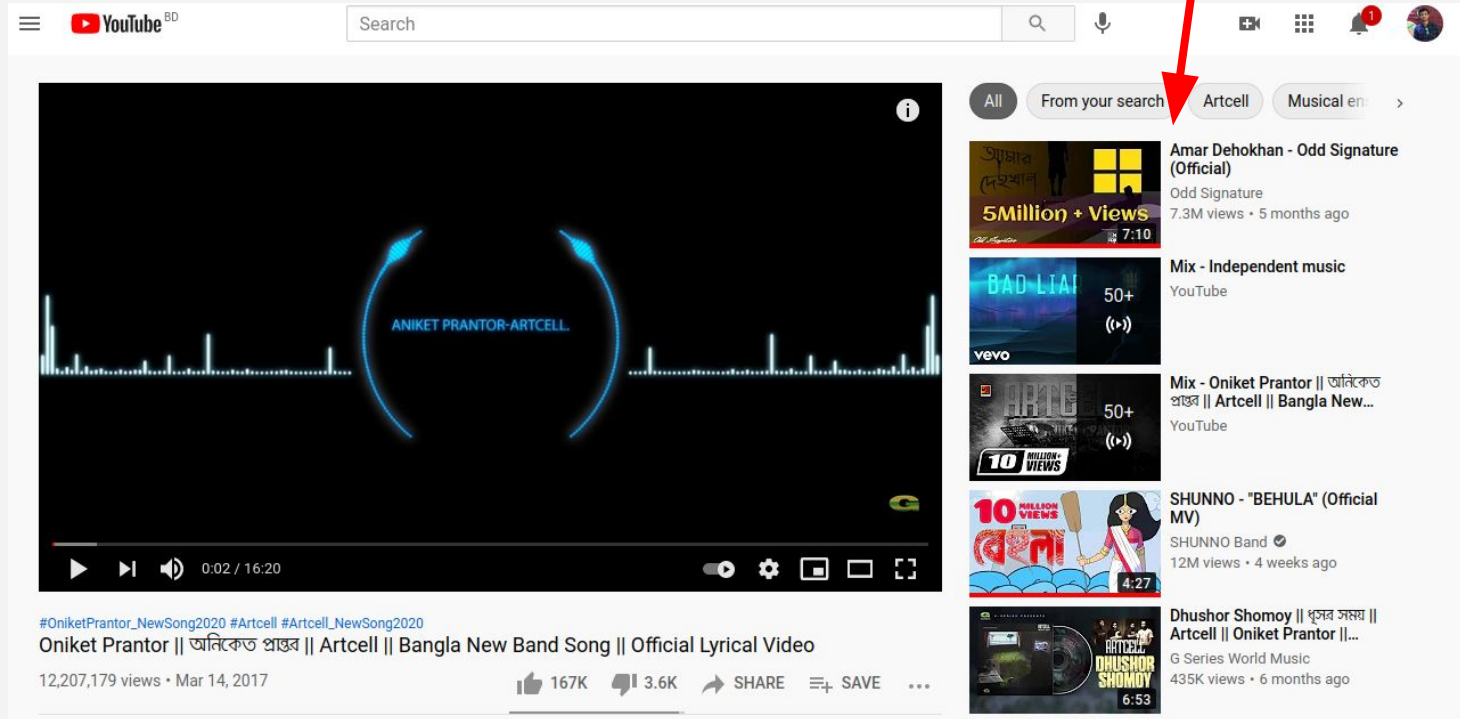
Start Your Free Month

Secure Server. We will not sell or rent your email address. We may contact you about the Netflix service. See our privacy policy. Free trial offer details.

More like The Godfather



Examples(Youtube)



The image shows a YouTube interface with a video player and a recommendations sidebar. A red arrow points to the 'Artcell' filter tab in the sidebar.

Video Player:

- Channel: YouTube BD
- Search bar
- Video title: Oniket Prantor || অনিকেত প্রান্তর || Artcell || Bangla New Band Song || Official Lyrical Video
- Views: 12,207,179 views • Mar 14, 2017
- Engagement: 167K likes, 3.6K dislikes
- Actions: SHARE, SAVE, ...

Recommendations Sidebar:

- Filters: All, From your search, **Artcell**, Musical en...
- Recommendation 1: Amar Dehokhan - Odd Signature (Official)
 - Odd Signature
 - 7.3M views • 5 months ago
- Recommendation 2: Mix - Independent music
 - YouTube
- Recommendation 3: Mix - Oniket Prantor || অনিকেত প্রান্তর || Artcell || Bangla New...
 - YouTube
- Recommendation 4: SHUNNO - "BEHULA" (Official MV)
 - SHUNNO Band
 - 12M views • 4 weeks ago
- Recommendation 5: Dhushor Shomoy || ধূসর সময় || Artcell || Oniket Prantor ||...
 - G Series World Music
 - 435K views • 6 months ago

Examples

- Facebook
- Amazon
- Ebay
- Amazon
- Science Papers
- StackOverflow
- E-commerce site(evaly, daraz etc)



Goals and benefits of Recommender Systems

For the consumers (users):

- Helping the users to find useful contents to satisfy their needs
- Reducing the time of content searching
- Providing relevant information from the massive information flow
- Exploring new preferences, trust in recommender system

For the business

- Improving business success indicators (or key performance indicators, KPI)
 - Increasing revenue, CTR, watching/listening duration
 - Increasing conversion rate and user engagement
 - Cross-selling, upselling, advertisement
- Reducing popularity effect, less popular contents are also consumed
- Promotions, targeting, campaign

Recommender System

movie	Alice	Bob	Carol	Dave
Love at last	5	5	0	0
Romance forever	5	?	?	0
Cute puppies of love	?	4	0	?
nonstop car chase	0	0	5	4
Sword vs Karate	0	0	5	?

rating=(0...5)

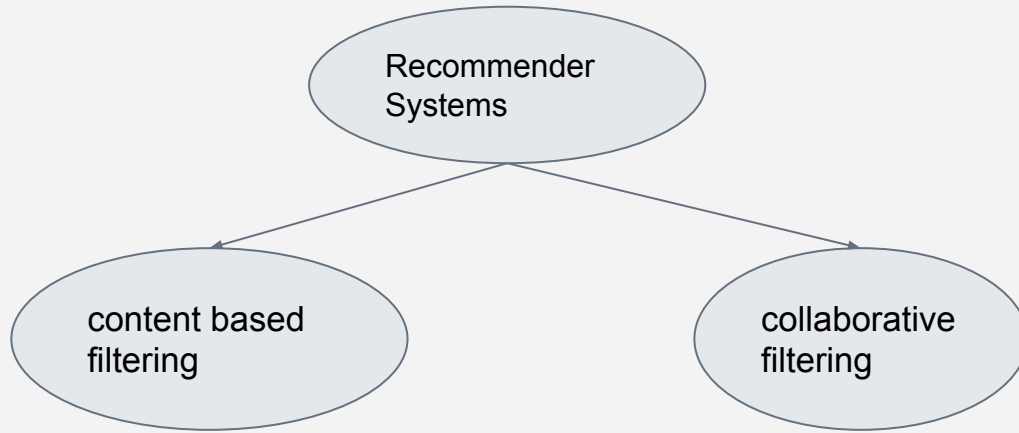
n_u = number of users

n_m = number of movies

$r(i,j)$ = 1 if user j has rated movie i

$y^{(i,j)}$ = rating given by user j to movie i (defined only if $r(i,j)=1$)

Recommendation techniques



Recommendation techniques

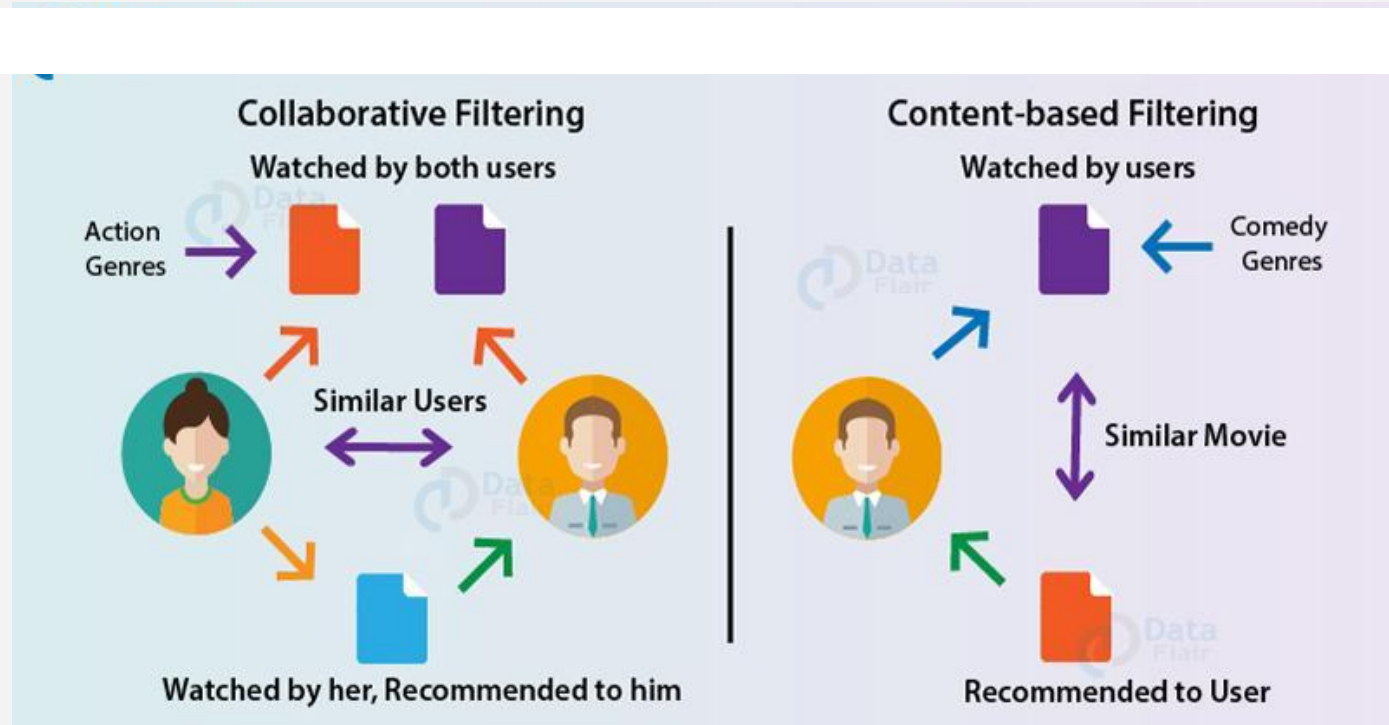
Content-based Filtering (CBF)

- Recommend items that are similar to the ones that the user liked in the past.
- Similarity based on the metadata of the items.
- E.g.: If the user likes romantic movies, recommend her the like

Collaborative Filtering (CF)

- Recommend items that are liked by users that have similar taste as the current user
- Similarity between users is calculated by the transaction history of users
- Only uses the transaction data domain independent

Recommendation techniques



Collaborative filtering

Collaborative filtering is a method of making automatic predictions (filtering) about the interests of a user by collecting preferences or taste information from many users (collaborating).

movie	Star war	Hope Dreams	Contact	Titanic
Joe	5	2	5	4
John	2	5	2.5	3
Al	2	2	4	2
Nathan	5	1	5	?

Collaborative filtering

1. Weight all users with respect to similarity with active user
2. Select a subset of users to use as a set of predictors
3. Compute a prediction from a weighted combination of selected neighbors' ratings

Weight all users with respect to similarity with active user

movie	Star war	Hope Dreams	Contact	Titanic
joe	5	2	5	4
John	2	5	2.5	3
Al	2	2	4	2
Nathan	5	1	5	?

Use cosine similarity

$$\text{similarity} = \cos(\theta) = \frac{A \cdot B}{\|A\| \|B\|}$$

Cosine Similarity

Joe [5,2,5]
John [2,5,2.5]
Al [2,2,4]
Nathan [5,1,5]



cos (Nathan,Joe) 0.99
cos (Nathan,John) 0.64
cos (Nathan,Al) 0.91

cosine similarity =

$$\text{similarity} = \cos(\theta) = \frac{A \cdot B}{\|A\| \|B\|}$$

$$\cos(\text{Nathan}, \text{Joe}) = \frac{5 \cdot 5 + 2 \cdot 1 + 5 \cdot 5}{\sqrt{5^2 + 2^2 + 5^2} \cdot \sqrt{5^2 + 1^2 + 5^2}} = 0.99$$

Select a subset of users to use as a set of predictors

if there are hundreds of user,
we can choose the higher similarity

choose n of m (sum of user is m)

Compute a prediction from a weighted combination of selected neighbors' ratings

movie	Star war	Hope Dreams	Contact	Titanic
joe	5	2	5	4
John	2	5	2.5	3
Al	2	2	4	2
Nathan	5	1	5	?

cos (Nathan,Joe) 0.99

cos (Nathan,John) 0.64

cos (Nathan,Al) 0.91


$$(0.99 * 4 + 0.64 * 3 + 0.91 * 2)$$

$$(0.99 + 0.64 + 0.91)$$

$$= 3.03$$

Content-based filtering

- Content-based filtering uses item features to recommend other items similar to what the user likes, based on their previous actions or explicit feedback.
- These methods are best suited to situations where there is known data on an item (name, location, description, etc.), but not on the user
- Content-based recommenders treat recommendation as a user-specific classification problem
- Learn a classifier for the user's likes and dislikes based on an item's features.



Thanks!