Business Case: Netflix - Data Exploration and Visualisation

🎯 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

1. Importing Libraries , Loading the data and Basic Observations

```
#importing libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import missingno as msno
import warnings
warnings.filterwarnings('ignore')
import copy
from wordcloud import WordCloud
```

```
!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
100% 3.40M/3.40M [00:00<00:00, 62.2MB/s]
```

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

```
df.head()
```

	show_id	type	title	director	cast	country	date_added	release_year	rating	dur
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	9
1	s2	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	September 24, 2021	2021	TV-MA	Se
					Sami Bouajila,					

```
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
```

🔍 Insights

From the above analysis, it is clear that, data has total of 12 features with lots of mixed alpha numeric data. Also we can see missing data in 5 of the total columns.

2.Exploratory Data Analysis

📝 Statistical Summary

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

	show_id	type	title	director	cast	country	date_added	rating	duration	:
count	8807	8807	8807	6173	7982	7976	8797	8803	8804	
unique	8807	2	8807	4528	7692	748	1767	17	220	
top	s1	Movie	Dick Johnson Is Dead	Rajiv Chilaka	David Attenborough	United States	January 1, 2020	TV-MA	1 Season	In

```
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

🔍 Insights

1. **Type of content** - Among the 8807 items available on Netflix, 6131 of them are movies, accounting for nearly 70% of the total content. The remaining 30% consists of TV series.
2. **Director** - Rajiv Chilaka holds the top position on the director list, with 19 credits to his name. He specializes in creating animated movies for children.
3. **Cast** - David Attenborough leads the actor list with 19 appearances in various films and shows on Netflix.
4. **Country** - The USA ranks at the top as the country with the highest production contribution to Netflix, accounting for 35% of the total content.
5. **Date Added** - January 1, 2020, stands out as the peak date for content uploads on Netflix. On that day alone, approximately 109 different shows and movies were added to the platform.

2. **Ratings** - There are 17 different types of ratings present on Netflix. The "TV-MA" (Mature Audience Only) rating dominates the charts, covering almost 36% of the total shows and movies on the platform with this rating.

👥 Duplicate Detection

```
df.duplicated().value_counts()
```

```
False    8807
dtype: int64
```

🔍 Insights

There are no duplicate entries in the dataset

✅ Sanity Check for columns

```
df.nunique()
```

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

```
# checking the unique values for columns
for i in ['type','release_year','rating','duration']:
    print('Unique Values in',i,'column are :-')
    print(df[i].unique())
    print('-'*70)
```

```
Unique Values in type column are :-
['Movie' 'TV Show']
----------------------------------------------------------------------
Unique Values in release_year column are :-
[2020 2021 1993 2018 1996 1998 1997 2010 2013 2017 1975 1978 1983 1987
 2012 2001 2014 2002 2003 2004 2011 2008 2009 2007 2005 2006 1994 2015
 2019 2016 1982 1989 1990 1991 1999 1986 1992 1984 1980 1961 2000 1995
 1985 1976 1959 1988 1981 1972 1964 1945 1954 1979 1958 1956 1963 1970
 1973 1925 1974 1960 1966 1971 1962 1969 1977 1967 1968 1965 1946 1942
 1955 1944 1947 1943]
----------------------------------------------------------------------
Unique Values in rating column are :-
['PG-13' 'TV-MA' 'PG' 'TV-14' 'TV-PG' 'TV-Y' 'TV-Y7' 'R' 'TV-G' 'G'
 'NC-17' '74 min' '84 min' '66 min' 'NR' nan 'TV-Y7-FV' 'UR']
----------------------------------------------------------------------
Unique Values in duration column are :-
['90 min' '2 Seasons' '1 Season' '91 min' '125 min' '9 Seasons' '104 min'
 '127 min' '4 Seasons' '67 min' '94 min' '5 Seasons' '161 min' '61 min'
 '166 min' '147 min' '103 min' '97 min' '106 min' '111 min' '3 Seasons'
 '110 min' '105 min' '96 min' '124 min' '116 min' '98 min' '23 min'
 '115 min' '122 min' '99 min' '88 min' '100 min' '6 Seasons' '102 min'
 '93 min' '95 min' '85 min' '83 min' '113 min' '13 min' '182 min' '48 min'
 '145 min' '87 min' '92 min' '80 min' '117 min' '128 min' '119 min'
 '143 min' '114 min' '118 min' '108 min' '63 min' '121 min' '142 min'
 '154 min' '120 min' '82 min' '109 min' '101 min' '86 min' '229 min'
 '76 min' '89 min' '156 min' '112 min' '107 min' '129 min' '135 min'
 '136 min' '165 min' '150 min' '133 min' '70 min' '84 min' '140 min'
 '78 min' '7 Seasons' '64 min' '59 min' '139 min' '69 min' '148 min'
 '189 min' '141 min' '130 min' '138 min' '81 min' '132 min' '10 Seasons'
 '123 min' '65 min' '68 min' '66 min' '62 min' '74 min' '131 min' '39 min'
 '46 min' '38 min' '8 Seasons' '17 Seasons' '126 min' '155 min' '159 min'
 '137 min' '12 min' '273 min' '36 min' '34 min' '77 min' '60 min' '49 min'
 '58 min' '72 min' '204 min' '212 min' '25 min' '73 min' '29 min' '47 min'
 '32 min' '35 min' '71 min' '149 min' '33 min' '15 min' '54 min' '224 min'
 '162 min' '37 min' '75 min' '79 min' '55 min' '158 min' '164 min'
 '173 min' '181 min' '185 min' '21 min' '24 min' '51 min' '151 min'
 '42 min' '22 min' '134 min' '177 min' '13 Seasons' '52 min' '14 min'
 '53 min' '8 min' '57 min' '28 min' '50 min' '9 min' '26 min' '45 min'
 '171 min' '27 min' '44 min' '146 min' '20 min' '157 min' '17 min'
 '203 min' '41 min' '30 min' '194 min' '15 Seasons' '233 min' '237 min'
 '230 min' '195 min' '253 min' '152 min' '190 min' '160 min' '208 min'
 '180 min' '144 min' '5 min' '174 min' '170 min' '192 min' '209 min'
 '187 min' '172 min' '16 min' '186 min' '11 min' '193 min' '176 min'
 '56 min' '169 min' '40 min' '10 min' '3 min' '168 min' '312 min'
 '153 min' '214 min' '31 min' '163 min' '19 min' '12 Seasons' nan
 '179 min' '11 Seasons' '43 min' '200 min' '196 min' '167 min' '178 min'
 '228 min' '18 min' '205 min' '201 min' '191 min']
----------------------------------------------------------------------
```

```
# checking the value_counts for columns
for i in ['type','release_year','rating','duration']:
    print('Value count in',i,'column are :-')
    print(df[i].value_counts())
    print('-'*70)
```

```
Value count in type column are :-
Movie      6131
TV Show    2676
Name: type, dtype: int64
----------------------------------------------------------------------
Value count in release_year column are :-
2018    1147
2017    1032
2019    1030
2020     953
2016     902
        ...
1959       1
1925       1
1961       1
1947       1
1966       1
Name: release_year, Length: 74, dtype: int64
----------------------------------------------------------------------
Value count in rating column are :-
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            80
G             41
TV-Y7-FV       6
NC-17          3
UR             3
74 min         1
84 min         1
66 min         1
Name: rating, dtype: int64
----------------------------------------------------------------------
Value count in duration column are :-
1 Season     1793
2 Seasons     425
3 Seasons     199
90 min        152
94 min        146
             ...
16 min          1
186 min         1
193 min         1
189 min         1
191 min         1
Name: duration, Length: 220, dtype: int64
----------------------------------------------------------------------
```

🔍 Insights

There is presense of 3 unusual values in rating column. We will replace them by NaN as below

```
df['rating'].replace({'74 min':np.nan ,'84 min' : np.nan, '66 min' : np.nan},inplace = True)
```

🧑‍💻 Missing Value Analysis

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

```
show_id            0
type               0
title              0
director        2634
cast             825
country          831
date_added        10
release_year       0
rating             7
duration           3
listed_in          0
description        0
dtype: int64
```

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

	show_id	type	title	director	cast	country	date_added	release_year	rating	durati
5541	s5542	Movie	Louis C.K. 2017	Louis C.K.	Louis C.K.	United States	April 4, 2017	2017	NaN	N
5794	s5795	Movie	Louis C.K.: Hilarious	Louis C.K.	Louis C.K.	United States	September 16, 2016	2010	NaN	N

```
ind = df[df['duration'].isna()].index
df.loc[ind] = df.loc[ind].fillna(method = 'ffill' , axis = 1)
df.loc[ind ,'rating'] = 'Not Available'
df.loc[ind]
```

	show_id	type	title	director	cast	country	date_added	release_year	rating	durat
5541	s5542	Movie	Louis C.K. 2017	Louis C.K.	Louis C.K.	United States	April 4, 2017	2017	Not Available	2
5794	s5795	Movie	Louis C.K.: Hilarious	Louis C.K.	Louis C.K.	United States	September 16, 2016	2010	Not Available	2

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

	show_id	type	title	director	cast	country	date_added	release_year	rati
5989	s5990	Movie	13TH: A Conversation with Oprah Winfrey & Ava ...	NaN	Oprah Winfrey, Ava DuVernay	NaN	January 26, 2017	2017	Na
6827	s6828	TV Show	Gargantia on the Verdurous Planet	NaN	Kaito Ishikawa, Hisako Kanemoto, Ai Kayano, Ka...	Japan	December 1, 2016	2013	Na

```
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	director	cast	country	date_added	release_year	rat
5989	s5990	Movie	13TH: A Conversation with Oprah Winfrey & Ava ...	NaN	Oprah Winfrey, Ava DuVernay	NaN	January 26, 2017	2017	Availa
6827	s6828	TV Show	Gargantia on the Verdurous Planet	NaN	Kaito Ishikawa, Hisako Kanemoto, Ai Kayano, Ka...	Japan	December 1, 2016	2013	Availa
					Flynn Curry				

```
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
```

```
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
```

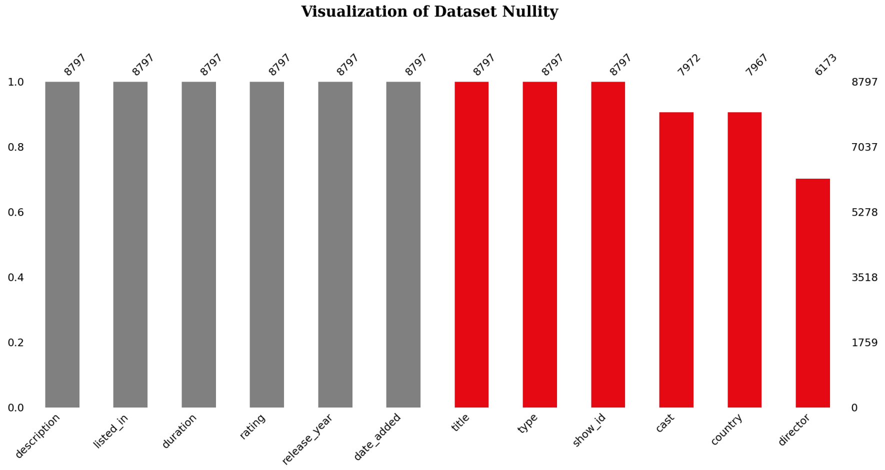
```
# total null values in each column
df.isna().sum()
```

```
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
dtype: int64
```

```
# percentage of nullity
for i in df.columns:
    null_rate = df[i].isnull().sum()/df.shape[0] * 100
    if null_rate > 0:
        print(f"{i}'s null rate : {round(null_rate,2)}%")
```

```
director's null rate : 29.83%
cast's null rate : 9.38%
country's null rate : 9.44%
```

```
# missing value visualisation
color = ['grey','grey','grey','grey','grey','grey','#E50914','#E50914','#E50914','#E50914','#E50914','#E50914']
ax = msno.bar(df,sort = 'descending',color = color,fontsize = 18)
ax.text(3.5,1.2,'Visualization of Dataset Nullity',{'font':'serif', 'color':'black','weight':'bold','size':25})
plt.show()
```



```
# Correlation between missing Values
ax = msno.heatmap(df,figsize = (15,6),fontsize = 10)
ax.text(1.5,0,'Co-relation between missing Values',{'font':'serif', 'color':'black','weight':'bold','size':15})
plt.show()
```

🔍 Insights

1. From our above analysis, there are total of 6 columns containing missing values. Director's column has the most missing values followed by cast and country column. Date added, ratings and duration have significantly less missing values (<1%)
2. The heatmap illustrates the correlation of missing data between each pair of columns. Apart from strong correlation between rating and duration column, The fact that all other values are close to 0 indicates that there is no dependence between the occurrence of missing values in two variables

🔁 Replacing the missing values

```
df['director'].fillna('Unknown Director',inplace = True)
df['cast'].fillna('Unknown cast',inplace = True)
df['country'].fillna('Unknown country',inplace = True)
```

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

```
show_id         0
type            0
title           0
director        0
cast            0
country         0
date_added      0
release_year    0
rating          0
duration        0
listed_in       0
description     0
dtype: int64
```

Adding new columns for better analysis

Add 3 columns - year_added,month_added,week_added to the df to facilitate further data analysis.

```
# converting date_added to datetime column
df['date_added'] = pd.to_datetime(df['date_added'])

#adding new columns
df['year_added'] = df['date_added'].dt.year
df['month_added'] = df['date_added'].dt.month_name()
df['week_added'] = df['date_added'].dt.isocalendar().week

df.head(3)
```

	show_id	type	title	director	cast	country	date_added	release_year	rating	du
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	Unknown cast	United States	2021-09-25	2020	PG-13	
1	s2	TV Show	Blood & Water	Unknown Director	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	2021-09-24	2021	TV-MA	S

Un-nesting the columns for better analysis

We will create a new df which has un-nested director,cast and country columns into multiple rows which will help while doing analysis related to them.

```
# creating a separate table
df1 = copy.deepcopy(df)


df1["director"] = df["director"].str.split(", ")
df1["cast"] = df["cast"].str.split(", ")
df1["country"] = df["country"].str.split(", ")

df1 = df1.explode(['director'])
df1 = df1.explode(['cast'])
df1 = df1.explode(['country'])
df1.head(3)
```

	show_id	type	title	director	cast	country	date_added	release_year	rating	durati
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	Unknown cast	United States	2021-09-25	2020	PG-13	90 r
1	s2	TV Show	Blood & Water	Unknown Director	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	Seasc

```
#checking shape of new df
df1.shape
```

```
(89313, 15)
```

3. Data Exploration and Non Graphical Analysis

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

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

```
movies  = df.loc[df['type'] == 'Movie']
tv_shows = df.loc[df['type'] == 'TV Show']
movies.duration.value_counts()
```

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

4.Visual Analysis - Univariate & Bivariate

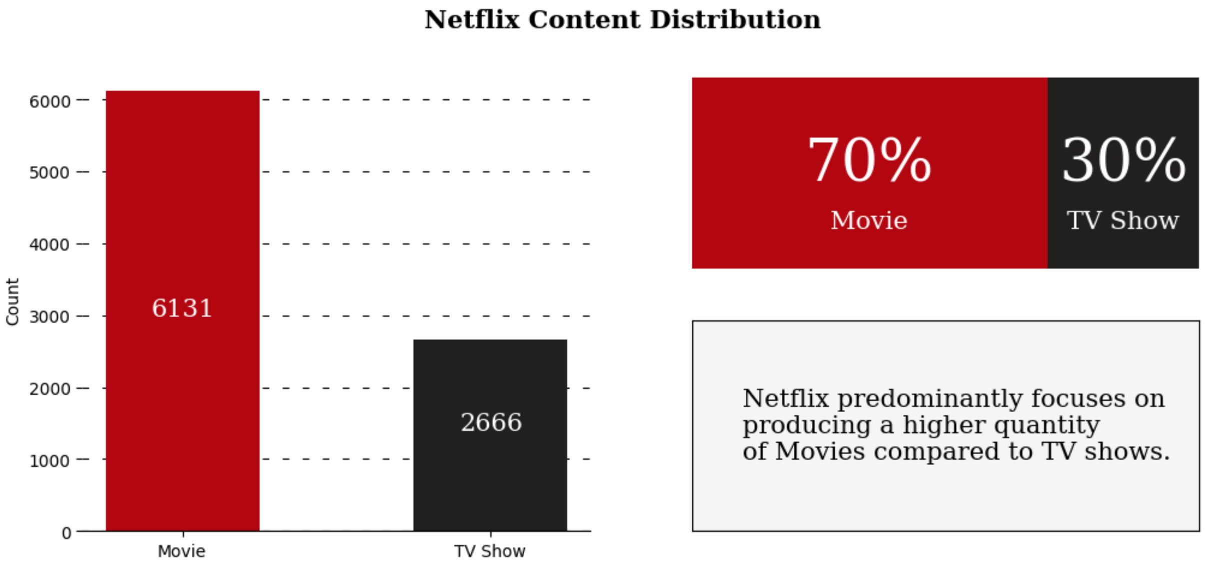
🎬 Content Distribution

```
x = df['type'].value_counts()
```

```
x = df['type'].value_counts()
x
```

```
Movie      6131
TV Show    2666
Name: type, dtype: int64
```

```
#setting the plot style
fig = plt.figure(figsize = (12,5))
gs = fig.add_gridspec(2,2)

# creating graph for count of movies
ax0 = fig.add_subplot(gs[:,0])
ax0.bar(x.index,x.values,color =['#b20710','#221f1f'],zorder = 2,width = 0.5)
ax0.set(ylabel = 'Count')

# adding value_count label
ax0.text(-0.1,3000,x.values[0],fontsize=15, fontweight='light', fontfamily='serif',color='white')
ax0.text(0.9,1400,x.values[1],fontsize=15, fontweight='light', fontfamily='serif',color='white')
ax0.grid(color='black', linestyle='--', axis='y', zorder=0,  dashes=(5,10))


#removing the axis lines
for s in ['top', 'left', 'right']:
    ax0.spines[s].set_visible(False)

# creating the visual for percentage distribution
ax1 = fig.add_subplot(gs[0,1])
ax1.barh(x.index[0],0.7,color = '#b20710')
ax1.barh(x.index[0],0.3,left = 0.7,color = '#221f1f')
ax1.set(xlim = (0,1))

#removing the axis info
ax1.set_xticks([])
ax1.set_yticks([])

# adding graph info
ax1.text(0.35,0.04,'70%',va = 'center', ha='center',fontsize=35, fontweight='light', fontfamily='serif',color='white')
ax1.text(0.35,-0.2,'Movie',va = 'center', ha='center',fontsize=15, fontweight='light', fontfamily='serif',color='white')
ax1.text(0.85,0.04,'30%',va = 'center', ha='center',fontsize=35, fontweight='light', fontfamily='serif',color='white')
ax1.text(0.85,-0.2,'TV Show',va = 'center', ha='center',fontsize=15, fontweight='light', fontfamily='serif',color='white')

#removing the axis lines
for s in ['top', 'left', 'right', 'bottom']:
    ax1.spines[s].set_visible(False)

# adding text insight
ax2 = fig.add_subplot(gs[1,1])
ax2.set_facecolor('#f6f5f5')
ax2.set_xticks([])
ax2.set_yticks([])

ax2.text(0.1,0.5,'Netflix predominantly focuses on\nproducing a higher quantity\nof Movies compared to TV shows.',
         va = 'center', ha='left',fontsize=15, fontweight='light', fontfamily='serif',color='black')

#adding title to the visual
fig.suptitle('Netflix Content Distribution',fontproperties = {'family':'serif', 'size':15,'weight':'bold'})

plt.show()
```



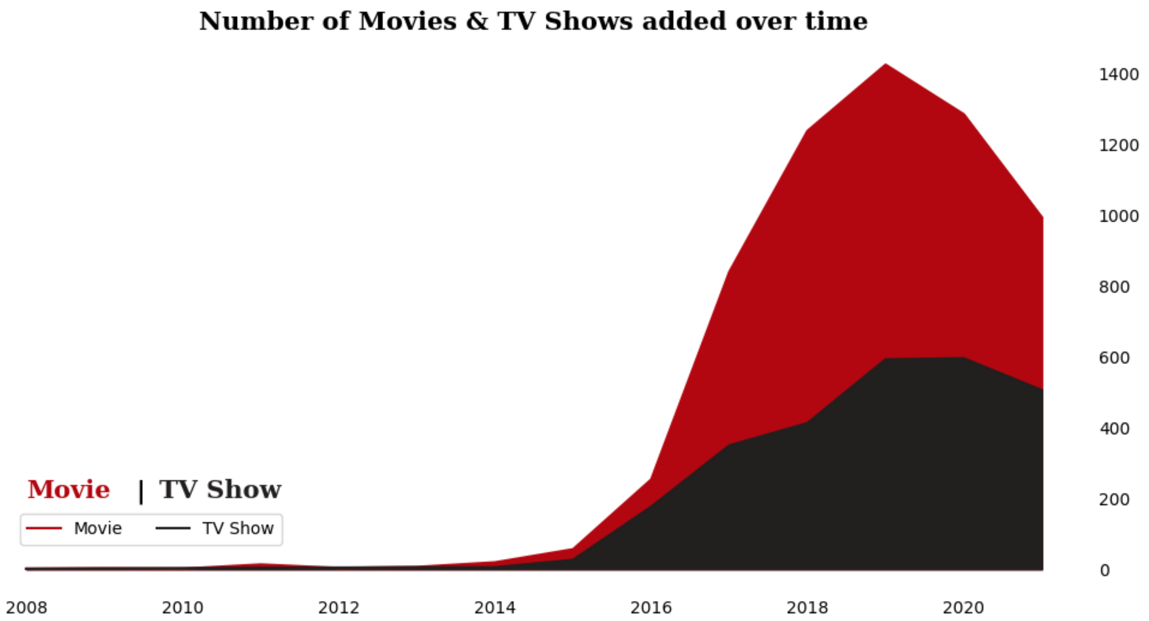
🔍 Insights

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

⏳ Evolution of Netflix's Growing Library of Movies & TV Shows

Analysis of number of Movies and TV shows added over time on Netflix

```
#setting the plot style
fig,ax = plt.subplots(figsize = (12,6))
color = ['#b20710','#221f1f']

#plotting the visual
for i,type_ in  enumerate(df['type'].unique()):
    temp_df = df.loc[df['type'] == type_,'year_added'].value_counts().sort_index()
    ax.plot(temp_df.index,temp_df.values,color = color[i],label = type_)
    ax.fill_between(temp_df.index,0,temp_df.values,color = color[i])

#changing the y-axis position from left to right
ax.yaxis.tick_right()

#removing the axis lines
for s in ['top','left','bottom','right']:
    ax.spines[s].set_visible(False)

#removing tick marks but keeping the labels
ax.tick_params(axis = 'both',length = 0)

#adding title to the visual
ax.set_title('Number of Movies & TV Shows added over time',
            {'font':'serif', 'size':15,'weight':'bold'})


#adding custom legend
ax.text(2008,200,"Movie", fontweight="bold", fontfamily='serif', fontsize=15, color='#b20710')
ax.text(2009.4,200,"|", fontweight="bold", fontfamily='serif', fontsize=15, color='black')
ax.text(2009.7,200,"TV Show", fontweight="bold", fontfamily='serif', fontsize=15, color='#221f1f')
plt.legend(loc = (0.04,0.09),ncol = 2)


plt.show()
```



🔍 Insights

- We see a slow start for Netflix over several years. **Things begin to pick up in 2015 and then there is a rapid increase from 2016.**
- As we saw in the timeline at the start of this analysis, **Netflix went global in 2016 - and it is extremely noticeable in this plot.**
- The rate of content additions decelerated in 2020, **possibly attributed to the impact of the COVID-19 pandemic.**

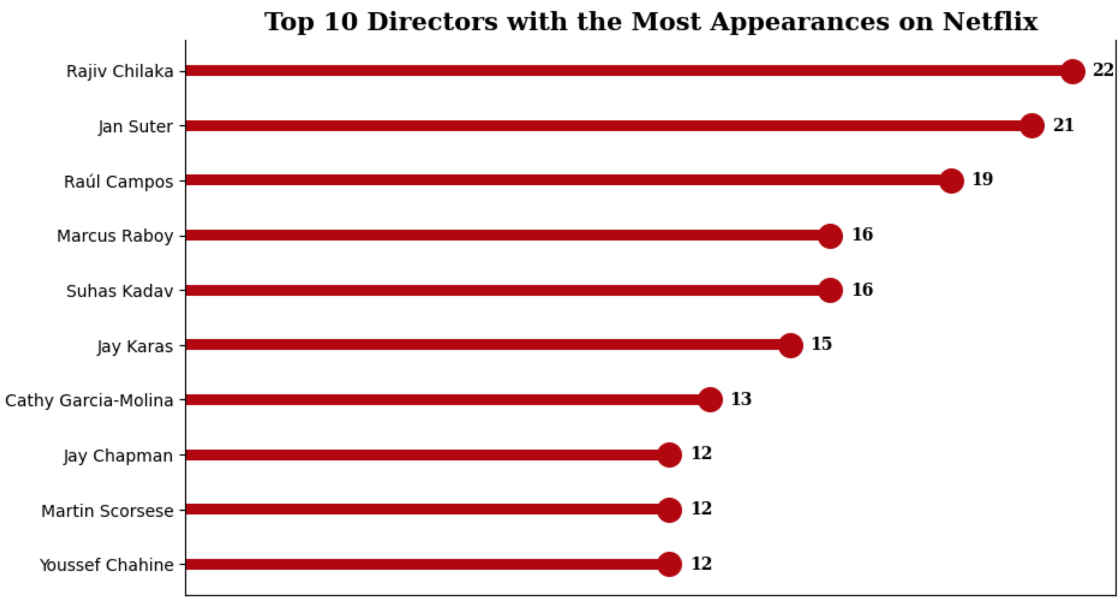
🎥 Directors with the Most Appearances

Top 10 directors who have appeared in most movies or TV shows.

```
d_cnt = df1.groupby('director')['title'].nunique().sort_values(ascending  = False)[0:11].reset_index()
d_cnt
```

	director	title
0	Unknown Director	2624
1	Rajiv Chilaka	22
2	Jan Suter	21
3	Raúl Campos	19
4	Marcus Raboy	16
5	Suhas Kadav	16
6	Jay Karas	15
7	Cathy Garcia-Molina	13
8	Jay Chapman	12
9	Martin Scorsese	12
10	Youssef Chahine	12

```
# droping unknown director and reversing the df
d_cnt = d_cnt.iloc[-1:-11:-1]

#setting the plot style
fig,ax = plt.subplots(figsize = (10,6))

#creating the plot
ax.barh(y = d_cnt['director'],width = d_cnt['title'],height = 0.2,color = '#b20710')
ax.scatter(y = d_cnt['director'], x = d_cnt['title'] , s = 200 , color = '#b20710' )

#removing x-axis
ax.set_xticks([])

#adding label to each bar
for y,x in zip(d_cnt['director'],d_cnt['title']):
    ax.text( x + 0.5 , y , x,{'font':'serif', 'size':10,'weight':'bold'},va='center')

#removing the axis lines
for s in ['top','bottom','right']:
    ax.spines[s].set_visible(False)

    #creating the title
    ax.set_title('Top 10 Directors with the Most Appearances on Netflix',
                {'font':'serif', 'size':15,'weight':'bold'})

    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

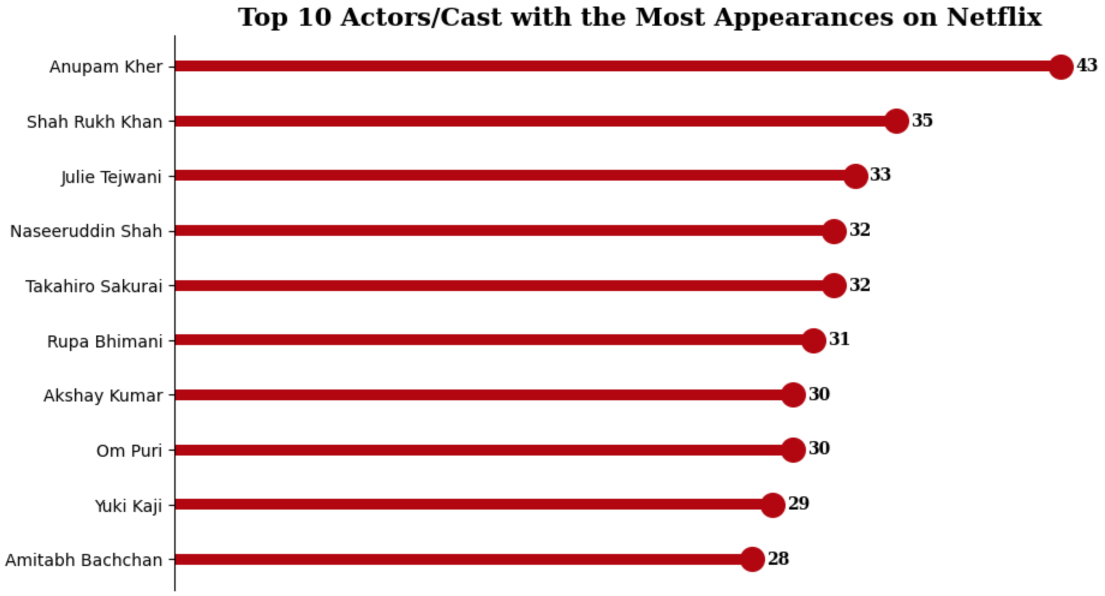
🧑‍🎤 Actor's with the Most Appearances

Top 10 Actor's who have appeared in most movies or TV shows.

```
a_cnt = df1.groupby('cast')['title'].nunique().sort_values(ascending = False)[0:11].reset_index()
a_cnt
```

	cast	title
0	Unknown cast	825
1	Anupam Kher	43
2	Shah Rukh Khan	35
3	Julie Tejwani	33
4	Naseeruddin Shah	32
5	Takahiro Sakurai	32
6	Rupa Bhimani	31
7	Akshay Kumar	30
8	Om Puri	30
9	Yuki Kaji	29
10	Amitabh Bachchan	28

```
# droping unknown actor and reversing the list
a_cnt = a_cnt.iloc[-1:-11:-1]

#setting the plot style
fig,ax = plt.subplots(figsize = (10,6))

#creating the plot
ax.barh(y = a_cnt['cast'],width = a_cnt['title'],height = 0.2,color = '#b20710')
ax.scatter(y = a_cnt['cast'], x = a_cnt['title'] , s = 200 , color = '#b20710' )

#removing x-axis
ax.set_xticks([])

#adding label to each bar
for y,x in zip(a_cnt['cast'],a_cnt['title']):
    ax.text( x + 0.7 , y , x,{'font':'serif', 'size':10,'weight':'bold'},va='center')

#removing the axis lines
for s in ['top','bottom','right']:
    ax.spines[s].set_visible(False)

#creating the title
ax.set_title('Top 10 Actors/Cast with the Most Appearances on Netflix',
            {'font':'serif', 'size':15,'weight':'bold'})

plt.show()
```



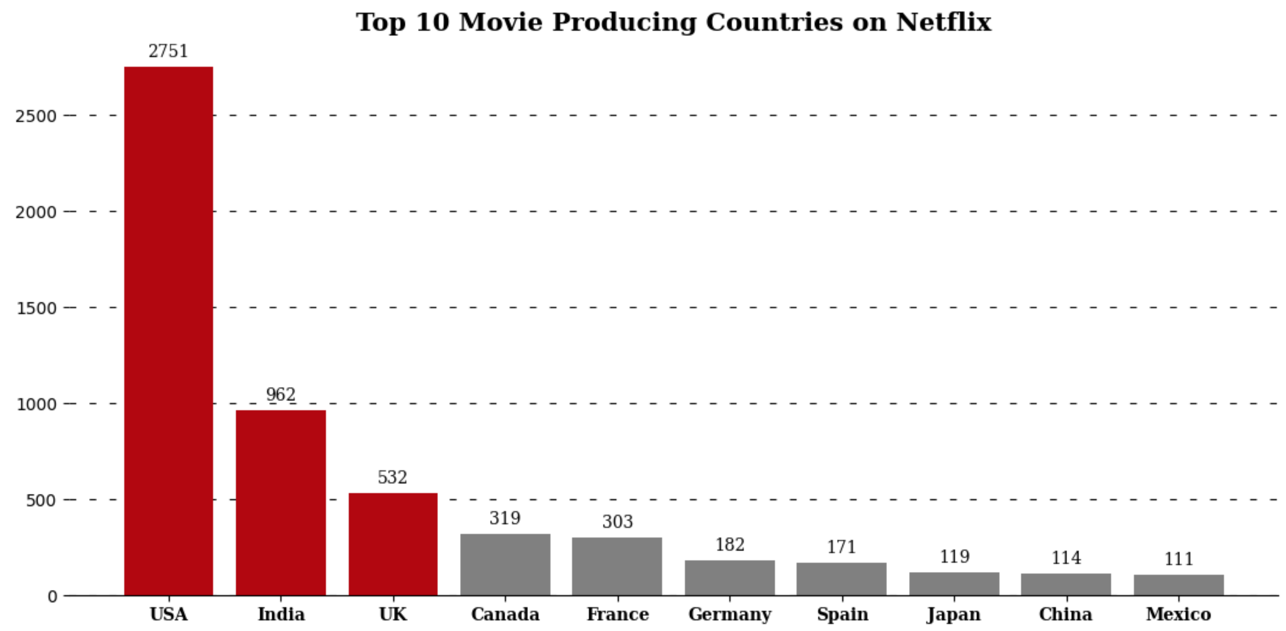
🔍 Insights

Significantly, 8 out of the top 10 Actors/Cast with the highest number of appearances on Netflix are of Indian origin.

```
#creating df for top 10 movies producing countries
df_movie = df1[df1['type'] == 'Movie']
df_movie = df_movie.groupby('country')['title'].nunique().sort_values(ascending = False).reset_index().loc[0:10]

#dropping unknown country column
df_movie = df_movie.drop(3)

#replacing country names in shortformat
df_movie['country'] = df_movie['country'].replace({'United States':'USA','United Kingdom':'UK','South Korea':'S korea'})
df_movie
```

	country	title
0	USA	2751
1	India	962
2	UK	532
4	Canada	319
5	France	303
6	Germany	182
7	Spain	171
8	Japan	119
9	China	114
10	Mexico	111

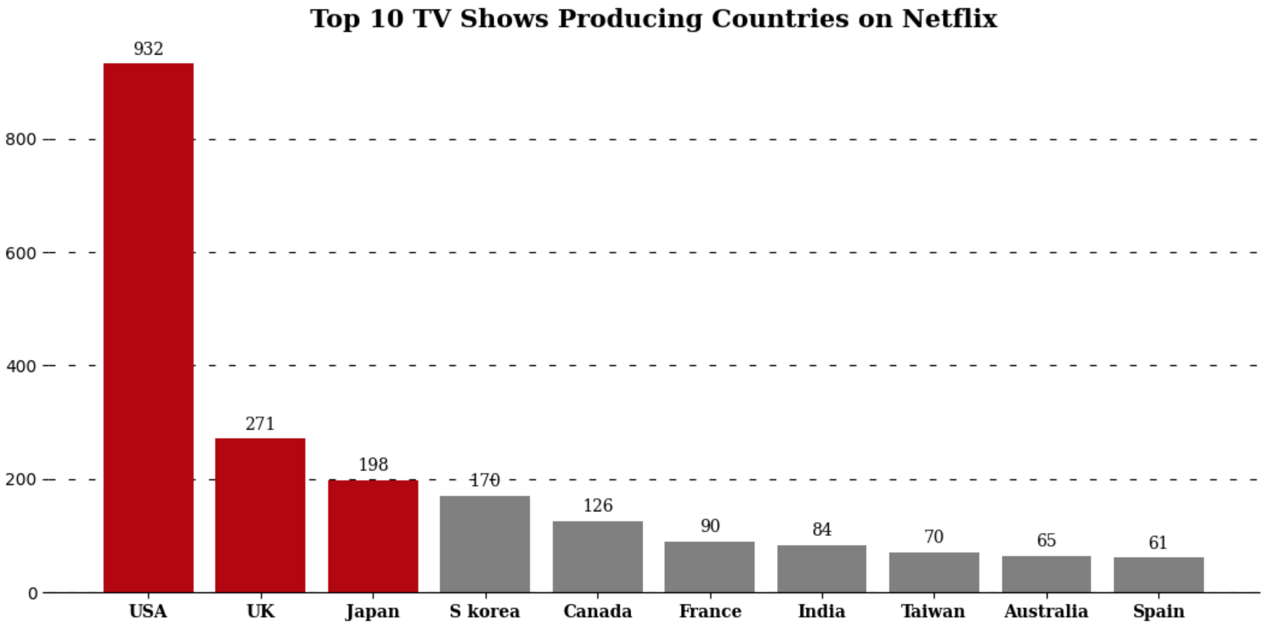
```
#setting the plot style
fig,ax = plt.subplots(figsize = (13,6))

color_map = ['grey' for i in range(10)]
color_map[0] = color_map[1] = color_map[2] =  '#b20710' # highlight color

#creating the plot
ax.bar(df_movie['country'],df_movie['title'],color = color_map,zorder = 2)

#adding valuecounts
for i in df_movie.index:
    ax.text(df_movie.loc[i,'country'],df_movie.loc[i,'title'] + 75, df_movie.loc[i,'title'],
           {'font':'serif', 'size':10},ha = 'center',va = 'center')

#setting grid style
ax.grid(color = 'black',linestyle = '--',axis = 'y',zorder = 0,dashes = (5,10))

#customizing the x-axis labels
ax.set_xticklabels(df_movie['country'],fontweight = 'bold',fontfamily='serif')

#removing the axis lines

for s in ['top','left','right']:
    ax.spines[s].set_visible(False)

#adding title to the visual
ax.set_title('Top 10 Movie Producing Countries on Netflix',
            {'font':'serif', 'size':15,'weight':'bold'})

plt.show()

```



```
#creating df for top 10 tv shows producing countries
df_tv = df1[df1['type'] == 'TV Show']
df_tv = df_tv.groupby('country')['title'].nunique().sort_values(ascending = False).reset_index().loc[0:10]

#dropping unknown country column
df_tv = df_tv.drop(1)

#replacing country names in shortformat
df_tv['country'] = df_tv['country'].replace({'United States':'USA','United Kingdom':'UK','South Korea':'S korea'})
df_tv
```

	country	title
0	USA	932
2	UK	271
3	Japan	198
4	S korea	170
5	Canada	126
6	France	90
7	India	84
8	Taiwan	70
9	Australia	65
10	Spain	61

```
#setting the plot style
fig,ax = plt.subplots(figsize = (13,6))

color_map = ['grey' for i in range(10)]
color_map[0] = color_map[1] = color_map[2] =  '#b20710' # highlight color

#creating the plot
ax.bar(df_tv['country'],df_tv['title'],color = color_map,zorder = 2)

#adding valuecounts
for i in df_tv.index:
    ax.text(df_tv.loc[i,'country'],df_tv.loc[i,'title'] + 25, df_tv.loc[i,'title'],
           {'font':'serif', 'size':10},ha = 'center',va = 'center')

#setting grid style
ax.grid(color = 'black',linestyle = '--',axis = 'y',zorder = 0,dashes = (5,10))

#customizing the x-axis labels
ax.set_xticklabels(df_tv['country'],fontweight = 'bold',fontfamily='serif')

#removing the axis lines

for s in ['top','left','right']:
    ax.spines[s].set_visible(False)

#adding title to the visual
ax.set_title('Top 10 TV Shows Producing Countries on Netflix',
            {'font':'serif', 'size':15,'weight':'bold'})

plt.show()
```



🔍 Insights

1. Content Investment Strategy

- Netflix heavily invests in content production in the USA, its home country, to attract and retain subscribers. India, being the second on the list, signifies Netflix's strategic focus on the Indian market due to its significant population and growing demand for streaming services.

2. Global Expansion

- The presence of shows from various countries, such as UK, Canada, France, Japan,etc. highlights Netflix's effort to cater to a diverse global audience.This also enables Netflix to provide content that resonates with the cultural and linguistic preferences of different regions.

3. TV Shows Vs Movies

- Indian's prefer to watch movies over TV shows, on contrary South koreans perfer Tv shows over movies.

🎥 🆚 📺 Content Split

Content split for Top 10 Countries which have produced the most Movies and most TV Shows on Netflix.

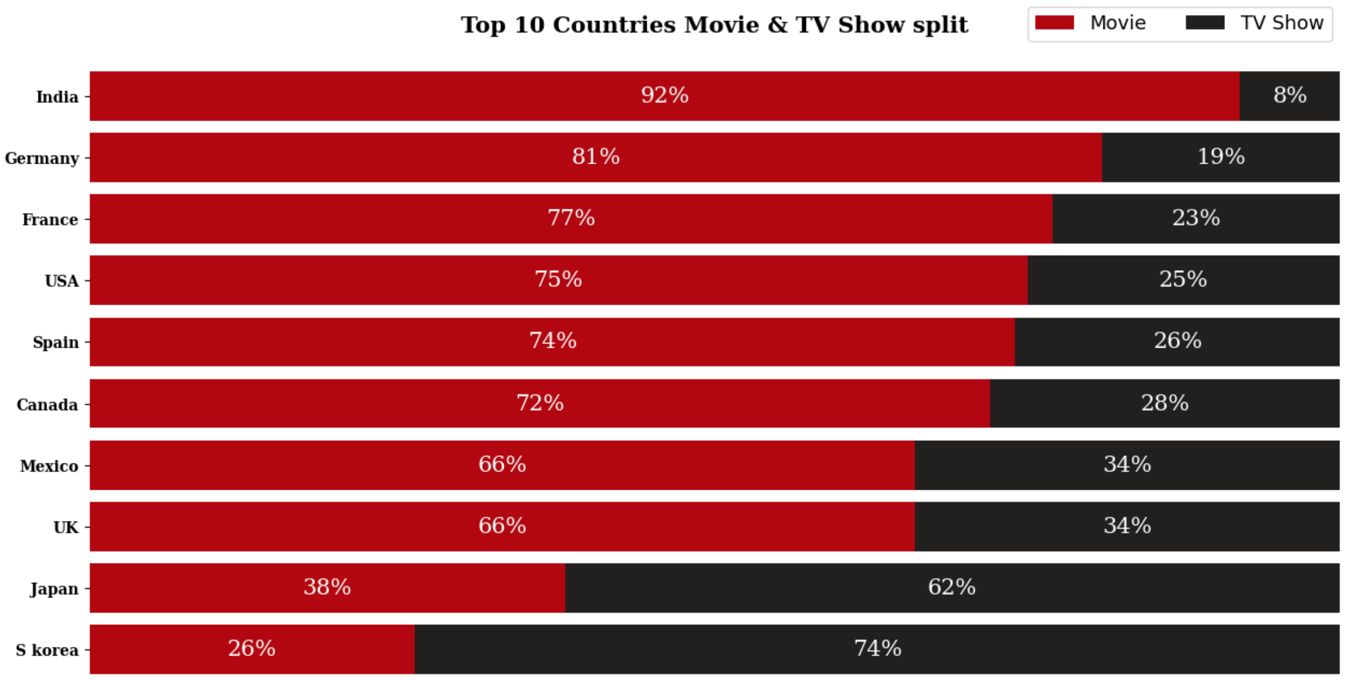
```
#creating a df for top 10 countries based on overall content count
c_cnt = df1.groupby('country')['title'].nunique().sort_values(ascending  = False).reset_index().loc[0:10]

c_cnt = c_cnt.drop(2) #dropping unknown country column

#renaming the countries
c_cnt['country'] = c_cnt['country'].replace({'United States':'USA','United Kingdom':'UK','South Korea':'S korea'})
c_cnt
```

	country	title
0	USA	3683
1	India	1046
3	UK	803
4	Canada	445
5	France	393
6	Japan	317
7	Spain	232
8	S korea	231
9	Germany	226
10	Mexico	169

```
#creating a df to calculate split between tv-show and movies
df_merge = pd.merge(c_cnt,df_movie, on = 'country', how = 'left')
df_merge = pd.merge(df_merge,df_tv, on = 'country',how = 'left')

#renaming the columns
df_merge.rename(columns = {'title_x':'Total_Count','title_y':'Movie_Count','title':'TV_Show_Count'},inplace = True)

#filling the uncaptured information
df_merge['Movie_Count'].fillna(df_merge['Total_Count']-df_merge['TV_Show_Count'],inplace = True)
df_merge['TV_Show_Count'].fillna(df_merge['Total_Count']-df_merge['Movie_Count'],inplace = True)

#calculating the %split between movies and tv-shows
df_merge['Movie%'] = round((df_merge['Movie_Count']/df_merge['Total_Count'])*100)
df_merge['TV%'] = round((df_merge['TV_Show_Count']/df_merge['Total_Count'])*100)

#changing the data-type of columns to int
for i in df_merge.columns[1:]:
    df_merge[i] = df_merge[i].astype('int')

#sorting the df
df_merge = df_merge.sort_values(by= 'Movie%')
df_merge
```

	country	Total_Count	Movie_Count	TV_Show_Count	Movie%	TV%
7	S korea	231	61	170	26	74
5	Japan	317	119	198	38	62
2	UK	803	532	271	66	34

```
#setting the plot style
fig,ax = plt.subplots(figsize = (15,8))

#plotting the visual
ax.barh(df_merge['country'],width = df_merge['Movie%'],color = '#b20710')
ax.barh(df_merge['country'],width = df_merge['TV%'],left = df_merge['Movie%'],color ='#221f1f')
ax.set(xlim=(0,100))

#customizing ticks
ax.set_xticks([])
ax.set_yticklabels(df_merge['country'],fontweight = 'bold',fontfamily='serif')

#adding % values in the bars

for i in df_merge.index:
    ax.text((df_merge.loc[i,'Movie%'])/2,df_merge.loc[i,'country'],f"{df_merge.loc[i,'Movie%']}%",
            va = 'center', ha='center',fontsize=15, fontweight='light', fontfamily='serif',color='white')

    ax.text((df_merge.loc[i,'Movie%'] + (df_merge.loc[i,'TV%']/2)),df_merge.loc[i,'country'],f"{df_merge.loc[i,'TV%']}%",
            va = 'center', ha='center',fontsize=15, fontweight='light', fontfamily='serif',color='white')

#removing the axis lines

for s in ['top','left','right','bottom']:
    ax.spines[s].set_visible(False)

#adding title to the visual
ax.set_title('Top 10 Countries Movie & TV Show split',
            {'font':'serif', 'size':15,'weight':'bold'})

#adding legend
ax.legend(['Movie','TV Show'],loc = (0.75,1),ncol = 2,fontsize = 13)

plt.show()
```



🔍 Insights

Content Preferences

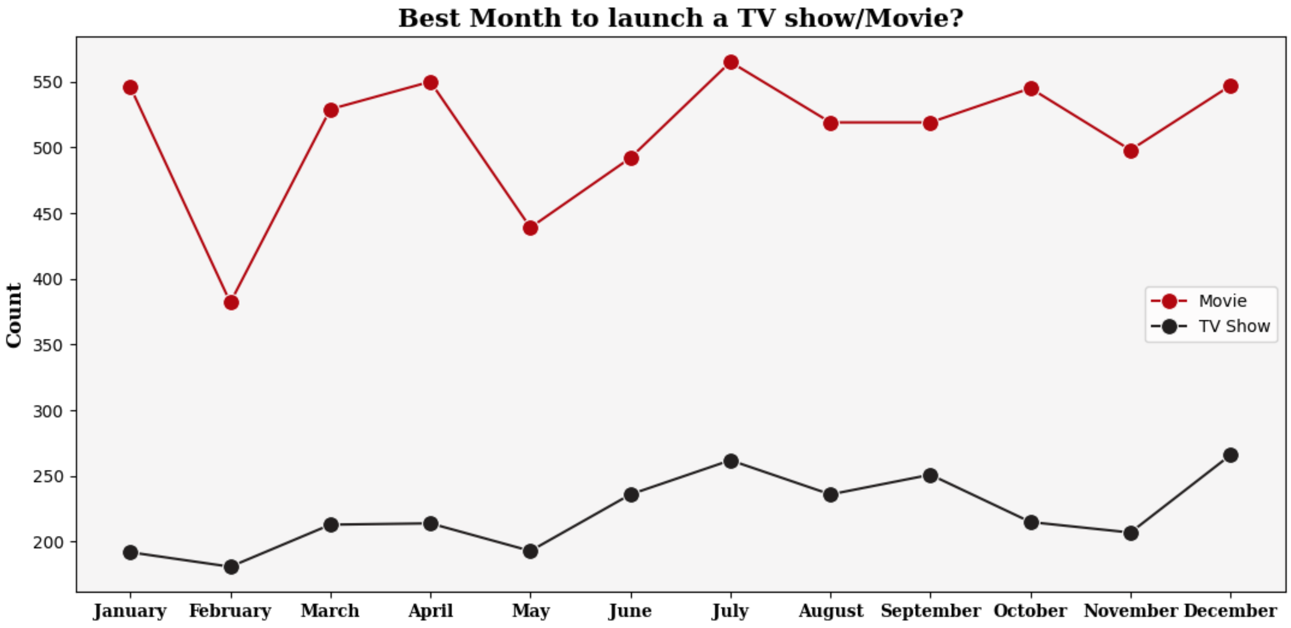
- TV shows are more popular than movies in Asian countries, especially South Korea and Japan, where they account for more than 60% of the content.
- Movies are more popular than TV shows in European countries,where they account for more than 65% of the content.
- India has the highest percentage of movies (92%) among all the countries, which may indicate a high demand for movies.
- North American countries have similar movie percentages (around 70%) and similar TV show percentages (around 30%) as each other,suggesting a similar preference or taste among these markets.

📅 Best Month to launch a TV show/Movie?

```
month = df.groupby('month_added')['type'].value_counts()
month.name = 'count' # to avoid error while doing reset_index
month = month.reset_index()

#converting month_added to categorical type to help in future sorting steps
months = ['January', 'February', 'March', 'April', 'May', 'June', 'July', 'August', 'September', 'October', 'November', 'December']
month['month_added'] = pd.Categorical(month['month_added'], categories=months, ordered=True)

month.head()
```

```
   month_added     type  count
0        April    Movie    550
1        April  TV Show    214
2       August    Movie    519
3       August  TV Show    236
4     December    Movie    547
```

```
# creating two different tables for movies and tv shows
month_movie = month.loc[month['type'] == 'Movie'].sort_values(by = 'month_added')
month_tv = month.loc[month['type'] == 'TV Show'].sort_values(by = 'month_added')

#setting the plot style
fig,ax = plt.subplots(figsize = (13,6))
ax.set_facecolor('#f6f5f5')

#creating the plot
sns.lineplot(data = month_movie, x = 'month_added', y = 'count',marker = 'o',markersize = 10,color ='#b20710',
             label = 'Movie',ax = ax)
sns.lineplot(data = month_tv, x = 'month_added', y = 'count',marker = 'o',markersize = 10,color ='#221f1f',
             label = 'TV Show', ax = ax)

#customizing the axis ticks
ax.set_xticklabels(month_movie['month_added'],fontweight = 'bold',fontfamily='serif')

#customizing axis label
plt.xlabel(None)
plt.ylabel('Count',fontweight = 'bold',fontfamily='serif',fontsize = 12)

#customizing legend
plt.legend(loc = 'center right')

#creating the title
ax.set_title('Best Month to launch a TV show/Movie?',
            {'font':'serif', 'size':15,'weight':'bold'})

plt.show()
```



🔍 Insights

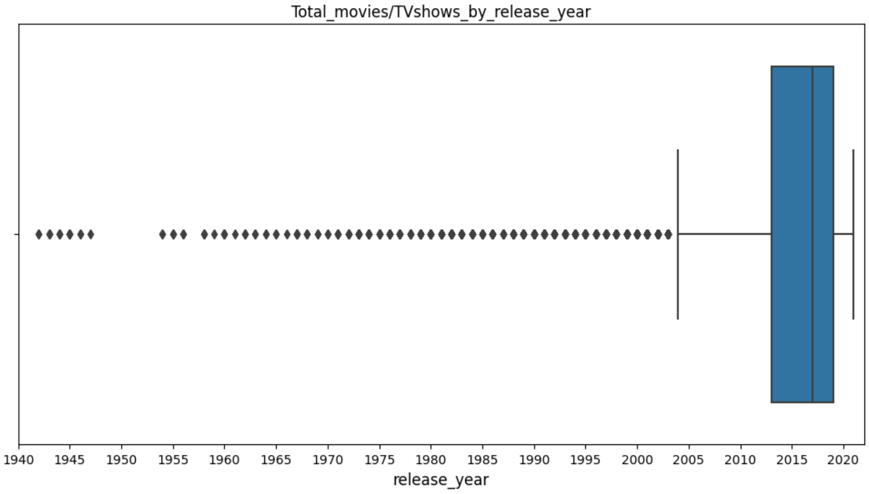
1. Consistent Patterns The monthly upload count of both Movies and TV shows exhibits a remarkably similar trend.

2. Seasonal Fluctuations

- There is a notable correlation between content uploads and holiday seasons, with January and December witnessing significant spikes in content additions.
- The months of July, August, October, and December record higher content upload counts, whereas February, May, and November experience comparatively lower counts.
- They may choose to focus on certain months or seasons to release high content and schedule fewer releases based on information about historical viewer preferences and behavior.

Total content distribution by release year of the content

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



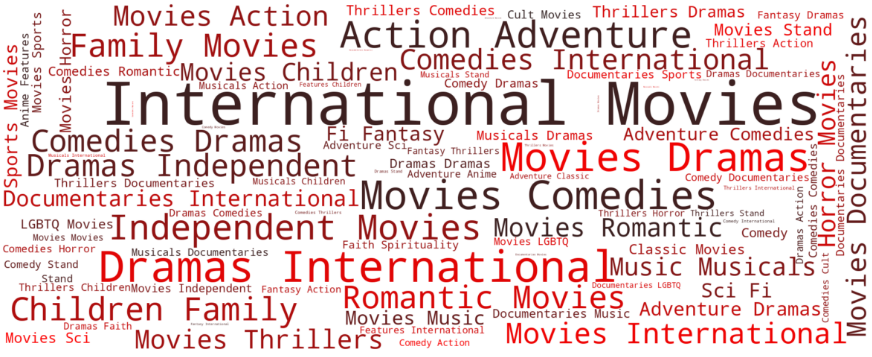
Insights

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

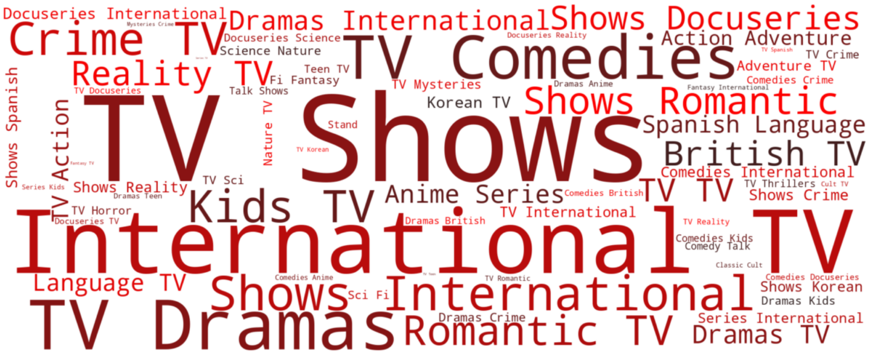
Genre Galore

Analysis of different genre's for Movies and TV Shows present on Netflix.

```
movie_genre = df[df['type'] == 'Movie']

text = str(list(movie_genre['listed_in'])).replace(',','').replace("'",'').replace('"','').replace('[','').replace(']','')

color = sns.color_palette("dark:red", as_cmap=True)

wordcld = WordCloud(max_words = 150, width = 2000,  height = 800,background_color = 'white',colormap = color).generate(text)

plt.figure(figsize=(15, 7))
plt.imshow(wordcld,interpolation = 'bilinear')
plt.axis('off')
plt.show()
```



```
tv_genre = df[df['type'] == 'TV Show']

text = str(list(tv_genre['listed_in'])).replace(',','').replace("'",'').replace('"','').replace('[','').replace(']','')

color = sns.color_palette("dark:red", as_cmap=True)

wordcld = WordCloud(max_words = 150, width = 2000,  height = 800,background_color = 'white',colormap = color).generate(text)

plt.figure(figsize=(15, 7))
plt.imshow(wordcld,interpolation = 'bilinear')
plt.axis('off')
plt.show()
```



🔍 Insights

- Popular Movie genres on Netflix include **International Movies, Comedies, Dramas, Action, and Romantic films.**
- Among TV Shows on Netflix, popular genres encompass **Drama, Crime, Romance, Kids' content, Comedies, and International series.**

🔍 Insights based on Non-Graphical and Visual Analysis

- Around 70% content on Netflix is Movies and around 30% content is TV shows.
- The movies and TV shows uploading on the Netflix started from the year 2008, It had very lesser content till 2014.
- Year 2015 marks the drastic surge in the content getting uploaded on Netflix. It continues the uptrend since then and 2019 marks the highest number of movies and TV shows added on the Netflix. Year 2020 and 2021 has seen the drop in content added on Netflix, possibly because of Pandemic. But still , TV shows content have not dropped as drastic as movies.
- Since 2018, A drop in the movies is seen , but rise in TV shows is observed clearly. Being in continuous uptrend , TV shows surpassed the movies count in mid 2020. It shows the rise in popularity of tv shows in recent years.
- Netflix has movies from variety of directors. Around 4993 directors have their movies or tv shows on Netflix
- Netflix has movies from total 122 countries, United States being the highset contributor with almost 37% of all the content.
- The release year for shows is concentrated in the range 2005-2021.
- 50 mins - 150 mins is the range of movie durations, excluding potential outliers.
- 1-3 seasons is the range for TV shows seasons, excluding potential outliers.

- various ratings of content is avaialble on netfilx, for the various viewers categories like kids, adults , families. Highest number of movies and TV shows are rated TV-MA (for mature audiences).
- Content in most of the ratings is available in lesser quanitity except in US. Ratings like TV-Y7 , TV-Y7 FV , PG ,TV-G , G , TV-Y , TV-PG are very less avaialble in all countries except US
- International Movies and TV Shows , Dramas , and Comedies are the top 3 genres on Netflix for both Movies and TV shows.
- Mostly country specific popular genres are observed in each country. Only United States have a good mix of almost all genres. Eg. Korean TV shows (Korea), British TV Shows (UK), Anime features and Anime series (Japan) and so on.
- Indian Actors have been acted in maximum movies on netflix. Top 5 actors are in India based on quantity of movies.
- Shorter duration movies have been popular in last 10 years.

🔍 Business Insights

- Netflix have majority of content which is released after the year 2000. It is observed that the content older than year 2000 is very scarce on Netflix. Senior Citizen could be the target audience for such content, which is almost missing currently.
- Maximum content (more than 80%) is

  > TV-MA - Content intended for mature audiences aged 17 and above

```
> TV-14 - Content suitable for viewers aged 14 and above.

> TV-PG - Parental guidance suggested (similar ratings - PG-13 , PG)

> R - Restricted Content, that may not be suitable for viewers under age 17.
```

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

- 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.
- Maximum content of Netflix which is around 75% , is coming from the top 10 countries. Rest of the world only contributes 25% of the content. More countries can be focussed in future to grow the business.
- Liking towards the shorter duration content is on the rise. (duration 75 to 150 minutes and seasons 1 to 3) This can be considered while production of new content on Netflix -- drop in content is seen across all the countries and type of content in year 2020 and 2021, possibly because of Pandemic.

Recommendations

- Very limited genres are focussed in most of the countries except US. It seems the current available genres suits best for US and few countries but maximum countries need some more genres which are highly popular in the region. eg. Indian Mythological content is highly popular. We can create such more country specific genres and It might also be liked acorss the world just like Japanese Anime.
- Country specific insights - The content need to be targetting the demographic of any country. Netflix can produce higher number of content in the perticular rating as per demographic of the country.
- 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.