Movie Recommendation System

This project has been made as the course project for the CS328-data science at IIT Gandhinagar

Contributors:

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```
In [1]: import pandas as pd import numpy as np

In [2]: #Reading the CSV data files movies=pd.read_csv('movies.csv') ratings=pd.read_csv('ratingsmovie.csv')

In [3]: movies.head(17)
```

Out[3]:	movield		title	genres	
	0	1	Toy Story (1995)	Adventure Animation Children Comedy Fantasy	
	1	2	Jumanji (1995)	Adventure Children Fantasy	
	2	3	Grumpier Old Men (1995)	Comedy Romance	
	3	4	Waiting to Exhale (1995)	Comedy Drama Romance	
	4	5	Father of the Bride Part II (1995)	Comedy	
	5	6	Heat (1995)	Action Crime Thriller	
	6	7	Sabrina (1995)	Comedy Romance	
	7	8	Tom and Huck (1995)	Adventure Children	
	8	9	Sudden Death (1995)	Action	

	movield	title	genres
9	10	GoldenEye (1995)	Action Adventure Thriller
10	11	American President, The (1995)	Comedy Drama Romance
11	12	Dracula: Dead and Loving It (1995)	Comedy Horror
12	13	Balto (1995)	Adventure Animation Children
13	14	Nixon (1995)	Drama
14	15	Cutthroat Island (1995)	Action Adventure Romance
15	16	Casino (1995)	Crime Drama
16	17	Sense and Sensibility (1995)	Drama Romance

In [4]:

ratings

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UU		_+] •

	userId	movield	rating	timestamp
0	1	296	5.0	1147880044
1	1	306	3.5	1147868817
2	1	307	5.0	1147868828
3	1	665	5.0	1147878820
4	1	899	3.5	1147868510
•••			•••	
25000090	162541	50872	4.5	1240953372
25000091	162541	55768	2.5	1240951998
25000092	162541	56176	2.0	1240950697
25000093	162541	58559	4.0	1240953434
25000094	162541	63876	5.0	1240952515

25000095 rows × 4 columns

genres	movield title		
Adventure Animation Children Comedy Fantasy	Toy Story (1995)	1	0
Adventure Children Fantasy	Jumanji (1995)	2	1
Comedy Romance	Grumpier Old Men (1995)	3	2
Comedy Drama Romance	Waiting to Exhale (1995)	4	3
Comedy	Father of the Bride Part II (1995)	5	4
			•••
Action Comedy Romance	Santosh Subramaniam (2008)	209155	57356
Drama	We (2018)	209157	57357
Documentary	Window of the Soul (2001)	209159	57358
Comedy Drama	Bad Poems (2018)	209163	57359
Action Adventure Drama	Women of Devil's Island (1962)	209171	57360

57361 rows × 3 columns

```
In [9]: ratings.shape
Out[9]: (25000095, 4)

In [10]: movies.shape
Out[10]: (57361, 3)

In [11]: # Forming a new column for the release year of the movie movies_new=movies_new['release_year']=''

In [12]: movies_new
```

Out[12]:	movield		title	genres	release_year
	0	1	Toy Story (1995)	Adventure Animation Children Comedy Fantasy	
	1	2	Jumanji (1995)	Adventure Children Fantasy	
	2	3	Grumpier Old Men (1995)	Comedy Romance	
	3	4	Waiting to Exhale (1995)	Comedy Drama Romance	
	4	5	Father of the Bride Part II (1995)	Comedy	
	•••				
	57356	209155	Santosh Subramaniam (2008)	Action Comedy Romance	
	57357	209157	We (2018)	Drama	
	57358	209159	Window of the Soul (2001)	Documentary	
	57359	209163	Bad Poems (2018)	Comedy Drama	
	57360	209171	Women of Devil's Island (1962)	Action Adventure Drama	

57361 rows × 4 columns

```
In [13]:
          #Separating the release year from the title of the movie
          #Also, separating the
          for i in range(movies new.shape[0]):
              a=movies new['title'].iloc[i]
              movies new.title[i]=a[:-7]
              movies new['release year'][i]=a[-5:-1]
              movies new.genres[i]=movies new.genres[i].replace('|','')
         C:\Users\Dell\AppData\Local\Temp/ipykernel 42668/3028130940.py:5: SettingWithCopyWarning:
         A value is trying to be set on a copy of a slice from a DataFrame
         See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user guide/indexing.html#returning-a-view-versu
          s-a-copy
           movies new.title[i]=a[:-7]
         C:\Users\Dell\AppData\Local\Temp/ipykernel 42668/3028130940.py:6: SettingWithCopyWarning:
         A value is trying to be set on a copy of a slice from a DataFrame
         See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user guide/indexing.html#returning-a-view-versu
          s-a-copy
           movies new['release_year'][i]=a[-5:-1]
         C:\Users\Dell\AppData\Local\Temp/ipykernel 42668/3028130940.py:7: SettingWithCopyWarning:
          A value is trying to be set on a copy of a slice from a DataFrame
         See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user guide/indexing.html#returning-a-view-versu
          s-a-copy
           movies new.genres[i]=movies new.genres[i].replace('|','')
In [14]:
          movies new['genres']=movies new['genres'].apply(lambda x:x.lower())
In [15]:
          # movies new.head(60)
In [16]:
          movies new
Out[16]:
                                        title
                                                                           genres release_year
                movield
             0
                                    Toy Story adventure animation children comedy fantasy
                                                                                        1995
             1
                      2
                                      Jumanji
                                                            adventure children fantasy
                                                                                        1995
```

	movield	title	genres	release_year
2	3	Grumpier Old Men	comedy romance	1995
3	4	Waiting to Exhale	comedy drama romance	1995
4	5	Father of the Bride Part II comedy		1995
•••				
57356	209155	Santosh Subramaniam	action comedy romance	2008
57357	209157	We	drama	2018
57358	209159	Window of the Soul	Window of the Soul documentary	
57359	209163	Bad Poems	comedy drama	2018
57360	209171	Women of Devil's Island	action adventure drama	1962

57361 rows × 4 columns

```
#Checking for any duplicate entry in the database ratings.duplicated().sum()
```

Out[17]:

```
In [18]: #Dropping the 'timestamp' column from the dataset
    ratings.drop(['timestamp'],axis=1,inplace=True)
```

In [19]: ratings

Out[19]:		userId	movield	rating
	0	1	296	5.0
	1	1	306	3.5
	2	1	307	5.0
	3	1	665	5.0

	userId	movield	rating
4	1	899	3.5
•••			
25000090	162541	50872	4.5
25000091	162541	55768	2.5
25000092	162541	56176	2.0
25000093	162541	58559	4.0
25000094	162541	63876	5.0

25000095 rows × 3 columns

In [20]:

#Merging the movies and ratings dataset on the basis of the column 'movieId'
movierating=movies_new.merge(ratings,on='movieId')

In [21]:

movierating

Out[21]:		movield	title	genres	release_year	userId	rating
	0	1	Toy Story	adventure animation children comedy fantasy	1995	2	3.5
	1	1	Toy Story	adventure animation children comedy fantasy	1995	3	4.0
	2	1	Toy Story	adventure animation children comedy fantasy	1995	4	3.0
	3	1	Toy Story	adventure animation children comedy fantasy	1995	5	4.0
	4	1	Toy Story	adventure animation children comedy fantasy	1995	8	4.0
	•••						
	24973463	209155	Santosh Subramaniam	action comedy romance	2008	134916	5.0
	24973464	209157	We	drama	2018	119571	1.5
	24973465	209159	Window of the Soul	documentary	2001	115835	3.0
	24973466	209163	Bad Poems	comedy drama	2018	6964	4.5

Out[

	movield	title	genres	release_year	userId	rating
24973467	209171	Women of Devil's Island	action adventure drama	1962	119571	3.0

24973468 rows × 6 columns

In [22]: temp1=movierating.groupby('title').sum()

#Grouping together the data with the same 'userId' and storing only the data of those users who have rated more than 1000 movies x=movierating.groupby('userId').count()['rating']>1000 #Performing Boolean indexing to get the index of the users who have rated more than 1000 movies userwithrating=x[x].index

In [24]: #Storing the data of the users who have rated more than 1000 movies in a new dataset filteredratings=movierating[movierating['userId'].isin(userwithrating)]

In [25]: filteredratings

[25]:		movield	title	genres	release_year	userld	rating
	53	1	Toy Story	adventure animation children comedy fantasy	1995	187	3.5
	130	1	Toy Story	adventure animation children comedy fantasy	1995	426	2.5
	170	1	Toy Story	adventure animation children comedy fantasy	1995	541	5.0
	172	1	Toy Story	adventure animation children comedy fantasy	1995	548	4.5
	199	1	Toy Story	adventure animation children comedy fantasy	1995	626	4.5
	•••						
	24973441	209057	The Somme	drama	2005	115548	3.0
	24973442	209069	Snapshots	drama romance	2002	30779	3.0
	24973449	209121	Adrenalin: The BMW Touring Car Story	documentary	2014	53808	4.0
	24973454	209135	Jane B. by Agnès V.	documentary fantasy	1988	154484	3.5
	24973460	209147	The Carpet of Horror	crime horror	1962	83426	3.5

movield title genres release_year userld rating

4169404 rows × 6 columns

In [26]: #List of all the movies whihe are rated by the user with userId=548
filteredratings.loc[filteredratings['userId']==548]

#Grouping together the data with the same 'movieId' and storing only those movies which have been rated by at least 50 users y=filteredratings.groupby('movieId').count()['rating']>50
#Performing Boolean indexing to get the index of the movies which have been rated by more than 50 users ratingsonmovies=y[y].index

In [28]: #Storing the data of the movies which have been rated by more than 50 users in a new dataset filteredmovies=filteredratings[filteredratings['movieId'].isin(ratingsonmovies)]

In [29]: filteredmovies

Out[29]:		movield	title	genres	release_year	userId	rating
	53	1	Toy Story	adventure animation children comedy fantasy	1995	187	3.5
	130	1	Toy Story	adventure animation children comedy fantasy	1995	426	2.5
	170	1	Toy Story	adventure animation children comedy fantasy	1995	541	5.0
	172	1	Toy Story	adventure animation children comedy fantasy	1995	548	4.5
	199	1	Toy Story	adventure animation children comedy fantasy	1995	626	4.5
	•••						
	24971045	205383	El Camino: A Breaking Bad Movie	crime drama thriller	2019	149294	4.0
	24971046	205383	El Camino: A Breaking Bad Movie	crime drama thriller	2019	149890	4.0
	24971048	205383	El Camino: A Breaking Bad Movie	crime drama thriller	2019	151009	4.0
	24971050	205383	El Camino: A Breaking Bad Movie	crime drama thriller	2019	152937	2.5
	24971066	205383	El Camino: A Breaking Bad Movie	crime drama thriller	2019	161560	2.5

	movield	t	title	nres re	lease_year	userId								
3854	1296 rows × 6 columns													
	# Counting the number of movies we are left with in the dataset after the two filterings #filteredmovies.movieId.nunique()													
1]: fi	<pre>filteredmovies_new=filteredmovies.groupby('title').first()</pre>													
2]: fi	filteredmovies_new.reset_index(inplace=True)													
33]: fi	lteredmovies_new													
[33]:	titl	e movield	genres	release_year	userId	rating								
(0	189577	sci-fi thriller	Та	3013	3.0								
	1 '7	1 117867	action drama thriller war	2014	426	2.5								
;	2 'Round Midnigh	t 26564	drama musical	1986	9391	3.0								
	3 'Salem's Lo	t 27751	drama horror mystery thriller	2004	548	3.0								
	4 'Til There Was Yo	u 779	drama romance	1997	2177	4.0								
	••													
976	5 xX	x 5507	action crime thriller	2002	187	3.5								
976	6 xXx: Return of Xander Cag	e 167738	action adventure crime thriller	2017	2389	2.5								
976	7 xXx: State of the Union	n 33158	action crime thriller	2005	187	3.0								
976	8 ¡Three Amigos	! 2478	comedy western	1986	626	2.0								
976	9 À nous la liberté (Freedom for Us	5560	comedy musical	1931	847	2.5								

9770 rows × 6 columns

```
(Project)Movie-Recommendation-System
In [34]:
          #For checking the genres of any respective movie
          filteredmovies new.loc[filteredmovies new['title']=='Forrest Gump',['title','genres']]
Out[34]:
                      title
                                           genres
         3136 Forrest Gump comedy drama romance war
         Content Based Recommender System
In [35]:
          from sklearn.feature extraction.text import CountVectorizer
          cv=CountVectorizer()
In [36]:
          #Converting the genre terms into arrays, these arrays would be used for camparing the genres of the movie
          vectors=cv.fit transform(filteredmovies new['genres']).toarray()
```

```
In [37]:
          #For finding out the similarity between the arrays, which are formed using the genres of the movies.
          from sklearn.metrics.pairwise import cosine similarity
          similarity = cosine similarity(vectors)
```

```
In [51]:
          similarity[0][9768]
```

Out[51]:

```
In [38]:
          #filteredmovies new.loc[filteredmovies new['title']=='Titanic','release year']
```

```
In [39]:
          #Takes a movie name and recommends the most similar movies as per its the genre tags.
          def contentrecommend(movie):
              movieindex=filteredmovies new[filteredmovies new['title']==movie].index[0]
              distances=similarity[movieindex]
              movieslist=sorted(list(enumerate(distances)),reverse=True, key=lambda x:x[1])[1:20]
              for i in movieslist:
```

```
print(filteredmovies new.iloc[i[0]].title)
              return
In [40]:
          contentrecommend('Salaam Bombay!')
         12 Angry Men
         12 Years a Slave
         13 Hours
         2 ou 3 choses que je sais d'elle (2 or 3 Things I Know About Her)
         20th Century Women
         28 Days
         3 Women (Three Women)
         4 Months, 3 Weeks and 2 Days (4 luni, 3 saptamâni si 2 zile)
         45 Years
         54
         61*
         71 Fragments of a Chronology of Chance (71 Fragmente einer Chronologie des Zufalls)
         8 Mile
         8 Seconds
         99 Homes
         A Ghost Story
         Aberdeen
         Accattone
In [ ]:
          #Star Trek: Nemesis
          #Harry Potter and the Chamber of Secrets
          #Salaam Bombay!
          #S.W.A.T.
          #Fast & Furious 6 (Fast and the Furious 6, The)
          #A.I. Artificial Intelligence
          #Spv Kids
          #Revenge of the Nerds II: Nerds in Paradise
          #Goonies, The
          #Zootopia
```

Collaborative Filtering Based Recommender System

```
In [52]: #Creating a matrix with movie title as rows, userId as columns, and the values as the ratings given to the movie by the correspond ratingmatrix=filteredmovies.pivot_table(index='title',columns='userId',values='rating')
```

In [53]: ratingmatrix.shape (9770, 2665) Out[53]: In [54]: #This matrix shows rating given to a movie by a user with corresponding userId ratingmatrix Out[54]: userId 187 426 541 548 626 653 757 803 846 847 ... 161560 161586 161675 161826 161928 162047 162271 162495 162508 1 title NaN NaN NaN NaN NaN NaN NaN NaN NaN ... NaN NaN NaN NaN NaN NaN NaN NaN NaN '71 2.5 NaN NaN NaN NaN NaN NaN NaN ... NaN 'Round NaN NaN NaN NaN NaN NaN NaN NaN NaN ... NaN NaN NaN NaN NaN NaN NaN NaN NaN Midnight 'Salem's NaN NaN NaN 3.0 NaN NaN NaN NaN NaN ... NaN NaN NaN NaN NaN NaN NaN NaN NaN Lot 'Til There NaN NaN NaN NaN NaN NaN NaN NaN NaN ... NaN NaN NaN NaN NaN NaN NaN NaN NaN Was You xXxNaN 3.0 3.0 NaN NaN 3.0 1.5 NaN ... 2.0 1.5 NaN 1.0 3.0 NaN NaN NaN NaN xXx: Return of NaN NaN NaN NaN NaN NaN NaN NaN NaN ... NaN NaN NaN NaN NaN NaN NaN NaN NaN Xander Cage xXx: State of 3.0 NaN NaN NaN NaN NaN NaN NaN NaN ... 0.5 NaN NaN NaN NaN NaN NaN NaN NaN the Union ¡Three NaN NaN NaN NaN 2.0 4.0 3.0 NaN 0.5 2.5 4.0 2.5 ... NaN 1.0 NaN NaN NaN NaN NaN Amigos! NaN NaN NaN NaN NaN NaN NaN NaN NaN 2.5 NaN NaN 2.5 ... NaN NaN NaN NaN NaN liberté

userld 187 426 541 548 626 653 757 803 846 847 ... 161560 161586 161675 161826 161928 162047 162271 162495 162508 1

title

(Freedom for Us)

9770 rows × 2665 columns

In [55]: #Replacing the missing values with 0
ratingmatrix.fillna(0,inplace=True)

In [56]: ratingmatrix

Out[56]: 187 426 541 548 626 653 757 803 846 847 ... 161560 161586 161675 161826 161928 162047 162271 162495 162508 16251¢ title 0.0 '71 0.0 2.5 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 'Round 0.0 0.0 0.0 0.0 0.0 0.0 2.5 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Midnight 'Salem's 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 Lot 'Til There 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 **Was You** 3.0 0.0 0.0 3.0 1.5 0.0 ... 2.0 1.5 0.0 1.0 0.0 0.0 0.0 0.0 2.5 хXх 0.0 0.0 3.0 3.0 xXx: Return of 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 Xander Cage xXx: 3.0 0.0 0.0 0.0 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 State of

userld 187 426 541 548 626 653 757 803 846 847 ... 161560 161586 161675 161826 161928 162047 162271 162495 162508 162516

title

	the Union																					
	¡Three Amigos!	0.0	0.0	0.0	0.0	2.0	4.0	3.0	0.0	0.5	2.5		0.0	1.0	0.0	0.0	0.0	0.0	2.5	4.0	0.0	2.0
	À nous la liberté (Freedom for Us)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5		0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0
	9770 rows	× 266	55 coli	umns																		
In [57]:	<pre>from sklearn.metrics.pairwise import cosine_similarity</pre>															.						
In [58]:	<pre>#Finding out the cosine similarity between the movies similarityscores=cosine_similarity(ratingmatrix)</pre>																					
In [65]:	similarityscores.shape																					
Out[65]:	(9770, 9770)																					
In [59]:	similari	similarityscores[0]																				
Out[59]:		array([1. , 0.06339446, 0.02196289,, 0.13518302, 0.07176835, 0.03885632])																				
In [126	simi #dis	ommend ex=np larit stance	d(mov: .where tems=: es=sin	ienam e(rat:	e): ingma d(li:	atrix st(en	.inde	ex==mo	ovier	name)	[0][0	ð]	the top				se= True)	[1:21]				

```
print(ratingmatrix.index[i[0]])
               return
In [127...
           recommend('Titanic')
          Forrest Gump
          Sixth Sense, The
          Matrix, The
          Shawshank Redemption, The
          Back to the Future
          Jurassic Park
          Silence of the Lambs, The
          Men in Black (a.k.a. MIB)
          Star Wars: Episode IV - A New Hope
          Raiders of the Lost Ark (Indiana Jones and the Raiders of the Lost Ark)
          Gladiator
          Truman Show, The
          Toy Story
          Pulp Fiction
          Groundhog Day
          E.T. the Extra-Terrestrial
          Star Wars: Episode V - The Empire Strikes Back
          Terminator, The
          Saving Private Ryan
          Terminator 2: Judgment Day
In [128...
           #Star Trek: Nemesis
           #Harry Potter and the Chamber of Secrets
           #Salaam Bombay!
           #S.W.A.T.
           #Fast & Furious 6 (Fast and the Furious 6, The)
           #A.I. Artificial Intelligence
           #Spy Kids
           #Revenge of the Nerds II: Nerds in Paradise
           #Titanic
```

Enhancing the Collabortive filtering based recommendation system:

```
#Considering the movie genres even for recommending the movies def enhancedrecommend(moviename):
```

```
index=np.where(ratingmatrix.index==moviename)[0][0]
similaritems=sorted(list(enumerate(similarityscores[index])),key=lambda x:x[1],reverse=True)[1:21]
#Forming a dictionary to store the index of movies which are similar to the given movie based on user rating and genres.
hybridsimilaritems={}
for j in similaritems:__setitem__(j[0],similarity[index][j[0]])
keys = list(hybridsimilaritems.keys())
values = list(hybridsimilaritems.values())
sorted_value_index = np.argsort(values)
sorthybridsimilaritems = {keys[i]: values[i] for i in sorted_value_index}
revsorthybridsimilaritems = dict(reversed(list(sorthybridsimilaritems.items())))
for k in list(revsorthybridsimilaritems.keys()):
    print(ratingmatrix.index[k])
return
```

In [135...

```
enhancedrecommend('Titanic')
```

Forrest Gump Shawshank Redemption, The Sixth Sense, The Groundhog Day Gladiator Saving Private Ryan E.T. the Extra-Terrestrial Pulp Fiction Truman Show, The Silence of the Lambs, The Matrix, The Back to the Future Jurassic Park Terminator 2: Judgment Day Men in Black (a.k.a. MIB) Star Wars: Episode IV - A New Hope Toy Story Star Wars: Episode V - The Empire Strikes Back Terminator, The Raiders of the Lost Ark (Indiana Jones and the Raiders of the Lost Ark)

```
In [ ]: #Star Trek: Nemesis
    #Harry Potter and the Chamber of Secrets
    #Salaam Bombay!
    #S.W.A.T.
```

```
#Fast & Furious 6 (Fast and the Furious 6, The)
#A.I. Artificial Intelligence
#Spy Kids
#Revenge of the Nerds II: Nerds in Paradise
#Titanic
```