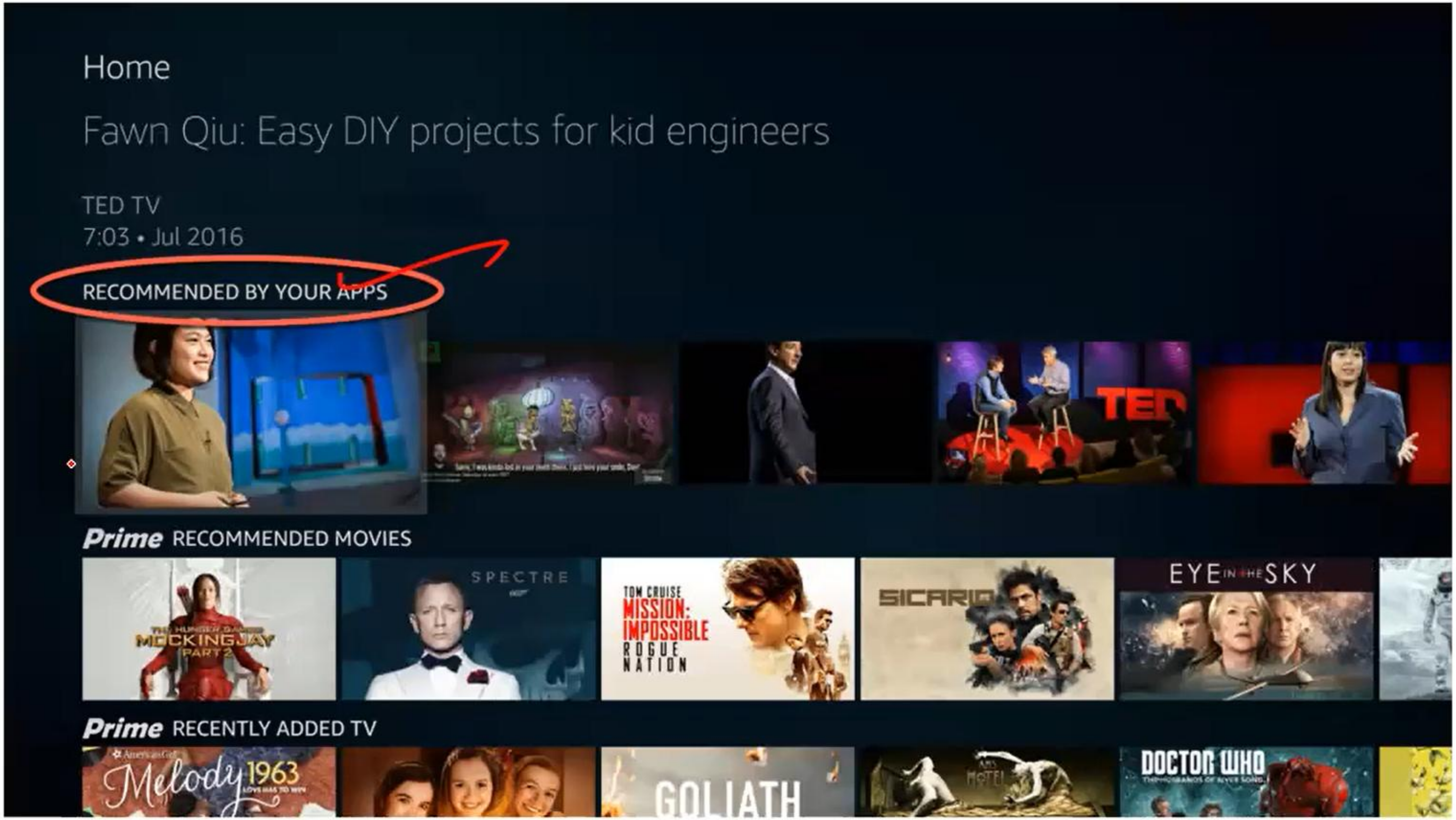
7.

Recommendation System

Recommendation Engine



Types of recommendation Engine

Collaborative Recommendation System

- User based/Memory Based System
- Item Based

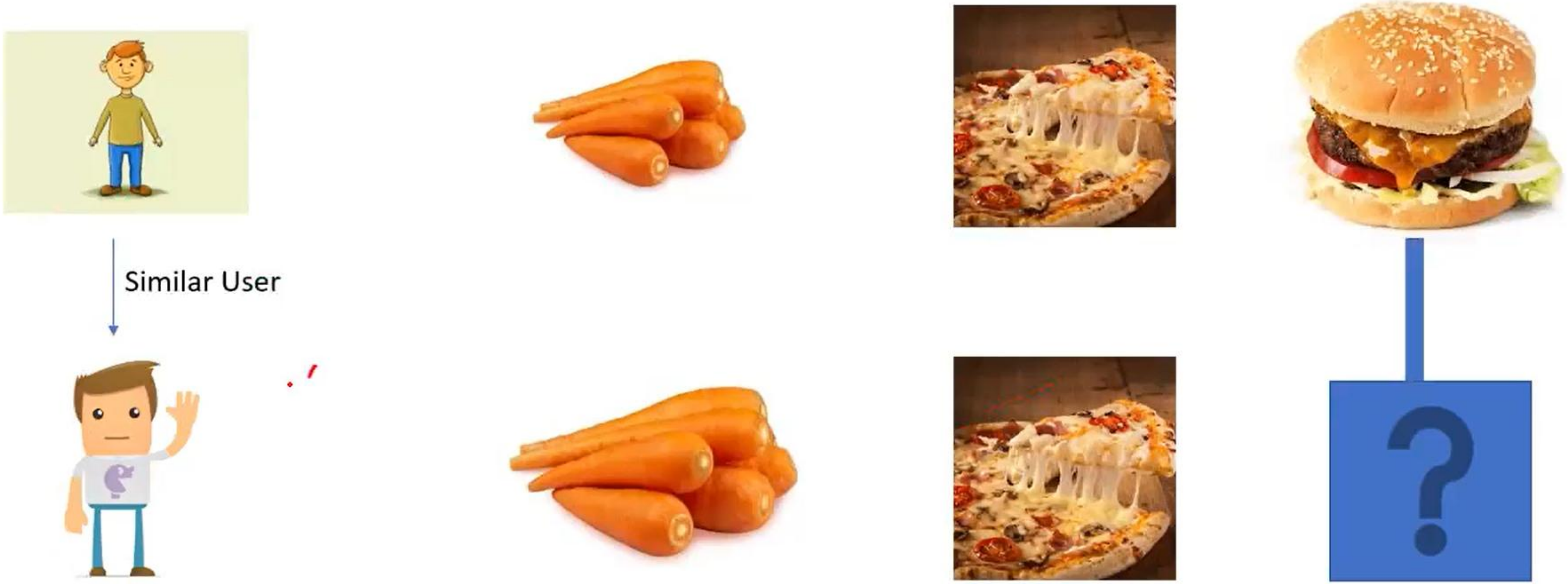
Content Based Recommendation System

Popularity Based Recommendation System

Overview about RS

Collaborative Recommendation System

User based/Memory Based System



Overview about RS

Collaborative Recommendation System

User based/Memory Based System

Collaborative Recommendation System

User based/Memory Based System

Little Deeper How this overview works

Little Deeper How this overview works

Collaborative Recommendation System

User based/Memory Based System

Dataset

	user_id	movie_id	rating	unix_timestamp
0	196	242	3	881250949
1	186	302	3	891717742
2	22	377	1	878887116
3	244	51	2	880606923
4	166	346	1	886397596
...	...	...	...	...
99995	880	476	3	880175444
99996	716	204	5	879795543
99997	276	1090	1	874795795
99998	13	225	2	882399156
99999	12	203	3	879959583

100000 rows × 4 columns

Little Deeper How this overview works

Collaborative Recommendation System

User based/Memory Based System

Pivot Table

movie_id	1	2	3	4	5	6	7	8	9	10	...	1673	1674	1675	1676	1677	1678	1679	1680	1681	1682
user_id																					
1	5.0	3.0	4.0	3.0	3.0	5.0	4.0	1.0	5.0	3.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	4.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
940	0.0	0.0	0.0	2.0	0.0	0.0	4.0	5.0	3.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
941	5.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Little Deeper How this overview works

Collaborative Recommendation System

User based/Memory Based System

Similarity Table(Cosine)

	0	1	2	3	4	5	6	7	8	9	...	933	934	935	936	
0	2.220446e-15	0.833069	0.952540	0.935642	6.215248e-01	0.569761	0.559633	0.680928	0.921862	0.623456	...	0.630473	0.880518	0.725124	0.810295	0.80
1	8.330690e-01	0.000000	0.889409	0.821879	9.270210e-01	0.754157	0.892672	0.896656	0.838952	0.840138	...	0.843014	0.692058	0.641211	0.575954	0.68
2	9.525405e-01	0.889409	0.000000	0.655849	9.787555e-01	0.927585	0.933863	0.916940	0.938960	0.934849	...	0.968125	0.957247	0.836171	0.930962	0.87
3	9.356422e-01	0.821879	0.655849	0.000000	9.681958e-01	0.931956	0.908770	0.811940	0.898716	0.939141	...	0.947893	0.963216	0.866885	0.806529	0.85
4	6.215248e-01	0.927021	0.978755	0.968196	1.110223e-16	0.762714	0.626400	0.751070	0.943153	0.798573	...	0.661206	0.919420	0.905076	0.920221	0.85
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
938	8.819047e-01	0.771417	0.973729	0.969862	9.285415e-01	0.888148	0.892973	0.904102	0.960148	0.928540	...	0.933961	0.568846	0.741979	0.773551	0.56
939	6.859280e-01	0.773210	0.838110	0.803142	7.600453e-01	0.647551	0.670075	0.753117	0.879505	0.657039	...	0.672847	0.892976	0.812464	0.818683	0.82
940	8.513831e-01	0.838515	0.898757	0.847959	8.604049e-01	0.855554	0.940007	0.853855	0.856755	0.909695	...	0.953048	0.796699	0.711682	0.765789	0.68
941	8.204921e-01	0.827732	0.866584	0.829914	8.475026e-01	0.682672	0.717997	0.824678	0.907503	0.787670	...	0.773560	0.926487	0.910412	0.870446	0.90
942	6.018253e-01	0.894202	0.973444	0.941248	6.860592e-01	0.723958	0.605636	0.700191	0.924383	0.778140	...	0.736209	0.789237	0.856747	0.922207	0.79

943 rows × 943 columns

Little Deeper How this overview works

Collaborative Recommendation System

User based/Memory Based System

Prediction Table

movie_id	1	2	3	4	5	6	7	8	9	10	...
user_id											
1	5.0	3.0	4.0	3.0	3.0	5.0	4.0	1.0	5.0	3.0	...
2	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	...
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
5	4.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...
...	...	...	...	...	...	...	...	...	...	...	...
939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	...
940	0.0	0.0	0.0	2.0	0.0	0.0	4.0	5.0	3.0	0.0	...
941	5.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	...
942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...

	Star Wars	Hoop Dreams	Contact	Titanic
Joe	5	2	5	4
John	2	5		3
Al	2	2	4	2
Nathan	5	1	5	?

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

Little Deeper How this overview works

Collaborative Recommendation System

User based/Memory Based System

Prediction Table

	Star Wars	Hoop Dreams	Contact	Titanic
Joe	5	2	5	4
John	2	5		3
Al	2	2	4	2
Nathan	5	1	5	?

	Star Wars	Hoop Dreams	Contact	Titanic	
Joe	5	2	5	4	0.99
John	2	5		3	0.64
Al	2	2	4	2	0.91
Nathan	5	1	5	?	

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

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

$$\frac{(0.99*4+0.64*3+0.91*2)}{(0.99+0.64+0.91)}$$

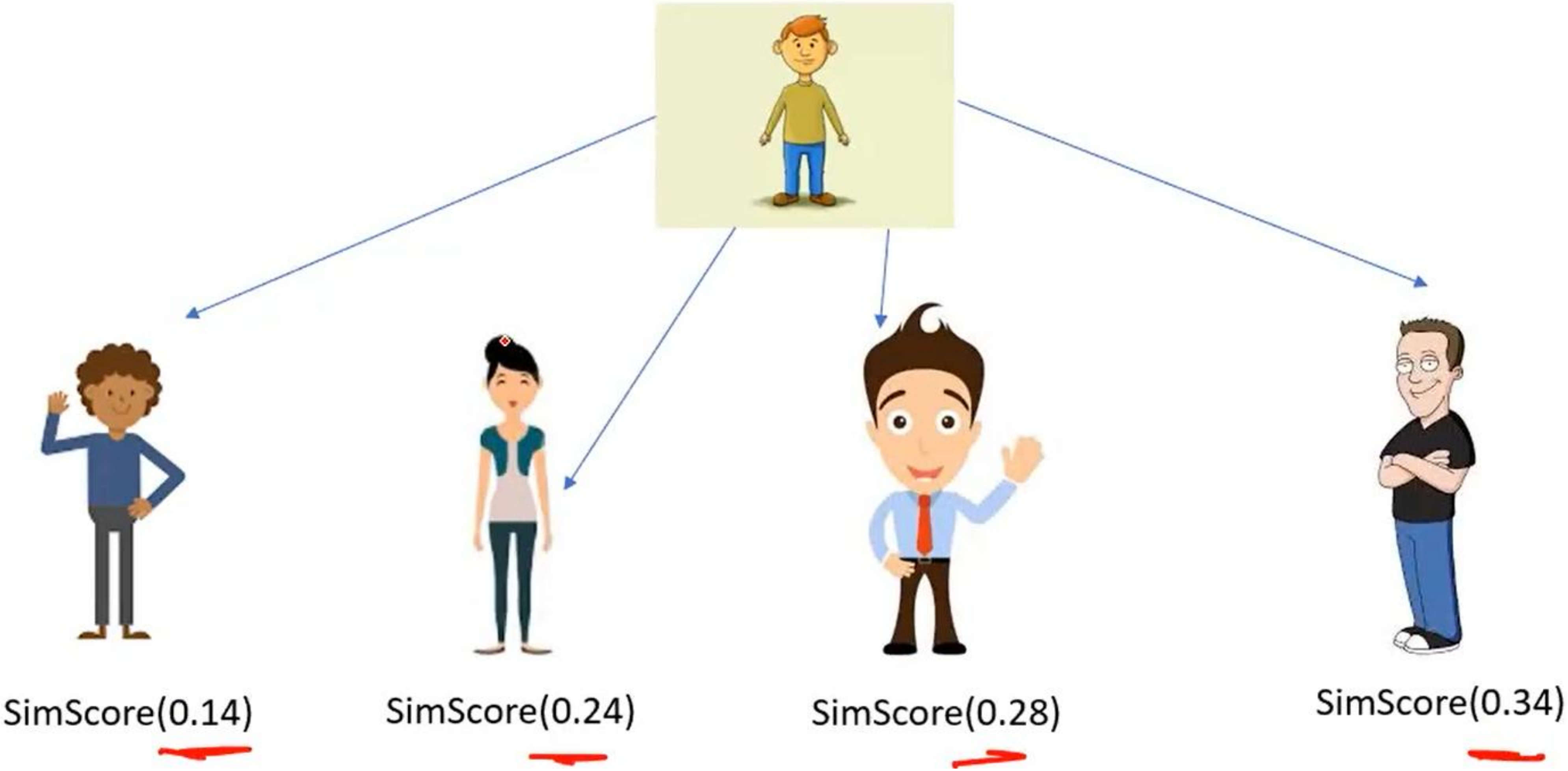
? = 3.03

Little Deeper How this overview works

Collaborative Recommendation System

User based/Memory Based System

Similar users Based on Similarity Table



Little Deeper How this overview works

Collaborative Recommendation System

User based/Memory Based System

User_Input movie Id





Movie_Id	Movie_Id	Movie_Id	Movie_Id	Movie_Id
34	34	34	67	67
45	45	56	83	83
67	89	67	56	53
93	673	78	83	87
57	876	89	86	86
83	893	93	90	90
98				
89				
100				

Collaborative Recommendation System

User based/Memory Based System

Highest Rated Movie_id

Movie_Id	Prediction Value
50	0.99
78	0.89
87	0.75
90	0.74
673	0.45
876	0.37
893	0.25

Threshold=0.7

Sorted Movie_List

50
78
87
90

Little Deeper How this overview works

Collaborative Recommendation System

User based/Memory Based System

Retrieve the Movie Title using
Highest rated movieid

Threshold=0.7

Sorted Movie_List

50
78
87
90

Movie Title

InterSteller
Inception
Gravity
Imitation Game

Collaborative Recommendation System

User based/Memory Based System

STEPS FOR USER BASED RECOMMENDATION SYSTEM

Step1: Create Pivot Table , values as rating

Step2: Create similarity table between Users using Pivot → Cosine Decision

Step3: Predict the non filled rating for the users using formula*(This helps to find the not watched film)

Step4: Select the user_input

Step5: For the user_input select the similar user using similarity Table(Minimum Distance is the similar)

Step6: Create a list of movie id for similar user

Step7: Create a list of movie id for user_input

Step8: Filter the movieid of user_input which is not present in similar user

Step9: Filtered movieid have to check with Prediction table(step3 Answer) because of filtered movieid list are the recommended list

Collaborative Recommendation System

User based/Memory Based System

STEPS FOR USER BASED RECOMMENDATION SYSTEM

Step10: But we have to select only the highest rated movie of the filtered list.

Step11: With help of threshold value we can select the highest rated movie(Completely using predicted table)

Step12: Now we have only the highest rated movieid list of important user.

Step13: Now load the movie tile table

Step14: Using movie title table we can retrive the highesr rated movie list of the user_input(Final Recommendation Title.)

In [156]:
```
#def userbased(input_user,user_similarity,user_predictions,similar_user_count,similar_user_movieid_count,thres):
Recommended_movie=userbased(5,user_similarity,user_pred,2,0.8)
```

```
['Twelve Monkeys (1995)']
['Richard III (1995)']
['Postino, Il (1994)']
['Cold Comfort Farm (1995)']
['Lone Star (1996)']
['Swingers (1996)']
['When the Cats Away (Chacun cherche son chat) (1996)']
['Chasing Amy (1997)']
['Heat (1995)']
['Sense and Sensibility (1995)']
['Secrets & Lies (1996)']
['Donnie Brasco (1997)']
["Ulee's Gold (1997)"]
['Mother (1996)']
['Cop Land (1997)']
The common Movie in Recom & User: []
```

In [153]:
```
len(Recommended_movie)
```

Out[153]:
```
12
```

Content Based Recommendation

Overview

Toy story

↓

Item vector

↓

(0, 1, 1)

$0 \times 9 + 1 \times 0 + 1 \times -6$

$0 + 0 + -6$

-6

Nikhil

↓

User vector

↓

(9, 0, -6)

Star wars

↓

Item vector

↓

(1, 0, 0)

$9 \times 1 + 0 \times 0 + -6 \times 0$

$9 + 0 + 0$

9

Recommended

Childe

Content Based Recommendation

Movie Vector

	1	2	3	4	5	6	7	8	9	10	...	1673	1674	1675	1676	1677	1678	1679	1680	1681	1682
Action	0	1	0	1	0	0	0	0	0	0	...	1	0	0	0	0	0	0	0	0	0
Adventure	0	1	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
Animation	1	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
Children's	1	0	0	0	0	0	0	1	0	0	...	0	0	0	0	0	0	0	0	0	0
Comedy	1	0	0	1	0	0	0	1	0	0	...	0	0	0	0	0	0	0	0	1	0
Crime	0	0	0	0	1	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
Documentary	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
Drama	0	0	0	1	1	1	1	1	1	1	...	0	1	1	1	1	1	0	1	0	1
Fantasy	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
Film-Noir	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
Horror	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
Musical	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
Mystery	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0
Romance	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	1	1	0	0
Sci-Fi	0	0	0	0	0	0	1	0	0	0	...	0	0	0	0	0	0	0	0	0	0
Thriller	0	1	1	0	1	0	0	0	0	0	...	1	0	0	0	0	0	1	0	0	0
War	0	0	0	0	0	0	0	0	0	1	...	0	0	0	0	0	0	0	0	0	0
Western	0	0	0	0	0	0	0	0	0	0	...	0	0	0	0	0	0	0	0	0	0

18 rows × 1682 columns

05:54

Content Based Recommendation

How to create User Vector

Step1: Pivot Table

movie_id	1	2	3	4	5	6	7	8	9	10	...	1673	1674	1675	1676	1677	1678	1679	1680	1681	1682
user_id																					
1	5.0	3.0	4.0	3.0	3.0	5.0	4.0	1.0	5.0	3.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	4.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
939	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
940	0.0	0.0	0.0	2.0	0.0	0.0	4.0	5.0	3.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
941	5.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
942	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
943	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

943 rows × 1682 columns