

Group Project Strategic Analysis Report

Recommendation System



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Introduction:¶

In this project, we are going to explore what is a recommendation system ? its uses, and how we can grow our business with the help of this system ? and then we will build recommendations. A recommendation system is a subclass of Information filtering Systems that seeks to predict the rating or the preference a user might give to an item. In simple words, it is an algorithm that suggests relevant items to users. I am going to build 2 recommendation systems one on the movie dataset and the other one on the product dataset.

There are three types of recommendation system:

Collaborative filtering:

Collaborative Filtering is a Machine Learning technique used to identify relationships between pieces of data. One important thing to keep in mind is that in an approach based purely on collaborative filtering, the similarity is not calculated using factors like the age of users, genre of the movie, or any other data about users or items. It is calculated only on the basis of the rating (explicit or implicit) a user gives to an item. For example, two users can be considered similar if they give the same ratings to ten movies despite there being a big difference in their age. In this project, we will focus on that type of filtering.

Advantages of Collaborative filtering:

- We don't need domain knowledge because the embeddings are automatically learned.
- The model can help users discover new interests. In isolation, the ML system may not know the user is interested in a given item, but the model might still recommend it because similar users are interested in that item.
- To some extent, the system needs only the feedback matrix to train a matrix factorization model. In particular, the system doesn't need contextual features. In practice, this can be used as one of multiple candidate generators.

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. **Netflix** is also using that kind of filtering for recommendation

Hybrid Model:

Hybrid filters combine several passive or active filters, their structure may be of series or parallel topology or a combination of the two. this type of filtering is used for advanced level recommendation systems

Examples of Recommendation systems:

- Movie recommendation system.
- Product recommendation system.
- Books recommendation system.

Roles and Responsibilities:

Today in the Modern world many companies are using recommendation engines to recommend movies, music, television programs, books, documents, websites, conferences, tourism scenic spots, and learning materials, and involve the areas of e-commerce, e-learning, e-library, e-government, and e-business services.

Business Perspective

A recommendation system is used to predict whether a customer will buy any specific product or not based on previous shopping history. We can use recommendations to bring any kind of business to another level. On top of strengthening relationships with your customers, the recommendation engines can provide higher returns to your business as it can help boost engagement opportunities with your products and offer a greater influx of cross-selling opportunities.

Netflix, YouTube, Tinder, and Amazon are all examples of recommender systems in use. The systems entice users with relevant suggestions based on the choices they make. Recommender systems can also enhance experiences for: News Websites.

Some benefits of recommendation system:

- Engage Shoppers.
- Increase Average Order Value.
- Increase the Number of Items per Order.
- Convert Shoppers to Customers.

Google Recommendation System:

When you use Google Shopping, you're browsing products from advertisers and sellers who have chosen to feature their products on Google Shopping. Unless otherwise indicated, offers on Google Shopping are ranked based on relevance, including your search terms and other Google activity.

Netflix Recommendation System:

Netflix uses machine learning, a subset of artificial intelligence, to help their algorithms "learn" without human assistance. Machine learning gives the platform the ability to automate millions of decisions based on user activities. Netflix takes feedback from every visit to the website service and continually re-trains our algorithms with those signals to improve the accuracy of their prediction of what we're most likely to watch.

Statistics:

I am going to build two recommendations with help of Nearest Neighbor. I will use the collaborative filtering technique. I have two datasets one is about movies rating and the other one is about amazon product reviews.

Movie Recommendation System:

I have a dataset of [movies reviews](#). This dataset contains features. The dataset is pretty so I don't have to do much work for cleaning.

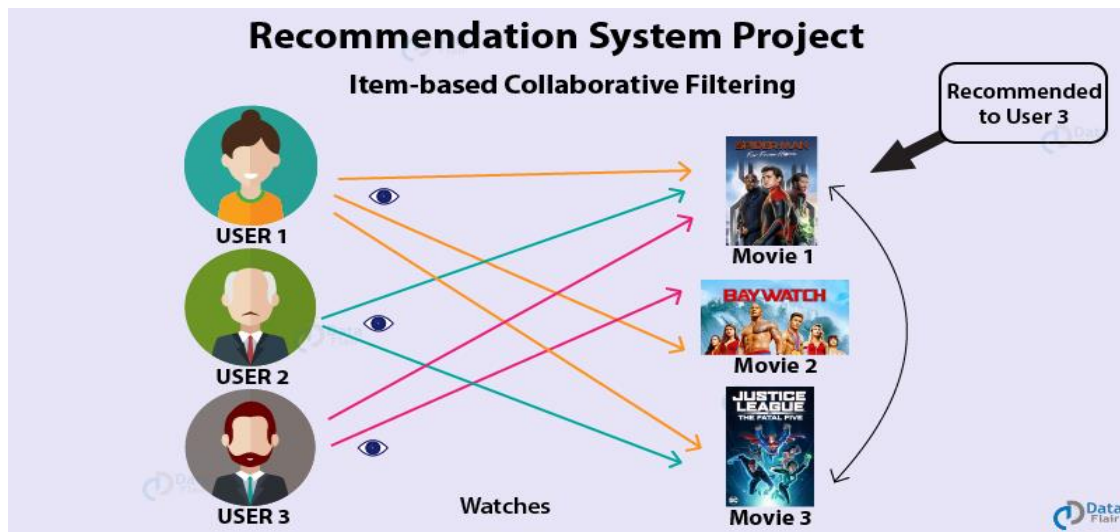
	userId	movieId	rating	title
0	1	1	4.0	Toy Story (1995)
1	5	1	4.0	Toy Story (1995)
2	7	1	4.5	Toy Story (1995)
3	15	1	2.5	Toy Story (1995)
4	17	1	4.5	Toy Story (1995)

Dataset Information

Out[7]:

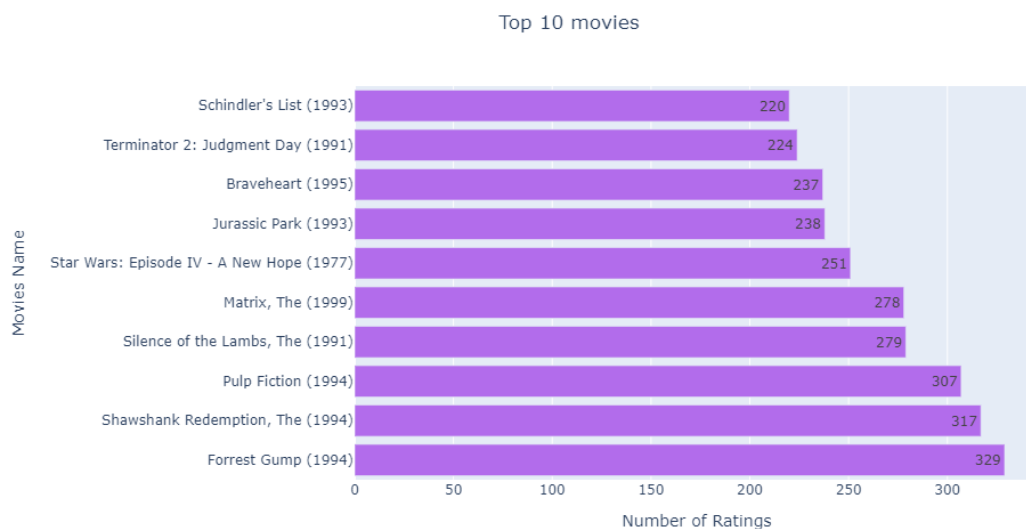
	count	mean	std	min	25%	50%	75%	max
userId	100836.0	326.127564	182.618491	1.0	177.0	325.0	477.0	610.0
movieId	100836.0	19435.295718	35530.987199	1.0	1199.0	2991.0	8122.0	193609.0
rating	100836.0	3.501557	1.042529	0.5	3.0	3.5	4.0	5.0

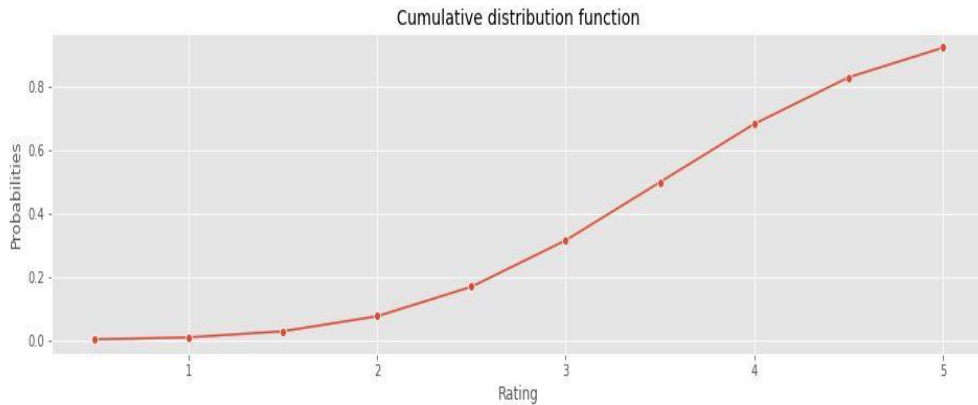
Exploratory data Analysis of Movies dataset:



Exploratory data Analysis on Movies dataset:

- According to the dataset these are the best movies and top-rated movies.

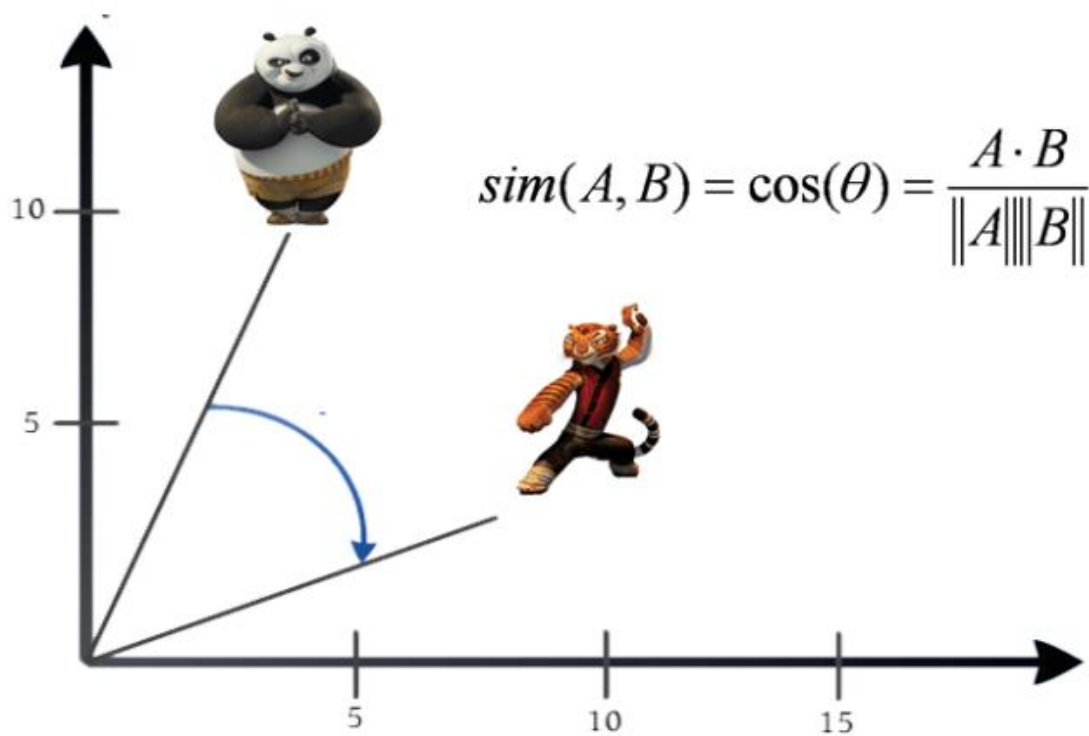




Nearest Neighbors:

kNN is a machine learning algorithm to find clusters of similar users based on common book ratings, and make predictions using the average rating of top-k nearest neighbors.

Cosine Similarity



We are going to use the Nearest neighbors to do collaborative filtering. I will use **cosine similarity** to calculate the distance between the points. Cosine similarity is a metric used to measure how similar two items are. Mathematically, it measures the cosine of the angle between two vectors projected in a multi-dimensional space. The output value ranges from 0–to 1. 0 means no similarity, whereas 1 means that both the items are 100% similar.

Results of Movie recommendation system:

I have created a function that will take 5 parameters title of the movie, model, number of recommendations, and dataset. I have chosen the title of the toy story. Now you can see the recommendation engine is giving 20 suggestions which closer to the toy story.

```
In [31]: def recommendation(movie_name,data,model,n_recommendations):
          model.fit(data)
          idx = process.extractOne(movie_name,df_movies['title'])[2]
          print('Movie Selected : ', df_movies['title'][idx],'Index: ',idx)
          print('Searching for recommendations..... ')
          distances , indices = model.kneighbors(data[idx],n_neighbors = n_recommendations)
          for i in indices:
              print(df_movies['title'][i].where(i!=idx))
```

```
recommendation('toy story',mat_movies_users,model_knn,20)
```

```
Movie Selected : Toy Story (1995) Index: 0
```

```
Searching for recommendations.....
```

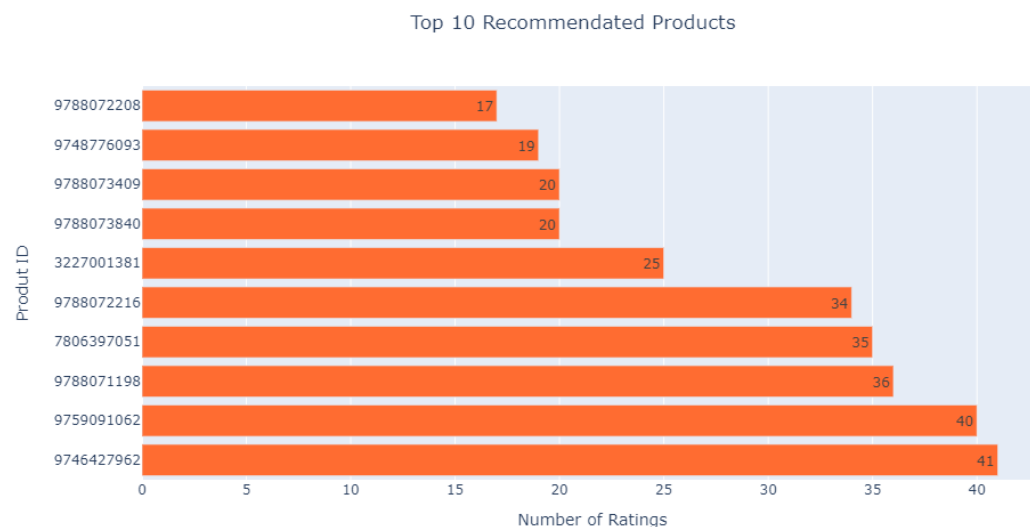
```
0 NaN
2353 'night Mother (1986)
418 Jurassic Park (1993)
615 Independence Day (a.k.a. ID4) (1996)
224 Star Wars: Episode IV - A New Hope (1977)
314 Forrest Gump (1994)
322 Lion King, The (1994)
910 Once Upon a Time in the West (C'era una volta ...
546 Mission: Impossible (1996)
963 Diva (1981)
968 Arsenic and Old Lace (1944)
3189 Rififi (Du rififi chez les hommes) (1955)
506 Aladdin (1992)
123 Apollo 13 (1995)
257 Pulp Fiction (1994)
897 Cheech and Chong's Up in Smoke (1978)
815 Willy Wonka & the Chocolate Factory (1971)
1182 Fall (1997)
31 Twelve Monkeys (a.k.a. 12 Monkeys) (1995)
277 Shawshank Redemption, The (1994)
Name: title, dtype: object
```


Product Recommendation System:

For product Recommendation I am going to use the [amazon reviews dataset](#). the dataset contains 4 features but it does not contain the product title feature. we only have got product id. so our recommendation system will only return product id instead of title.

	UserId	ProductId	Rating	Timestamp
0	A39HTATAQ9V7YF	0205616461	5.0	1369699200
1	A3JM6GV9MNOF9X	0558925278	3.0	1355443200
2	A1Z513UWSAAO0F	0558925278	5.0	1404691200
3	A1WMRR494NWEWV	0733001998	4.0	1382572800
4	A3IAAVS479H7M7	0737104473	1.0	1274227200

Results of Product Recommendation Engine



Product:

- Eyeliner Pen.

Suggestions:

- Kms California Hair Conditioner.
- Anti Aging face cream.
- Women's Perfume.
- Peanuts: A Charlie Brown Christmas.

Conclsion:¶

We have built two recommendation Systems based on collaborative filtering with the help of **Nearest Neighbors**. We calculated the items' similarities with the help of cosine similarity. Both models are working great. Most online stores, such as **eBay** and **Amazon**, will constantly offer their customers recommendations by sorting through their search results and what they have purchased, this is because a recommendation system is a perfect way to offer a compelling user experience.

By getting to know your customers through content-based approaches, you will ensure that they keep coming back to you. As you learn what does and doesn't sell, you can offer your main target audience exactly what they need. This will quickly lead to more sales and more profit for you!

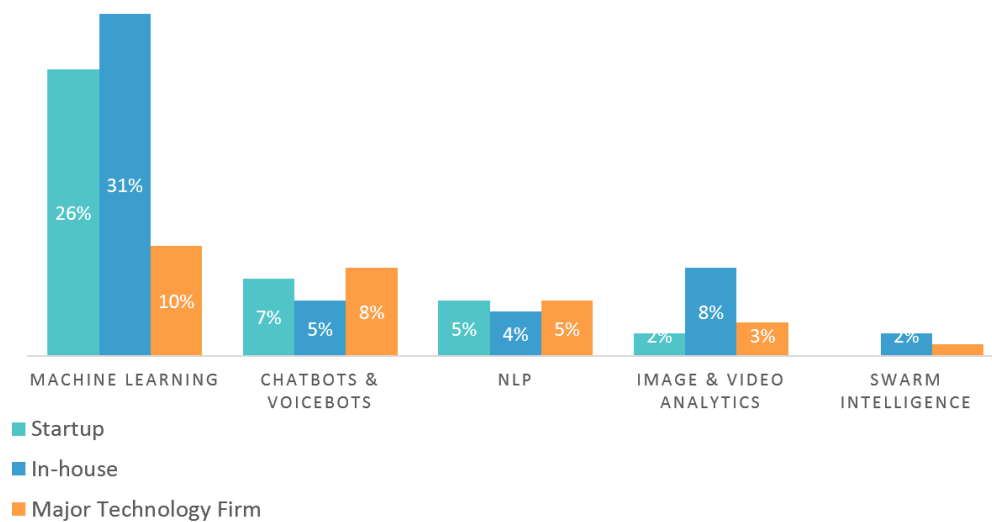
Benefits of Recommendation System:

- Attracts more traffic
- Engages shoppers through diversity
- Increases customer satisfaction and retention
- Boosts conversion rates
- Augments upselling and cross-selling efforts
- Raises average order value and purchases, and more.

Artificial Intelligence:

Many businesses take up **artificial intelligence** (AI) technology to try to reduce operational costs, increase efficiency, grow revenue and improve customer experience. For the greatest benefits, businesses should look at putting the full range of smart technologies - including machine learning, natural language processing and more - into their processes and products. However, even businesses that are new to AI can reap major

Artificial Intelligence (AI) Use-case Distribution in Retail Organizations, in %, by Operating Model, Global, 2018



Source: Capgemini SE



Notebooks Url:

Product Recommendation System:

<https://github.com/NishR100/Recommendation-Sytems/blob/28f91ff576c6b67ed8ec5596af91a2b1cfb10609/Movie%20Recommendation%20System.ipynb>

Movies Recommendation System:

<https://github.com/NishR100/Recommendation-Sytems/blob/28f91ff576c6b67ed8ec5596af91a2b1cfb10609/Product%20Recommendation%20system.ipynb>

References:

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Bias and Debias in Recommender System: A Survey and Future Directions at:

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5 Advantages Recommendation Engines Can Offer to Businesses at:

<https://towardsdatascience.com/5-advantages-recommendation-engines-can-offer-to-businesses-10b663977673>

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<https://www.width.ai/post/recommender-systems-recommendation-systems>