data-exploration-and-visualization

May 15, 2024

1 1. Introduction

What is Netflix?

Netflix, Inc. is an American subscription streaming service and production company. It offers a library of films and television series through distribution deals as well as its own productions, known as Netflix Originals. As of March 31, 2023, with an estimated 232.5 million paid memberships in more than 190 countries, it is the most-subscribed video on demand streaming service.

Founded by Reed Hastings and Marc Randolph in Scotts Valley, California, Netflix initially operated as a DVD sales and rental business. However, within a year, it shifted its focus exclusively to DVD rentals. In 2007, the company introduced streaming media and video on demand services, marking a significant step in its evolution.

Objective

Analyzing the data and generate insights that could help Netflix in deciding which type of shows/movies to produce and how they can grow the business in different countries

About Data

This tabular dataset consists of data as of mid-2021, about 8807 movies and tv shows available on Netflix, along with details such as - cast, directors, ratings, release year, duration, etc. The data is available in a single csv file.

2 1. Importing Libraries and Loading the data

[ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

[ ]:
```
df = pd.read_csv('netflix.csv')
```

3 1. Analysing basic metrics

```
[ ]: df.head()
```

```
[ ]:   show_id     type                 title         director  \
    0      s1    Movie   Dick Johnson Is Dead  Kirsten Johnson
    1      s2  TV Show          Blood & Water              NaN
    2      s3  TV Show              Ganglands  Julien Leclercq
    3      s4  TV Show  Jailbirds New Orleans              NaN
    4      s5  TV Show           Kota Factory              NaN

                                                    cast        country  \
    0                                                NaN  United States
    1  Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban…   South Africa
    2  Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi…            NaN
    3                                                NaN            NaN
    4  Mayur More, Jitendra Kumar, Ranjan Raj, Alam K…          India

               date_added  release_year rating   duration  \
    0  September 25, 2021          2020  PG-13     90 min
    1  September 24, 2021          2021  TV-MA  2 Seasons
    2  September 24, 2021          2021  TV-MA   1 Season
    3  September 24, 2021          2021  TV-MA   1 Season
    4  September 24, 2021          2021  TV-MA  2 Seasons

                                                listed_in  \
    0                                       Documentaries
    1    International TV Shows, TV Dramas, TV Mysteries
    2  Crime TV Shows, International TV Shows, TV Act…
    3                              Docuseries, Reality TV
    4  International TV Shows, Romantic TV Shows, TV …

                                             description
    0  As her father nears the end of his life, filmm…
    1  After crossing paths at a party, a Cape Town t…
    2  To protect his family from a powerful drug lor…
    3  Feuds, flirtations and toilet talk go down amo…
    4  In a city of coaching centers known to train I…
```

These are the first 5 rows of the dataset. The actual size of the dataset is given below. total 8807 rows and 12 columns.

```
[ ]: df.shape
```

```
[ ]: (8807, 12)
```

```
[ ]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8807 entries, 0 to 8806
Data columns (total 12 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   show_id       8807 non-null   object
 1   type          8807 non-null   object
 2   title         8807 non-null   object
 3   director      6173 non-null   object
 4   cast          7982 non-null   object
 5   country       7976 non-null   object
 6   date_added    8797 non-null   object
 7   release_year  8807 non-null   int64
 8   rating        8803 non-null   object
 9   duration      8804 non-null   object
 10  listed_in     8807 non-null   object
 11  description   8807 non-null   object
dtypes: int64(1), object(11)
memory usage: 825.8+ KB
```

[ ]:
```
df.isna().sum()  #sum of missing/null values
```

[ ]:
```
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
```

These are total features of our dataset. It is seen that show_id column has all unique values, Title column has all unique values i.e. total 8807 which equates with total rows in the dataset. Hence It can be concluded that ,

Total 8807 movies/TV shows data is provided in the dataset.

[ ]:
```
df.describe()
```

[ ]:
```
       release_year
count   8807.000000
mean    2014.180198
std        8.819312
```

```
min      1925.000000
25%      2013.000000
50%      2017.000000
75%      2019.000000
max      2021.000000
```

Only single column having numerical values. It gives idea of release year of the content ranges between what timeframe. Rest all the columns are having categorical data.

[ ]:
```
df.describe(include = object)
```

[ ]:
```
       show_id   type                 title       director  \
count     8807   8807                  8807           6173
unique    8807      2                  8807           4528
top         s1  Movie  Dick Johnson Is Dead  Rajiv Chilaka
freq         1   6131                     1             19

                       cast        country       date_added rating  duration  \
count                  7982           7976             8797   8803      8804
unique                 7692            748             1767     17       220
top     David Attenborough  United States  January 1, 2020  TV-MA  1 Season
freq                     19           2818              109   3207      1793

                           listed_in  \
count                           8807
unique                           514
top     Dramas, International Movies
freq                             362

                                              description
count                                                8807
unique                                               8775
top     Paranormal activity at a lush, abandoned prope…
freq                                                    4
```

4 2. Data Cleaning

[ ]:
```
#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
```

3 missing values are found in duration column , and it is also found that by mistake those data got entered in rating column

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

```
[ ]:      show_id   type                                 title    director  \
     5541   s5542  Movie                      Louis C.K. 2017  Louis C.K.
     5794   s5795  Movie                Louis C.K.: Hilarious  Louis C.K.
     5813   s5814  Movie  Louis C.K.: Live at the Comedy Store  Louis C.K.

                  cast        country          date_added  release_year  rating  \
     5541   Louis C.K.  United States       April 4, 2017          2017  74 min
     5794   Louis C.K.  United States  September 16, 2016          2010  84 min
     5813   Louis C.K.  United States     August 15, 2016          2015  66 min

          duration listed_in                                        description
     5541      NaN    Movies  Louis C.K. muses on religion, eternal love, gi…
     5794      NaN    Movies  Emmy-winning comedy writer Louis C.K. brings h…
     5813      NaN    Movies  The comic puts his trademark hilarious/thought…
```

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

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

```
[ ]: # replaced the wrong entries done in the rating column
     df.loc[ind ,'rating'] = 'Not Available'
```

```
[ ]: df.loc[ind]
```

```
[ ]:      show_id   type                                 title    director  \
     5541   s5542  Movie                      Louis C.K. 2017  Louis C.K.
     5794   s5795  Movie                Louis C.K.: Hilarious  Louis C.K.
     5813   s5814  Movie  Louis C.K.: Live at the Comedy Store  Louis C.K.

                  cast        country          date_added release_year  \
     5541   Louis C.K.  United States       April 4, 2017         2017
     5794   Louis C.K.  United States  September 16, 2016         2010
     5813   Louis C.K.  United States     August 15, 2016         2015
```

```
            rating duration listed_in  \
5541  Not Available   74 min    Movies
5794  Not Available   84 min    Movies
5813  Not Available   66 min    Movies

                                         description
5541  Louis C.K. muses on religion, eternal love, gi…
5794  Emmy-winning comedy writer Louis C.K. brings h…
5813  The comic puts his trademark hilarious/thought…
```

Fill the null values in rating column

```
[ ]: df[df.rating.isna()]
```

```
[ ]:     show_id     type                                              title  \
     5989   s5990    Movie  13TH: A Conversation with Oprah Winfrey & Ava …
     6827   s6828  TV Show                   Gargantia on the Verdurous Planet
     7312   s7313  TV Show                                        Little Lunch
     7537   s7538    Movie                              My Honor Was Loyalty

                 director                                              cast  \
     5989             NaN                        Oprah Winfrey, Ava DuVernay
     6827             NaN  Kaito Ishikawa, Hisako Kanemoto, Ai Kayano, Ka…
     7312             NaN  Flynn Curry, Olivia Deeble, Madison Lu, Oisín …
     7537  Alessandro Pepe  Leone Frisa, Paolo Vaccarino, Francesco Miglio…

             country        date_added release_year rating  duration  \
     5989        NaN  January 26, 2017         2017    NaN    37 min
     6827      Japan  December 1, 2016         2013    NaN  1 Season
     7312  Australia  February 1, 2018         2015    NaN  1 Season
     7537      Italy     March 1, 2017         2015    NaN   115 min

                                 listed_in  \
     5989                           Movies
     6827  Anime Series, International TV Shows
     7312                Kids' TV, TV Comedies
     7537                           Dramas

                                              description
     5989  Oprah Winfrey sits down with director Ava DuVe…
     6827  After falling through a wormhole, a space-dwel…
     7312  Adopting a child's perspective, this show take…
     7537  Amid the chaos and horror of World War II, a c…
```

```
[ ]: indices = df[df.rating.isna()].index
     indices
```

```
[ ]: Int64Index([5989, 6827, 7312, 7537], dtype='int64')
```

```
[ ]: df.loc[indices, 'rating'] = 'Not Available'
```

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

```
[ ]:     show_id     type                                              title  \
5989   s5990    Movie  13TH: A Conversation with Oprah Winfrey & Ava …
6827   s6828  TV Show                  Gargantia on the Verdurous Planet
7312   s7313  TV Show                                       Little Lunch
7537   s7538    Movie                               My Honor Was Loyalty

               director                                               cast  \
5989                NaN                        Oprah Winfrey, Ava DuVernay
6827                NaN  Kaito Ishikawa, Hisako Kanemoto, Ai Kayano, Ka…
7312                NaN  Flynn Curry, Olivia Deeble, Madison Lu, Oisín …
7537  Alessandro Pepe  Leone Frisa, Paolo Vaccarino, Francesco Miglio…

        country        date_added release_year         rating  duration  \
5989        NaN  January 26, 2017         2017  Not Available    37 min
6827      Japan  December 1, 2016         2013  Not Available  1 Season
7312  Australia  February 1, 2018         2015  Not Available  1 Season
7537      Italy     March 1, 2017         2015  Not Available   115 min

                                     listed_in  \
5989                                    Movies
6827  Anime Series, International TV Shows
7312                  Kids' TV, TV Comedies
7537                                    Dramas

                                            description
5989  Oprah Winfrey sits down with director Ava DuVe…
6827  After falling through a wormhole, a space-dwel…
7312  Adopting a child's perspective, this show take…
7537  Amid the chaos and horror of World War II, a c…
```

```
[ ]: #In rating column , NR (Not rated) is same as UR (Unrated). lets change UR to NR

     df.rating.unique()
```

```
[ ]: array(['PG-13', 'TV-MA', 'PG', 'TV-14', 'TV-PG', 'TV-Y', 'TV-Y7', 'R',
            'TV-G', 'G', 'NC-17', 'Not Available', 'NR', 'TV-Y7-FV', 'UR'],
           dtype=object)
```

```
[ ]: 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
     Not Available        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'].value_counts()
```

```
[ ]: January 1, 2020      109
     November 1, 2019      89
     March 1, 2018         75
     December 31, 2019     74
     October 1, 2018       71
                         …
     December 4, 2016       1
     November 21, 2016      1
     November 19, 2016      1
     November 17, 2016      1
     January 11, 2020       1
     Name: date_added, Length: 1767, dtype: int64
```

```
[ ]: #For 'date_added' column, all values confirm to date format, So we can convert␣
      ↪its data type from object to datetime

     df['date_added'] = pd.to_datetime(df['date_added'])
     df['date_added']
```

```
[ ]: 0       2021-09-25
     1       2021-09-24
     2       2021-09-24
     3       2021-09-24
     4       2021-09-24
                …
```

```
8802   2019-11-20
8803   2019-07-01
8804   2019-11-01
8805   2020-01-11
8806   2019-03-02
Name: date_added, Length: 8797, dtype: datetime64[ns]
```

[ ]:
```
#We can add the new column 'year_added' by extracting the year from␣
↪'date_added' column

df['year_added'] = df['date_added'].dt.year
```

[ ]:
```
#Similar way, We can add the new column 'month_added' by extracting the month␣
↪from 'date_added' column

df['month_added'] = df['date_added'].dt.month
```

[ ]:
```
df[['date_added' , 'year_added' , 'month_added']].info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 8797 entries, 0 to 8806
Data columns (total 3 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   date_added   8797 non-null   datetime64[ns]
 1   year_added   8797 non-null   int64
 2   month_added  8797 non-null   int64
dtypes: datetime64[ns](1), int64(2)
memory usage: 274.9 KB
```

[ ]:
```
# total null values in each column
df.isna().sum()
```

[ ]:
```
show_id            0
type               0
title              0
director        2624
cast             825
country          830
date_added         0
release_year       0
rating             0
duration           0
listed_in          0
description        0
year_added         0
month_added        0
```

```
dtype: int64
```

```
[ ]: # % Null values in each column

     round((df.isna().sum()/ df.shape[0])*100)
```

```
[ ]: show_id          0.0
     type             0.0
     title            0.0
     director        30.0
     cast             9.0
     country          9.0
     date_added       0.0
     release_year     0.0
     rating           0.0
     duration         0.0
     listed_in        0.0
     description      0.0
     year_added       0.0
     month_added      0.0
     dtype: float64
```

Insights:

- We can see that, after cleaning some data we still have null values in 3 columns. These are much higher in numbers.
- For some content - country is missing. (9%)
- For some content - director names are missing (30%)
- For some content - cast is missing (9%)

5 3. Non-Graphical Analysis: Value counts and unique attributes

```
[ ]: # 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      421
3 Seasons      198
4 Seasons       94
5 Seasons       64
6 Seasons       33
7 Seasons       23
8 Seasons       17
9 Seasons        9
10 Seasons       6
13 Seasons       2
15 Seasons       2
12 Seasons       2
17 Seasons       1
11 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  \
     4250   s4251  TV Show            Pioneers: First Women Filmmakers*
```

```
966     s967    Movie                               Get the Grift
967     s968  TV Show                   Headspace Guide to Sleep
968     s969  TV Show                                      Sexify
972     s973  TV Show                                       Fatma
…        …       …                                           …
466     s467  TV Show                          My Unorthodox Life
467     s468    Movie  Private Network: Who Killed Manuel Buendía?
468     s469    Movie             The Guide to the Perfect Family
471     s472    Movie                              Day of Destiny
8437   s8438  TV Show                      The Netflix Afterparty

                    director  \
4250                     NaN
966           Pedro Antonio
967                      NaN
968                      NaN
972                      NaN
…                        …
466                      NaN
467           Manuel Alcalá
468           Ricardo Trogi
471   Akay Mason, Abosi Ogba
8437                     NaN

                                                   cast        country  \
4250                                                NaN            NaN
966   Marcus Majella, Samantha Schmütz, Caito Mainie…         Brazil
967                                 Evelyn Lewis Prieto            NaN
968   Aleksandra Skraba, Maria Sobocińska, Sandra Dr…         Poland
972   Burcu Biricik, Uğur Yücel, Mehmet Yılmaz Ak, H…         Turkey
…                                                   …            …
466                                                 NaN            NaN
467                                 Daniel Giménez Cacho            NaN
468   Louis Morissette, Émilie Bierre, Catherine Cha…            NaN
471   Olumide Oworu, Denola Grey, Gbemi Akinlade, Ji…            NaN
8437       David Spade, London Hughes, Fortune Feimster  United States

     date_added release_year rating  duration  \
4250 2018-12-30         1925  TV-14  1 Season
966  2021-04-28         2021  TV-MA    95 min
967  2021-04-28         2021   TV-G  1 Season
968  2021-04-28         2021  TV-MA  1 Season
972  2021-04-27         2021  TV-MA  1 Season
…          …             …     …        …
466  2021-07-14         2021  TV-MA  1 Season
467  2021-07-14         2021  TV-MA   100 min
468  2021-07-14         2021  TV-MA   102 min
```

```
471  2021-07-13         2021  TV-PG   110 min
8437 2021-01-02         2021  TV-MA  1 Season

                                                listed_in  \
4250                                             TV Shows
966                        Comedies, International Movies
967                       Docuseries, Science & Nature TV
968        International TV Shows, TV Comedies, TV Dramas
972      International TV Shows, TV Dramas, TV Thrillers
…                                                     …
466                                            Reality TV
467                   Documentaries, International Movies
468                Comedies, Dramas, International Movies
471    Children & Family Movies, Dramas, Internationa…
8437           Stand-Up Comedy & Talk Shows, TV Comedies

                                              description  year_added  \
4250   This collection restores films from women who …        2018
966    After a botched scam, Clóvis bumps into Lohane…        2021
967    Learn how to sleep better with Headspace. Each…        2021
968    To build an innovative sex app and win a tech …        2021
972    Reeling from tragedy, a nondescript house clea…        2021
…                                                     …         …
466    Follow Julia Haart, Elite World Group CEO and …        2021
467    A deep dive into the work of renowned Mexican …        2021
468    A couple in Québec deals with the pitfalls, pr…        2021
471    With their family facing financial woes, two t…        2021
8437   Hosts David Spade, Fortune Feimster and London…        2021

      month_added
4250           12
966             4
967             4
968             4
972             4
…             …
466             7
467             7
468             7
471             7
8437            1

[593 rows x 14 columns]
```

[ ]:
```
# 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

     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
```

Insights:

- 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 x 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
     5925   s5926    Movie
     7007   s7008    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 x 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 x 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 x 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
     Wouter Bouvijn            NaN      1.0
     YC Tom Lee                NaN      1.0
     Yasuhiro Irie             NaN      1.0
     Yim Pilsung               NaN      1.0

     [4993 rows x 2 columns]
```

```
[ ]: #'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 x 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
```

```
[ ]: 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
```

```
[ ]: # 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()
```

```
[ ]: type                         Movie  TV Show
     listed_in
     Action & Adventure           859.0      NaN
     Anime Features                71.0      NaN
     Anime Series                   NaN    175.0
     British TV Shows               NaN    252.0
     Children & Family Movies     641.0      NaN
     Classic & Cult TV              NaN     26.0
     Classic Movies               116.0      NaN
```

```
Comedies                        1674.0      NaN
Crime TV Shows                     NaN    469.0
Cult Movies                       71.0      NaN
Documentaries                    869.0      NaN
Docuseries                         NaN    394.0
Dramas                          2427.0      NaN
Faith & Spirituality              65.0      NaN
Horror Movies                    357.0      NaN
Independent Movies               756.0      NaN
International Movies            2752.0      NaN
International TV Shows             NaN   1350.0
Kids' TV                           NaN    449.0
Korean TV Shows                    NaN    151.0
LGBTQ Movies                     102.0      NaN
Movies                            57.0      NaN
Music & Musicals                 375.0      NaN
Reality TV                         NaN    255.0
Romantic Movies                  616.0      NaN
Romantic TV Shows                  NaN    370.0
Sci-Fi & Fantasy                 243.0      NaN
Science & Nature TV                NaN     92.0
Spanish-Language TV Shows          NaN    173.0
Sports Movies                    219.0      NaN
Stand-Up Comedy                  343.0      NaN
Stand-Up Comedy & Talk Shows       NaN     56.0
TV Action & Adventure              NaN    167.0
TV Comedies                        NaN    574.0
TV Dramas                          NaN    762.0
TV Horror                          NaN     75.0
TV Mysteries                       NaN     98.0
TV Sci-Fi & Fantasy                NaN     83.0
TV Shows                           NaN     16.0
TV Thrillers                       NaN     57.0
Teen TV Shows                      NaN     69.0
Thrillers                        577.0      NaN
```

[ ]:
```python
# Exploring cast column

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 x 3 columns]
```

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

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

```
[ ]: Empty DataFrame
     Columns: [show_id, type, cast]
     Index: []
```

```
[ ]: # 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)
```

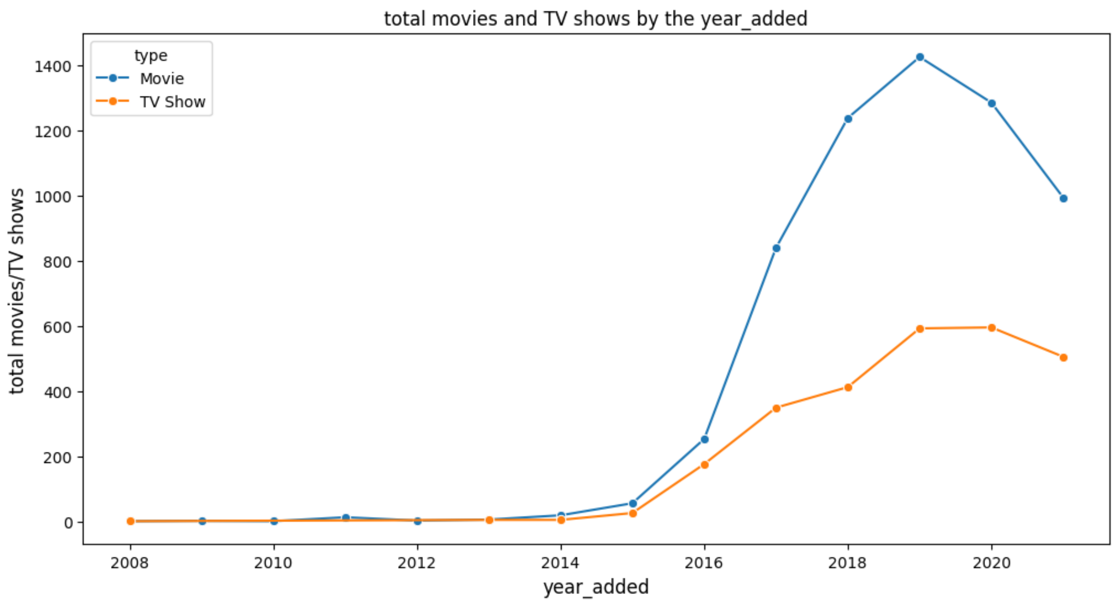
```
[ ]: type                 Movie  TV Show
     cast
     Takahiro Sakurai       7.0     25.0
     Yuki Kaji             10.0     19.0
     Junichi Suwabe         4.0     17.0
     Daisuke Ono            5.0     17.0
     Ai Kayano              2.0     17.0
     …                    …       …
    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

     [36403 rows x 2 columns]
```

6 4. Visual Analysis - Univariate & Bivariate

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()
```



Insights: * 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.

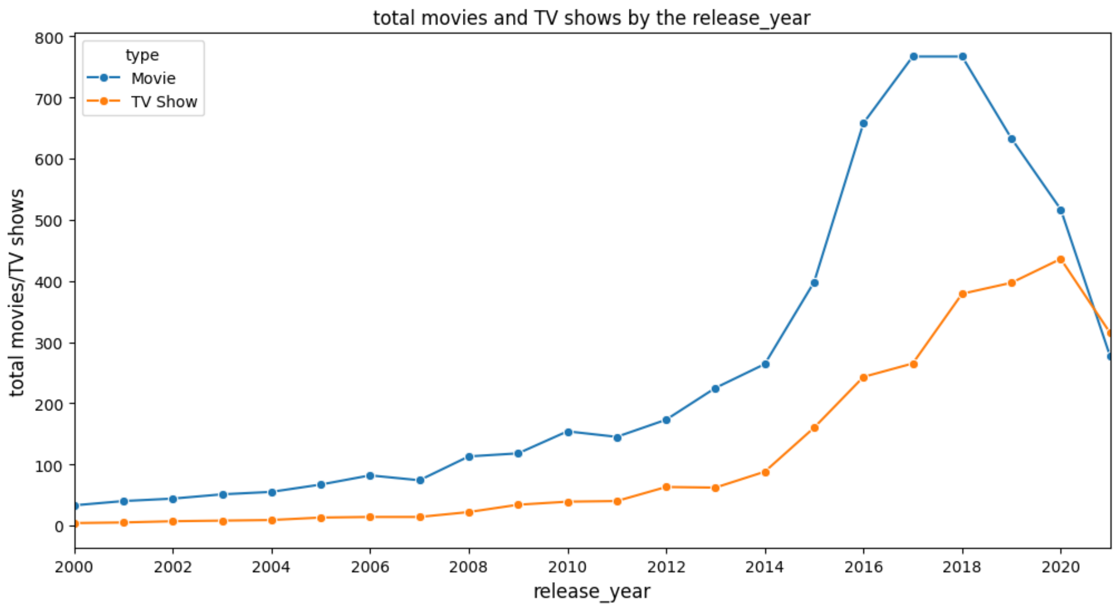
Distribution of 'Release_year'

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 x 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()
```

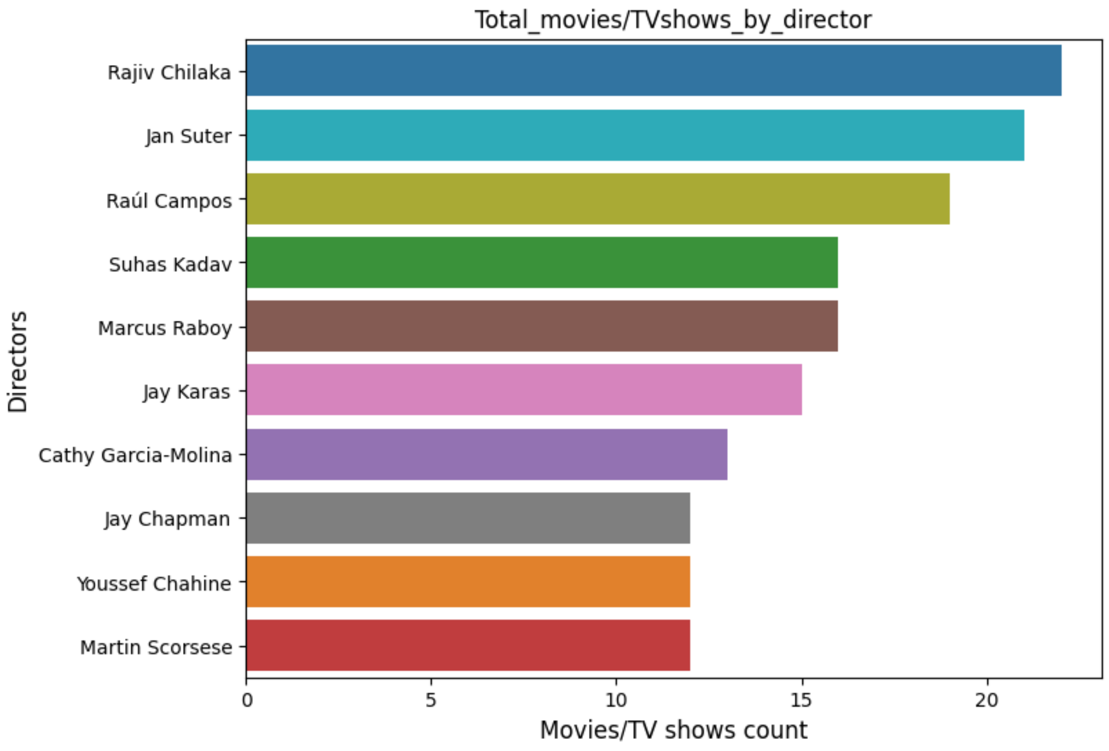


Insights: * 2018 marks the highest number of movie and TV show releases. * Since 2018, A drop in movies is seen and rise in TV shows is observed clearly, and TV shows surpasses the movies count in mid 2020. * In recent years TV shows are focussed more than Movies. * The yearly number of releases has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

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' , hue = '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()
```



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

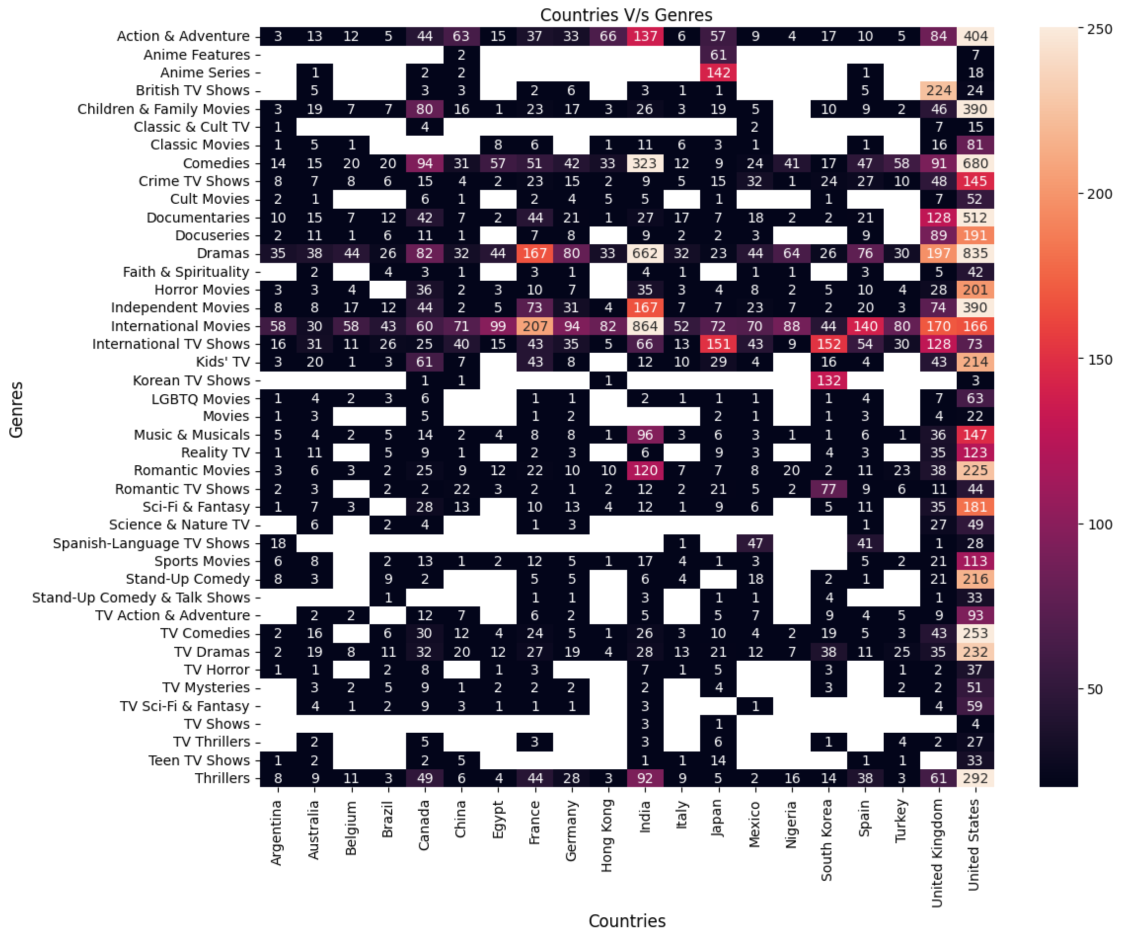
Lets check popular genres in top 20 countries

[ ]:
```
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')
```



Insights: * 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.

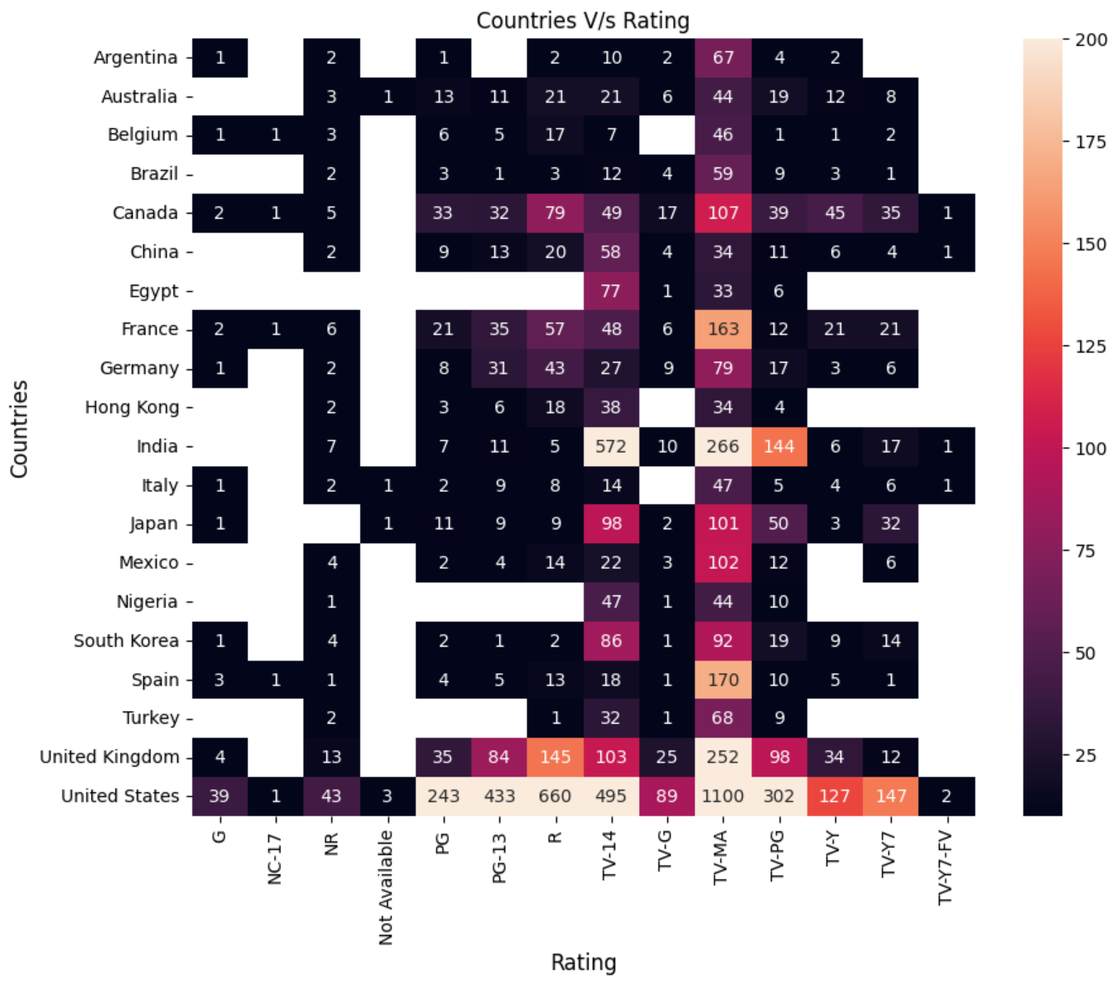
Country-wise Rating of Content

```
[ ]: 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')
```



Insights:

- 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.

7 5. Missing Value & Outlier check

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
```

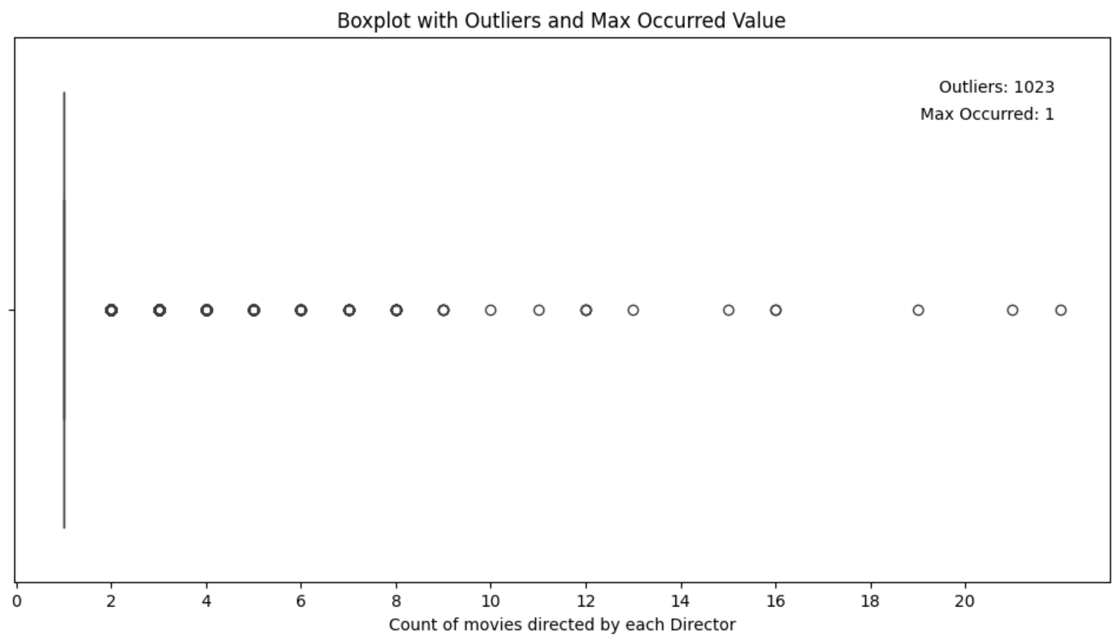
```
[ ]: outliers = calculate_outliers(x)  # Implement your outlier calculation method
     max_occurred_value = calculate_max_occurred_value(x)  # Implement your method␣
      ↪to find the maximum-occurred value
     set(outliers)
```

```
[ ]: {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()
```



Insights: * 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.

8 6. 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.

9 7. 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.

10 8. 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 .

- Country Japan have only 3 rating of content largely served - TV-MA, TV-14 , TV-PG. Japan have high population of age above 60, and this can be served by increasing the content suitable for this age group.

- Netflix is currently serving mostly Mature audiences or Children with parental guidance. It have scope to cater other audiences as well such as familymen , Senior citizen , kids of various age etc.

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