Netflix Business Case Study

Importing Libraries , Loading dataset

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

```
from google.colab import drive
```

```
drive.mount("/content/drive")
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
df = pd.read_csv('/content/drive/MyDrive/Colab Notebooks/netflix.csv')
```

```
df
```

	show_id	type	title	director	cast	country	date_added	release_ye
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	20
1	s2	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	September 24, 2021	20
2	s3	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	September 24, 2021	20
3	s4	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	20
4	s5	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam	India	September 24, 2021	20

```
df.shape
```

```
(8807, 12)
```

The Dataset has 8807 Rows & 12 Columns

```
df.nunique()
```

```
show_id         8807
type               2
title           8807
director        4528
cast            7692
country          748
date_added      1767
release_year      74
rating            17
duration         220
listed_in        514
description     8775
dtype: int64
```

cheking the Unique Value in the Dataset

Overall null values in each column of the dataset -

```
df.isna().sum()
```

```
     show_id            0
     type               0
     title              0
     director        2634
     cast             825
     country          831
     date_added        10
     release_year       0
     rating             4
     duration           3
     listed_in          0
     description        0
     dtype: int64
```

Form The Above analyse the Data set has many Missing Values in Director, Cast, Country

```
df[df['duration'].isna()]
```

	show_id	type	title	director	cast	country	date_added	release_year	rat
5541	s5542	Movie	Louis C.K. 2017	Louis C.K.	Louis C.K.	United States	April 4, 2017	2017	74

```
indices = df[df['duration'].isna()].index
```

```
df.loc[indices] = df.loc[indices].fillna(method = 'ffill' , axis = 1)
```

```
df.loc[indices ,'rating'] = 'Unknown'
```

```
df.loc[indices]
```

	show_id	type	title	director	cast	country	date_added	release_year	ra
5541	s5542	Movie	Louis C.K. 2017	Louis C.K.	Louis C.K.	United States	April 4, 2017	2017	Unk

Filling the null values

```
df.fillna("Unknown", inplace = True )
```

```
df
```

	show_id	type	title	director	cast	country	date_added	release_y
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	Unknown	United States	September 25, 2021	2

Ama

```
df.groupby(["rating"])["title"].count()
```

```
rating
G            41
NC-17         3
NR           80
PG          287
PG-13       490
R           799
TV-14      2160
TV-G        220
TV-MA      3207
TV-PG       863
TV-Y        307
TV-Y7       334
TV-Y7-FV      6
UR            3
Unknown       7
Name: title, dtype: int64
```

Mayur

The rating column has NR which is same as UR.

Show Factory 24, 2021

```
df.loc[df['rating'] == 'UR' , 'rating'] = 'NR'
df.rating.value_counts()
```

```
TV-MA      3207
TV-14      2160
TV-PG       863
R           799
PG-13       490
TV-Y7       334
TV-Y        307
PG          287
TV-G        220
NR           83
G            41
Unknown       7
TV-Y7-FV      6
NC-17         3
Name: rating, dtype: int64
```

- dropped the null from date_added column

```
df.drop(df.loc[df['date_added'].isna()].index , axis = 0 , inplace = True)
```

```
df['date_added'].isna().sum()
```

```
0
```

```
df['date_added']
```

```
0       September 25, 2021
1       September 24, 2021
2       September 24, 2021
3       September 24, 2021
4       September 24, 2021
               ...
8802     November 20, 2019
8803          July 1, 2019
8804      November 1, 2019
8805      January 11, 2020
8806         March 2, 2019
Name: date_added, Length: 8807, dtype: object
```

We can add the new column 'year_added' by extracting the year from 'date_added' column

Non Graphical Analysis

```
# 2 types of content present in dataset - either Movie or TV Show
df['type'].unique()

     array(['Movie', 'TV Show'], dtype=object)
```

```
movies  = df.loc[df['type'] == 'Movie']
tv_shows = df.loc[df['type'] == 'TV Show']
```

```
movies.duration.value_counts()

     90 min     152
     94 min     146
     97 min     146
     93 min     146
     91 min     144
               ...
     208 min      1
     5 min        1
     16 min       1
     186 min      1
     191 min      1
     Name: duration, Length: 205, dtype: int64
```

```
tv_shows.duration.value_counts()

     1 Season      1793
     2 Seasons      425
     3 Seasons      199
     4 Seasons       95
     5 Seasons       65
     6 Seasons       33
     7 Seasons       23
     8 Seasons       17
     9 Seasons        9
     10 Seasons       7
     13 Seasons       3
     15 Seasons       2
     12 Seasons       2
     11 Seasons       2
     17 Seasons       1
     Name: duration, dtype: int64
```

Since movie and TV shows both have different format for duration, we can change duration for movies as minutes & TV shows as seasons

```
movies['duration'] = movies['duration'].str[:-3]
movies['duration'] = movies['duration'].astype('float')
```

```
tv_shows['duration'] = tv_shows.duration.str[:-7].apply(lambda x : x.strip())
tv_shows['duration'] = tv_shows['duration'].astype('float')
```

```
tv_shows.rename({'duration': 'duration_in_seasons'} ,axis = 1 , inplace = True)
movies.rename({'duration': 'duration_in_minutes'} ,axis = 1 , inplace = True)
```

```
tv_shows.duration_in_seasons

     1       2.0
     2       1.0
     3       1.0
     4       2.0
     5       1.0
            ...
     8795    2.0
     8796    2.0
     8797    3.0
     8800    1.0
     8803    2.0
     Name: duration_in_seasons, Length: 2666, dtype: float64
```

```
movies.duration_in_minutes

     0        90.0
     6        91.0
     7       125.0
     9       104.0
     12      127.0
             ...
     8801     96.0
     8802    158.0
     8804     88.0
```

```
8805     88.0
8806    111.0
Name: duration_in_minutes, Length: 6131, dtype: float64
```

when was first movie added on netflix and when is the most recent movie added on netflix as per data i.e. dataset duration

```
timeperiod = pd.Series((df['date_added'].min().strftime('%B %Y') , df['date_added'].max().strftime('%B %Y')))
timeperiod.index = ['first' , 'Most Recent']
timeperiod
```

```
first            January 2008
Most Recent    September 2021
dtype: object
```

The oldest and the most recent movie/TV show released on the Netflix in which year?

```
df.release_year.min() , df.release_year.max()
```

```
(1925, 2021)
```

```
df.loc[(df.release_year == df.release_year.min()) | (df.release_year == df.release_year.max())].sort_values('release_year')
```

	show_id	type	title	director	cast	country	date_added	release_
4250	s4251	TV Show	Pioneers: First Women Filmmakers*	NaN	NaN	NaN	2018-12-30	
966	s967	Movie	Get the Grift	Pedro Antonio	Marcus Majella, Samantha Schmütz, Caito Mainie...	Brazil	2021-04-28	
967	s968	TV Show	Headspace Guide to Sleep	NaN	Evelyn Lewis Prieto	NaN	2021-04-28	
968	s969	TV Show	Sexify	NaN	Aleksandra Skraba, Maria Sobocińska, Sandra Dr...	Poland	2021-04-28	
972	s973	TV Show	Fatma	NaN	Burcu Biricik, Uğur Yücel, Mehmet Yılmaz Ak, H...	Turkey	2021-04-27	

Which are different ratings available on Netflix in each type of content? Check the number of content released in each type.

```
df.groupby(['type' , 'rating'])['show_id'].count()
```

```
type     rating
Movie    G                   41
         NC-17                3
         NR                  78
         Not Available        5
         PG                 287
         PG-13              490
         R                  797
         TV-14             1427
         TV-G               126
         TV-MA             2062
         TV-PG              540
         TV-Y               131
         TV-Y7            139
         TV-Y7-FV           5
TV Show  NR                 4
         Not Available      2
         R                  2
         TV-14            730
         TV-G              94
         TV-MA           1143
         TV-PG            321
         TV-Y             175
         TV-Y7            194
         TV-Y7-FV           1
Name: show_id, dtype: int64
```

Working on the columns having maximum null values and the columns having comma separated multiple values for each record

- Country column

```
df['country'].value_counts()
```

```
United States                             2812
India                                      972
United Kingdom                             418
Japan                                      244
South Korea                                199
                                          ...
Romania, Bulgaria, Hungary                   1
Uruguay, Guatemala                           1
France, Senegal, Belgium                     1
Mexico, United States, Spain, Colombia       1
United Arab Emirates, Jordan                 1
Name: country, Length: 748, dtype: int64
```

We see that many movies are produced in more than 1 country. Hence, the country column has comma separated values of countries.

This makes it difficult to analyse how many movies were produced in each country. We can use explode function in pandas to split the country column into different rows.

we are Creating a separate table for country , to avoid the duplicasy of records in our origional table after exploding.

```
country_tb = df[['show_id' , 'type' , 'country']]
country_tb.dropna(inplace = True)
country_tb['country'] = country_tb['country'].apply(lambda x : x.split(','))
country_tb = country_tb.explode('country')
country_tb
```

	show_id	type	country
0	s1	Movie	United States
1	s2	TV Show	South Africa
4	s5	TV Show	India
7	s8	Movie	United States
7	s8	Movie	Ghana
...	...	...	...
8801	s8802	Movie	Jordan
8802	s8803	Movie	United States
8804	s8805	Movie	United States
8805	s8806	Movie	United States
8806	s8807	Movie	India

10010 rows × 3 columns

```
# some duplicate values are found, which have unnecessary spaces. some empty strings found
country_tb['country'] = country_tb['country'].str.strip()
```

```
country_tb.loc[country_tb['country'] == '']
```

	show_id	type	country
193	s194	TV Show	
365	s366	Movie	
1192	s1193	Movie	
2224	s2225	Movie	
4653	s4654	Movie	

```
country_tb = country_tb.loc[country_tb['country'] != '']
```

```
country_tb['country'].nunique()
```

```
122
```

Netflix has movies from the total 122 countries.

Total movies and tv shows in each country

```
x = country_tb.groupby(['country' , 'type'])['show_id'].count().reset_index()
x.pivot(index = ['country'] , columns = 'type' , values = 'show_id').sort_values('Movie',ascending = False)
```

type	Movie	TV Show
country		
United States	2752.0	932.0
India	962.0	84.0
United Kingdom	534.0	271.0
Canada	319.0	126.0
France	303.0	90.0
...	...	...
Azerbaijan	NaN	1.0
Belarus	NaN	1.0
Cuba	NaN	1.0
Cyprus	NaN	1.0
Puerto Rico	NaN	1.0

122 rows × 2 columns

- Director column

```
df['director'].value_counts()
```

```
Rajiv Chilaka                     19
Raúl Campos, Jan Suter            18
Marcus Raboy                      16
Suhas Kadav                       16
Jay Karas                         14
                                  ..
Raymie Muzquiz, Stu Livingston     1
Joe Menendez                       1
Eric Bross                         1
Will Eisenberg                     1
Mozez Singh                        1
Name: director, Length: 4528, dtype: int64
```

There are some movies which are directed by multiple directors. Hence multiple names of directors are given in comma separated format. We will explode the director column as well. It will create many duplicate records in originaltable hence we created separate table for directors.

```
dir_tb = df[['show_id' , 'type' , 'director']]
dir_tb.dropna(inplace = True)
dir_tb['director'] = dir_tb['director'].apply(lambda x : x.split(','))
dir_tb
```

	show_id	type	director
0	s1	Movie	[Kirsten Johnson]
2	s3	TV Show	[Julien Leclercq]
5	s6	TV Show	[Mike Flanagan]
6	s7	Movie	[Robert Cullen, José Luis Ucha]
7	s8	Movie	[Haile Gerima]
...	...	...	...
8801	s8802	Movie	[Majid Al Ansari]
8802	s8803	Movie	[David Fincher]
8804	s8805	Movie	[Ruben Fleischer]
8805	s8806	Movie	[Peter Hewitt]
8806	s8807	Movie	[Mozez Singh]

6173 rows × 3 columns

```
dir_tb = dir_tb.explode('director')
```

```
dir_tb['director'] = dir_tb['director'].str.strip()
```

```
# checking if empty stirngs are there in director column
dir_tb.director.apply(lambda x : True if len(x) == 0 else False).value_counts()
```

```
False    6978
Name: director, dtype: int64
```

```
dir_tb
```

	show_id	type	director
0	s1	Movie	Kirsten Johnson
2	s3	TV Show	Julien Leclercq
5	s6	TV Show	Mike Flanagan
6	s7	Movie	Robert Cullen
6	s7	Movie	José Luis Ucha
...	...	...	...
8801	s8802	Movie	Majid Al Ansari
8802	s8803	Movie	David Fincher
8804	s8805	Movie	Ruben Fleischer
8805	s8806	Movie	Peter Hewitt
8806	s8807	Movie	Mozez Singh

6978 rows × 3 columns

```
dir_tb['director'].nunique()
```

```
4993
```

There are total 4993 unique directors in the dataset.

Total movies and tv shows directed by each director

```
x = dir_tb.groupby(['director' , 'type'])['show_id'].count().reset_index()
x.pivot(index= ['director'] , columns = 'type' , values = 'show_id').sort_values('Movie' ,ascending = False)
```

type	**Movie**	**TV Show**
director		
Rajiv Chilaka	22.0	NaN
Jan Suter	21.0	NaN
Raúl Campos	19.0	NaN
Suhas Kadav	16.0	NaN
Marcus Raboy	15.0	1.0
...	...	...
Vijay S. Bhanushali	NaN	1.0
YC Tom Lee	NaN	1.0

- 'listed_in' column to understand more about genres

```
genre_tb = df[['show_id' , 'type', 'listed_in']]
```

```
genre_tb['listed_in'] = genre_tb['listed_in'].apply(lambda x : x.split(','))
genre_tb = genre_tb.explode('listed_in')
genre_tb['listed_in'] = genre_tb['listed_in'].str.strip()
```

```
genre_tb
```

	show_id	**type**	**listed_in**
0	s1	Movie	Documentaries
1	s2	TV Show	International TV Shows
1	s2	TV Show	TV Dramas
1	s2	TV Show	TV Mysteries
2	s3	TV Show	Crime TV Shows
...	...	...	...
8805	s8806	Movie	Children & Family Movies
8805	s8806	Movie	Comedies
8806	s8807	Movie	Dramas
8806	s8807	Movie	International Movies
8806	s8807	Movie	Music & Musicals

19303 rows × 3 columns

```
genre_tb.listed_in.unique()
```

```
array(['Documentaries', 'International TV Shows', 'TV Dramas',
       'TV Mysteries', 'Crime TV Shows', 'TV Action & Adventure',
       'Docuseries', 'Reality TV', 'Romantic TV Shows', 'TV Comedies',
       'TV Horror', 'Children & Family Movies', 'Dramas',
       'Independent Movies', 'International Movies', 'British TV Shows',
       'Comedies', 'Spanish-Language TV Shows', 'Thrillers',
       'Romantic Movies', 'Music & Musicals', 'Horror Movies',
       'Sci-Fi & Fantasy', 'TV Thrillers', "Kids' TV",
       'Action & Adventure', 'TV Sci-Fi & Fantasy', 'Classic Movies',
       'Anime Features', 'Sports Movies', 'Anime Series',
       'Korean TV Shows', 'Science & Nature TV', 'Teen TV Shows',
       'Cult Movies', 'TV Shows', 'Faith & Spirituality', 'LGBTQ Movies',
       'Stand-Up Comedy', 'Movies', 'Stand-Up Comedy & Talk Shows',
       'Classic & Cult TV'], dtype=object)
```

```
genre_tb.listed_in.nunique()
```

```
42
```

Total 42 genres present in dataset

```
df.merge(genre_tb , on = 'show_id' ).groupby(['type_y'])['listed_in_y'].nunique()
```

```
type_y
Movie      20
```

```
TV Show    22
Name: listed_in_y, dtype: int64
```

Movies have 20 genres and TV shows have 22 genres.

```
# total movies/TV shows in each genre
x = genre_tb.groupby(['listed_in' , 'type'])['show_id'].count().reset_index()
x.pivot(index = 'listed_in' , columns = 'type' , values = 'show_id').sort_index()
```

Documentaries 869.0 NaN

```
# Exploring cast column
```

Horror Movies 357.0 NaN

```
cast_tb = df[['show_id' , 'type' ,'cast']]
cast_tb.dropna(inplace = True)
cast_tb['cast'] = cast_tb['cast'].apply(lambda x : x.split(','))
cast_tb = cast_tb.explode('cast')
cast_tb
```

	show_id	type	cast
1	s2	TV Show	Ama Qamata
1	s2	TV Show	Khosi Ngema
1	s2	TV Show	Gail Mabalane
1	s2	TV Show	Thabang Molaba
1	s2	TV Show	Dillon Windvogel
...	...	...	...
8806	s8807	Movie	Manish Chaudhary
8806	s8807	Movie	Meghna Malik
8806	s8807	Movie	Malkeet Rauni
8806	s8807	Movie	Anita Shabdish
8806	s8807	Movie	Chittaranjan Tripathy

64057 rows × 3 columns

```
cast_tb['cast'] = cast_tb['cast'].str.strip()
```

TV Comedies NaN 574.0

```
# checking empty strings
cast_tb[cast_tb['cast'] == '']
```

show_id	type	cast

TV Sci-Fi & Fantasy NaN 83.0

```
# Total actors on the Netflix
cast_tb.cast.nunique()
```

```
36403
```

```
# Total movies/TV shows by each actor
x = cast_tb.groupby(['cast' , 'type'])['show_id'].count().reset_index()
x.pivot(index = 'cast' , columns = 'type' , values = 'show_id').sort_values('TV Show' , ascending = False)
```

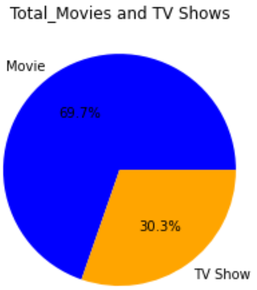
type	Movie	TV Show
cast		
Takahiro Sakurai	7.0	25.0
Yuki Kaji	10.0	19.0
Junichi Suwabe	4.0	17.0
Daisuke Ono	5.0	17.0
Ai Kayano	2.0	17.0
...	...	...
Şerif Sezer	1.0	NaN
Şevket Çoruh	1.0	NaN
Şinasi Yurtsever	3.0	NaN
Şükran Ovalı	1.0	NaN
Ṣọpẹ́ Dìrísù	1.0	NaN

36403 rows × 2 columns

4. Visual Analysis - Univariate & Bivariate

- 4.1. Distribution of content across the different types

```
types = df.type.value_counts()
plt.pie(types,  labels=types.index, autopct='%1.1f%%' , colors = ['blue' , 'orange'])
plt.title('Total_Movies and TV Shows')
plt.show()
```

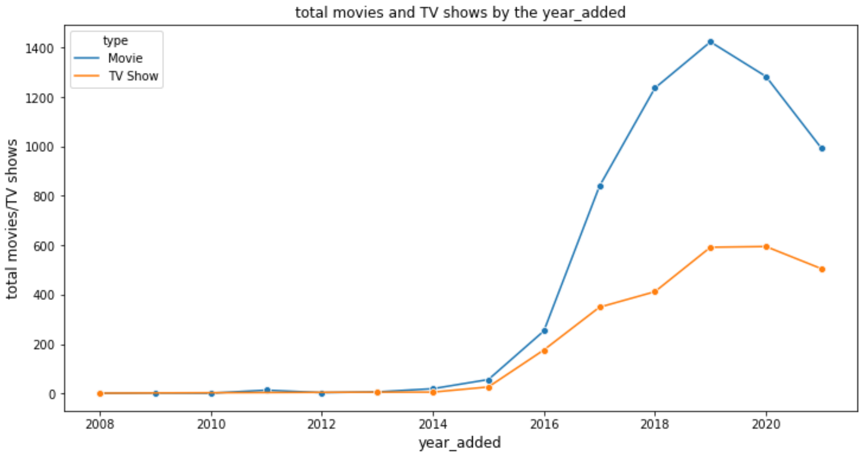


It is observed that , around 70% content is Movies and around 30% content is TV shows.

- 4.2 Distribution of 'date_added' column

How has the number of movies/TV shows added on Netflix per year changed over the time?

```
d = df.groupby(['year_added' ,'type' ])['show_id'].count().reset_index()
d.rename({'show_id' : 'total movies/TV shows'}, axis = 1 , inplace = True)


plt.figure(figsize = (12,6))
sns.lineplot(data = d , x = 'year_added' , y = 'total movies/TV shows' , hue = 'type', marker = 'o'  , ms = 6)
plt.xlabel('year_added' , fontsize = 12)
plt.ylabel('total movies/TV shows' , fontsize = 12)
plt.title('total movies and TV shows by the year_added' , fontsize = 12)
plt.show()
```



Observation:

- The content added on the Netflix surged drastically after 2015.
- 2019 marks the highest number of movies and TV shows added on the Netflix.
- Year 2020 and 2021 has seen the drop in content added on Netflix, possibly because of Pandemic. But still , TV shows content have not dropped as drastic as movies. In recent years TV shows are focussed more than Movies.

- 4.3 Distribution of 'Release_year' column

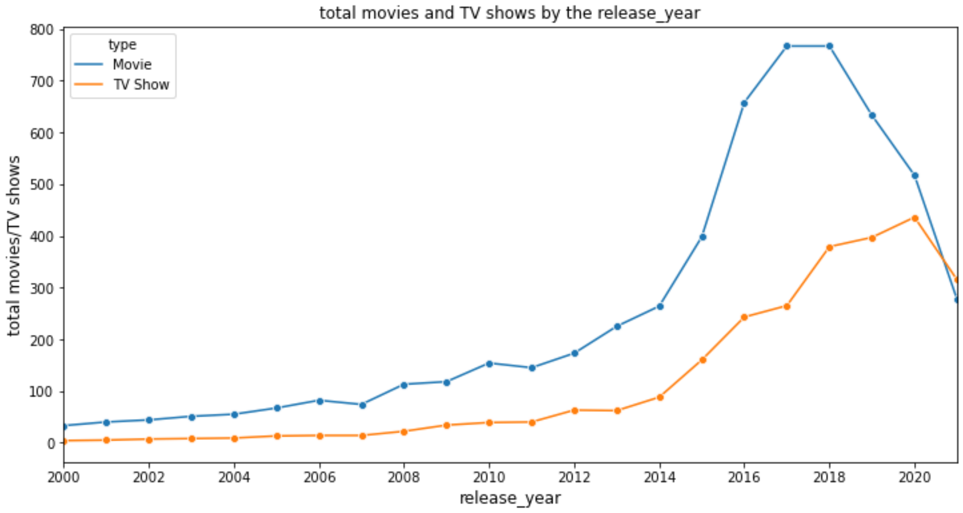
How has the number of movies released per year changed over the last 20-30 years?

```
d = df.groupby(['type' , 'release_year'])['show_id'].count().reset_index()
d.rename({'show_id' : 'total movies/TV shows'}, axis = 1 , inplace = True)
d
```

	type	release_year	total movies/TV shows
0	Movie	1942	2
1	Movie	1943	3
2	Movie	1944	3
3	Movie	1945	3
4	Movie	1946	1
...	...	...	...
114	TV Show	2017	265
115	TV Show	2018	379
116	TV Show	2019	397
117	TV Show	2020	436
118	TV Show	2021	315

119 rows × 3 columns

```
plt.figure(figsize = (12,6))
sns.lineplot(data = d , x = 'release_year' , y = 'total movies/TV shows' , hue = 'type' , marker = 'o'  , ms = 6 )
plt.xlabel('release_year' , fontsize = 12)
plt.ylabel('total movies/TV shows' , fontsize = 12)
plt.title('total movies and TV shows by the release_year' , fontsize = 12)
plt.xlim( left = 2000 , right = 2021)
plt.xticks(np.arange(2000 , 2021 , 2))
plt.show()
```



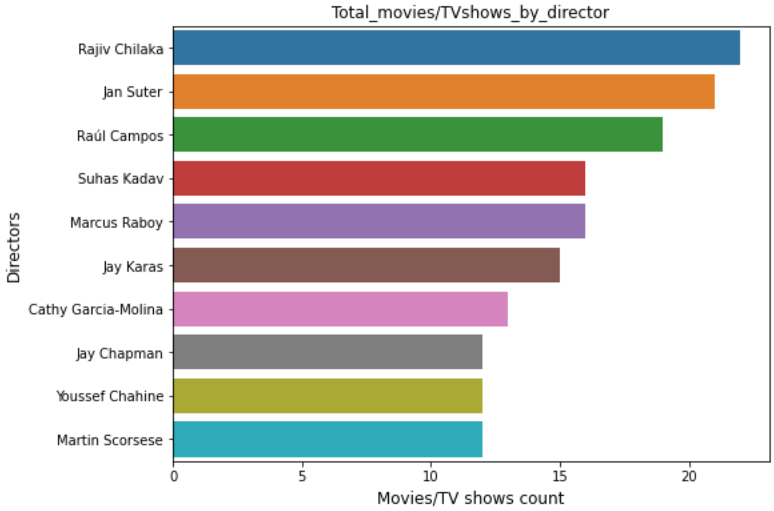
Observation:

- 2018 marks the highest number of movie and TV show releases.
- Since 2018, A drop in movies is seen and rise in TV shows is observed clearly, and TV shows surpasses the movies count in mid 2020.
- In recent years TV shows are focussed more than Movies.
- The yearly number of releases has surged drastically from 2015.

- 4.4 Total movies/TV shows by each director

```
# total Movies directed by top 10 directors
top_10_dir = dir_tb.director.value_counts().head(10).index
df_new = dir_tb.loc[dir_tb['director'].isin(top_10_dir)]
```

```
plt.figure(figsize= (8 , 6))
sns.countplot(data = df_new , y = 'director' , order = top_10_dir , orient = 'v')
plt.xlabel('total_movies/TV shows' , fontsize = 12)
plt.xlabel('Movies/TV shows count')
plt.ylabel('Directors' , fontsize = 12)
plt.title('Total_movies/TVshows_by_director')
plt.show()
```



Observation:

- The top 3 directors on Netflix in terms of count of movies directed by them are - Rajiv Chilaka, Jan Suter, Raúl Campos

- 4.4 Checking Outliers for number of movies directed by each director

```
x = dir_tb.director.value_counts()
x
```

```
     Rajiv Chilaka     22
     Jan Suter         21
     Raúl Campos       19
     Suhas Kadav       16
     Marcus Raboy      16
                       ..
     Raymie Muzquiz     1
     Stu Livingston     1
     Joe Menendez       1
     Eric Bross         1
     Mozez Singh        1
     Name: director, Length: 4993, dtype: int64
```

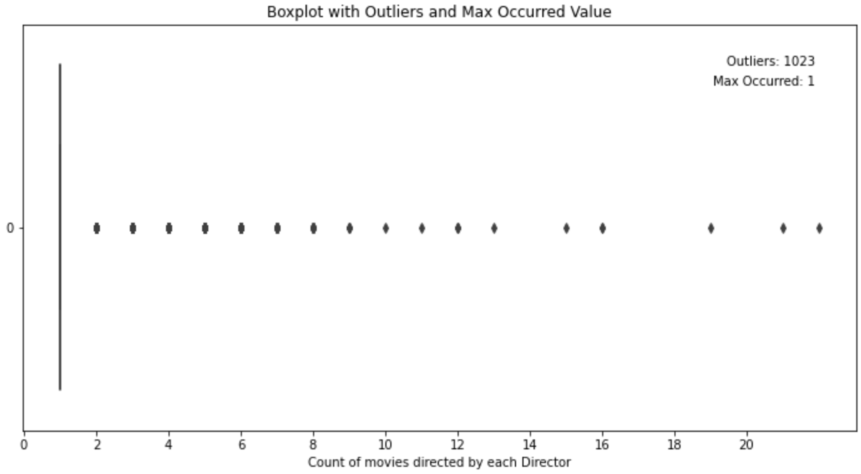
```
def calculate_outliers(data):
    # Calculate the first quartile (Q1)
    q1 = np.percentile(data, 25)

    # Calculate the third quartile (Q3)
    q3 = np.percentile(data, 75)

    # Calculate the interquartile range (IQR)
    iqr = q3 - q1

    # Determine the lower and upper bounds for outliers
    lower_bound = q1 - 1.5 * iqr
    upper_bound = q3 + 1.5 * iqr

    # Identify outliers in the dataset
    outliers = [value for value in data if value < lower_bound or value > upper_bound]

    return outliers


def calculate_max_occurred_value(data):
    # Calculate the unique values and their counts in the dataset
    unique_values, value_counts = np.unique(data, return_counts=True)

    # Find the index of the maximum count
    max_count_index = np.argmax(value_counts)

    # Retrieve the corresponding unique value with the maximum count
    max_occurred_value = unique_values[max_count_index]

    return max_occurred_value


outliers = calculate_outliers(x)  # Implement your outlier calculation method
max_occurred_value = calculate_max_occurred_value(x)  # Implement your method to find the maximum-occurred value
set(outliers)
```

```
{2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 19, 21, 22}
```

```
max_occurred_value
```

```
1
```

```
plt.figure(figsize = (12,6))
sns.boxplot(data=x, showfliers=True, whis=1.5 , orient = 'h')

# Calculate the outliers and maximum-occurred value
outliers = calculate_outliers(x)  # Implement your outlier calculation method
max_occurred_value = calculate_max_occurred_value(x)  # Implement your method to find the maximum-occurred value

# Annotate the plot
plt.text(0.95, 0.9, f"Outliers: {len(outliers)}", transform=plt.gca().transAxes, ha='right')
plt.text(0.95, 0.85, f"Max Occurred: {max_occurred_value}", transform=plt.gca().transAxes, ha='right')


plt.xlabel("Count of movies directed by each Director")
plt.xticks(np.arange(0,22,2))
plt.title("Boxplot with Outliers and Max Occurred Value")

# Show the plot
plt.show()
```



It is Observed that maximum occured value is 1, which means maximum directors on the Netflix have directed 1 movie/Tv show. There are few directors who have directed more than 1 movies/tv shows and they are outliers.

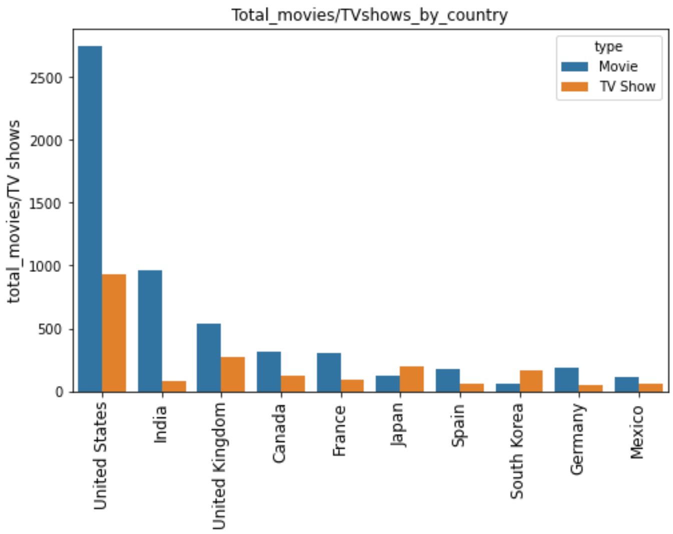
- 4.5 Total movies/TV shows by each country

```
# Lets check for top 10 countries
top_10_country = country_tb.country.value_counts().head(10).index
df_new = country_tb.loc[country_tb['country'].isin(top_10_country)]
```

```
x = df_new.groupby(['country' , 'type'])['show_id'].count().reset_index()
x.pivot(index = 'country' , columns = 'type' , values = 'show_id').sort_values('Movie',ascending = False)
```

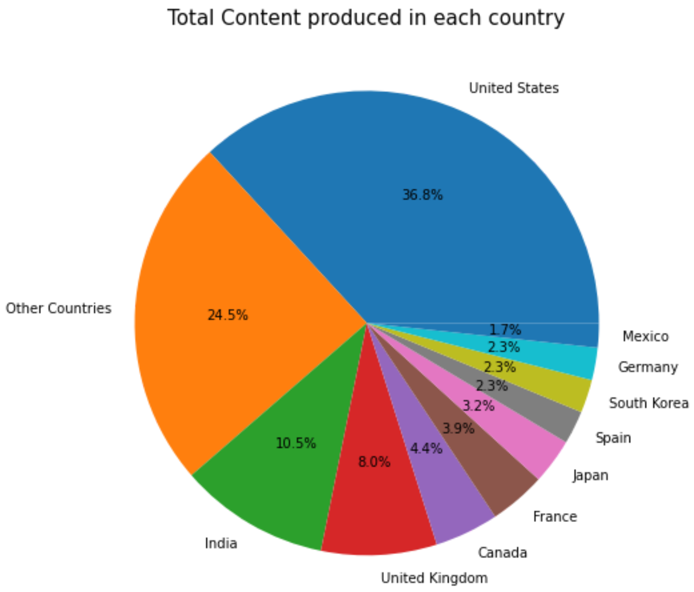
type	Movie	TV Show
country		
United States	2752	938

```
plt.figure(figsize= (8,5))
sns.countplot(data = df_new , x = 'country' , order = top_10_country , hue = 'type')
plt.xticks(rotation = 90 , fontsize = 12)
plt.ylabel('total_movies/TV shows' , fontsize = 12)
plt.xlabel('')
plt.title('Total_movies/TVshows_by_country')
plt.show()
```



```
top_10_country = country_tb.country.value_counts().head(10).index
country_tb['cat'] = country_tb['country'].apply(lambda x : x if x in top_10_country else 'Other Countries' )
```

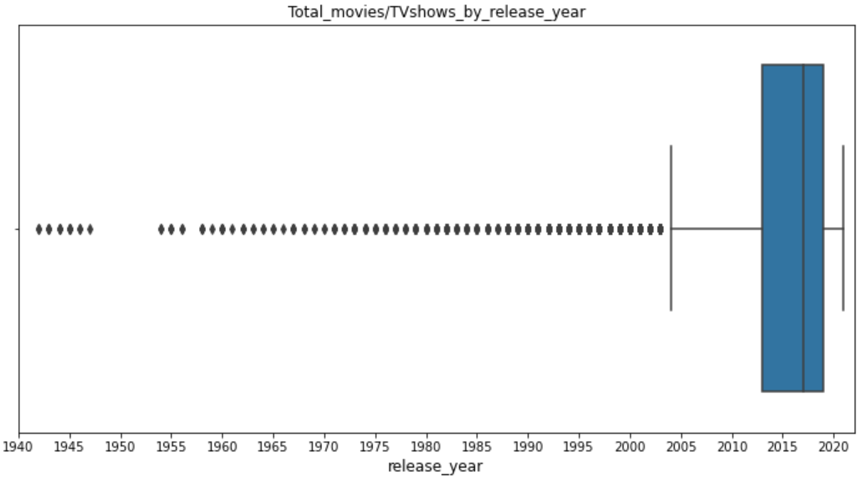
```
x = country_tb.cat.value_counts()

plt.figure(figsize = (8,8))
plt.pie(x , labels = x.index, autopct='%1.1f%%')
plt.title('Total Content produced in each country' , fontsize = 15)
plt.show()
```



- Observation:
  - United States is the HIGHEST contributor country on Netflix, followed by India and United Kingdom.
  - Maximum content of Netflix which is around 75% , is coming from these top 10 countries. Rest of the world only contributes 25% of the content.

- 4.6 Total content distribution by release year of the content

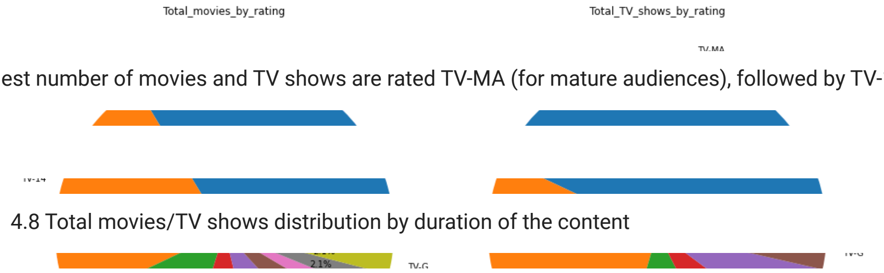
```
plt.figure(figsize= (12,6))
sns.boxplot(data = df , x = 'release_year')
plt.xlabel('release_year' , fontsize = 12)
plt.title('Total_movies/TVshows_by_release_year')
plt.xticks(np.arange(1940 , 2021 , 5))
plt.xlim((1940 , 2022))
plt.show()
```



- Netflix have major content which is released in the year range 2000-2021
- It seems that the content older than year 2000 is almost missing from the Netflix.

- 4.7 Total movies/TV shows distribution by rating of the content

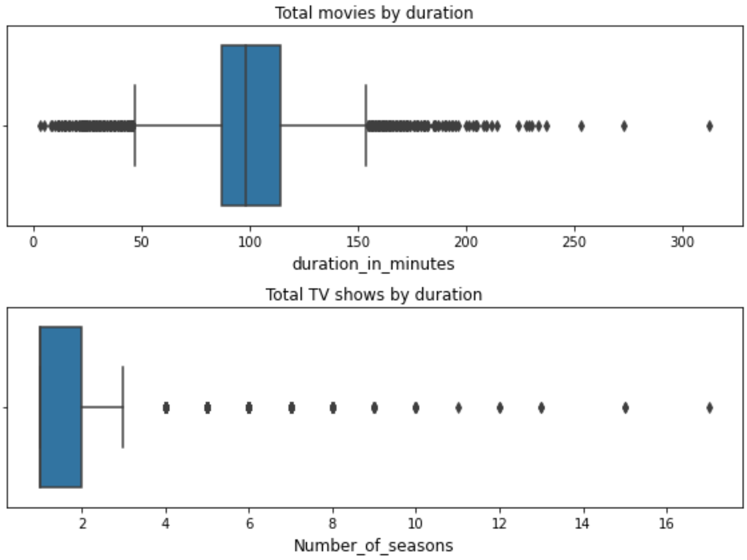
```
m = movies.loc[~movies.rating.isin(['Not Available' , 'NC-17' , 'TV-Y7-FV'])]
m = m.rating.value_counts()
t = tv_shows.loc[~tv_shows.rating.isin(['Not Available' , 'R' , 'NR', 'TV-Y7-FV'])]
t = t.rating.value_counts()


fig, ax = plt.subplots(1,2, figsize=(14,8))
ax[0].pie(m , labels = m.index, autopct='%1.1f%%')
ax[0].set_title('Total_movies_by_rating')

ax[1].pie(t , labels = t.index, autopct='%1.1f%%')
ax[1].set_title('Total_TV_shows_by_rating')

plt.tight_layout()
plt.show()
```



Highest number of movies and TV shows are rated TV-MA (for mature audiences), followed by TV-14 & R/TV-PG

- 4.8 Total movies/TV shows distribution by duration of the content

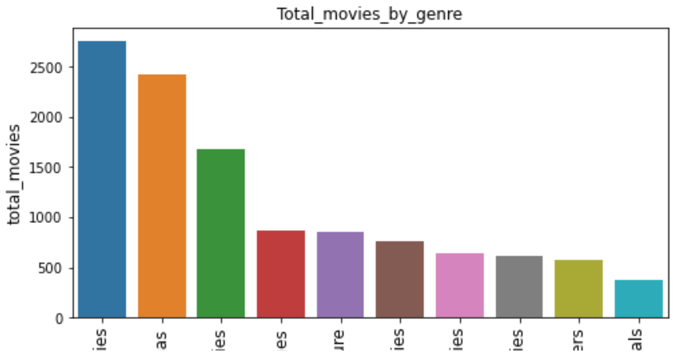
```
fig, ax = plt.subplots(2,1, figsize=(8,6))

sns.boxplot (data = movies , x = 'duration_in_minutes' ,ax =ax[0])
ax[0].set_xlabel('duration_in_minutes' ,  fontsize = 12)
ax[0].set_title('Total movies by duration')

sns.boxplot (data = tv_shows , x = 'duration_in_seasons' , ax = ax[1])
ax[1].set_xlabel('Number_of_seasons' ,  fontsize = 12)
ax[1].set_title('Total TV shows by duration')

plt.tight_layout()
plt.show()
```



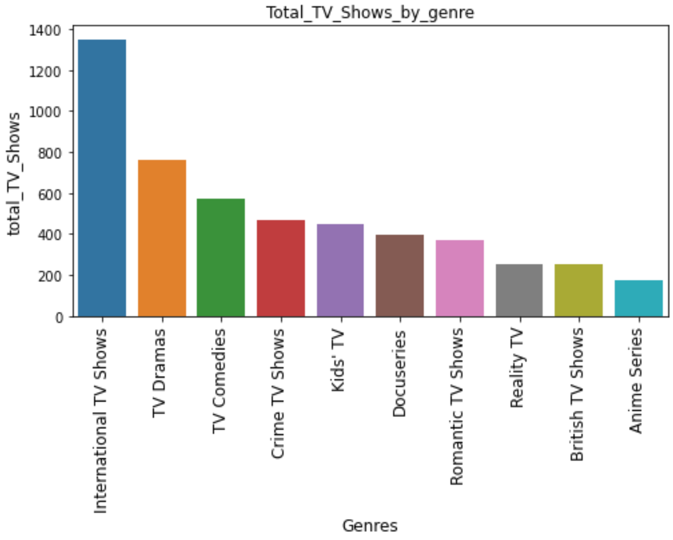
- Movie Duration: 50 mins - 150 mins is the range excluding potential outliers (values lying outside the whiskers of boxplot)
- TV Show Duration: 1-3 seasons is the range for TV shows excluding potential outliers

- 4.9 Total movies/TV shows in each Genre

```
# Lets check the count for top 10 genres in Movies and TV_shows


top_10_movie_genres = genre_tb[genre_tb['type'] == 'Movie'].listed_in.value_counts().head(10).index
df_movie = genre_tb.loc[genre_tb['listed_in'].isin(top_10_movie_genres)]


top_10_TV_genres = genre_tb[genre_tb['type'] == 'TV Show'].listed_in.value_counts().head(10).index
df_tv = genre_tb.loc[genre_tb['listed_in'].isin(top_10_TV_genres)]


plt.figure(figsize= (8,4))
sns.countplot(data = df_movie , x = 'listed_in' , order = top_10_movie_genres)
plt.xticks(rotation = 90 , fontsize = 12)
plt.ylabel('total_movies' , fontsize = 12)
plt.xlabel('Genres' , fontsize = 12)
plt.title('Total_movies_by_genre')
plt.show()
```



```
plt.figure(figsize= (8,4))
sns.countplot(data = df_tv , x = 'listed_in' , order = top_10_TV_genres)
plt.xticks(rotation = 90 , fontsize = 12)
plt.ylabel('total_TV_Shows' , fontsize = 12)
plt.xlabel('Genres' , fontsize = 12)
plt.title('Total_TV_Shows_by_genre')
plt.show()
```



- International Movies and TV Shows , Dramas , and Comedies are the top 3 genres on Netflix for both Movies and TV shows.

5. Bivariate Analysis

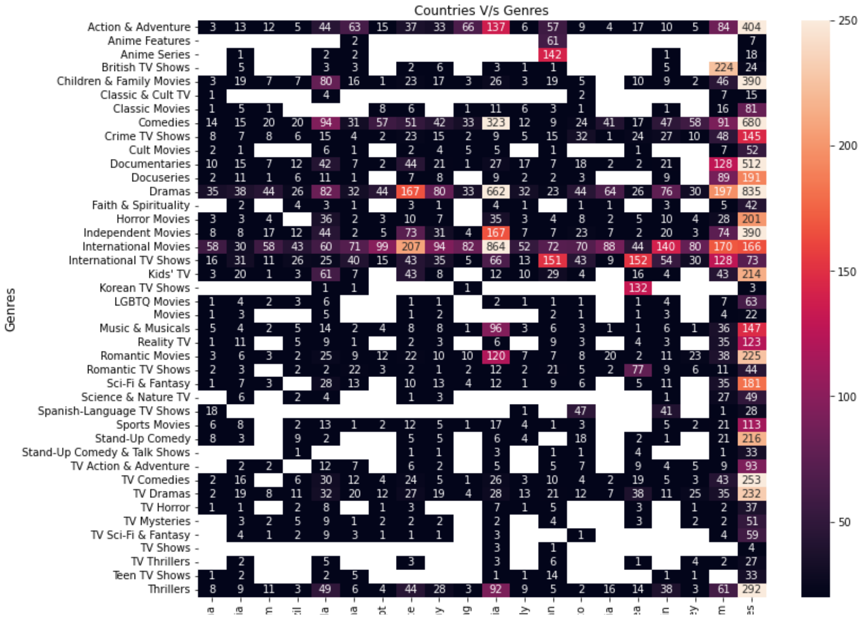
- 5.1 Lets check popular genres in top 20 countries

```
top_20_country = country_tb.country.value_counts().head(20).index
top_20_country = country_tb.loc[country_tb['country'].isin(top_20_country)]
```

```
x = top_20_country.merge(genre_tb , on = 'show_id').drop_duplicates()
country_genre = x.groupby([ 'country' , 'listed_in'])['show_id'].count().sort_values(ascending = False).reset_index()
country_genre = country_genre.pivot(index = 'listed_in' , columns = 'country' , values = 'show_id')
```

```
plt.figure(figsize = (12,10))
sns.heatmap(data = country_genre , annot = True , fmt=".0f" , vmin = 20 , vmax = 250 )
plt.xlabel('Countries' , fontsize = 12)
plt.ylabel('Genres' , fontsize = 12)
plt.title('Countries V/s Genres' , fontsize = 12)
```

```
Text(0.5, 1.0, 'Countries V/s Genres')
```



Popular genres across countries: Action & Adventure, Children & Family Movies, Comedies, Dramas, International Movies & TV Shows, TV Dramas, Thrillers

Country-specific genres: Korean TV shows (Korea), British TV Shows (UK), Anime features and Anime series (Japan), Spanish TV Shows (Argentina, Mexico and Spain)

United States and UK have a good mix of almost all genres.

Maximum International movies are produced in India.

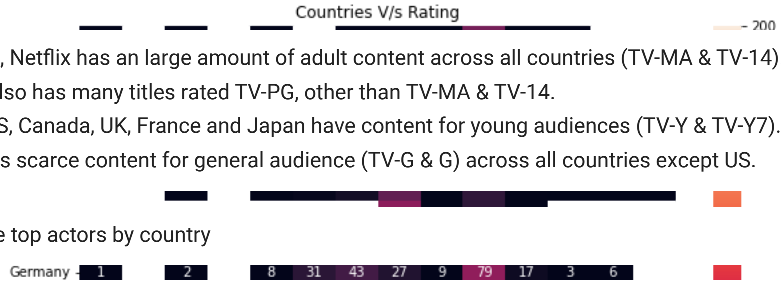
5.2 Country-wise Rating of Content

```
x = top_20_country.merge(df , on = 'show_id').groupby(['country_x' , 'rating'])['show_id'].count().reset_index()
```

```
country_rating = x.pivot(index = ['country_x'] , columns = 'rating' , values = 'show_id')
```

```
plt.figure(figsize = (10,8))
sns.heatmap(data = country_rating , annot = True , fmt=".0f"  , vmin = 10 , vmax=200)
plt.ylabel('Countries' , fontsize = 12)
plt.xlabel('Rating' , fontsize = 12)
plt.title('Countries V/s Rating' , fontsize = 12)
```

```
Text(0.5, 1.0, 'Countries V/s Rating')
```



- Overall, Netflix has an large amount of adult content across all countries (TV-MA & TV-14).
- India also has many titles rated TV-PG, other than TV-MA & TV-14.
- Only US, Canada, UK, France and Japan have content for young audiences (TV-Y & TV-Y7).
- There is scarce content for general audience (TV-G & G) across all countries except US.

- 5.3 The top actors by country

```
x = cast_tb.merge(country_tb , on = 'show_id').drop_duplicates()
x = x.groupby(['country' , 'cast'])['show_id'].count().reset_index()
x.loc[x['country'].isin(['United States'])].sort_values('show_id' , ascending = False).head(5)
```

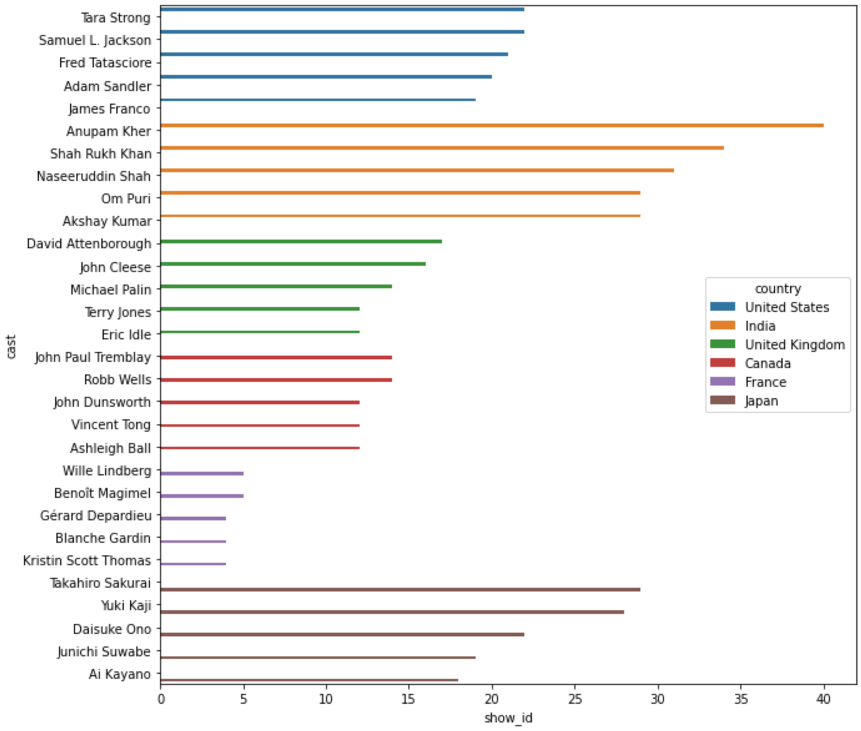
	country	cast	show_id
49405	United States	Tara Strong	22
48330	United States	Samuel L. Jackson	22
40463	United States	Fred Tatasciore	21
35733	United States	Adam Sandler	20
41672	United States	James Franco	19

```
country_list = ['India'  , 'United Kingdom' , 'Canada' , 'France' , 'Japan']
top_5_actors = x.loc[x['country'].isin(['United States'])].sort_values('show_id' , ascending = False).head(5)


for i in country_list:
    new = x.loc[x['country'].isin([i])].sort_values('show_id' , ascending = False).head(5)
    top_5_actors = pd.concat( [top_5_actors , new] , ignore_index = True)



# top 5 actors in top countries and their movies/tv shows count
top_5_actors
```

	country	cast	show_id
0	United States	Tara Strong	22
1	United States	Samuel L. Jackson	22
2	United States	Fred Tatasciore	21
3	United States	Adam Sandler	20
4	United States	James Franco	19

```
plt.figure(figsize = (10,10))
sns.barplot(data = top_5_actors , y = 'cast' , x = 'show_id' , hue = 'country')
```

```
<AxesSubplot:xlabel='show_id', ylabel='cast'>
```



- 5.4 Top 5 directors by Genre

```
genre_list = [ 'Children & Family Movies', 'Comedies','Dramas', 'International Movies', 'Documentaries' ,
              'International TV Shows', 'Sci-Fi & Fantasy', 'Thrillers', 'Horror Movies']

x = dir_tb.merge(genre_tb , on = 'show_id').groupby([ 'listed_in' , 'director',])['show_id'].count().reset_index()

top_5_dir = x.loc[x['listed_in'] == 'Action & Adventure'].sort_values('show_id' , ascending = False).head()

for i in genre_list:
    new = x.loc[x['listed_in'] == i].sort_values('show_id' , ascending = False).head()
    top_5_dir = pd.concat([top_5_dir , new])

top_5_dir
```

4590	Dramas	Hanung Bramantyo	8
5544	Dramas	S.S. Rajamouli	7
7509	International Movies	Cathy Garcia-Molina	13
9330	International Movies	Youssef Chahine	10
9340	International Movies	Yılmaz Erdoğan	9
7620	International Movies	David Dhawan	8
8208	International Movies	Kunle Afolayan	8
3834	Documentaries	Vlad Yudin	6
3799	Documentaries	Thierry Donard	5
3217	Documentaries	Edward Cotterill	4
3262	Documentaries	Frank Capra	4
3075	Documentaries	Barry Avrich	4
9373	International TV Shows	Alastair Fothergill	3
9419	International TV Shows	Hsu Fu-chun	2
9436	International TV Shows	Jung-ah Im	2
9501	International TV Shows	Shin Won-ho	2
9478	International TV Shows	Pali Yahya	1
10752	Sci-Fi & Fantasy	Lilly Wachowski	4
10744	Sci-Fi & Fantasy	Lana Wachowski	4
10684	Sci-Fi & Fantasy	Guillermo del Toro	3
10790	Sci-Fi & Fantasy	Paul W.S. Anderson	3
10635	Sci-Fi & Fantasy	Barry Sonnenfeld	3
11974	Thrillers	Rathindran R Prasad	4
11698	Thrillers	David Fincher	4
11612	Thrillers	Anurag Kashyap	3
11636	Thrillers	Brad Anderson	3
11754	Thrillers	Gregory Hoblit	3
6280	Horror Movies	Rocky Soraya	6
6260	Horror Movies	Poj Arnon	5
6267	Horror Movies	Rathindran R Prasad	4
6191	Horror Movies	Leigh Janiak	3
6052	Horror Movies	Banjong Pisanthanakun	3

- 5.5 Top 5 genres in each country

```
x = genre_tb.merge(country_tb , on = 'show_id').drop_duplicates()
x = x.groupby(['country' , 'listed_in'])['show_id'].count().reset_index()
x.loc[x['country'] == 'United States'].sort_values('show_id' , ascending = False).head(5)

country_list = ['India'  , 'United Kingdom' , 'Canada' , 'France' , 'Japan']
top_5_genre = x.loc[x['country'].isin(['United States'])].sort_values('show_id' , ascending = False).head(5)

for i in country_list:
    new = x.loc[x['country'] == i].sort_values('show_id' , ascending = False).head(5)
    top_5_genre = pd.concat( [top_5_genre , new] , ignore_index = True)
```

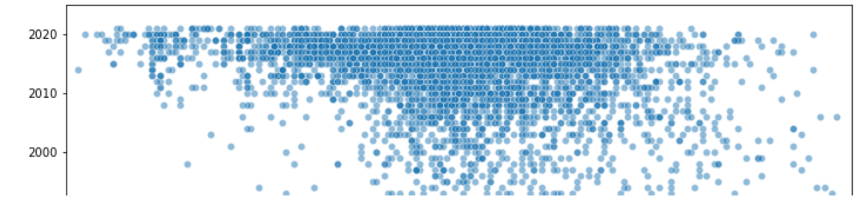
```
top_5_genre
```

	country	listed_in	show_id
0	United States	Dramas	835
1	United States	Comedies	680
2	United States	Documentaries	512
3	United States	Action & Adventure	404
4	United States	Independent Movies	390
5	India	International Movies	864
6	India	Dramas	662
7	India	Comedies	323
8	India	Independent Movies	167
9	India	Action & Adventure	137
10	United Kingdom	British TV Shows	224
11	United Kingdom	Dramas	197
12	United Kingdom	International Movies	170
13	United Kingdom	International TV Shows	128
14	United Kingdom	Documentaries	128
15	Canada	Comedies	94
16	Canada	Dramas	82
17	Canada	Children & Family Movies	80
18	Canada	Kids' TV	61
19	Canada	International Movies	60
20	France	International Movies	207
21	France	Dramas	167
22	France	Independent Movies	73
23	France	Comedies	51
24	France	Thrillers	44
25	Japan	International TV Shows	151
26	Japan	Anime Series	142
27	Japan	International Movies	72
28	Japan	Anime Features	61
29	Japan	Action & Adventure	57

- 5.6 Variation in duration of movies by Release year

```
plt.figure(figsize = (12,8))
sns.scatterplot(movies['duration_in_minutes'], movies['release_year'],  alpha=0.5)
plt.xlim((0,200))
```

```
(0.0, 200.0)
```



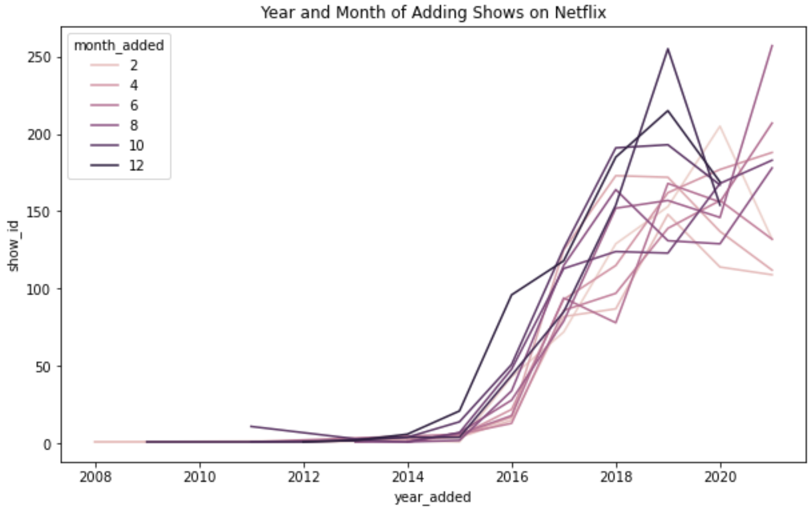
- Observation
  - The movies shorter than 150 minutes duration have increased drastically after 2000 while movies longer than 150 minutes are not much popular.
  - There is a huge surge in the number of shorter duration movies (less than 75 mins) post 2010. Overall, Short movies have been popular in last 10 years.

- 5.7 What is the best time of the year when maximum content get added on the Netflix?

```
month_year = df.groupby(['year_added' , 'month_added'])['show_id'].count().reset_index()
```

```
plt.figure(figsize = (10,6))
sns.lineplot(data=month_year, x = 'year_added', y = 'show_id', hue='month_added')
plt.title('Year and Month of Adding Shows on Netflix')
```

```
Text(0.5, 1.0, 'Year and Month of Adding Shows on Netflix')
```



- The number of shows getting added is increasing with each year until 2020.
- Also, months in the last quarter of the year (Oct-Dec) have more shows being added than the other months of the year. This could be because US has its festive season in Dec and India also has Diwali in Oct-Nov.

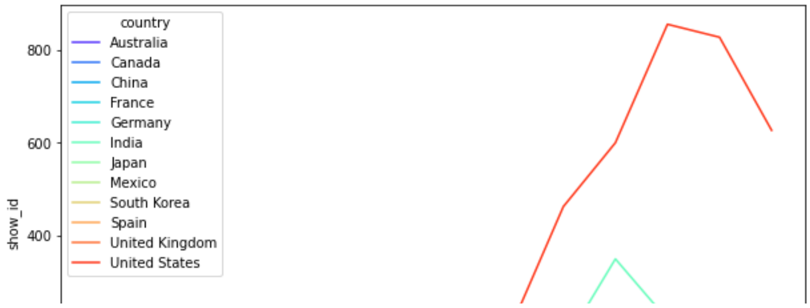
- 5.8 Which countries are adding more number of content over the time?

```
country_list = country_tb.country.value_counts().head(12).index
top_12_country = country_tb.loc[country_tb['country'].isin(country_list)]
country_year = top_12_country.merge(df , on = 'show_id')[['show_id','country_x' ,'type_x' , 'year_added' ]]
country_year.columns = ['show_id', 'country', 'type', 'year_added']
```

```
country_year = country_year.groupby(['country' , 'year_added'])['show_id'].count().reset_index()
```

```
plt.figure(figsize = (10,6))
sns.lineplot(data = country_year , x = 'year_added' , y = 'show_id' , hue = 'country' , palette ='rainbow' )
```

```
<AxesSubplot:xlabel='year_added', ylabel='show_id'>
```

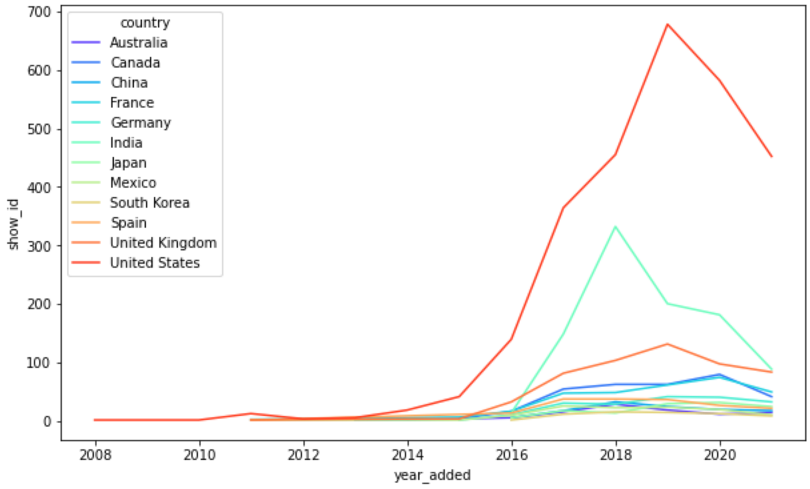


Observation : United Stated have always added highset number of movies/TV shows over the time. Since 2016, India has seen spike in popularity of content and added more number of content, followed by United Kingdom at 3rd position.

```
movie_type = country_year.loc[country_year.type == 'Movie'].groupby(['country' , 'year_added'])['show_id'].count().reset_index()
tv_type = country_year.loc[country_year.type == 'TV Show'].groupby(['country' , 'year_added'])['show_id'].count().reset_index()
```

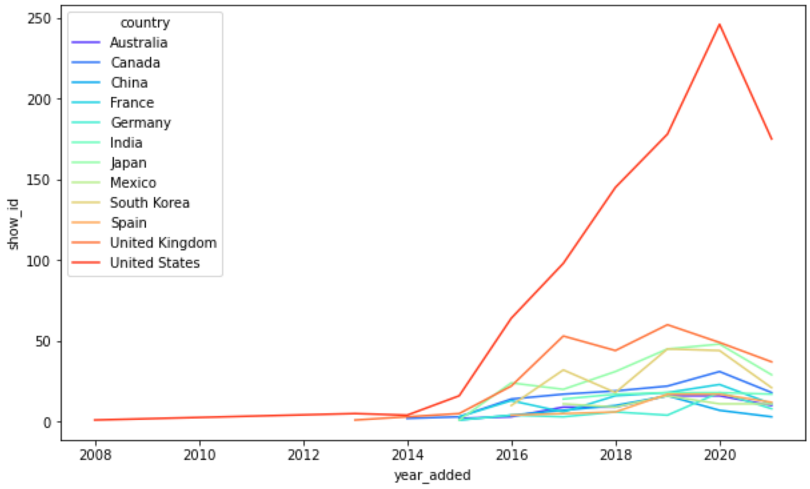
```
plt.figure(figsize = (10,6))
sns.lineplot(data = movie_type , x = 'year_added' , y = 'show_id' , hue = 'country' , palette ='rainbow' )
```

```
<AxesSubplot:xlabel='year_added', ylabel='show_id'>
```



```
plt.figure(figsize = (10,6))
sns.lineplot(data = tv_type , x = 'year_added' , y = 'show_id' , hue = 'country' , palette ='rainbow' )
```

```
<AxesSubplot:xlabel='year_added', ylabel='show_id'>
```



Observation: It is observed that United States tops in both movies and TV Shows. India is at 2nd positon in movies but In TV shows United Kingdom is at 2nd position, followed by India ,South Korea , Australia. It shows in countries like United Kingdom , South Korea , Australia TV Shows popularity is rising more than movies

Insights based on Non-Graphical and Visual Analysis

- Around 70% content on Netflix is Movies and around 30% content is TV shows.
- The movies and TV shows uploading on the Netflix started from the year 2008, It had very lesser content till 2014.
- Year 2015 marks the drastic surge in the content getting uploaded on Netflix. It continues the uptrend since then and 2019 marks the highest number of movies and TV shows added on the Netflix. Year 2020 and 2021 has seen the drop in content added on Netflix, possibly because of Pandemic. But still , TV shows content have not dropped as drastic as movies.
- Since 2018, A drop in the movies is seen , but rise in TV shows is observed clearly. Being in continuous uptrend , TV shows surpassed the movies count in mid 2020. It shows the rise in popularity of tv shows in recent years.
- Netflix has movies from variety of directors. Around 4993 directors have their movies or tv shows on Netflix.
- Netflix has movies from total 122 countries, United States being the highset contributor with almost 37% of all the content.
- The release year for shows is concentrated in the range 2005-2021.
- 50 mins - 150 mins is the range of movie durations, excluding potential outliers.
- 1-3 seasons is the range for TV shows seasons, excluding potential outliers.
- various ratings of content is avaialble on netfilx, for the various viewers categories like kids, adults , families. Highest number of movies and TV shows are rated TV-MA (for mature audiences).
- Content in most of the ratings is available in lesser quanitity except in US. Ratings like TV-Y7 , TV-Y7 FV , PG ,TV-G , G , TV-Y , TV-PG are very less avaialble in all countries except US.
- International Movies and TV Shows , Dramas , and Comedies are the top 3 genres on Netflix for both Movies and TV shows.
- Mostly country specific popular genres are observed in each country. Only United States have a good mix of almost all genres. Eg. Korean TV shows (Korea), British TV Shows (UK), Anime features and Anime series (Japan) and so on.
- Indian Actors have been acted in maximum movies on netflix. Top 5 actors are in India based on quantity of movies.
- Shorter duration movies have been popular in last 10 years.

Business Insights

- Netflix have majority of content which is released after the year 2000. It is observed that the content older than year 2000 is very scarce on Netflix. Senior Citizen could be the target audience for such content, which is almost missing currently.
- Maximum content (more than 80%) is
    - TV-MA - Content intended for mature audiences aged 17 and above.
    - TV-14 - Content suitable for viewers aged 14 and above.
    - TV-PG - Parental guidance suggested (similar ratings - PG-13 , PG)
    - R - Restricted Content, that may not be suitable for viewers under age 17.

These ratings' movies target Matured and Adult audience. Rest 20 % of the content is for kids aged below 13. It shows that Netflix is currently serving mostly Mature audiences or Children with parental guidance.

- Most popular genres on Netflix are International Movies and TV Shows , Dramas , Comedies, Action & Adventure, Children & Family Movies, Thrillers.
- Maximum content of Netflix which is around 75% , is coming from the top 10 countries. Rest of the world only contributes 25% of the content. More countries can be focussed in future to grow the business.
- Liking towards the shorter duration content is on the rise. (duration 75 to 150 minutes and seasons 1 to 3) This can be considered while production of new content on Netflix.
- drop in content is seen across all the countries and type of content in year 2020 and 2021, possibly because of Pandemic.

Recommendations

- Very limited genres are focussed in most of the countries except US. It seems the current available genres suits best for US and few countries but maximum countries need some more genres which are highly popular in the region. eg. Indian Mythological content is highly popular. We can create such more country specific genres and It might also be liked acorss the world just like Japanese Anime.

- Country specific insights - The content need to be targetting the demographic of any country. Netflix can produce higher number of content in the perticular rating as per demographic of the country. Eg.
    - The country like India , which is highly populous , has maximum content available only in three rating TV-MA, TV-14 , TV-PG. It is unlikely to serve below 14 age and above 35 year age group .