Business Case: Netflix - Data Exploration and Visualisation

Importing required libraries

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

import warnings
warnings.filterwarnings('ignore')
```

Downloading the Netflix dataset

```
!gdown
https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/000/940
/original/netflix.csv
```

```
Downloading...
From:
https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/000/940
/original/netflix.csv
To: /content/netflix.csv
   0% 0.00/3.40M [00:00<?, ?B/s] 100% 3.40M/3.40M [00:00<00:00,
53.2MB/s]
```

Reading csv file into dataframe

```
df=pd.read_csv('/content/netflix.csv')

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...
```

```
df.shape
```

```
(8807, 12)
```

There were 8807 data points and 12 columns are there

```
df.describe(include = 'all')
```

```
       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
mean       NaN    NaN                    NaN            NaN
std        NaN    NaN                    NaN            NaN
min        NaN    NaN                    NaN            NaN
25%        NaN    NaN                    NaN            NaN
50%        NaN    NaN                    NaN            NaN
75%        NaN    NaN                    NaN            NaN
max        NaN    NaN                    NaN            NaN

                       cast        country       date_added
release_year  \
count                  7982           7976             8797
8807.000000
unique                 7692            748             1767
NaN
top     David Attenborough  United States  January 1, 2020
```

```
NaN
freq                     19            2818                109
NaN
mean                    NaN             NaN                NaN
2014.180198
std                     NaN             NaN                NaN
8.819312
min                     NaN             NaN                NaN
1925.000000
25%                     NaN             NaN                NaN
2013.000000
50%                     NaN             NaN                NaN
2017.000000
75%                     NaN             NaN                NaN
2019.000000
max                     NaN             NaN                NaN
2021.000000

       rating  duration                     listed_in  \
count    8803      8804                          8807
unique     17       220                           514
top     TV-MA  1 Season  Dramas, International Movies
freq     3207      1793                           362
mean      NaN       NaN                           NaN
std       NaN       NaN                           NaN
min       NaN       NaN                           NaN
25%       NaN       NaN                           NaN
50%       NaN       NaN                           NaN
75%       NaN       NaN                           NaN
max       NaN       NaN                           NaN

                                                 description
count                                                   8807
unique                                                  8775
top     Paranormal activity at a lush, abandoned prope...
freq                                                       4
mean                                                     NaN
std                                                      NaN
min                                                      NaN
25%                                                      NaN
50%                                                      NaN
75%                                                      NaN
max                                                      NaN
```

The output of df.describe(include='all') will be a DataFrame with various statistics for each column in the original DataFrame df, providing a quick overview of the data distribution and central tendency of both numerical and categorical attributes.

The above table Gives the count and unique values in each columns

```
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.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
```

The above table gives unique values in each columns

```
df.isnull().sum()/len(df)*100
```

```
show_id          0.000000
type             0.000000
title            0.000000
director        29.908028
cast             9.367549
country          9.435676
date_added       0.113546
release_year     0.000000
```

```
rating           0.045418
duration         0.034064
listed_in        0.000000
description      0.000000
dtype: float64
```

There were 29 % missing values in Director column, 9 % each in cast and country column

column names

```
df.columns
```

```
Index(['show_id', 'type', 'title', 'director', 'cast', 'country',
'date_added',
       'release_year', 'rating', 'duration', 'listed_in',
'description'],
      dtype='object')
```

Since some columns have nested values, will unnest them and prepare final dataset

```
# Unnesting-Directors column

data1=df['director'].apply(lambda x: str(x).split(', ')).tolist()
df1 = pd.DataFrame(data1, index = df['title'])
df1 = df1.stack()#converting wide to long
df1 = pd.DataFrame(df1.reset_index())
df1.rename(columns={0:'Directors'},inplace=True)
df1 = df1.drop(['level_1'],axis=1)
df1.head(10)
```

	title	Directors
0	Dick Johnson Is Dead	Kirsten Johnson
1	Blood & Water	nan
2	Ganglands	Julien Leclercq
3	Jailbirds New Orleans	nan
4	Kota Factory	nan
5	Midnight Mass	Mike Flanagan
6	My Little Pony: A New Generation	Robert Cullen
7	My Little Pony: A New Generation	José Luis Ucha
8	Sankofa	Haile Gerima
9	The Great British Baking Show	Andy Devonshire

```
## Unnesting - cast column

Data2=df['cast'].apply(lambda x: str(x).split(', ')).tolist()
df2 = pd.DataFrame(Data2, index = df['title'])
df2 = df2.stack()
df2 = pd.DataFrame(df2.reset_index())
df2.rename(columns={0:'Actors'},inplace=True)
```

```
df2 = df2.drop(['level_1'],axis=1)
df2.head(10)
```

```
                  title             Actors
0  Dick Johnson Is Dead                nan
1         Blood & Water         Ama Qamata
2         Blood & Water        Khosi Ngema
3         Blood & Water      Gail Mabalane
4         Blood & Water     Thabang Molaba
5         Blood & Water   Dillon Windvogel
6         Blood & Water    Natasha Thahane
7         Blood & Water        Arno Greeff
8         Blood & Water  Xolile Tshabalala
9         Blood & Water    Getmore Sithole
```

```
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...
```

```
## Unnesting - listed_in column

Data3=df['listed_in'].apply(lambda x: str(x).split(', ')).tolist()
df3 = pd.DataFrame(Data3, index = df['title'])
df3 = df3.stack()
df3 = pd.DataFrame(df3.reset_index())
df3.rename(columns={0:'Genre'},inplace=True)
df3 = df3.drop(['level_1'],axis=1)
df3.head(10)
```

```
                   title                    Genre
0   Dick Johnson Is Dead          Documentaries
1          Blood & Water  International TV Shows
2          Blood & Water              TV Dramas
3          Blood & Water           TV Mysteries
4              Ganglands         Crime TV Shows
5              Ganglands  International TV Shows
6              Ganglands   TV Action & Adventure
7  Jailbirds New Orleans             Docuseries
8  Jailbirds New Orleans             Reality TV
9           Kota Factory  International TV Shows
```

```
## Unnesting - country column

Data4=df['country'].apply(lambda x: str(x).split(', ')).tolist()
df4 = pd.DataFrame(Data4, index = df['title'])
df4 = df4.stack()
df4 = pd.DataFrame(df4.reset_index())
df4.rename(columns={0:'Country'},inplace=True)
df4 = df4.drop(['level_1'],axis=1)
df4.head(10)
```

```
                             title        Country
0              Dick Johnson Is Dead  United States
1                     Blood & Water   South Africa
2                         Ganglands            nan
3               Jailbirds New Orleans            nan
4                        Kota Factory          India
5                       Midnight Mass            nan
6  My Little Pony: A New Generation            nan
7                            Sankofa  United States
8                            Sankofa          Ghana
9                            Sankofa   Burkina Faso
```

Combine all the unnested dataframes

```
df5 = df2.merge(df1,on=['title'],how='inner')

df6 = df5.merge(df3,on=['title'],how='inner')

df7 = df6.merge(df4,on=['title'],how='inner')

df7.head()
```

```
                   title       Actors        Directors
Genre  \
0  Dick Johnson Is Dead          nan  Kirsten Johnson
Documentaries
1         Blood & Water   Ama Qamata              nan  International
TV Shows
2         Blood & Water   Ama Qamata              nan                TV
Dramas
3         Blood & Water   Ama Qamata              nan             TV
Mysteries
4         Blood & Water  Khosi Ngema              nan  International
TV Shows

         Country
0  United States
1   South Africa
2   South Africa
3   South Africa
4   South Africa
```

```
df7.shape
```

```
(201991, 5)
```

Merging unnested data with the given dataframe

```
df = df7.merge(df[['show_id', 'type', 'title', 'date_added',
       'release_year', 'rating', 'duration']],on=['title'],how='left')
df.head()
```

```
                   title       Actors        Directors
Genre  \
0  Dick Johnson Is Dead          nan  Kirsten Johnson
Documentaries
1         Blood & Water   Ama Qamata              nan  International
TV Shows
2         Blood & Water   Ama Qamata              nan                TV
Dramas
3         Blood & Water   Ama Qamata              nan             TV
Mysteries
4         Blood & Water  Khosi Ngema              nan  International
```

```
TV Shows

         Country show_id     type          date_added  release_year
rating  \
0  United States      s1    Movie  September 25, 2021          2020
PG-13
1   South Africa      s2  TV Show  September 24, 2021          2021
TV-MA
2   South Africa      s2  TV Show  September 24, 2021          2021
TV-MA
3   South Africa      s2  TV Show  September 24, 2021          2021
TV-MA
4   South Africa      s2  TV Show  September 24, 2021          2021
TV-MA

    duration
0     90 min
1  2 Seasons
2  2 Seasons
3  2 Seasons
4  2 Seasons

df.shape

(201991, 11)
```

Final Dataset will have around 2 Lakh rows and 11 columns

```
df.isnull().sum()

title             0
Actors            0
Directors         0
Genre             0
Country           0
show_id           0
type              0
date_added      158
release_year      0
rating           67
duration          3
dtype: int64
```

As we can see there are some missing values we wil treat them

```
total_null = df.isnull().sum().sort_values(ascending = False)
percent =
((df.isnull().sum()/df.isnull().count())*100).sort_values(ascending =
```

```
False)
print("Total records = ", df.shape[0])

missing_data =
pd.concat([total_null,percent.round(2)],axis=1,keys=['Total
Missing','In Percent'])
missing_data.head(10)
```

```
Total records =  201991
```

	Total Missing	In Percent
date_added	158	0.08
rating	67	0.03
duration	3	0.00
title	0	0.00
Actors	0	0.00
Directors	0	0.00
Genre	0	0.00
Country	0	0.00
show_id	0	0.00
type	0	0.00

Above table gives missing values summary in absolute value and in Percentage, date added has the maximum missing values

Missing value treatment

```
## some columns having nan which is missing value, we have to replace

df['Actors'].replace(['nan'],['Unknown Actor'],inplace=True)
df['Directors'].replace(['nan'],['Unknown Director'],inplace=True)
df['Country'].replace(['nan'],[np.nan],inplace=True)
df.head()
```

```
                  title         Actors         Directors  \
0  Dick Johnson Is Dead  Unknown Actor   Kirsten Johnson
1         Blood & Water     Ama Qamata  Unknown Director
2         Blood & Water     Ama Qamata  Unknown Director
3         Blood & Water     Ama Qamata  Unknown Director
4         Blood & Water    Khosi Ngema  Unknown Director

                     Genre        Country show_id     type
date_added  \
0           Documentaries  United States      s1    Movie  September
25, 2021
1  International TV Shows   South Africa      s2  TV Show  September
24, 2021
2               TV Dramas   South Africa      s2  TV Show  September
24, 2021
3            TV Mysteries   South Africa      s2  TV Show  September
```

```
24, 2021
4  International TV Shows   South Africa      s2  TV Show  September
24, 2021

   release_year rating   duration
0          2020  PG-13     90 min
1          2021  TV-MA  2 Seasons
2          2021  TV-MA  2 Seasons
3          2021  TV-MA  2 Seasons
4          2021  TV-MA  2 Seasons
```

```
total_null = df.isnull().sum().sort_values(ascending = False)
percent =
((df.isnull().sum()/df.isnull().count())*100).sort_values(ascending =
False)
print("Total records = ", df.shape[0])

missing_data =
pd.concat([total_null,percent.round(2)],axis=1,keys=['Total
Missing','In Percent'])
missing_data.head(10)
```

```
Total records =  201991

            Total Missing  In Percent
Country             11897        5.89
date_added            158        0.08
rating                 67        0.03
duration                3        0.00
title                   0        0.00
Actors                  0        0.00
Directors               0        0.00
Genre                   0        0.00
show_id                 0        0.00
type                    0        0.00
```

After replacing string nan with np.nan, actual null values of country went upto 5.89 %

```
df[df.duration.isnull()]
```

```
                                       title      Actors   Directors
Genre  \
126537                      Louis C.K. 2017  Louis C.K.  Louis C.K.
Movies
131603                 Louis C.K.: Hilarious  Louis C.K.  Louis C.K.
Movies
131737  Louis C.K.: Live at the Comedy Store  Louis C.K.  Louis C.K.
Movies

             Country show_id   type          date_added  release_year
```

```
\
126537  United States   s5542  Movie       April 4, 2017          2017

131603  United States   s5795  Movie  September 16, 2016          2010

131737  United States   s5814  Movie     August 15, 2016          2015


        rating duration
126537  74 min      NaN
131603  84 min      NaN
131737  66 min      NaN
```

Duration and rating columns got messed up and values got exchanged will add rating column values into duration column missing values

```
df.loc[df['duration'].isnull(),'duration'] =
df.loc[df['duration'].isnull(),'duration'].fillna(df['rating'])
df.loc[df['rating'].str.contains('min', na=False),'rating'] = 'NR'
df['rating'].fillna('NR',inplace=True)
df.isnull().sum()
```

```
title               0
Actors              0
Directors           0
Genre               0
Country         11897
show_id             0
type                0
date_added        158
release_year        0
rating              0
duration            0
dtype: int64
```

Filling missing values of date added column with mode value with respective release years

```
for i in df[df['date_added'].isnull()]['release_year'].unique():
    date = df[df['release_year'] == i]['date_added'].mode().values[0]
    df.loc[df['release_year'] == i,'date_added'] =
df.loc[df['release_year']==i,'date_added'].fillna(date)

df[df.Country.isna()]
```

```
              title         Actors         Directors
Genre  \
58        Ganglands  Sami Bouajila   Julien Leclercq          Crime TV
Shows
59        Ganglands  Sami Bouajila   Julien Leclercq  International TV
Shows
```

```
60        Ganglands  Sami Bouajila   Julien Leclercq   TV Action &
Adventure
61        Ganglands   Tracy Gotoas   Julien Leclercq          Crime TV
Shows
62        Ganglands   Tracy Gotoas   Julien Leclercq  International TV
Shows
...              ...            ...                ...
...
201424          YOM     Mayur Vyas  Unknown Director
Kids' TV
201425          YOM     Ketan Kava  Unknown Director
Kids' TV
201932  Zombie Dumb  Unknown Actor  Unknown Director
Kids' TV
201933  Zombie Dumb  Unknown Actor  Unknown Director         Korean TV
Shows
201934  Zombie Dumb  Unknown Actor  Unknown Director             TV
Comedies

       Country show_id     type          date_added  release_year
rating  \
58         NaN      s3  TV Show  September 24, 2021          2021  TV-
MA
59         NaN      s3  TV Show  September 24, 2021          2021  TV-
MA
60         NaN      s3  TV Show  September 24, 2021          2021  TV-
MA
61         NaN      s3  TV Show  September 24, 2021          2021  TV-
MA
62         NaN      s3  TV Show  September 24, 2021          2021  TV-
MA
...        ...     ...      ...                 ...           ...    .
..
201424     NaN   s8786  TV Show        June 7, 2018          2016  TV-
Y7
201425     NaN   s8786  TV Show        June 7, 2018          2016  TV-
Y7
201932     NaN   s8804  TV Show        July 1, 2019          2018  TV-
Y7
201933     NaN   s8804  TV Show        July 1, 2019          2018  TV-
Y7
201934     NaN   s8804  TV Show        July 1, 2019          2018  TV-
Y7

         duration
58       1 Season
59       1 Season
60       1 Season
61       1 Season
```

```
62        1 Season
...            ...
201424    1 Season
201425    1 Season
201932   2 Seasons
201933   2 Seasons
201934   2 Seasons

[11897 rows x 11 columns]
```

Filling missing values of country column with mode value with respective directors

```
for i in df[df['Country'].isnull()]['Directors'].unique():
    if i in df[~df['Country'].isnull()]['Directors'].unique():
        country = df[df['Directors'] == i]['Country'].mode().values[0]
        df.loc[df['Directors'] == i,'Country'] =
df.loc[df['Directors'] == i,'Country'].fillna(country)
df.isnull().sum()
```

```
title              0
Actors             0
Directors          0
Genre              0
Country         4276
show_id            0
type               0
date_added         0
release_year       0
rating             0
duration           0
dtype: int64
```

Remaing missing values will be replaced using actors column

```
for i in df[df['Country'].isnull()]['Actors'].unique():
    if i in df[~df['Country'].isnull()]['Actors'].unique():
        imp = df[df['Actors'] == i]['Country'].mode().values[0]
        df.loc[df['Actors'] == i,'Country'] =
df.loc[df['Actors']==i,'Country'].fillna(imp)

df['Country'].fillna('Unknown Country',inplace=True)
df.isnull().sum()
```

```
title           0
Actors          0
Directors       0
Genre           0
Country         0
show_id         0
```

```
type            0
date_added      0
release_year    0
rating          0
duration        0
dtype: int64
```

Now missing values handling is over, will deep dive into data analysis

```
#converting date added data type into datetime format to extract
years, month

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

df ['duration'] = df['duration'].str.replace(" min","")
df.head(6)
```

```
                  title         Actors         Directors  \
0  Dick Johnson Is Dead  Unknown Actor   Kirsten Johnson
1         Blood & Water     Ama Qamata  Unknown Director
2         Blood & Water     Ama Qamata  Unknown Director
3         Blood & Water     Ama Qamata  Unknown Director
4         Blood & Water    Khosi Ngema  Unknown Director
5         Blood & Water    Khosi Ngema  Unknown Director

                     Genre        Country show_id     type
date_added  \
0           Documentaries  United States      s1    Movie 2021-09-25

1  International TV Shows   South Africa      s2  TV Show 2021-09-24

2               TV Dramas   South Africa      s2  TV Show 2021-09-24

3            TV Mysteries   South Africa      s2  TV Show 2021-09-24

4  International TV Shows   South Africa      s2  TV Show 2021-09-24

5               TV Dramas   South Africa      s2  TV Show 2021-09-24


   release_year rating   duration
0          2020  PG-13         90
1          2021  TV-MA  2 Seasons
2          2021  TV-MA  2 Seasons
3          2021  TV-MA  2 Seasons
4          2021  TV-MA  2 Seasons
5          2021  TV-MA  2 Seasons
```

```
df['duration2'] = df.duration.copy()
df_ = df.copy()
```

```
df_.loc[df_['duration2'].str.contains('Season'),'duration2'] = 0
df_['duration2'] = df_.duration2.astype('int')
df_.head()
```

```
                  title         Actors         Directors  \
0  Dick Johnson Is Dead  Unknown Actor   Kirsten Johnson
1         Blood & Water     Ama Qamata  Unknown Director
2         Blood & Water     Ama Qamata  Unknown Director
3         Blood & Water     Ama Qamata  Unknown Director
4         Blood & Water    Khosi Ngema  Unknown Director

                     Genre        Country show_id     type
date_added  \
0           Documentaries  United States      s1    Movie 2021-09-25

1  International TV Shows   South Africa      s2  TV Show 2021-09-24

2               TV Dramas   South Africa      s2  TV Show 2021-09-24

3            TV Mysteries   South Africa      s2  TV Show 2021-09-24

4  International TV Shows   South Africa      s2  TV Show 2021-09-24


   release_year rating   duration  duration2
0          2020  PG-13         90         90
1          2021  TV-MA  2 Seasons          0
2          2021  TV-MA  2 Seasons          0
3          2021  TV-MA  2 Seasons          0
4          2021  TV-MA  2 Seasons          0
```

```
df_.duration2.describe()
```

```
count    201991.000000
mean         77.152789
std          52.269154
min           0.000000
25%           0.000000
50%          95.000000
75%         112.000000
max         312.000000
Name: duration2, dtype: float64
```

```
df_.T.apply(lambda x: x.nunique(), axis=1)
```

```
title            8807
Actors          36440
Directors        4994
Genre              42
Country           128
show_id          8807
```

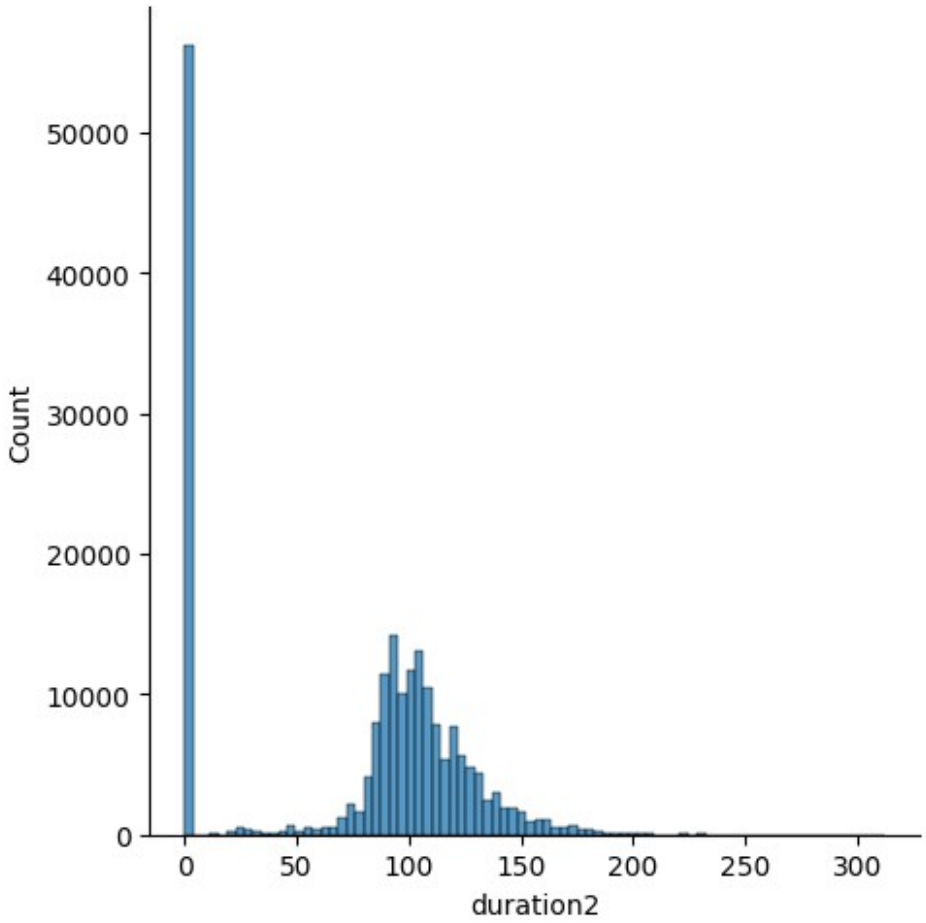
```
type                2
date_added       1714
release_year       74
rating             14
duration          220
duration2         206
dtype: int64
```

Actors has the most unique values follwed by title and directors

Univariate analysis of duration column

```
## Histogram to see the distribution of duration

plt.figure(figsize=(18,4))
sns.displot(df_['duration2'])

plt.show()
```

```
<Figure size 1800x400 with 0 Axes>
```



Most of the values is around 100 and basically 0 is the TV shows

Will convert them into bins, for easy visulaization

```
bins = [-1,1,50,80,100,120,150,200,315]
labels = ['<1','1-50','50-80','80-100','100-120','120-150','150-
200','200-315']
df_['duration2'] = pd.cut(df_['duration2'],bins = bins, labels =
labels )
df_.head()
```

```
                  title         Actors         Directors  \
0  Dick Johnson Is Dead  Unknown Actor   Kirsten Johnson
1         Blood & Water     Ama Qamata  Unknown Director
2         Blood & Water     Ama Qamata  Unknown Director
3         Blood & Water     Ama Qamata  Unknown Director
4         Blood & Water    Khosi Ngema  Unknown Director

                     Genre        Country show_id     type
date_added  \
0           Documentaries  United States      s1    Movie 2021-09-25

1  International TV Shows   South Africa      s2  TV Show 2021-09-24

2               TV Dramas   South Africa      s2  TV Show 2021-09-24

3            TV Mysteries   South Africa      s2  TV Show 2021-09-24

4  International TV Shows   South Africa      s2  TV Show 2021-09-24


   release_year rating   duration duration2
0          2020  PG-13         90    80-100
1          2021  TV-MA  2 Seasons        <1
2          2021  TV-MA  2 Seasons        <1
3          2021  TV-MA  2 Seasons        <1
4          2021  TV-MA  2 Seasons        <1
```

```
df_.loc[~df_['duration'].str.contains('Season'),'duration'] =
df_.loc[~df_['duration'].str.contains('Season'),'duration2']
df_.drop(['duration2'],axis=1,inplace=True)
df_.head()
```

```
                  title         Actors         Directors  \
0  Dick Johnson Is Dead  Unknown Actor   Kirsten Johnson
1         Blood & Water     Ama Qamata  Unknown Director
2         Blood & Water     Ama Qamata  Unknown Director
3         Blood & Water     Ama Qamata  Unknown Director
4         Blood & Water    Khosi Ngema  Unknown Director

                     Genre        Country show_id     type
```

```
date_added  \
0           Documentaries  United States      s1    Movie 2021-09-25

1  International TV Shows   South Africa      s2  TV Show 2021-09-24

2               TV Dramas   South Africa      s2  TV Show 2021-09-24

3            TV Mysteries   South Africa      s2  TV Show 2021-09-24

4  International TV Shows   South Africa      s2  TV Show 2021-09-24


   release_year rating   duration
0          2020  PG-13     80-100
1          2021  TV-MA  2 Seasons
2          2021  TV-MA  2 Seasons
3          2021  TV-MA  2 Seasons
4          2021  TV-MA  2 Seasons
```

Extracting day, week, year, month from date added column helps in checking which month got more TV shows like that

```
from datetime import datetime
from dateutil.parser import parse
df_["year_added"] = df_['date_added'].dt.year
df_["year_added"] = df_["year_added"].astype("Int64")
df_["month_added"] = df_['date_added'].dt.month
df_['month_name'] = df['date_added'].dt.month_name()
df_["month_added"] = df_["month_added"].astype("Int64")
df_["day_added"] = df_['date_added'].dt.day
df_["day_added"] = df_["day_added"].astype("Int64")
df_['Weekday_added'] = df_['date_added'].apply(lambda x:
parse(str(x)).strftime("%A"))
df_.head()
```

```
                  title         Actors         Directors  \
0  Dick Johnson Is Dead  Unknown Actor   Kirsten Johnson
1         Blood & Water     Ama Qamata  Unknown Director
2         Blood & Water     Ama Qamata  Unknown Director
3         Blood & Water     Ama Qamata  Unknown Director
4         Blood & Water    Khosi Ngema  Unknown Director

                     Genre        Country show_id     type
date_added  \
0           Documentaries  United States      s1    Movie 2021-09-25

1  International TV Shows   South Africa      s2  TV Show 2021-09-24

2               TV Dramas   South Africa      s2  TV Show 2021-09-24
```

```
3            TV Mysteries   South Africa      s2  TV Show 2021-09-24

4  International TV Shows   South Africa      s2  TV Show 2021-09-24


   release_year rating   duration  year_added  month_added month_name
\
0          2020  PG-13     80-100        2021             9  September

1          2021  TV-MA  2 Seasons        2021             9  September

2          2021  TV-MA  2 Seasons        2021             9  September

3          2021  TV-MA  2 Seasons        2021             9  September

4          2021  TV-MA  2 Seasons        2021             9  September


   day_added Weekday_added
0         25      Saturday
1         24        Friday
2         24        Friday
3         24        Friday
4         24        Friday
```

```
df_['title'] = df_['title'].str.replace(r"\(.*\)","")
df_.head()
```

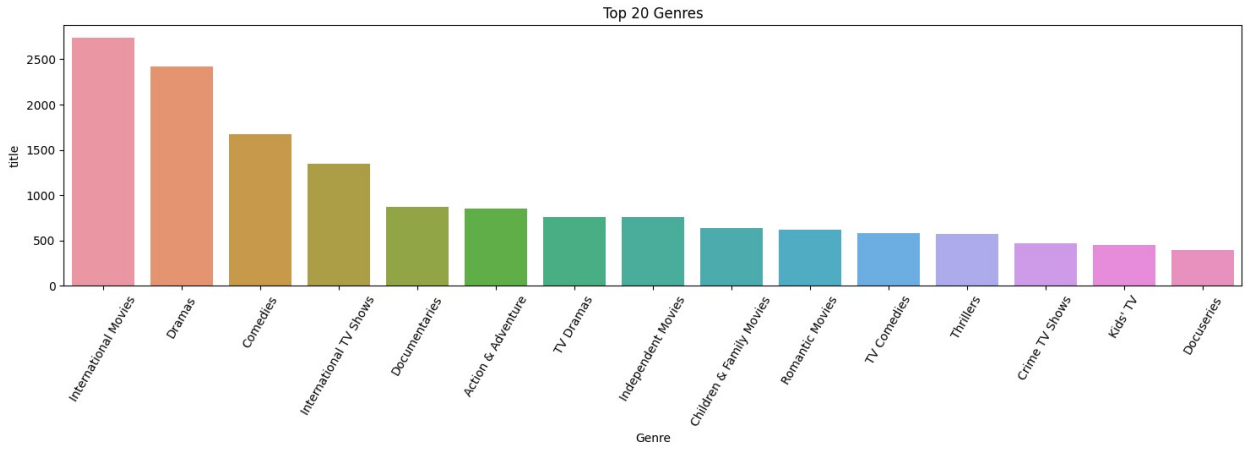
```
                  title         Actors         Directors  \
0  Dick Johnson Is Dead  Unknown Actor   Kirsten Johnson
1         Blood & Water     Ama Qamata  Unknown Director
2         Blood & Water     Ama Qamata  Unknown Director
3         Blood & Water     Ama Qamata  Unknown Director
4         Blood & Water    Khosi Ngema  Unknown Director

                    Genre        Country show_id     type
date_added  \
0           Documentaries  United States      s1    Movie 2021-09-25

1  International TV Shows   South Africa      s2  TV Show 2021-09-24

2               TV Dramas   South Africa      s2  TV Show 2021-09-24

3            TV Mysteries   South Africa      s2  TV Show 2021-09-24

4  International TV Shows   South Africa      s2  TV Show 2021-09-24


   release_year rating   duration  year_added  month_added month_name
\
0          2020  PG-13     80-100        2021             9  September
```

```
1          2021  TV-MA  2 Seasons        2021             9  September

2          2021  TV-MA  2 Seasons        2021             9  September

3          2021  TV-MA  2 Seasons        2021             9  September

4          2021  TV-MA  2 Seasons        2021             9  September
```

```
   day_added Weekday_added
0         25      Saturday
1         24        Friday
2         24        Friday
3         24        Friday
4         24        Friday
```

Univariate Analysis

```
df_genre=df_.groupby(['Genre']).agg({"title":"nunique"}).reset_index()
.sort_values(by=['title'],ascending=False)[:15]
plt.figure(figsize=(18,4))
sns.barplot(x = "Genre",y = 'title', data = df_genre)
plt.xticks(rotation = 60)
plt.title('Top 20 Genres')
plt.show()
```

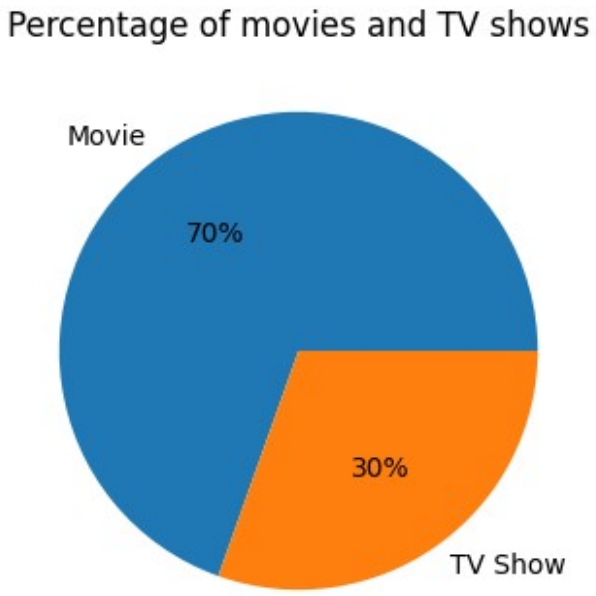


International Movies, Dramas and Comedies are the most popular

```
df_pie = df_.groupby(['type']).agg({'title':'nunique'}).reset_index()

df_pie
```

```
      type  title
0    Movie   6115
1  TV Show   2676
```

```
plt.figure(figsize=(10,4))

plt.pie(df_pie['title'], labels = df_pie['type'],autopct='%.0f%%')
plt.title('Percentage of movies and TV shows')
plt.show()
```



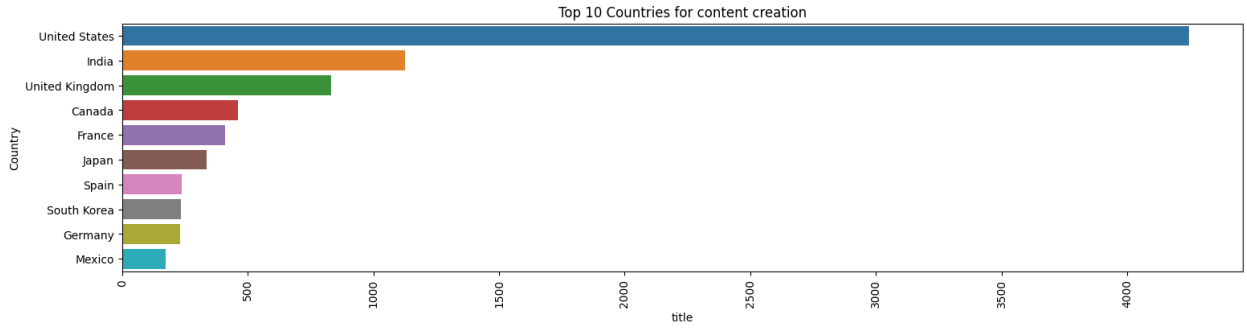
We have 70:30 ratio of Movies and TV Shows in our data

```
df_['Country'] = df_['Country'].str.replace(',', '')
df_.head()
```

```
                  title         Actors         Directors  \
0  Dick Johnson Is Dead  Unknown Actor   Kirsten Johnson
1         Blood & Water     Ama Qamata  Unknown Director
2         Blood & Water     Ama Qamata  Unknown Director
3         Blood & Water     Ama Qamata  Unknown Director
4         Blood & Water    Khosi Ngema  Unknown Director

                     Genre        Country show_id     type
date_added  \
0           Documentaries  United States      s1    Movie 2021-09-25

1  International TV Shows   South Africa      s2  TV Show 2021-09-24

2               TV Dramas   South Africa      s2  TV Show 2021-09-24

3            TV Mysteries   South Africa      s2  TV Show 2021-09-24
```

```
4  International TV Shows   South Africa      s2  TV Show 2021-09-24


   release_year rating   duration  year_added  month_added month_name
\
0          2020  PG-13     80-100        2021            9  September

1          2021  TV-MA  2 Seasons        2021            9  September

2          2021  TV-MA  2 Seasons        2021            9  September

3          2021  TV-MA  2 Seasons        2021            9  September

4          2021  TV-MA  2 Seasons        2021            9  September


   day_added Weekday_added
0         25      Saturday
1         24        Friday
2         24        Friday
3         24        Friday
4         24        Friday
```

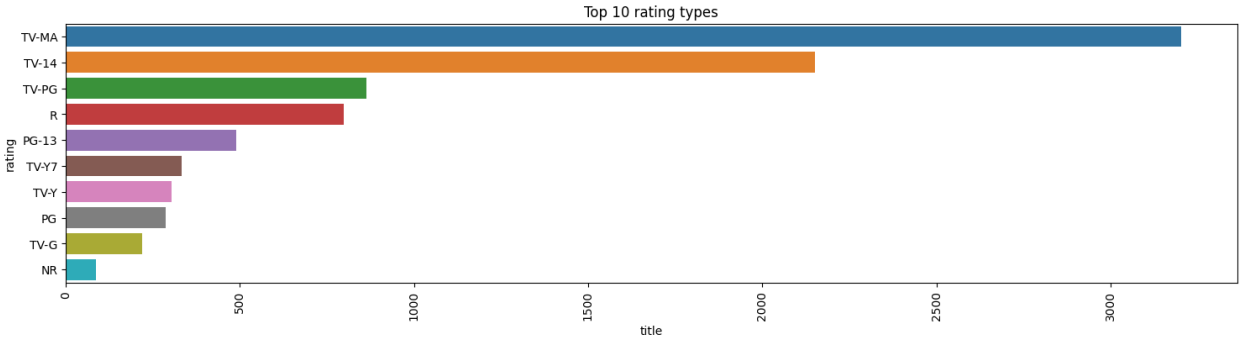
```
df_country =
df_.groupby(['Country']).agg({'title':'nunique'}).reset_index().sort_v
alues(by=['title'],ascending=False)[:10]
plt.figure(figsize=(18,4))
sns.barplot(y = "Country",x = 'title', data = df_country)
plt.xticks(rotation = 90)
plt.title('Top 10 Countries for content creation')
plt.show()
```



US,India,UK,Canada and France are leading countries in Content Creation on Netflix

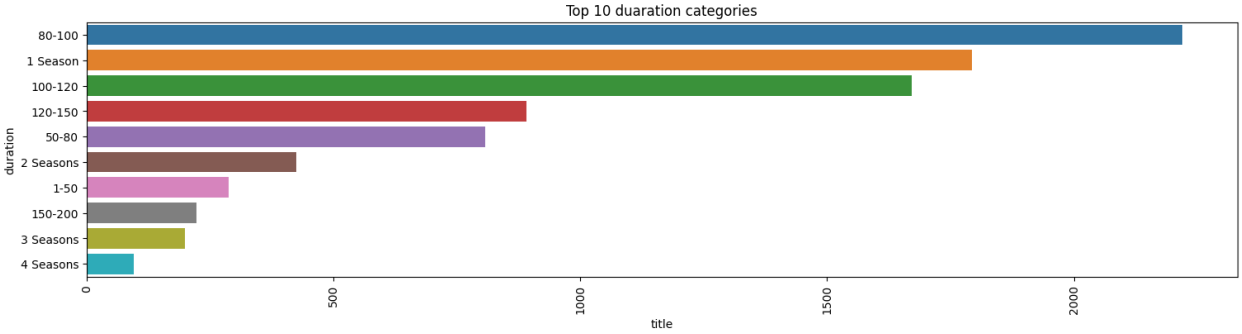
```
df_rating =
df_.groupby(['rating']).agg({'title':'nunique'}).reset_index().sort_va
lues(by=['title'],ascending=False)[:10]

plt.figure(figsize=(18,4))
```

```
sns.barplot(y = "rating",x = 'title', data = df_rating)
plt.xticks(rotation = 90)
plt.title('Top 10 rating types')
plt.show()
```



Most of the highly rated content on Netflix is intended for Mature Audiences

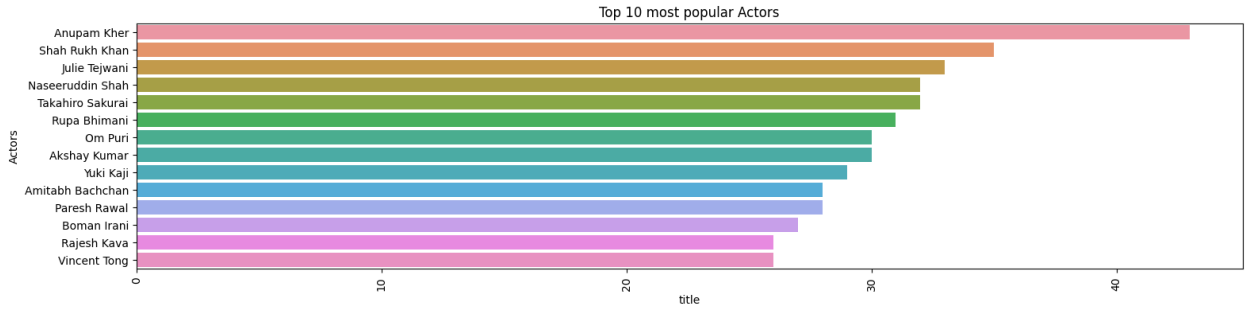
```
df_duration =
df_.groupby(['duration']).agg({'title':'nunique'}).reset_index().sort_
values(by=['title'],ascending=False)[:10]

plt.figure(figsize=(18,4))
sns.barplot(y = "duration",x = 'title', data = df_duration)
plt.xticks(rotation = 90)
plt.title('Top 10 duaration categories')
plt.show()
```



The duration of Most Watched content in our whole data is 80-100 mins. These must be movies and Shows having only 1 Season.

```
df_actors =
df_.groupby(['Actors']).agg({'title':'nunique'}).reset_index().sort_va
lues(by=['title'],ascending=False)[:15]
df_actors = df_actors[df_actors['Actors']!='Unknown Actor']
plt.figure(figsize=(18,4))
sns.barplot(y = "Actors",x = 'title', data = df_actors )
plt.xticks(rotation = 90)
```

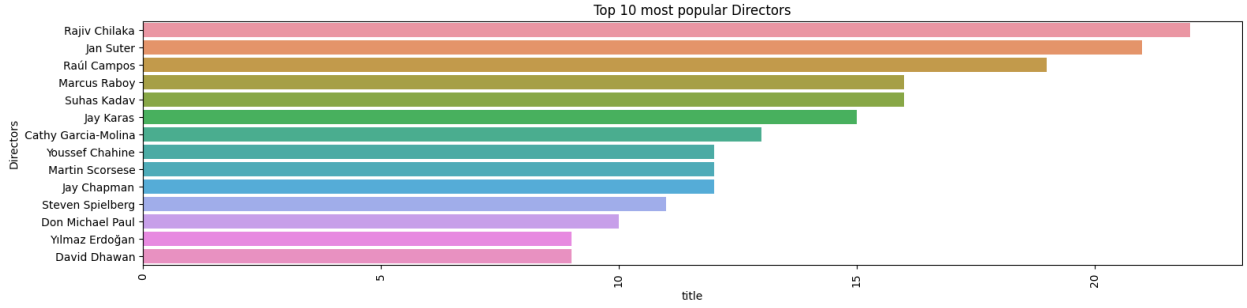
```
plt.title('Top 10 most popular Actors')
plt.show()
```



Anupam Kher,SRK,Julie Tejwani, Naseeruddin Shah and Takahiro Sakurai occupy the top stop in Most Watched content.

```
df_directors =
df_.groupby(['Directors']).agg({'title':'nunique'}).reset_index().sort
_values(by=['title'],ascending=False)[:15]
df_directors = df_directors[df_directors['Directors']!='Unknown
Director']
plt.figure(figsize=(18,4))
sns.barplot(y = "Directors",x = 'title', data = df_directors )
plt.xticks(rotation = 90)
plt.title('Top 10 most popular Directors')
plt.show
```

```
<function matplotlib.pyplot.show(close=None, block=None)>
```



Rajiv Chilaka, Jan Suter and Raul Campos are the most popular directors across Netflix

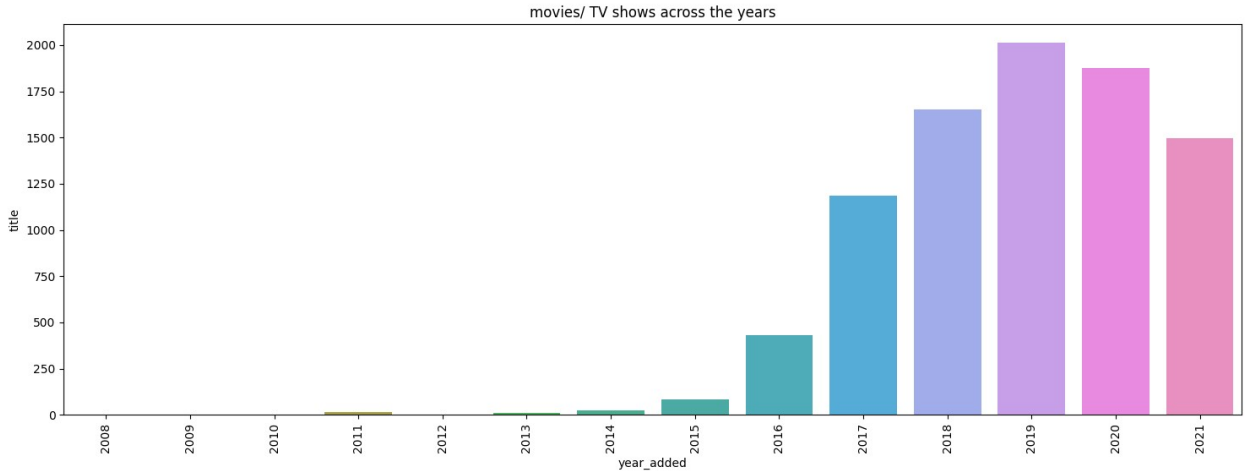
```
df_.head()
```

```
                  title          Actors          Directors  \
0  Dick Johnson Is Dead   Unknown Actor    Kirsten Johnson
1         Blood & Water      Ama Qamata   Unknown Director
2         Blood & Water      Ama Qamata   Unknown Director
3         Blood & Water      Ama Qamata   Unknown Director
4         Blood & Water     Khosi Ngema   Unknown Director
```

```
                     Genre        Country show_id     type
date_added  \
0           Documentaries  United States      s1    Movie 2021-09-25

1  International TV Shows   South Africa      s2  TV Show 2021-09-24

2               TV Dramas   South Africa      s2  TV Show 2021-09-24

3             TV Mysteries   South Africa      s2  TV Show 2021-09-24

4  International TV Shows   South Africa      s2  TV Show 2021-09-24


   release_year rating   duration  year_added  month_added month_name
\
0          2020  PG-13     80-100        2021            9  September

1          2021  TV-MA  2 Seasons        2021            9  September

2          2021  TV-MA  2 Seasons        2021            9  September

3          2021  TV-MA  2 Seasons        2021            9  September

4          2021  TV-MA  2 Seasons        2021            9  September


   day_added Weekday_added
0         25      Saturday
1         24        Friday
2         24        Friday
3         24        Friday
4         24        Friday
```

```
df =
df_.groupby(['year_added']).agg({'title':'nunique'}).reset_index()
plt.figure(figsize=(18,6))

sns.barplot(x = "year_added",y = 'title', data = df)
plt.xticks(rotation = 90)

plt.title('movies/ TV shows across the years')
plt.show
```

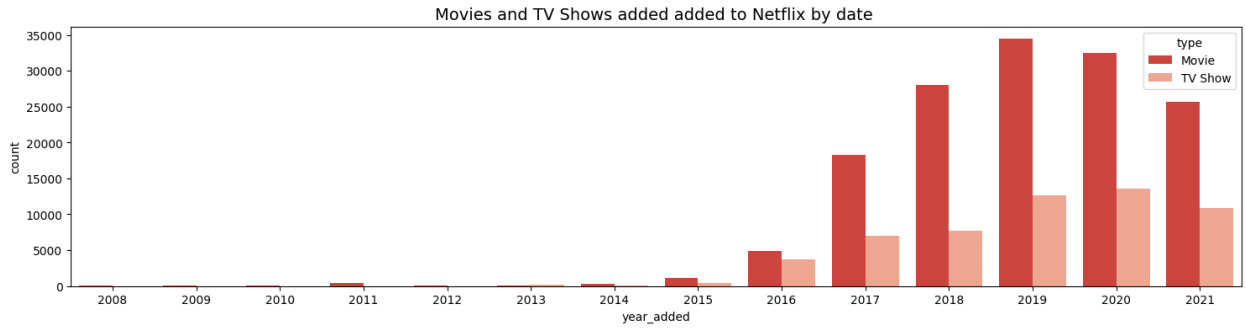
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



The Amount of Content across Netflix has increased from 2008 continuously till 2019. Then started decreasing from here(probably due to Covid)

```
fig = plt.figure(figsize = (18,4))

sns.countplot(data = df_,x = 'year_added',hue = 'type',palette
="Reds_r")
plt.title('Movies and TV Shows added added to Netflix by date ',
fontsize=14)
```

```
Text(0.5, 1.0, 'Movies and TV Shows added added to Netflix by date ')
```

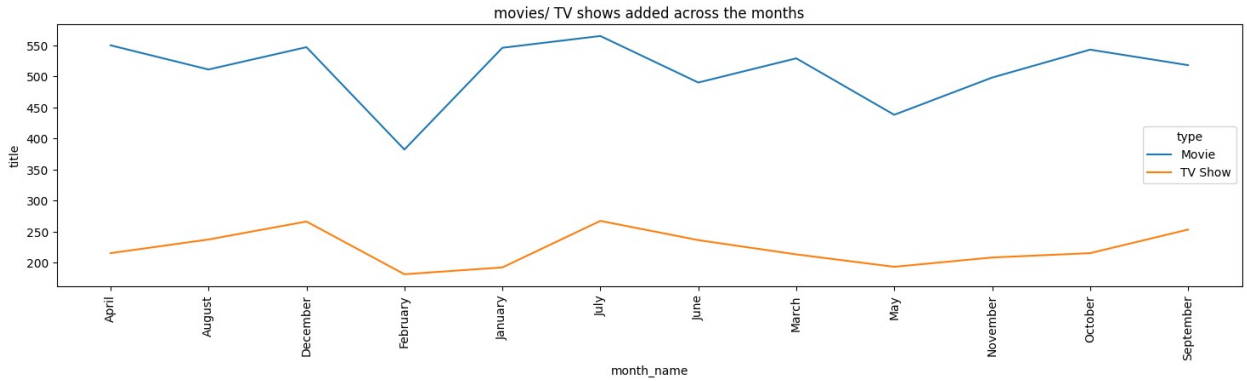


Over the years both TV shows and movie contents addtion has increased after 2020 its started declining may be due to Covid relief, Movies addtion is more compare to TV shows over the years

```
df_month = df_.groupby(['month_name',
'type']).agg({'title':'nunique'}).reset_index()

plt.figure(figsize=(18,4))
sns.lineplot(x = "month_name",y = 'title', data = df_month, color =
'red', hue = df_month.type )
plt.xticks(rotation = 90)
```

```
plt.title('movies/ TV shows added across the months')
plt.show
```

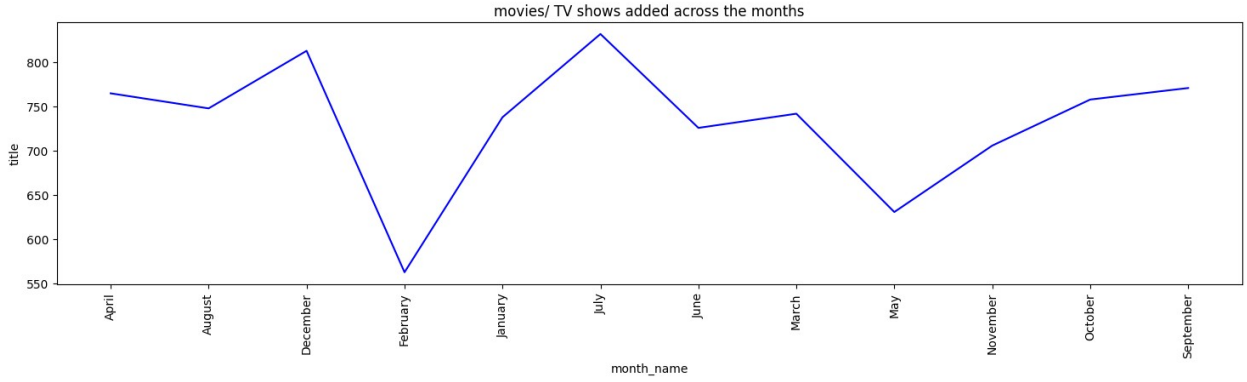
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



For both TV shows and Movies best launch month remain same which is July followed by December

```
df_month =
df_.groupby(['month_name']).agg({'title':'nunique'}).reset_index()

plt.figure(figsize=(18,4))
sns.lineplot(x = "month_name",y = 'title', data = df_month, color =
'blue' )
plt.xticks(rotation = 90)
plt.title('movies/ TV shows added across the months')
plt.show
```

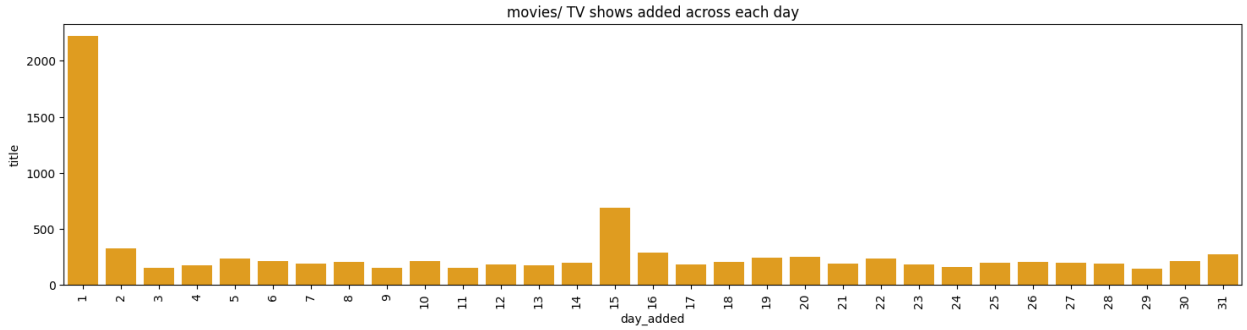
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



In general most of the content get added in december and july month

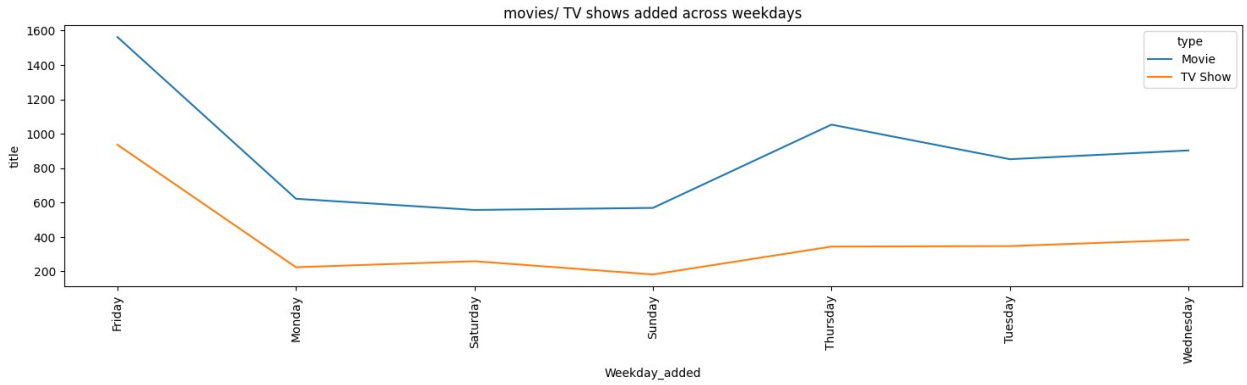
```
df_day =
df_.groupby(['day_added']).agg({'title':'nunique'}).reset_index()
```

```
plt.figure(figsize=(18,4))
sns.barplot(x = "day_added",y = 'title', data = df_day, color =
'orange' )
plt.xticks(rotation = 90)
plt.title('movies/ TV shows added across each day')
plt.show

<function matplotlib.pyplot.show(close=None, block=None)>
```



It was evident that 1st of every month was when the most content was added.

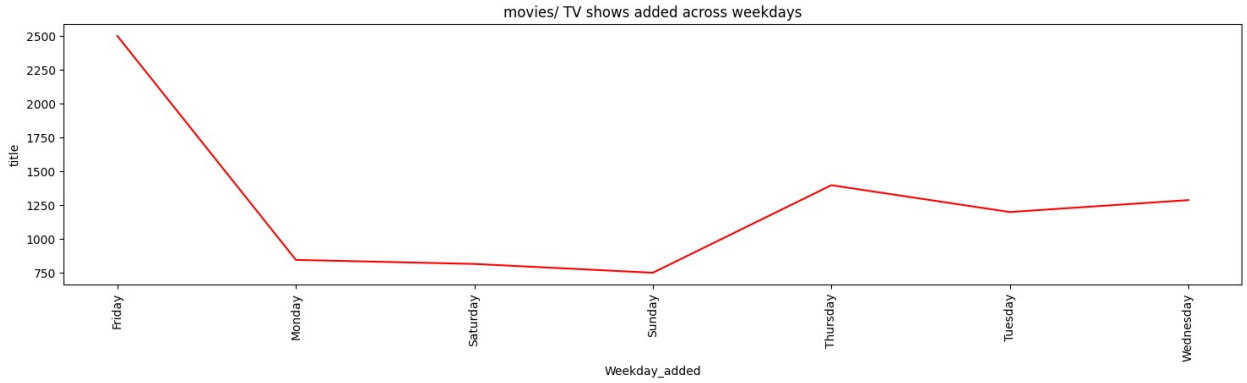
```
df_weekday = df_.groupby(['Weekday_added',
'type']).agg({'title':'nunique'}).reset_index()

plt.figure(figsize=(18,4))
sns.lineplot(x = "Weekday_added",y = 'title', data = df_weekday, color
= 'red' , hue = df_weekday.type)
plt.xticks(rotation = 90)
plt.title('movies/ TV shows added across weekdays')
plt.show

<function matplotlib.pyplot.show(close=None, block=None)>
```




```
df_weekday =
df_.groupby(['Weekday_added']).agg({'title':'nunique'}).reset_index()
```

```
plt.figure(figsize=(18,4))
sns.lineplot(x = "Weekday_added",y = 'title', data = df_weekday, color
= 'red' )
plt.xticks(rotation = 90)
plt.title('movies/ TV shows added across weekdays')
plt.show
```

```
<function matplotlib.pyplot.show(close=None, block=None)>
```



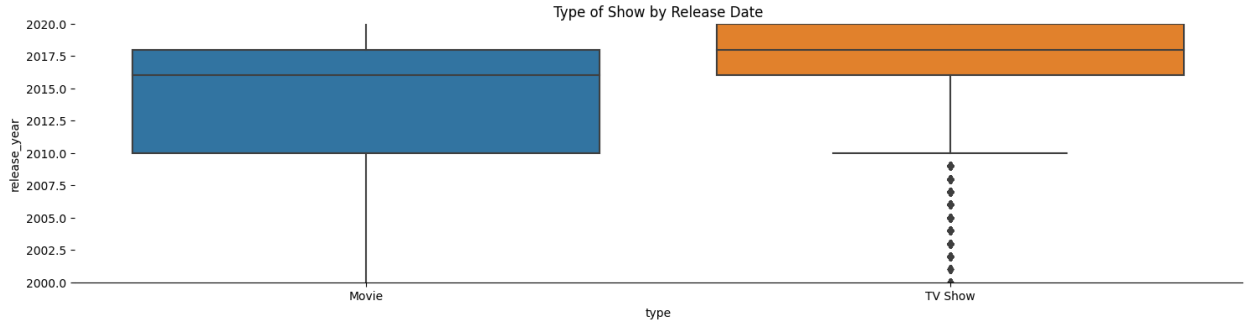
For content release on Netflix, Friday is the best day followed by Thursday

```
df_.columns
```

```
Index(['title', 'Actors', 'Directors', 'Genre', 'Country', 'show_id',
'type',
       'date_added', 'release_year', 'rating', 'duration',
'year_added',
       'month_added', 'month_name', 'day_added', 'Weekday_added'],
      dtype='object')
```

```
plt.figure(figsize=(18,4))
sns.boxplot(x='type', y='release_year', data=df_, )
sns.despine(left=True)
plt.title('Type of Show by Release Date')
plt.ylim(2000,2020)
```

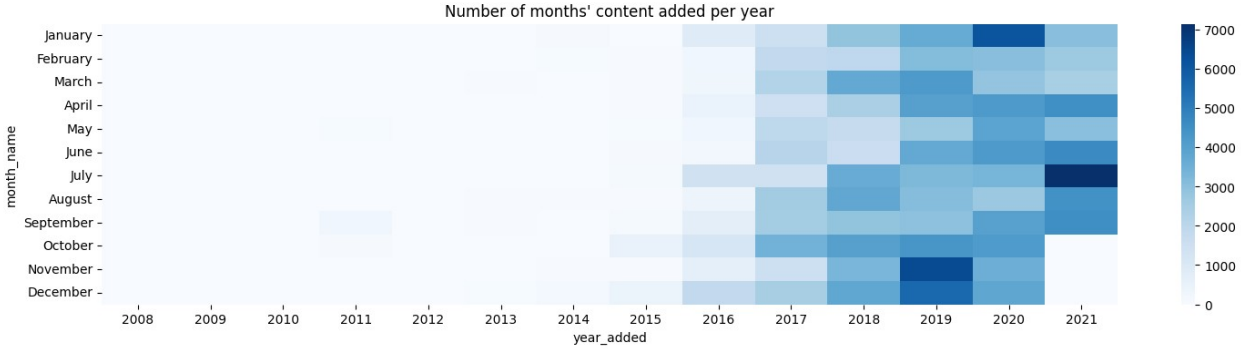
```
(2000.0, 2020.0)
```



It sees tv shows have a more recent release_year. This means tv shows are releasing more in recent years

Bivariate Analysis

```
month_order = ['January', 'February', 'March', 'April', 'May', 'June',
'July', 'August', 'September',
               'October', 'November', 'December']
content = df_.groupby('year_added')
['month_name'].value_counts().unstack().fillna(0)[month_order].T

plt.figure(figsize=(18,4))
plt.title("Number of months' content added per year")
sns.heatmap(content , cmap = 'Blues')
plt.show()
```

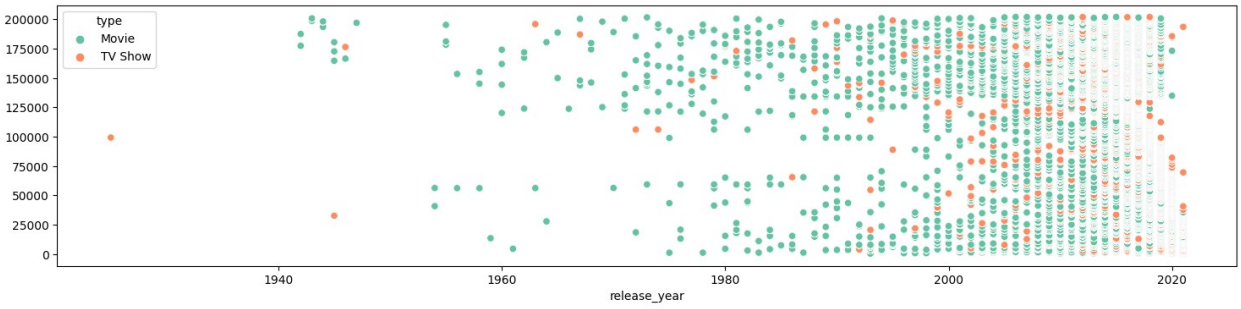


Most number of Movies and TV shows were added in November, 2019 and July, 2021

Fewer movies and TV shows were added from 2008 to 2015

```
plt.figure(figsize = (18,4))
sns.scatterplot(y = df_.index , x = df_.release_year , hue =
df_.type , palette='Set2')
```

```
<Axes: xlabel='release_year'>
```



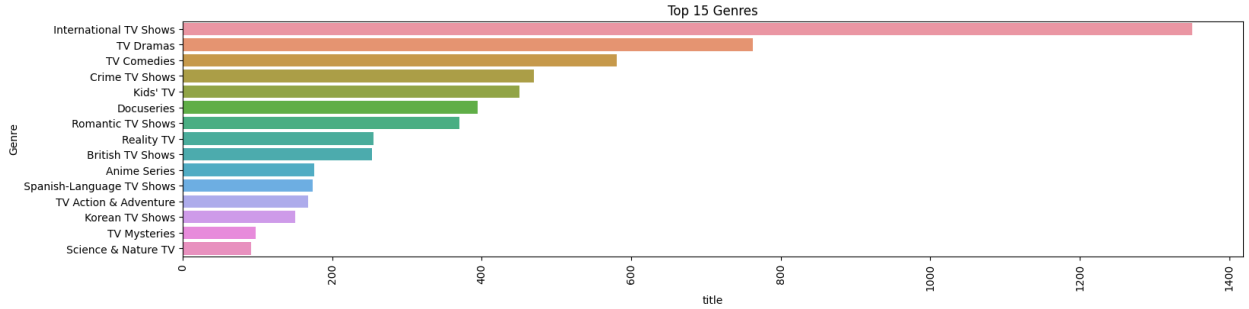

```
df_.groupby(['day_added']).agg({"title":"nunique"})
```

```
            title
day_added
1            2219
2             325
3             151
4             175
5             231
6             210
7             190
8             201
9             148
10            214
11            149
12            181
13            175
14            198
15            688
16            289
17            180
18            205
19            243
20            249
21            190
22            230
23            182
24            159
25            196
26            205
27            195
28            190
29            141
30            211
31            274
```

It was evident that 1st of every month was when the most content was added.

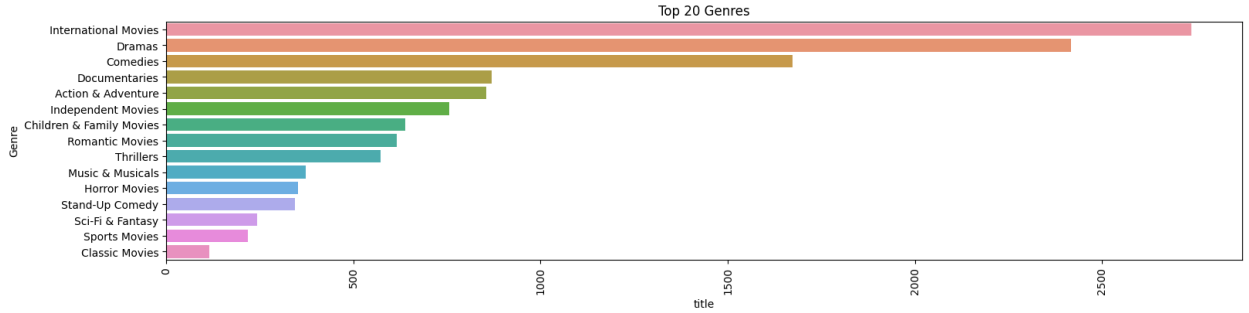
Univariate Analysis separately for shows and movies¶

```
df_shows = df_[df_['type']=='TV Show']
df_movies = df_[df_['type']=='Movie']
df_genre =
df_shows.groupby(['Genre']).agg({"title":"nunique"}).reset_index().sor
t_values(by=['title'],ascending=False)[:15]
plt.figure(figsize = (18,4))
sns.barplot(y = "Genre",x = 'title', data = df_genre)
plt.xticks(rotation = 90)
plt.title('Top 15 Genres')
plt.show()
```



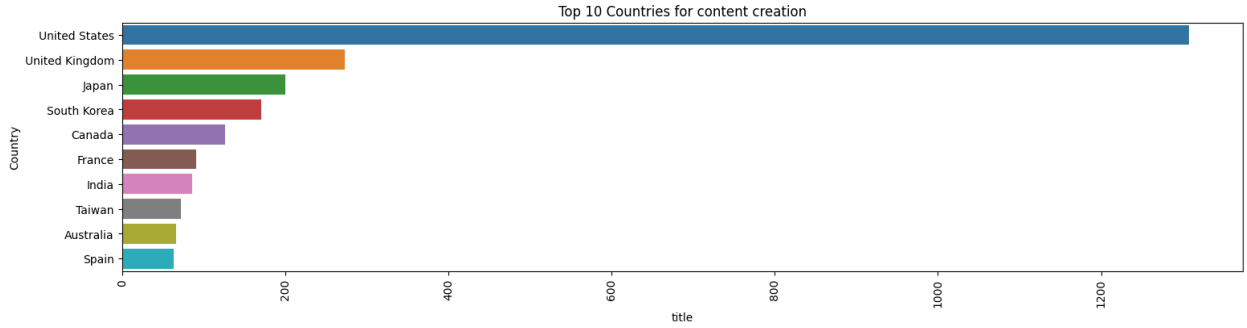
International TV Shows, Dramas and Comedy Genres are popular across TV Shows in Netflix

```
df_genre =
df_movies.groupby(['Genre']).agg({"title":"nunique"}).reset_index().so
rt_values(by=['title'],ascending=False)[:15]
plt.figure(figsize = (18,4))
sns.barplot(y = "Genre",x = 'title', data = df_genre)
plt.xticks(rotation = 90)
plt.title('Top 20 Genres')
plt.show()
```

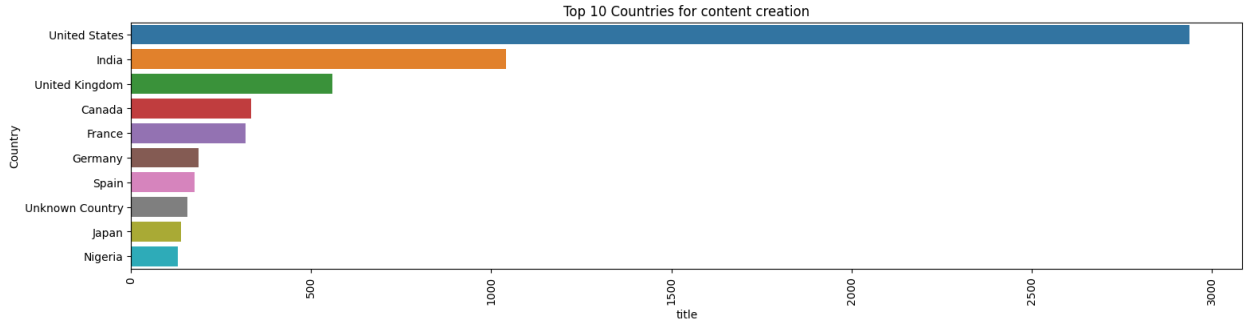


International Movies, Dramas and Comedy Genres are popular followed by Documentaries across Movies on Netflix

```
df_country =
df_shows.groupby(['Country']).agg({'title':'nunique'}).reset_index().s
ort_values(by=['title'],ascending=False)[:10]
plt.figure(figsize=(18,4))
sns.barplot(y = "Country",x = 'title', data = df_country)
plt.xticks(rotation = 90)
plt.title('Top 10 Countries for content creation')
plt.show()
```




```
df_country =
df_movies.groupby(['Country']).agg({'title':'nunique'}).reset_index().
sort_values(by=['title'],ascending=False)[:10]
plt.figure(figsize=(18,4))
sns.barplot(y = "Country",x = 'title', data = df_country)
plt.xticks(rotation = 90)
plt.title('Top 10 Countries for content creation')
plt.show()
```



United States is leading across both TV Shows and Movies, UK also provides great content across TV Shows and Movies. Surprisingly India is much more prevalent in Movies as compared TV Shows.

Moreover the number of Movies created in India outweigh the sum of TV Shows and Movies across UK since India was rated as second in net sum of whole content across Netflix.

Business Insights

Over the years both TV shows and movie contents addtion has increased till 2020, but after 2020 its started declining may be due to Covid relief, number of Movies added is more compare to TV shows over the years

Most of the content get added in december and july month, for day wise, Friday is the best day followed by Thursday

It was evident that 1st of every month was when the most content was added.

Anupam Kher,SRK,Julie Tejwani, Naseeruddin Shah and Takahiro Sakurai occupy the top stop in Most Watched content.

Rajiv Chilaka, Jan Suter and Raul Campos are the most popular directors across Netflix

Rajiv Chilaka director producing more movies

Netflix is more focussing on movies compare to TV shows

There is a 70:30 ratio of Movies and TV Shows content in Netflix platform

International Movies, Dramas and Comedies are the most popular are most popular Genre

US,India,UK,Canada and France are leading countries in Content Creation on Netflix

Most of the highly rated content on Netflix is intended for Mature Audiences

The duration of Most Watched content in our whole data is 80-120 mins. These must be movies and Shows having only 1 Season.

United States is leading across both TV Shows and Movies, UK also provides great content across TV Shows and Movies. Surprisingly India is much more prevalent in Movies as compared TV Shows.

Moreover the number of Movies created in India outweigh the sum of TV Shows and Movies across UK since India was rated as second in net sum of whole content across Netflix.

Recommendations

The most popular Genres across the countries and in both TV Shows and Movies are Drama, Comedy and International TV Shows/Movies, so recommended to generate more content on these genres.

Add TV Shows/ movies in the month of July 1st or August 1st.

Add movies for Indian Audience, it has been declining since 2018.

While creating content, take into consideration the popular actors/directors for that country. Also take into account the director-actor combination which is highly recommended.

For audience 80-120 mins is the recommended length for movies.