Capstone Project - 04

NETFLIX MOVIES AND TV SHOWS CLUSTERING

Presented By :- ABHISHEK KIRAR

Cohort- OSLO

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ONLY ON

NETFLIX

Introduction

AI

Netflix: Netflix is a company that manages a large collection of TV shows and movies, streaming it anytime via online. This business is profitable because users make a monthly payment to access the platform. However, customers can cancel their subscriptions at any time.

Methodology: Unsupervised Machine Learning (Clustering)

Database:
- Netflix Movies and TV Shows
- 7787 rows and 12 columns
- Data from last decade

Problem Statement

AI

This dataset consists of tv shows and movies available on Netflix as of 2019. The dataset is collected from Flixable which is a third-party Netflix search engine.

In 2018, they released an interesting report which shows that the number of TV shows on Netflix has nearly tripled since 2010. The streaming service's number of movies has decreased by more than 2,000 titles since 2010, while its number of TV shows has nearly tripled. It will be interesting to explore what all other insights can be obtained from the same dataset.
Integrating this dataset with other external datasets such as IMDB ratings, rotten tomatoes can also provide many interesting findings.

In this project, you are required to do
1. Exploratory Data Analysis
2. Understanding what type content is available in different countries
3. Is Netflix has increasingly focusing on TV rather than movies in recent years.
4. Clustering similar content by matching text-based features

Data Description

The data was collected from Flixable which is third party Netflix search engine. The dataset consists of movies and TV shows data till 2019. The dataset has 7787 rows of data.

The dataset consists of eleven textual columns and one numeric column.

Attribute Information :

1. **show_id :** Unique ID for every Movie / Tv Show
2. **type :** Identifier - A Movie or TV Show
3. **title :** Title of the Movie / Tv Show
4. **director :** Director of the Movie

Data Description

5. **cast :** Actors involved in the movie / show
6. **country :** Country where the movie / show was produced
7. **date_added :** Date it was added on Netflix
8. **release_year :** Actual Release year of the movie / show
9. **rating :** TV Rating of the movie / show
10. **duration :** Total Duration - in minutes or number of seasons
11. **listed_in :** Genre
12. **description:** The Summary description

Null Value

Null Value Treatment:

● *Director* feature have more than ***30.68%*** of null values. Filling null values by 'unknown'.

● *Country* feature have ***6.51%*** of null values. Filling null values by mode of feature.

● *Cast feature* have ***9.22%*** of null values. Filling null values by 'unknown'.

● *Rating* feature have ***0.09%*** of null values. Filling null values by mode of feature.

● *Date_added* feature have ***0.13%*** of null values. Dropping rows corresponding to null values.

Exploratory Data Analysis
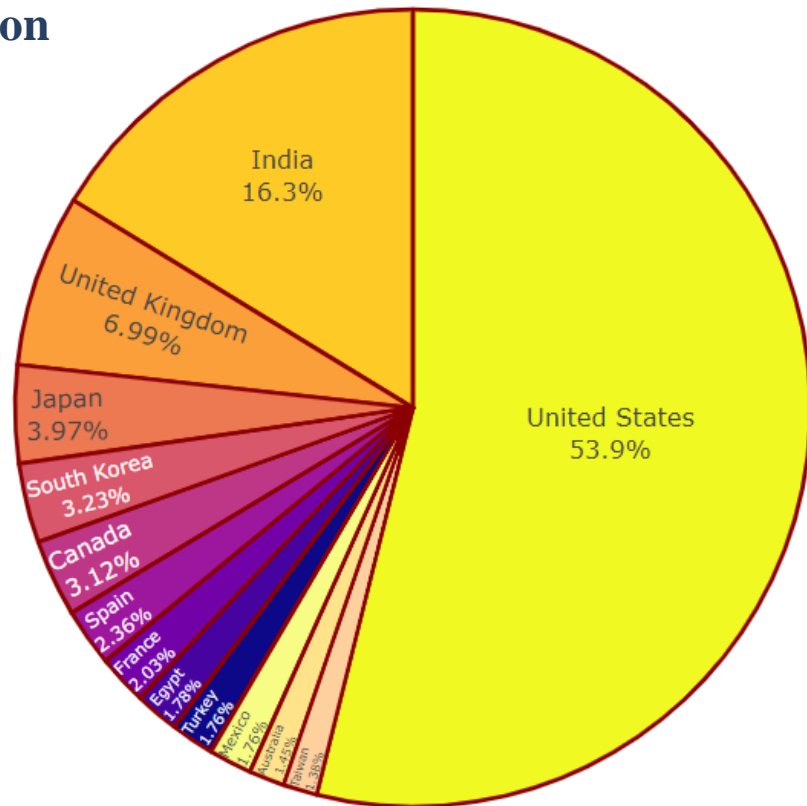
Type of content available on Netflix

•It is evident that there are more movies on Netflix than TV shows.

•Netflix has 5377 movies, which is more than double the quantity of TV shows.

index=Movie
type=5377
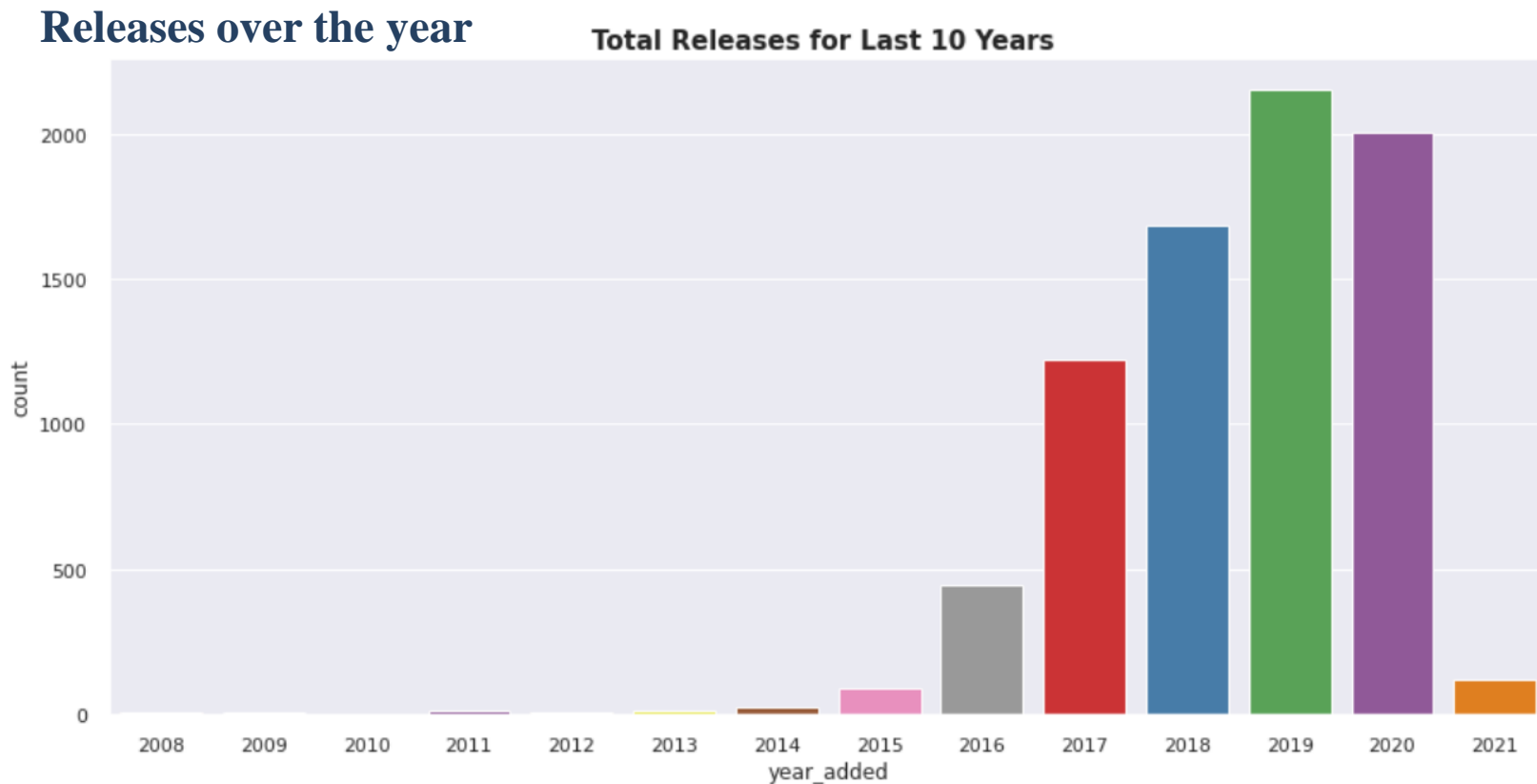
index=TV Show
type=2400

TV Show
30.9%

Movie
69.1%
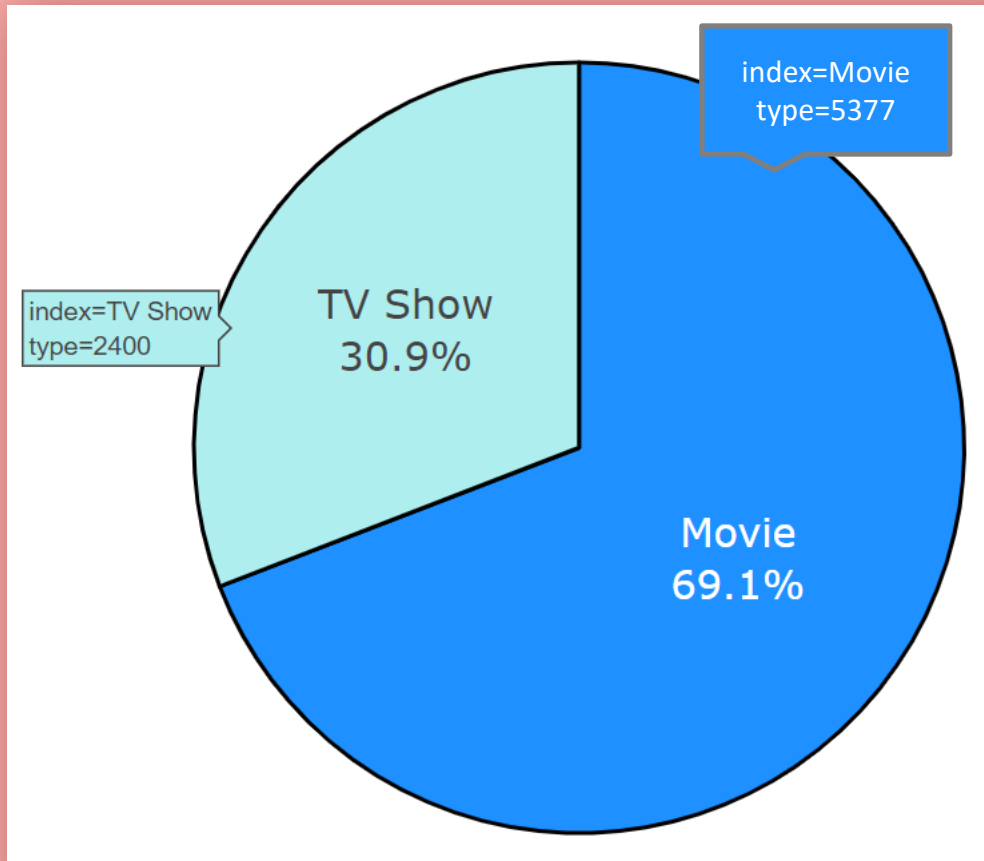
Exploratory Data Analysis

Top countries with highest content production

❑ United States has the most number of content on Netflix

❑ India has second highest content on Netflix

❑ Australia and Taiwan has least number of content on Netflix

Pie chart: United States 53.9%, India 16.3%, United Kingdom 6.99%, Japan 3.97%, South Korea 3.23%, Canada 3.12%, Spain 2.36%, France 2.03%, Egypt 1.78%, Turkey 1.76%, Mexico 1.76%, Australia 1.45%, Taiwan 1.33%

Exploratory Data Analysis

AI

Releases over the year

Total Releases for Last 10 Years

The number of release have significantly increased after 2015 and have dropped in 2021 because of Covid 19
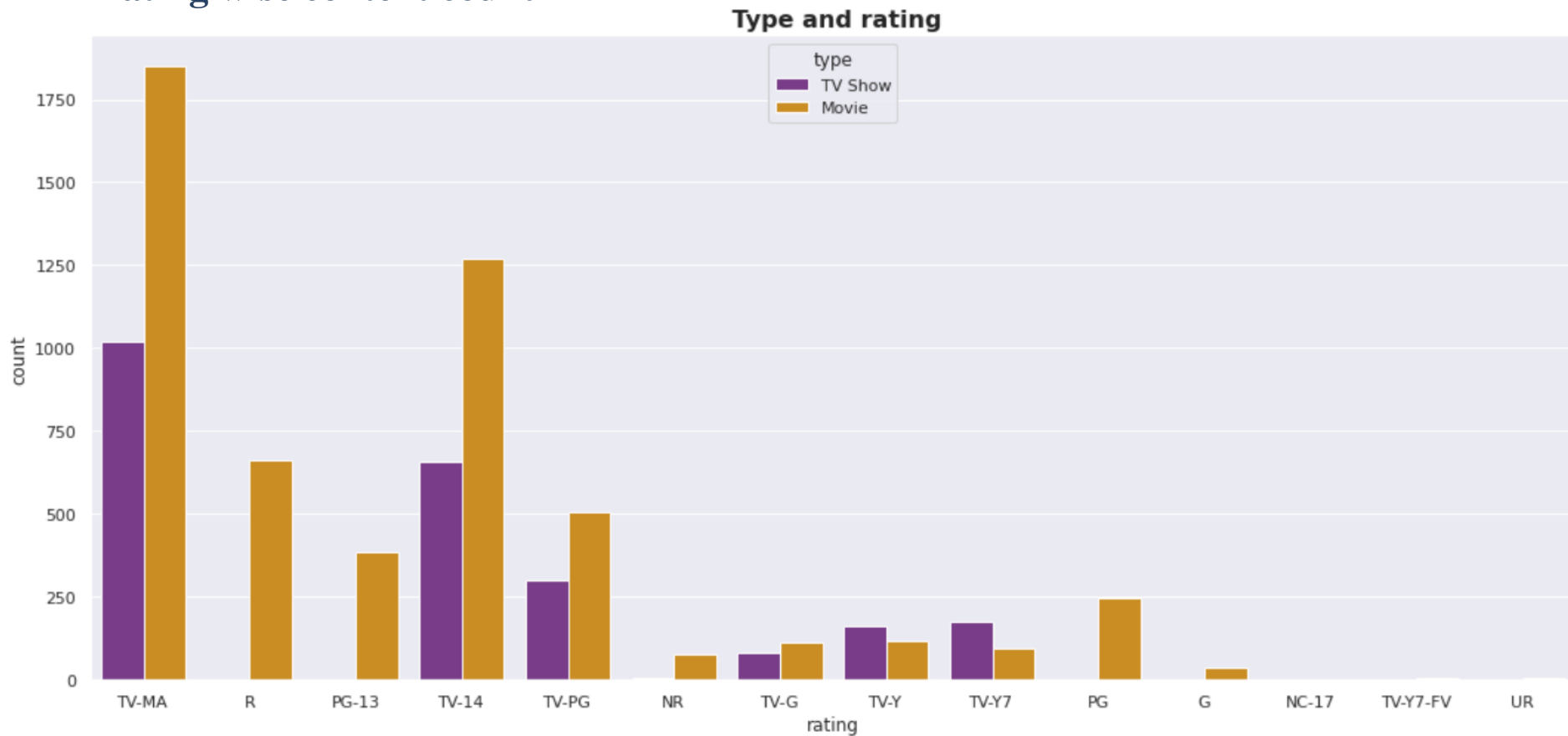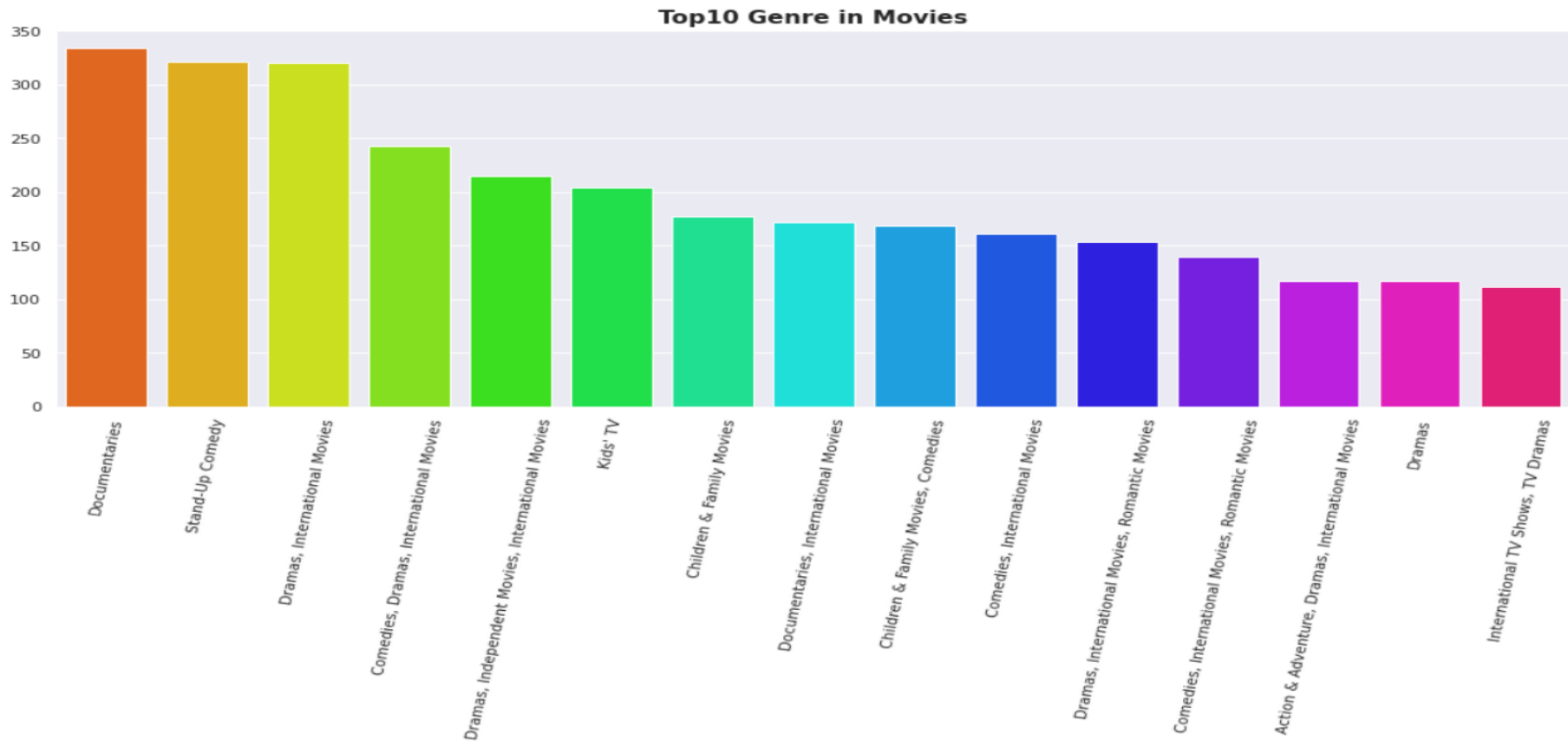
Exploratory Data Analysis

Exploratory Data Analysis
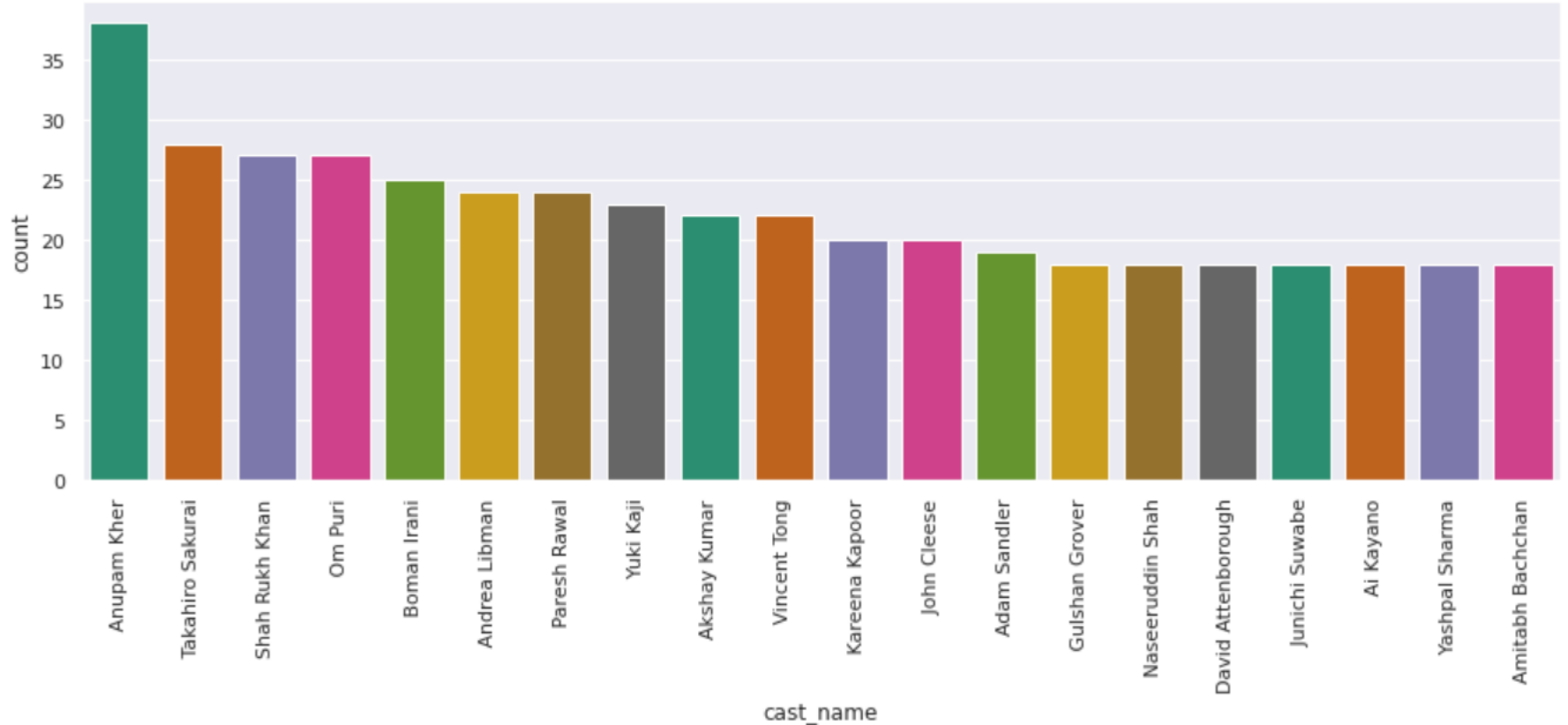
AI
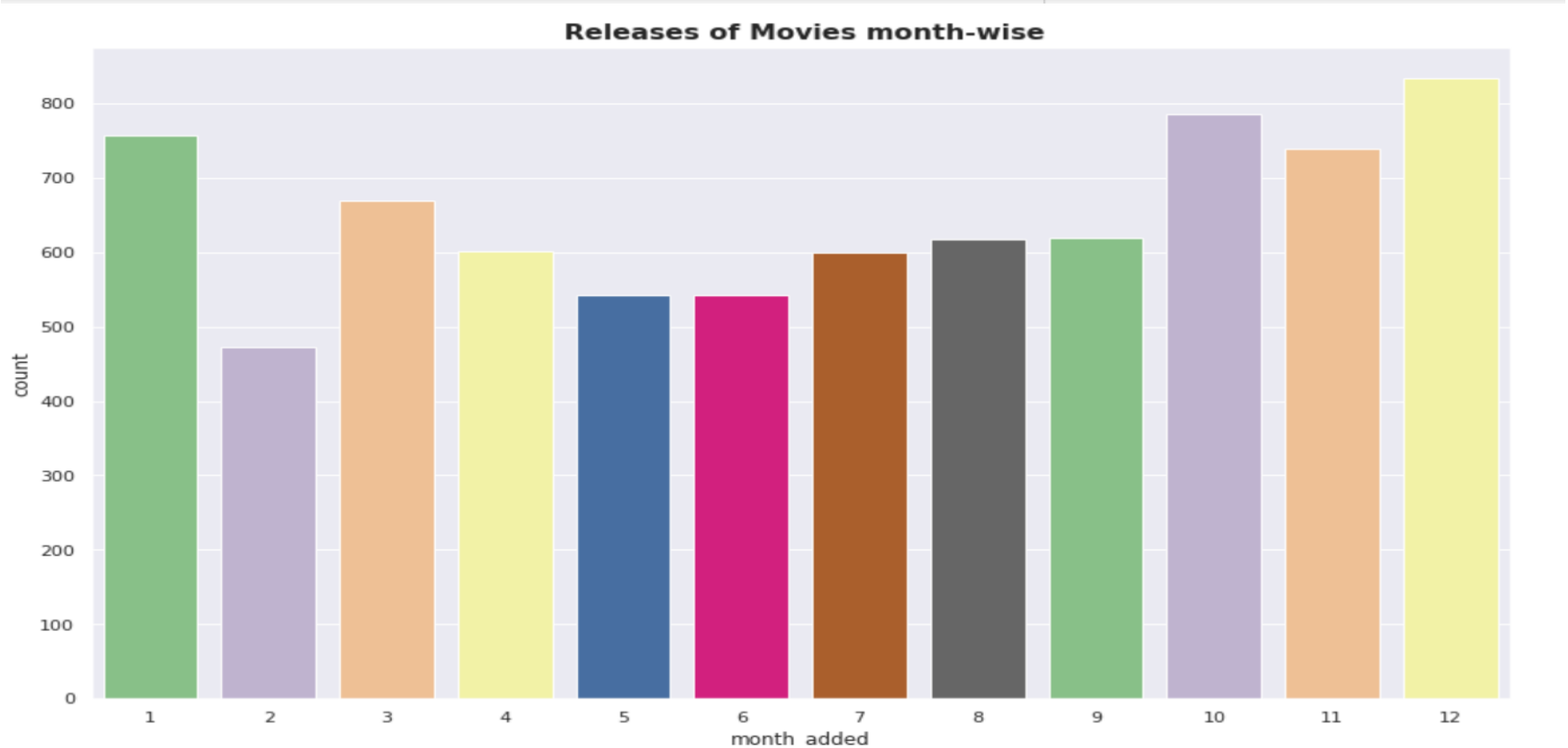
Rating wise content count

Exploratory Data Analysis

Top10 Genre in Movies

Documentaries is the most popular genre followed by comedy

Exploratory Data Analysis

Top-20 ACTORS on Netflix

Exploratory Data Analysis

Duration distribution of Movies

Length distribution of movies

Data Cleaning
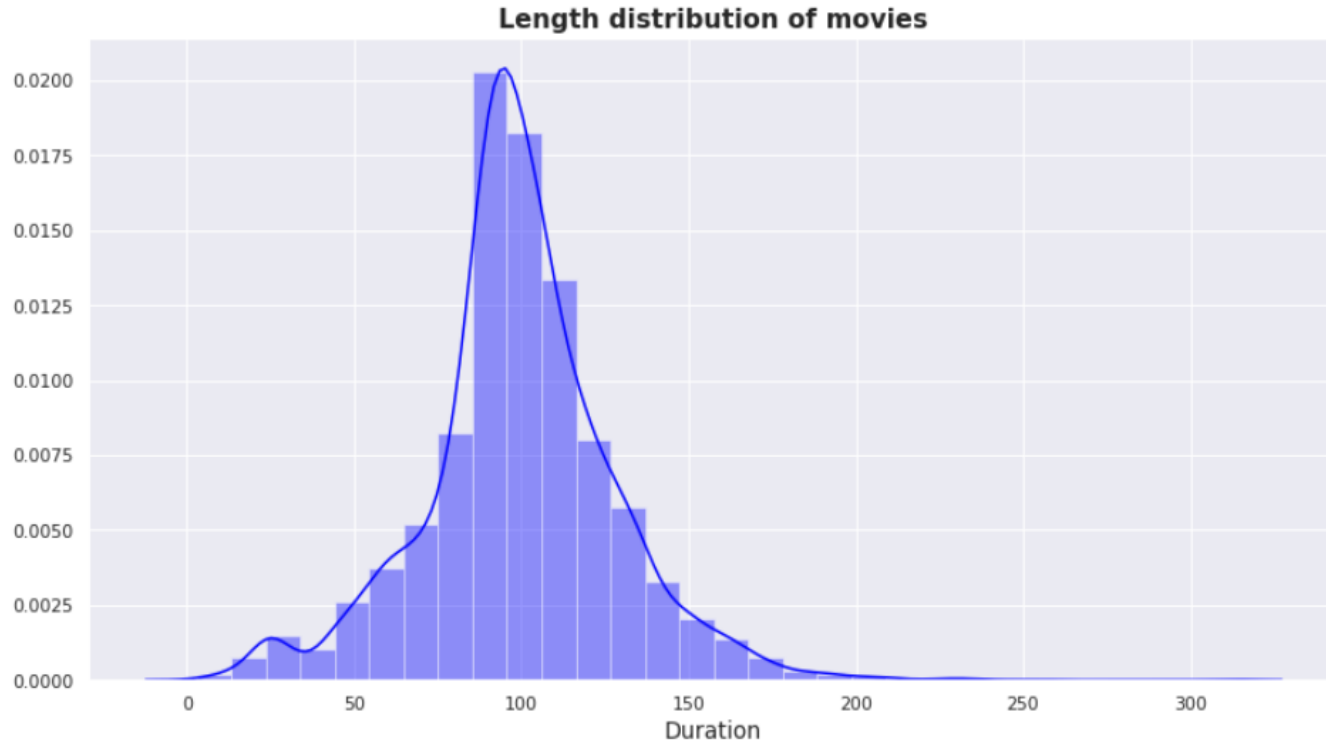
- <u>Label Encoding</u>
- <u>Lemmatisation-</u> Lemmatization, unlike Stemming, reduces the inflected words properly ensuring that the root word belongs to the language. In Lemmatization root word is called Lemma. For example, runs, running, ran are all forms of the word run, therefore run is the lemma of all these words.
- <u>Removing Stop words</u> - To remove stop words from a sentence, you can divide your text into words and then remove the word if it exits in the list of stop words provided by NLTK.
- <u>Tf - idf Vectorization -</u> TF-IDF stands for "Term Frequency — Inverse Document Frequency". This is a technique to quantify a word in documents, we generally compute a weight to each word which signifies the importance of the word in the document and corpus. This method is a widely used technique in Information Retrieval and Text Mining.
- <u>Min-max Scaling -</u> For each value in a feature, MinMaxScaler subtracts the minimum value in the feature and then divides by the range. It preserves shape of original distribution.

Topic Modelling (LDA and LSA)

- **Latent Semantic Analysis**(LSA) is used to find the hidden topics represented by the document or text. This hidden topics then are used for clustering the similar documents together. LSA is an unsupervised algorithm and hence we don't know the actual topic of the document.

- In natural language processing, the **Latent Dirichlet Allocation** (LDA) is a generative statistical model that allows sets of observations to be explained by unobserved groups that explain why some parts of the data are similar.

Topic Modelling (LDA and LSA)


```
NETFLIX Genre 0:
international shows movies dramas comedies romantic family life independent young

NETFLIX Genre 1:
shows crime british spanish language korean docuseries series reality romantic

NETFLIX Genre 2:
adventure action fi sci kids stand family children world series

NETFLIX Genre 3:
stand special comedy comedian comic talk family take show life

NETFLIX Genre 4:
family children movies shows save friend christmas comedieswhen music kids

NETFLIX Genre 5:
documentaries documentary music world docuseries series moviesthis sports life international

NETFLIX Genre 6:
comedies romantic friend kids love life school best high series

NETFLIX Genre 7:
series kids independent docuseries dramas friend science nature anime world

NETFLIX Genre 8:
horror movies fi sci romantic series reality kids thrillersa docuseries

NETFLIX Genre 9:
life docuseries young woman reality nature love science family romantic
```
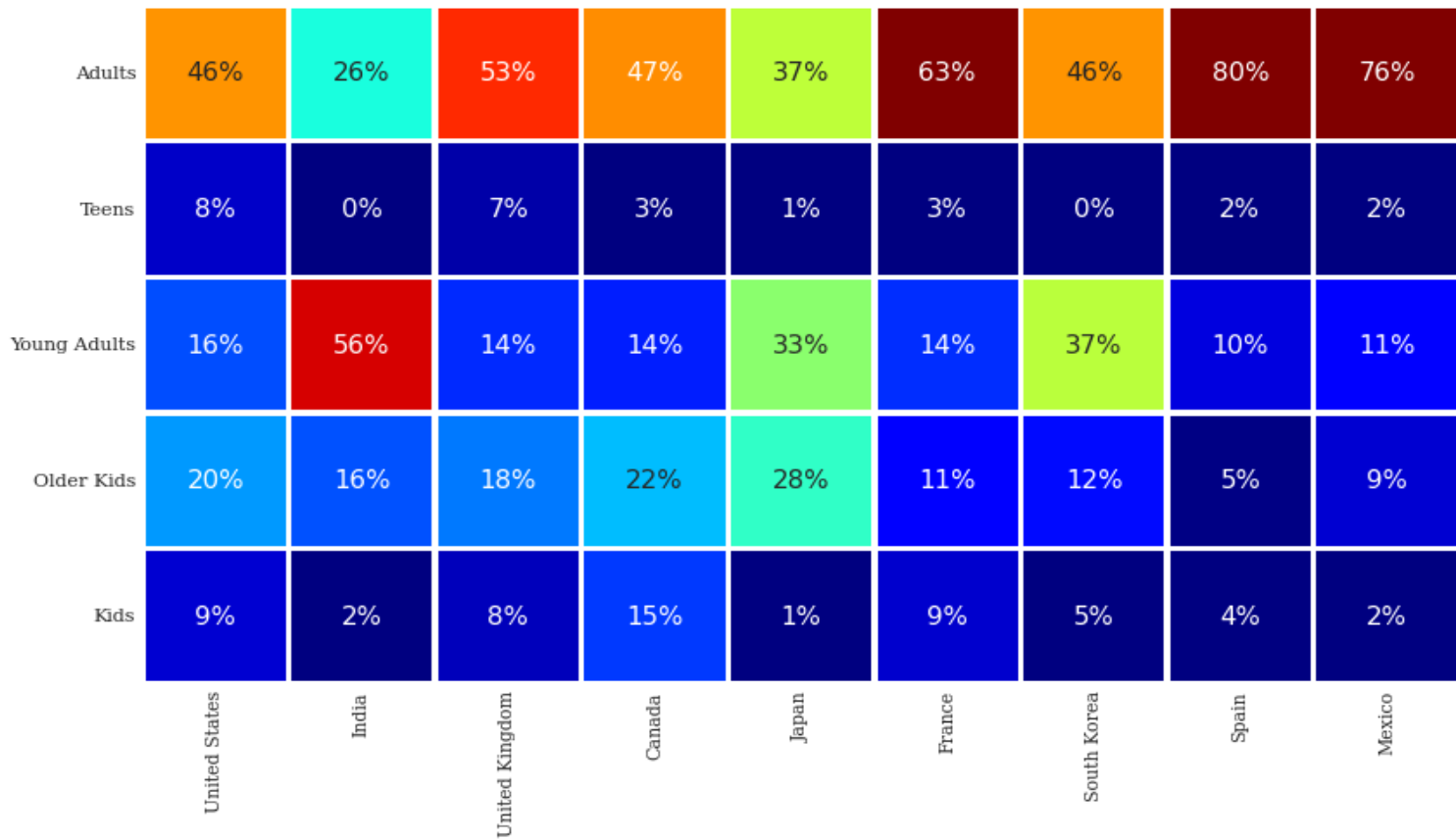
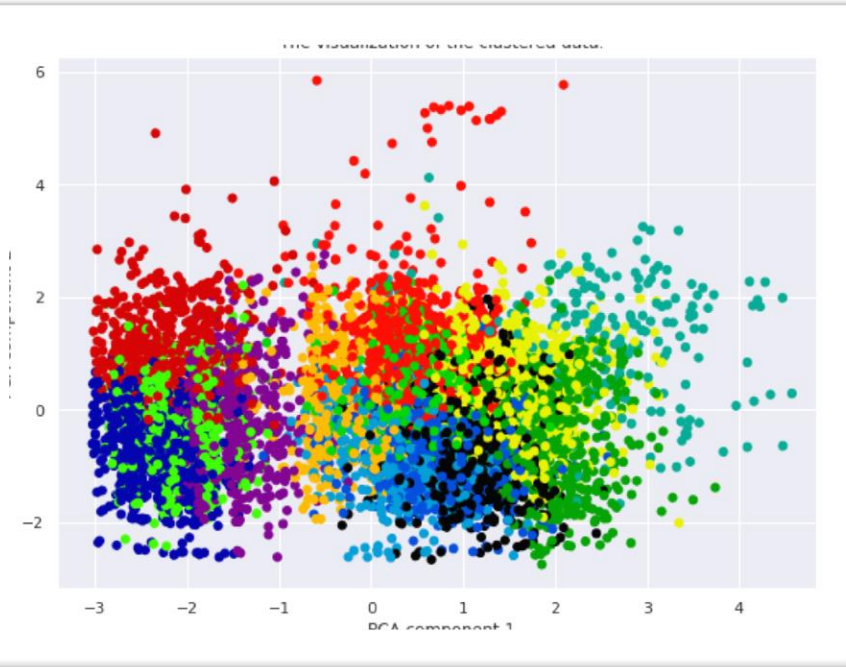# Word Cloud for Countries and Cast

Countries with the most content available

Which Cast to Choose?

Correlation Heatmap

Target ages proportion of total content by country

|	United States	India	United Kingdom	Canada	Japan	France	South Korea	Spain	Mexico
Adults	46%	26%	53%	47%	37%	63%	46%	80%	76%
Teens	8%	0%	7%	3%	1%	3%	0%	2%	2%
Young Adults	16%	56%	14%	14%	33%	14%	37%	10%	11%
Older Kids	20%	16%	18%	22%	28%	11%	12%	5%	9%
Kids	9%	2%	8%	15%	1%	9%	5%	4%	2%

Model Implementation

1. Affinity Propagation

Converged after 81 iterations.
Estimated number of clusters: 13
Silhouette Coefficient: 0.244
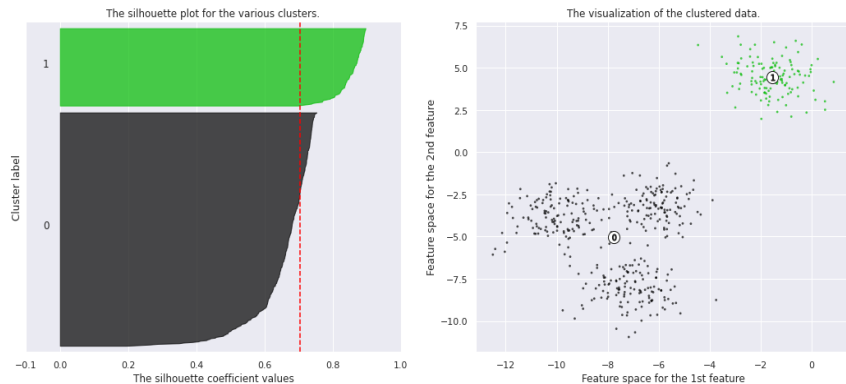
2. Agglomerative Propagation
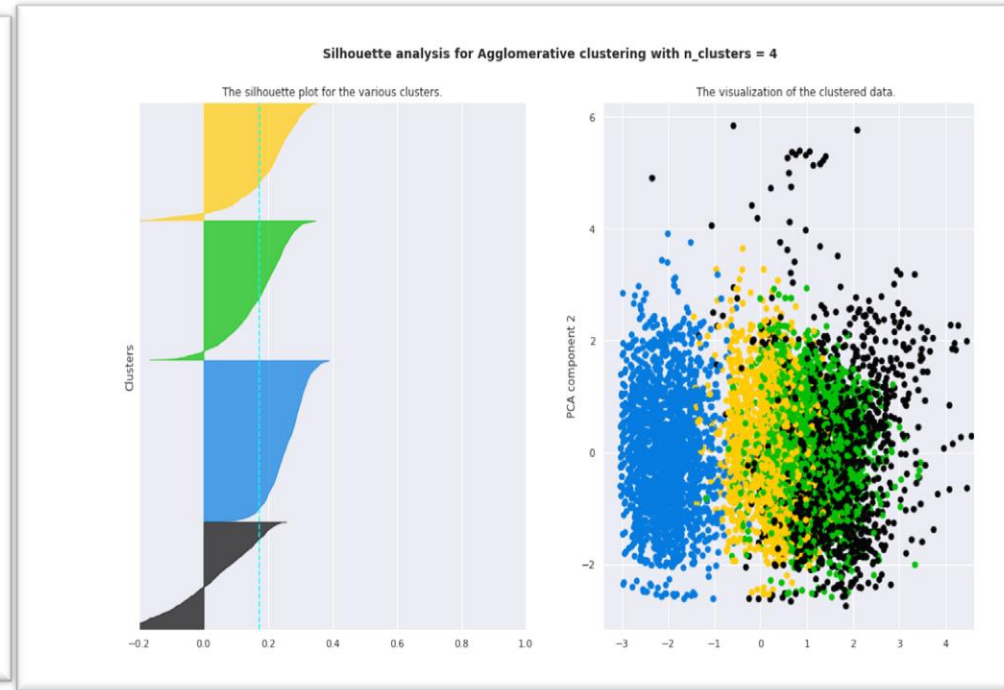
Assume we cut vertical lines with a horizontal line to obtain the number of clusters. Number of clusters = 4
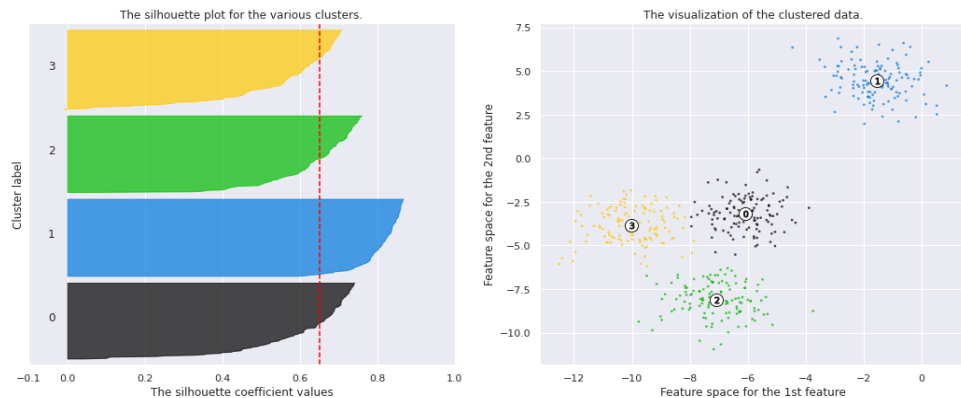The average silhouette_score is : 0.17296314851287742

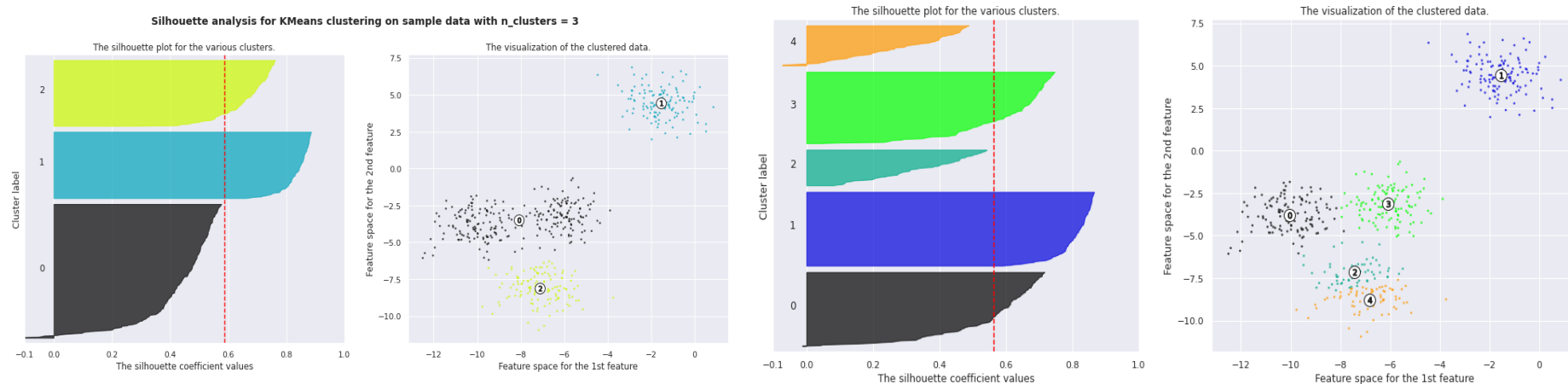# Model Implementation

3. k-means clustering

Model Implementation

3. k-means clustering

Silhouette analysis for KMeans clustering on sample data with n_clusters = 6

The silhouette plot for the various clusters.

The visualization of the clustered data.
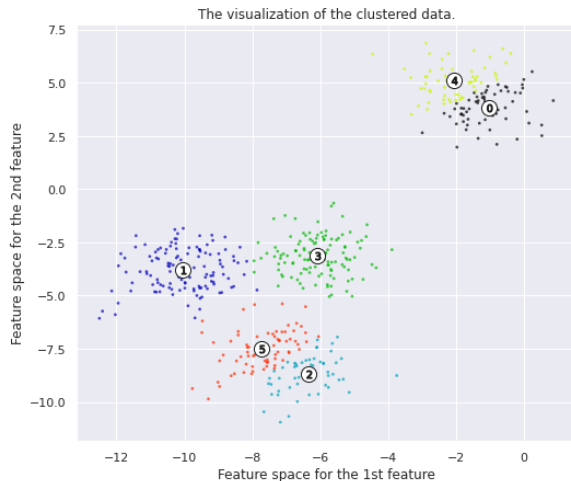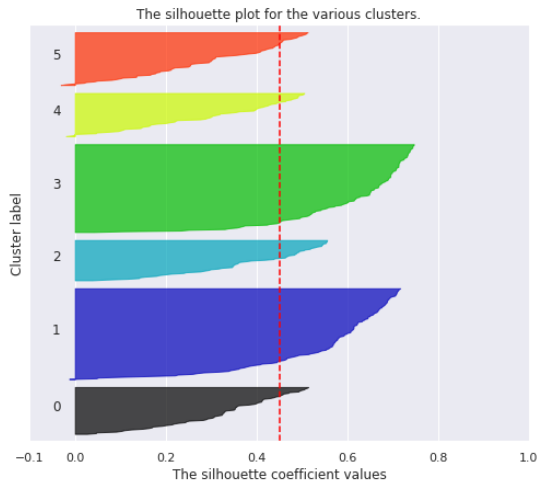
❖ Here is the Silhouette analysis done on the above plots to select an optimal value for n_clusters.

❖ The value of 4 and 5 for n_clusters looks to be the optimal one. The silhouette score for each cluster is above average silhouette scores.

For n_clusters = 2 The average silhouette_score is : 0.7049787496083262

For n_clusters = 3 The average silhouette_score is : 0.5882004012129721

For n_clusters = 4 The average silhouette_score is : 0.6505186632729437

For n_clusters = 5 The average silhouette_score is : 0.56376469026194

For n_clusters = 6 The average silhouette_score is : 0.4504666294372765

K - Means

To process the learning data, the K-means algorithm in data mining starts with a first group of randomly selected centroids, which are used as the beginning points for every cluster, and then performs iterative (repetitive) calculations to optimize the positions of the centroids

It halts creating and optimizing clusters when either:

- The centroids have stabilized — there is no change in their values because the clustering has been successful.

- The defined number of iterations has been achieved

K-Means Clustering

K-means algorithm is an iterative algorithm that tries to partition the dataset into K pre defined distinct non overlapping subgroups where each data point belongs to only one group.

1. Elbow Curve:
● The Elbow Curve is one of the most popular methods to determine this optimal value of k.
● The elbow curve uses the sum of squared distance (SSE)to choose an ideal value of k based on the distance between the data points and their assigned clusters.
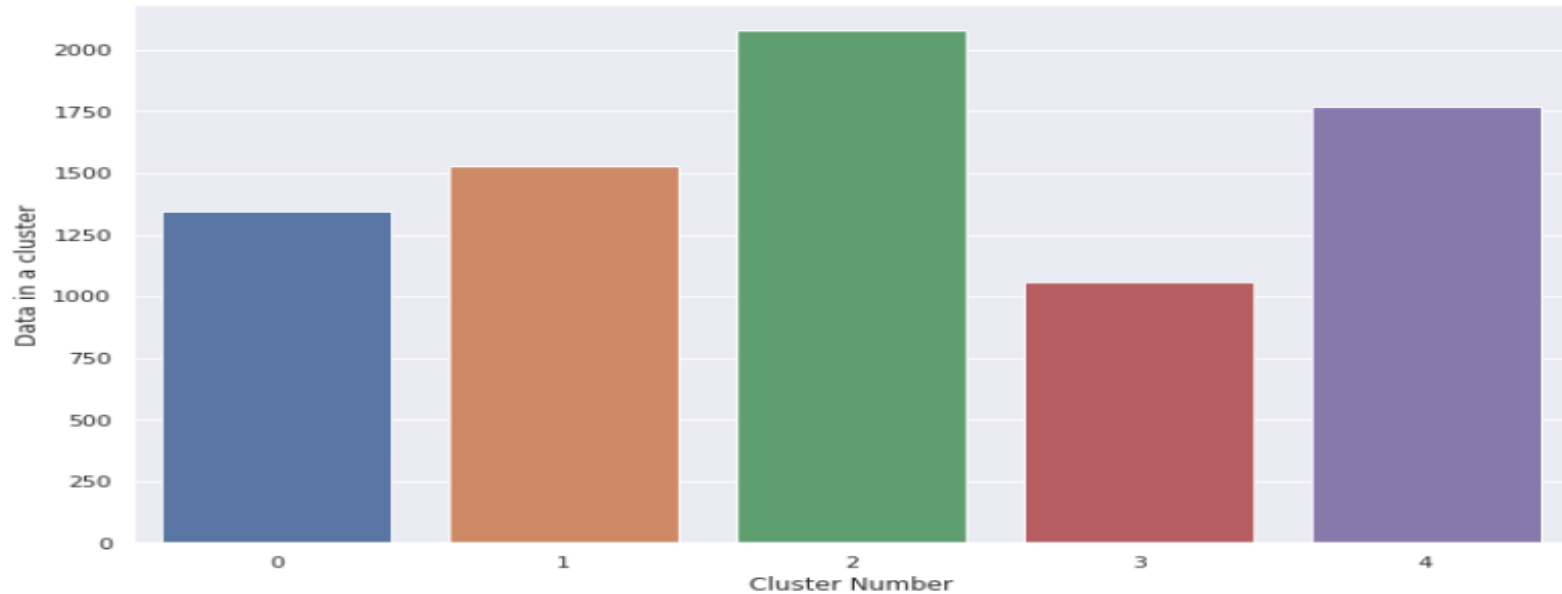
2. Silhouette score :
● Silhouette score is used to evaluate the quality of clusters created using clustering algorithms such as K Means in terms of how well samples are clustered with other samples that are similar to each other.

K-Means

Elbow Curve
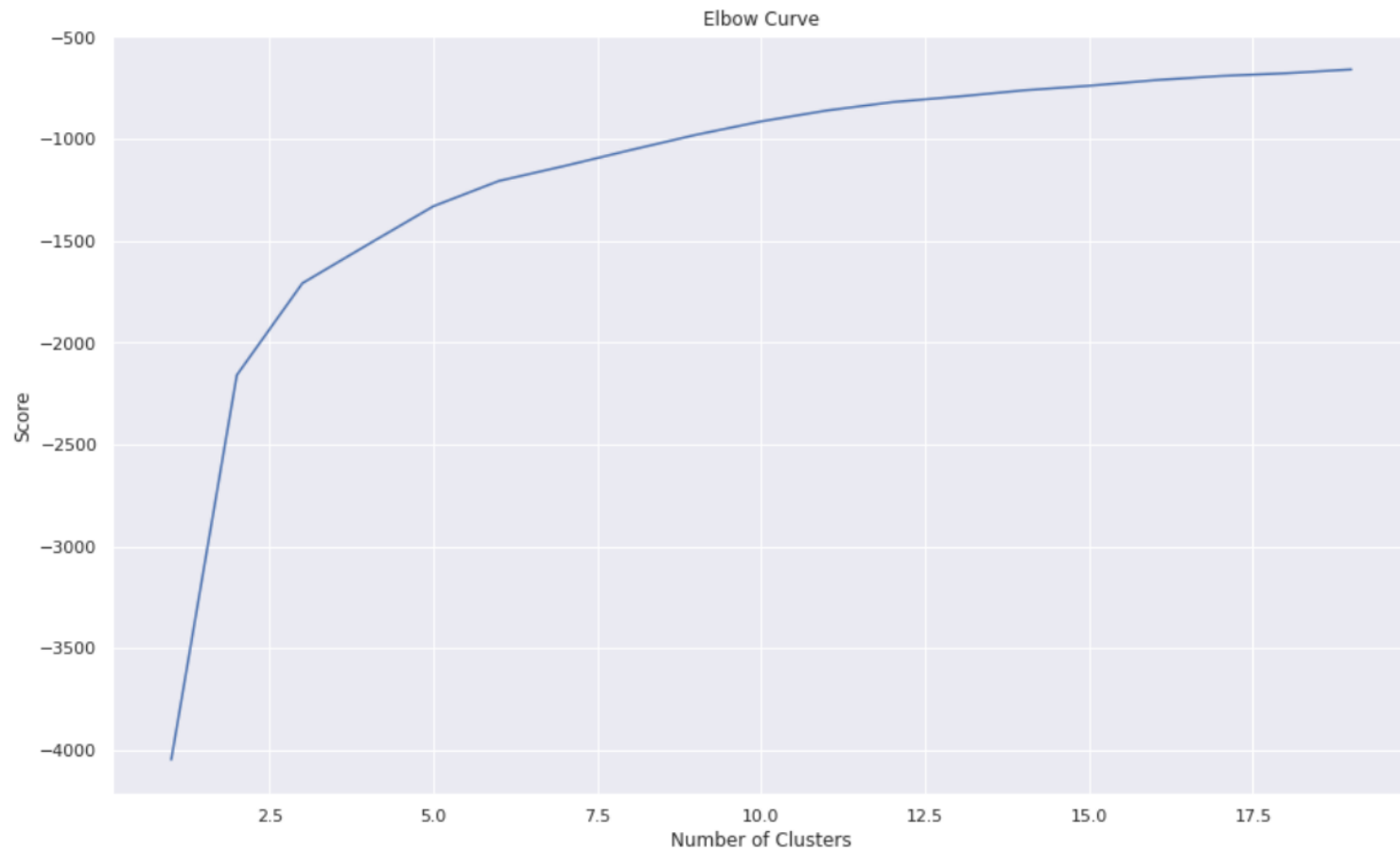
Clusters

We clearly see that one cluster is the largest and one cluster has the fewest number of movies.

Run Dashboard App

AI

NetflixRecommender

Favourite Movie/TV Show:

Well Done Abba   ✕ ▼

Recommendations

Title	Cast	Genre	Description
Brahman Naman	Shashank Arora, Tanmay Dhanania, Chaitanya Varad	Comedies, Independent Movies, International Movies	This homage to 1980s teen sex comedies follows a college quiz bowl champion who knows almost everything - except how to talk to women.
Halkaa	Tathastu, Aryan Preet, Ranvir Shorey	Comedies, Dramas, Independent Movies	Up against a corrupt government official and crushing poverty, a young boy in the Delhi slums attempts to raise funds to build himself his own toilet.
High End Yaariyan	Ninja, Ranjit Bawa, Jassi Gill	Comedies, International Movies, Romantic Movies	From romantic pursuits to their friendship, a trio of young men navigate the complexities of relationships while sharing a London apartment.
Kay Dyache Bola	Makarand Anaspure, Akshay Pendse, Umesh Kamat	Comedies, Dramas, International Movies	Wrongfully accused of murder, two students' last hope lies with their defense attorney, an inexperienced bumbler who's never even tried a case.
Motor Mitraan Di	Gurpreet Guggi, Happy Raikoti, Vikram Singh	Comedies, International Movies	When three brothers unwittingly get entangled in a murder associated with a fraudulent ashram leader, they set out to expose him to society as a fake.
Mumbai Delhi Mumbai	Shiv Pandit, Piaa Bajpai	Comedies, International Movies, Romantic Movies	In Delhi for the first time, a Mumbai girl loses her phone but gets a surprise chance at true love with a local boy who begrudgingly helps her.

Conclusion

⊛Data set contains 7787 rows and 12 columns in that cast and director features contains large number of missing values so we can drop it.

⊛We have two types of content TV shows and Movies (30.9% contains TV shows and 69.1% contains Movies).

⊛Most films were released in the years 2018, 2019, and 2020 and united states have the maximum content on Netflix.

⊛The months of October, November, December and January had the largest number of films and Tv-shows released.

⊛The USA, India, the United Kingdom, Canada, and Egypt are the top five producer countries.

⊛For the clustering algorithm, we utilized type, director, nation, released year, genre, and year.

⊛LDA and LSA has sorted much more similar titles in a group of genre.

⊛Applied different clustering models Kmeans, Hierarchical, Agglomerative clustering on data we got the best cluster arrangements.

⊛In Affinity Propagation, we had 13 clusters and a Silhouette Coefficient score of 0.244.

⊛We cut vertical lines with a horizontal line to obtain the number of clusters in Agglomerative Clustering. There were four clusters, with an average silhouette score of 0.17296314851287742.

⊛The final model we used was k-means clustering, which consisted of 2,3,4,5,6 clusters. 4 numbers of clusters gives us good fitting.

⊛After applying K - means optimal value of number of clusters is 5

⊛Silhouette score for a set of sample data points is used to measure how dense and well-separated the clusters are.

Thank you