Analysis on Netflix Movies & TV Shows

Netflix is a popular service that people across the world use for entertainment. In this EDA, I will explore the netflix-shows dataset through visualizations and graphs using matplotlib and seaborn.

Package Install and Import

First, we will install and import necessary packages.

```
!pip install jovian --upgrade --quiet
```

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

```
# jovian.commit(files=['../input/netflix-shows/netflix_titles.csv'], project='netflix-m
```

Loading the Dataset

Now we are ready to load the dataset. We will do this using the standard read_csv command from Pandas. Let's take a glimpse at how the data looks like.

```
netflix_titles_df = pd.read_csv('../input/netflix-shows/netflix_titles.csv')
netflix_titles_df.head()
```

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	lis
0	81145628	Movie	Norm of the North: King Sized Adventure	Richard Finn, Tim Maltby	Alan Marriott, Andrew Toth, Brian Dobson, Cole...	United States, India, South Korea, China	September 9, 2019	2019	TV-PG	90 min	Ch & F M Con
1	80117401	Movie	Jandino: Whatever it Takes	NaN	Jandino Asporaat	United Kingdom	September 9, 2016	2016	TV-MA	94 min	Sta Co
2	70234439	TV Show	Transformers Prime	NaN	Peter Cullen, Sumalee Montano, Frank Welker, J...	United States	September 8, 2018	2013	TV-Y7-FV	1 Season	Ki

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	lis
3	80058654	TV Show	Transformers: Robots in Disguise	NaN	Will Friedle, Darren Criss, Constance Zimmer, ...	United States	September 8, 2018	2016	TV-Y7	1 Season	Ki
4	80125979	Movie	#realityhigh	Fernando Lebrija	Nesta Cooper, Kate Walsh, John Michael Higgins...	United States	September 8, 2017	2017	TV-14	99 min	Con

After a quick glimpse at the dataset, it looks like a typical movies/shows dataset without user ratings. We can also see that there are NaN values in some columns.

Data Preparation and Cleaning

```
netflix_titles_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6234 entries, 0 to 6233
Data columns (total 12 columns):
 #   Column        Non-Null Count  Dtype 
---  ------        --------------  ----- 
 0   show_id       6234 non-null   int64 
 1   type          6234 non-null   object
 2   title         6234 non-null   object
 3   director      4265 non-null   object
 4   cast          5664 non-null   object
 5   country       5758 non-null   object
 6   date_added    6223 non-null   object
 7   release_year  6234 non-null   int64 
 8   rating        6224 non-null   object
 9   duration      6234 non-null   object
 10  listed_in     6234 non-null   object
 11  description   6234 non-null   object
dtypes: int64(2), object(10)
memory usage: 584.6+ KB
```

There are 6,234 entries and 12 columns to work with for EDA. Right off the bat, there are a few columns that contain null values ('director', 'cast', 'country', 'date_added', 'rating').

```
netflix_titles_df.nunique()
```

```
show_id         6234
type               2
title           6172
```

```
director        3301
cast            5469
country          554
date_added      1524
release_year      72
rating            14
duration         201
listed_in        461
description     6226
dtype: int64
```

Handling Null Values

We can see that for each of the columns, there are alot different unique values for some of them. It makes sense that show_id is large since it is a unique key used to identify a movie/show. Title, director, cast, country, date_added, listed_in, and description contain many unique values as well.

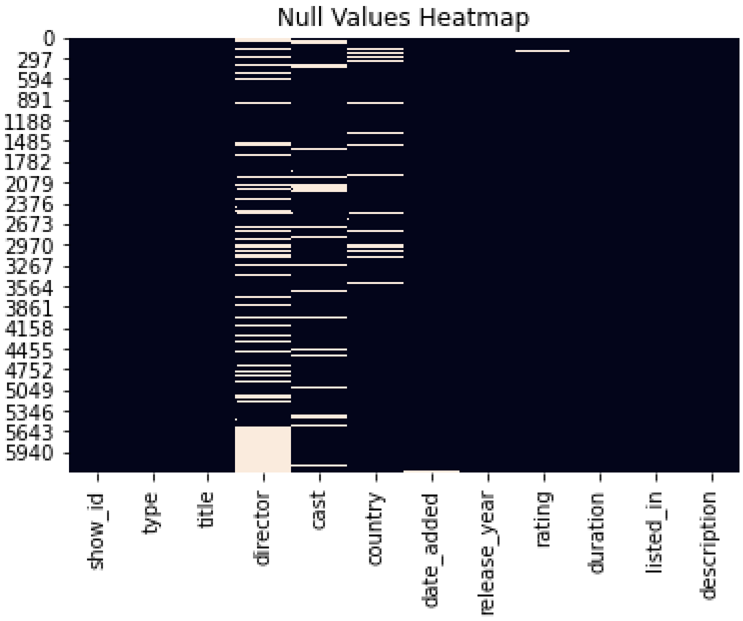
```
netflix_titles_df.isnull().values.any()
```

```
True
```

```
netflix_titles_df.isnull().sum().sum()
```

```
3036
```

```
sns.heatmap(netflix_titles_df.isnull(), cbar=False)
plt.title('Null Values Heatmap')
plt.show()
```



```
netflix_titles_df.isnull().sum()
```

```
show_id            0
type               0
title              0
```

```
director        1969
cast             570
country          476
date_added        11
release_year       0
rating            10
duration           0
listed_in          0
description        0
dtype: int64
```

Above in the heatmap and table, we can see that there are quite a few null values in the dataset. There are a total of 3,036 null values across the entire dataset with 1,969 missing points under 'director', 570 under 'cast', 476 under 'country', 11 under 'date_added', and 10 under 'rating'. We will have to handle all null data points before we can dive into EDA and modeling.

```
netflix_titles_df['director'].fillna('No Director', inplace=True)
netflix_titles_df['cast'].fillna('No Cast', inplace=True)
netflix_titles_df['country'].fillna('Country Unavailable', inplace=True)
netflix_titles_df.dropna(subset=['date_added','rating'],inplace=True)
```

```
netflix_titles_df.isnull().any()
```

```
show_id         False
type            False
title           False
director        False
cast            False
country         False
date_added      False
release_year    False
rating          False
duration        False
listed_in       False
description     False
dtype: bool
```

For null values, the easiest way to get rid of them would be to delete the rows with the missing data. However, this wouldn't be beneficial to our EDA since there is loss of information. Since 'director', 'cast', and 'country' contain the majority of null values, I will choose to treat each missing value as unavailable. The other two labels 'date_added' and 'rating' contains an insignificant portion of the data so I will drop them from the dataset. After, we can see that there are no more null values in the dataset.

Splitting the Dataset

Since the dataset can either contain movies or shows, it'd be nice to have datasets for both so we can take a deep dive into just Netflix movies or Netflix TV shows so we will create two new datasets. One for movies and the other one for shows.

```
netflix_movies_df = netflix_titles_df[netflix_titles_df['type']=='Movie'].copy()
netflix_movies_df.head()
```

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	l
0	81145628	Movie	Norm of the North: King Sized Adventure	Richard Finn, Tim Maltby	Alan Marriott, Andrew Toth, Brian Dobson, Cole...	United States, India, South Korea, China	September 9, 2019	2019	TV-PG	90 min	Ch Cc
1	80117401	Movie	Jandino: Whatever it Takes	No Director	Jandino Asporaat	United Kingdom	September 9, 2016	2016	TV-MA	94 min	S (
4	80125979	Movie	#realityhigh	Fernando Lebrija	Nesta Cooper, Kate Walsh, John Michael Higgins...	United States	September 8, 2017	2017	TV-14	99 min	Cc
6	70304989	Movie	Automata	Gabe Ibáñez	Antonio Banderas, Dylan McDermott, Melanie Gri...	Bulgaria, United States, Spain, Canada	September 8, 2017	2014	R	110 min	Interr Mov Fi & F
7	80164077	Movie	Fabrizio Copano: Solo pienso en mi	Rodrigo Toro, Francisco Schultz	Fabrizio Copano	Chile	September 8, 2017	2017	TV-MA	60 min	S (

```
netflix_shows_df = netflix_titles_df[netflix_titles_df['type']=='TV Show'].copy()
netflix_shows_df.head()
```

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration
2	70234439	TV Show	Transformers Prime	No Director	Peter Cullen, Sumalee Montano, Frank Welker, J...	United States	September 8, 2018	2013	TV-Y7-FV	1 Season
3	80058654	TV Show	Transformers: Robots in Disguise	No Director	Will Friedle, Darren Criss, Constance Zimmer, ...	United States	September 8, 2018	2016	TV-Y7	1 Season
5	80163890	TV Show	Apaches	No Director	Alberto Ammann, Eloy Azorín, Verónica Echegui,...	Spain	September 8, 2017	2016	TV-MA	1 Season

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration
8	80117902	TV Show	Fire Chasers	No Director	No Cast	United States	September 8, 2017	2017	TV-MA	1 Season
26	80244601	TV Show	Castle of Stars	No Director	Chaiyapol Pupart, Jintanutda Lummakanon, Worra...	Country Unavailable	September 7, 2018	2015	TV-14	1 Season

Data Preparation

In the duration column, there appears to be a discrepancy between movies and shows. Movies are based on the duration of the movie and shows are based on the number of seasons. To make EDA easier, I will convert the values in these columns into integers for both the movies and shows datasets.

```
netflix_movies_df.duration = netflix_movies_df.duration.str.replace(' min','').astype(i
netflix_shows_df.rename(columns={'duration':'seasons'}, inplace=True)
netflix_shows_df.replace({'seasons':{'1 Season':'1 Seasons'}}, inplace=True)
netflix_shows_df.seasons = netflix_shows_df.seasons.str.replace(' Seasons','').astype(i
```

Exploratory Analysis and Visualization

First we will begin analysis on the entire Netflix dataset consisting of both movies and shows. Revisiting the data, let us see how it looked like again.

```
netflix_titles_df.head()
```

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	lis
0	81145628	Movie	Norm of the North: King Sized Adventure	Richard Finn, Tim Maltby	Alan Marriott, Andrew Toth, Brian Dobson, Cole...	United States, India, South Korea, China	September 9, 2019	2019	TV-PG	90 min	Ch & F M Con
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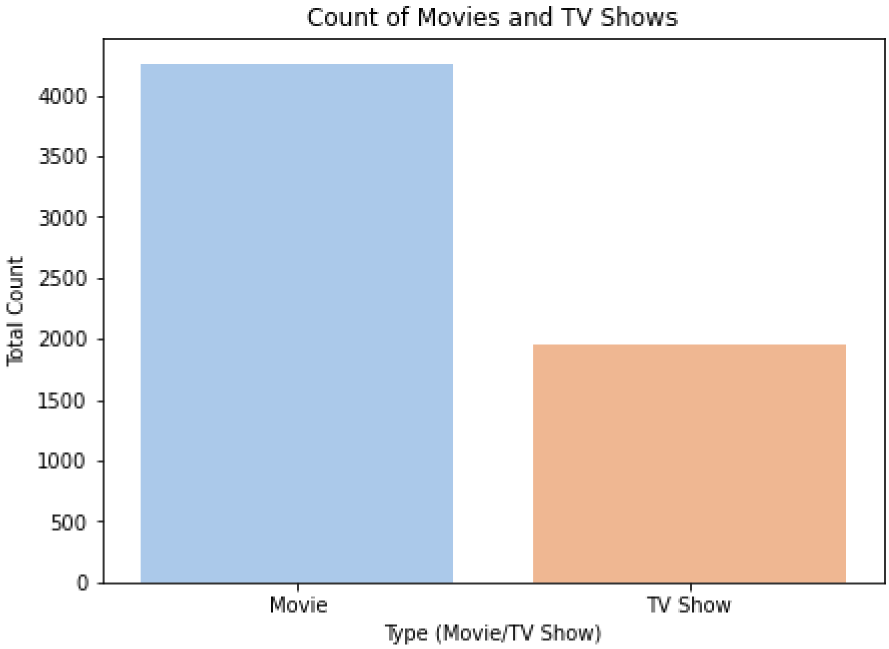
3	80058654	TV Show	Transformers: Robots in Disguise	No Director	Will Friedle, Darren Criss, Constance Zimmer, ...	United States	September 8, 2018	2016	TV-Y7	1 Season	Ki

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	lis
4	80125979	Movie	#realityhigh	Fernando Lebrija	Nesta Cooper, Kate Walsh, John Michael Higgins...	United States	September 8, 2017	2017	TV-14	99 min	Con

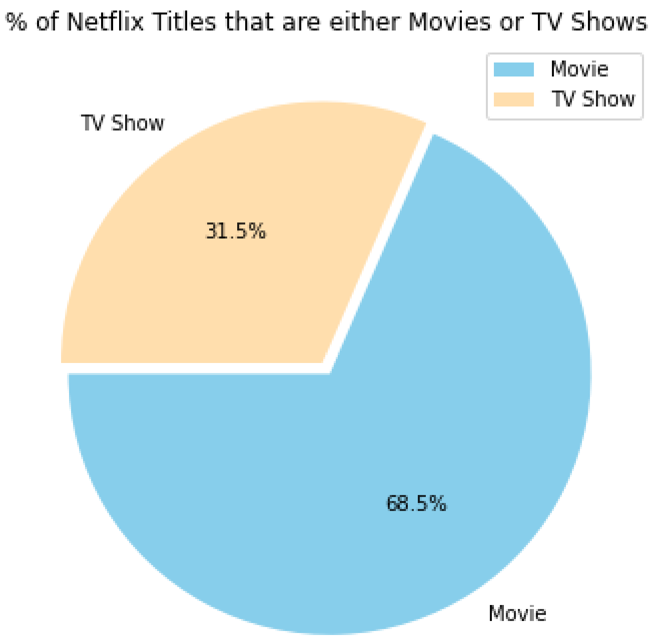
Netflix Film Types: Movie or TV Show

It'd be interesting to see the comparison between the total number of movies and shows in this dataset just to get an idea of which one is the majority.

```
plt.figure(figsize=(7,5))
g = sns.countplot(netflix_titles_df.type, palette="pastel");
plt.title("Count of Movies and TV Shows")
plt.xlabel("Type (Movie/TV Show)")
plt.ylabel("Total Count")
plt.show()
```



```
plt.figure(figsize=(12,6))
plt.title("% of Netflix Titles that are either Movies or TV Shows")
g = plt.pie(netflix_titles_df.type.value_counts(), explode=(0.025,0.025), labels=netfli
plt.legend()
plt.show()
```

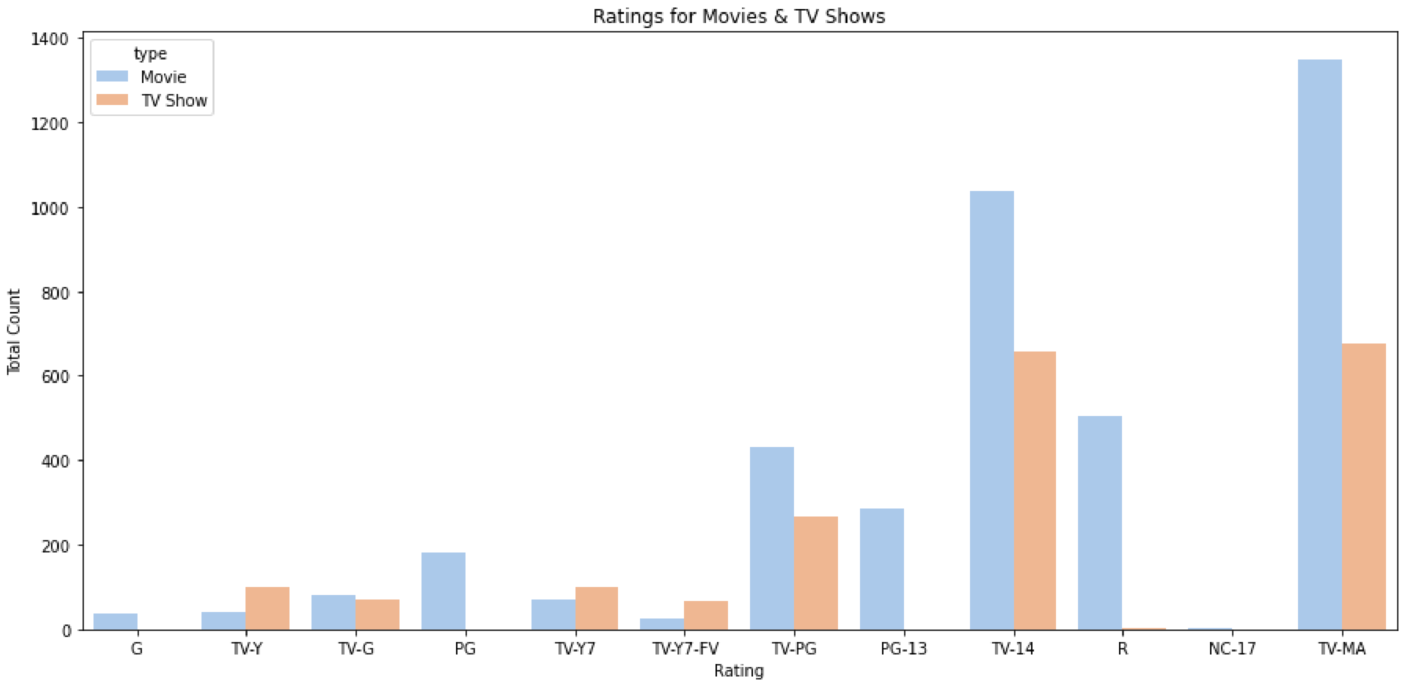


So there are roughly 4,000+ movies and almost 2,000 shows with movies being the majority. This makes sense since shows are always an ongoing thing and have episodes. If we were to do a headcount of TV show episodes vs. movies, I am sure that TV shows would come out as the majority. However, in terms of title, there are far more movie titles (68.5%) than TV show titles (31.5%).

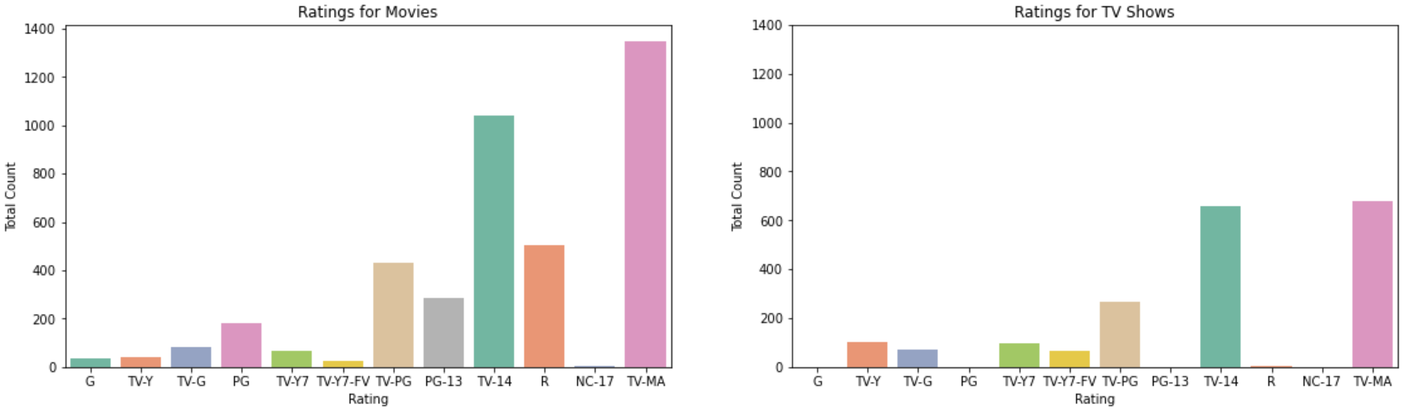
Netflix Film Ratings

Now, we will explore the ratings which are based on the film rating system. The ordering of the ratings will be based on the age of the respective audience from youngest to oldest. We will not include the ratings 'NR' and 'UR' in the visuals since they stand for unrated and non-rated content.

```
order =  ['G', 'TV-Y', 'TV-G', 'PG', 'TV-Y7', 'TV-Y7-FV', 'TV-PG', 'PG-13', 'TV-14', 'R
plt.figure(figsize=(15,7))
g = sns.countplot(netflix_titles_df.rating, hue=netflix_titles_df.type, order=order, pa
plt.title("Ratings for Movies & TV Shows")
plt.xlabel("Rating")
plt.ylabel("Total Count")
plt.show()
```



```
fig, ax = plt.subplots(1,2, figsize=(19, 5))
g1 = sns.countplot(netflix_movies_df.rating, order=order,palette="Set2", ax=ax[0]);
g1.set_title("Ratings for Movies")
g1.set_xlabel("Rating")
g1.set_ylabel("Total Count")
g2 = sns.countplot(netflix_shows_df.rating, order=order,palette="Set2", ax=ax[1]);
g2.set(yticks=np.arange(0,1600,200))
g2.set_title("Ratings for TV Shows")
g2.set_xlabel("Rating")
g2.set_ylabel("Total Count")
fig.show()
```



Overall, there is much more content for a more mature audience. For the mature audience, there is much more movie content than there are TV shows. However, for the younger audience (under the age of 17), it is the opposite, there are slightly more TV shows than there are movies.

```
netflix_titles_df['year_added'] = pd.DatetimeIndex(netflix_titles_df['date_added']).yea
netflix_movies_df['year_added'] = pd.DatetimeIndex(netflix_movies_df['date_added']).yea
netflix_shows_df['year_added'] = pd.DatetimeIndex(netflix_shows_df['date_added']).year
netflix_titles_df['month_added'] = pd.DatetimeIndex(netflix_titles_df['date_added']).mo
netflix_movies_df['month_added'] = pd.DatetimeIndex(netflix_movies_df['date_added']).mo
netflix_shows_df['month_added'] = pd.DatetimeIndex(netflix_shows_df['date_added']).mont
```

Content added each year

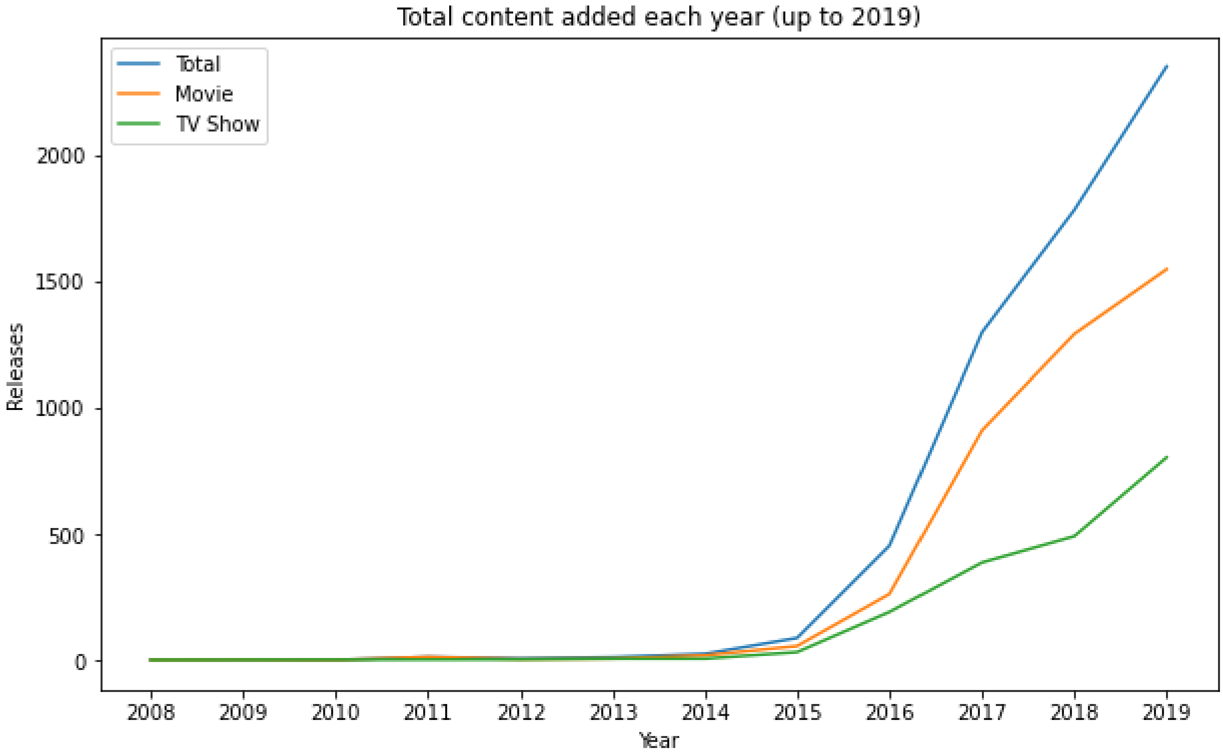
Now we will take a look at the amount content Netflix has added throughout the previous years. Since we are interested in when Netflix added the title onto their platform, we will add a 'year_added' column shows the year of the date from the 'date_added' column as shown above.

```
netflix_year = netflix_titles_df['year_added'].value_counts().to_frame().reset_index().
netflix_year = netflix_year[netflix_year.year != 2020]
netflix_year
```

	year	count
0	2019	2349
1	2018	1781
2	2017	1297
3	2016	453
5	2015	88
6	2014	25
7	2011	13
8	2013	12
9	2012	7
10	2009	2
11	2008	2
12	2010	1

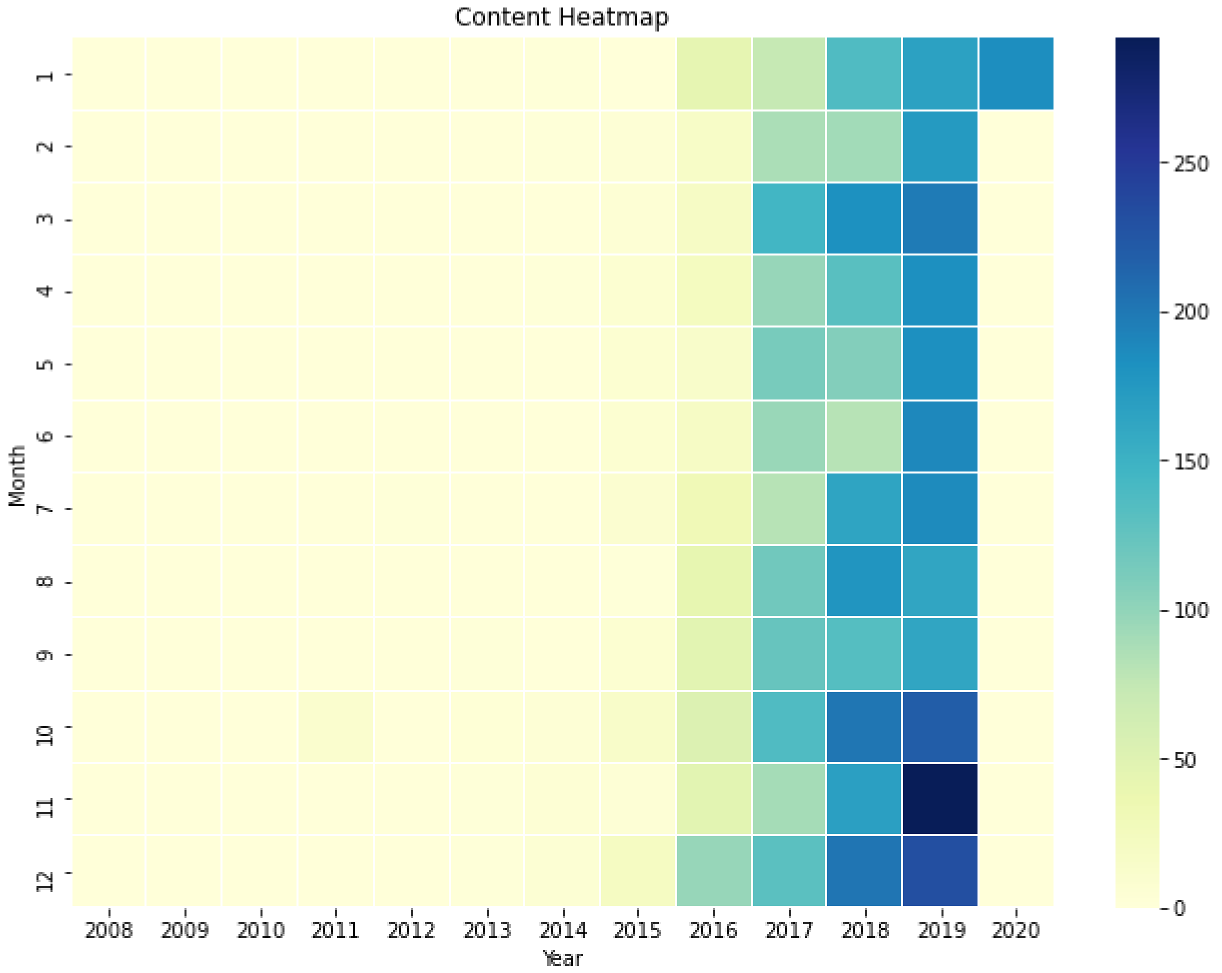
```
netflix_year2 = netflix_titles_df[['type','year_added']]
movie_year = netflix_year2[netflix_year2['type']=='Movie'].year_added.value_counts().to
movie_year = movie_year[movie_year.year != 2020]
show_year = netflix_year2[netflix_year2['type']=='TV Show'].year_added.value_counts().t
show_year = show_year[show_year.year != 2020]
```

```
fig, ax = plt.subplots(figsize=(10, 6))
sns.lineplot(data=netflix_year, x='year', y='count')
sns.lineplot(data=movie_year, x='year', y='count')
sns.lineplot(data=show_year, x='year', y='count')
ax.set_xticks(np.arange(2008, 2020, 1))
plt.title("Total content added each year (up to 2019)")
plt.legend(['Total','Movie','TV Show'])
plt.ylabel("Releases")
plt.xlabel("Year")
plt.show()
```



Based on the above timeline, we can see that the popular streaming platform started gaining traction after 2014. Since then, the amount of content added has been tremendous. I decided to exclude content added during 2020 since the data does not include a full years worth of data. We can see that there has been a consistent growth in the number of movies on Netflix compared to shows.

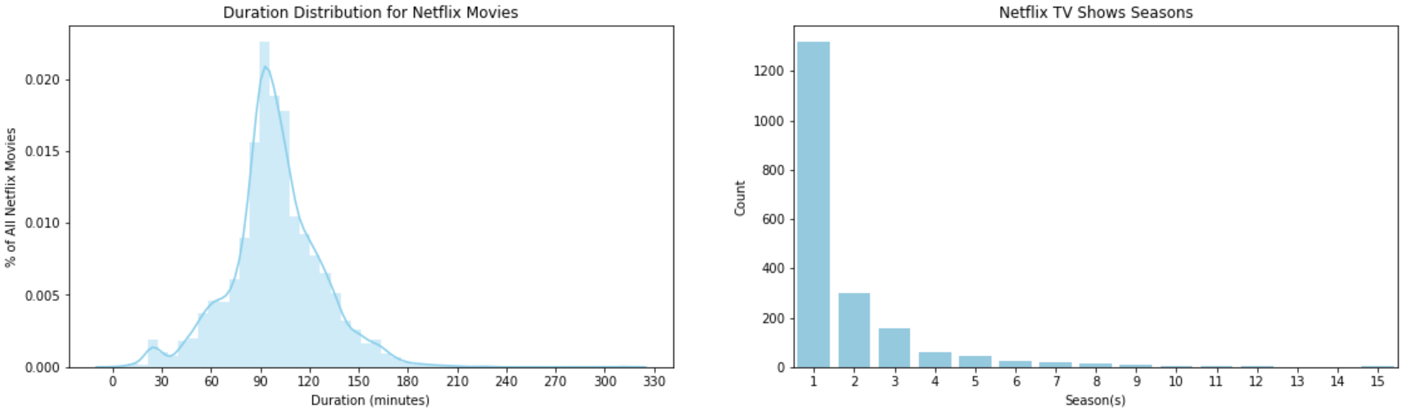
```
month_year_df = netflix_titles_df.groupby('year_added')['month_added'].value_counts().u

plt.figure(figsize=(11,8))
sns.heatmap(month_year_df, linewidths=0.025, cmap="YlGnBu")
plt.title("Content Heatmap")
plt.ylabel("Month")
plt.xlabel("Year")
plt.show()
```



In the above heatmap, we can see that around 2014 is when Netflix began to increase their content count. We can see over the years and months, Netflix continues to slowly increase the amount of content that is being added into their platform. We can see in 2020, the data stops at January since that is the latest month available in the dataset.

Netflix Film Duration

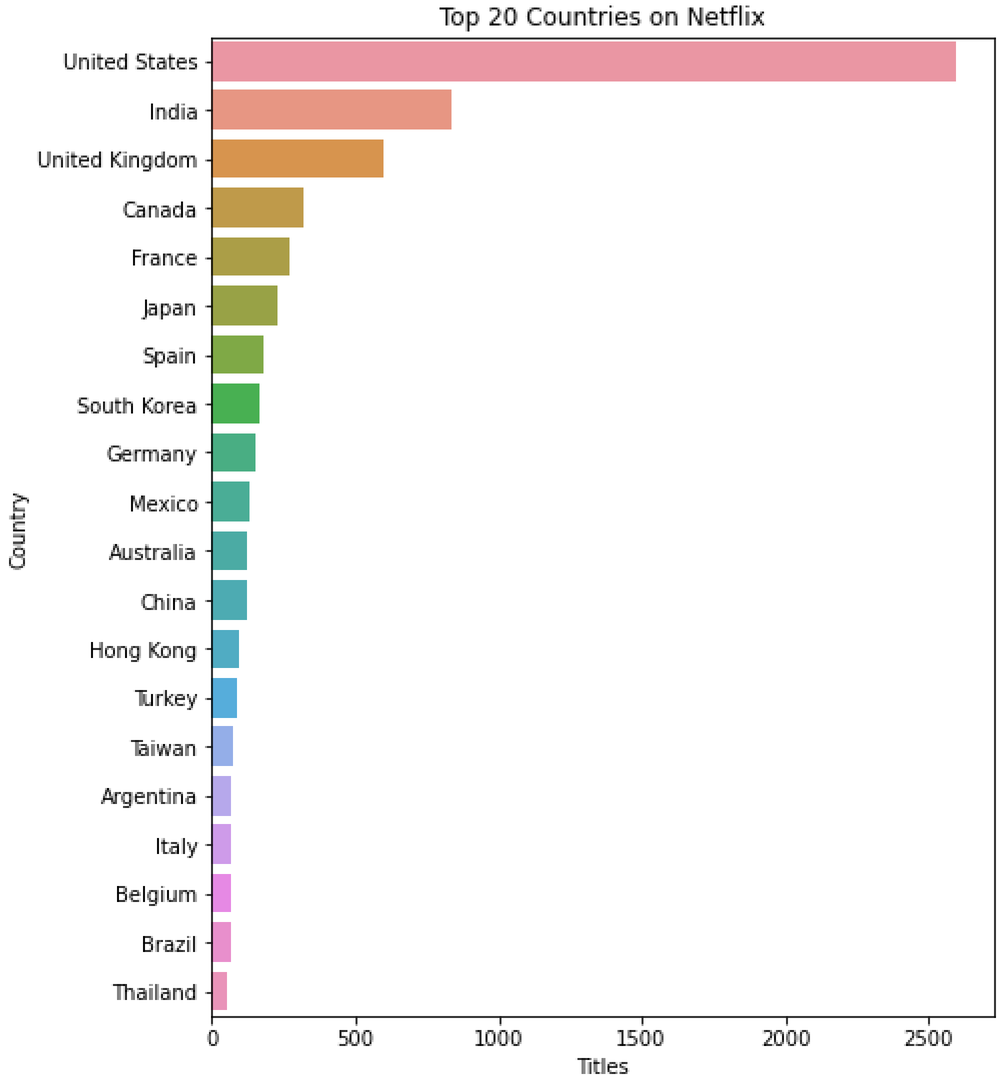
```
fig, ax = plt.subplots(1,2, figsize=(19, 5))
g1 = sns.distplot(netflix_movies_df.duration, color='skyblue',ax=ax[0]);
g1.set_xticks(np.arange(0,360,30))
g1.set_title("Duration Distribution for Netflix Movies")
g1.set_ylabel("% of All Netflix Movies")
g1.set_xlabel("Duration (minutes)")
g2 = sns.countplot(netflix_shows_df.seasons, color='skyblue',ax=ax[1]);
g2.set_title("Netflix TV Shows Seasons")
g2.set_ylabel("Count")
g2.set_xlabel("Season(s)")
fig.show()
```



Now we will look into the duration of Netflix films. Since movies are measured in time and shows are measured by seasons, we need to split the dataset between movies and TV shows. Above on the left, we can see that the duration for Netflix movies closely resembles a normal distribution with the average viewing time spanning about 90 minutes which seems to make sense. Netflix TV shows on the other hand seems to be heavily skewed to the right where the majority of shows only have 1 season.

Countries with the most content available

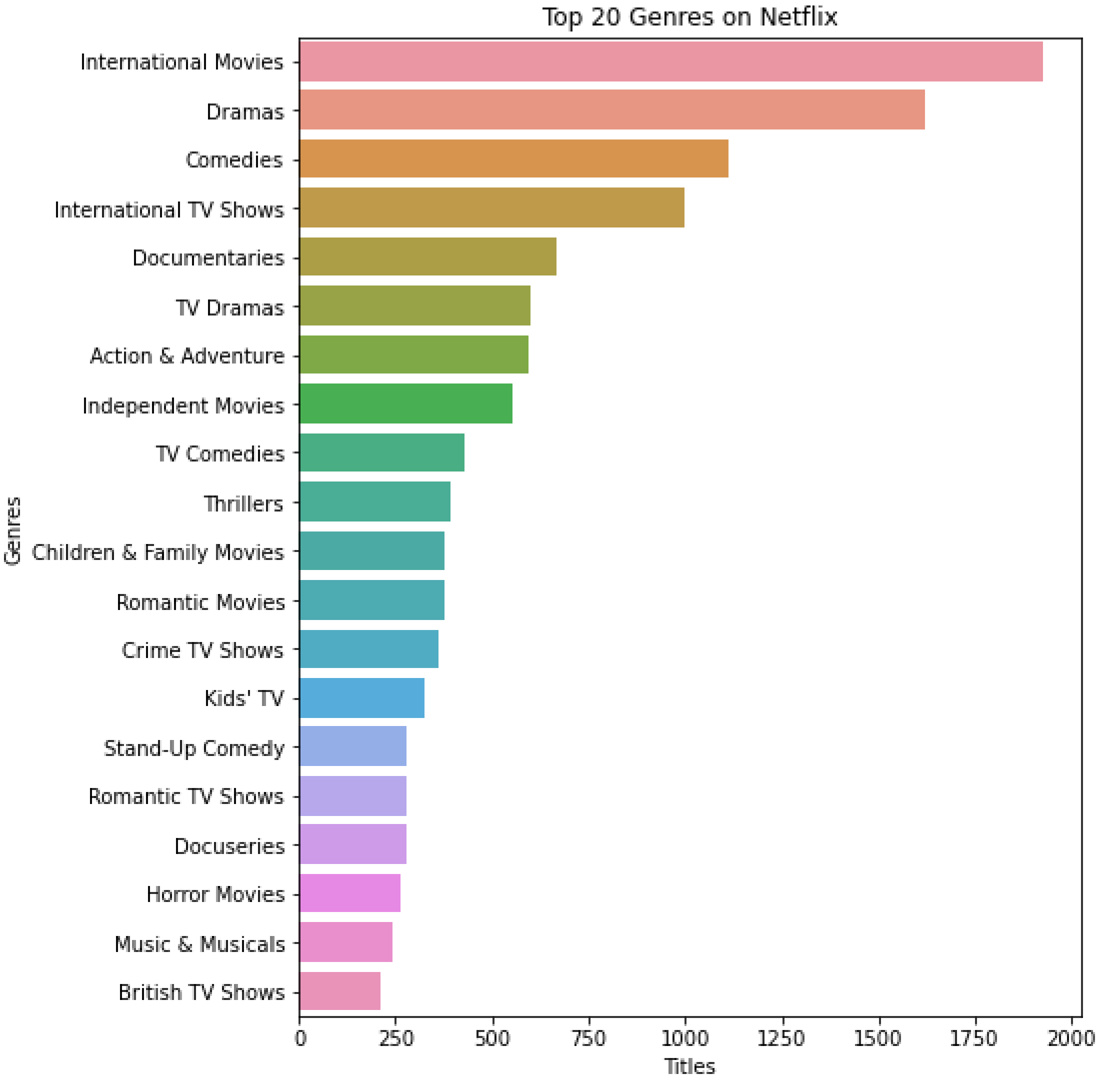
```
filtered_countries = netflix_titles_df.set_index('title').country.str.split(', ', expar
filtered_countries = filtered_countries[filtered_countries != 'Country Unavailable']

plt.figure(figsize=(7,9))
g = sns.countplot(y = filtered_countries, order=filtered_countries.value_counts().index
plt.title('Top 20 Countries on Netflix')
plt.xlabel('Titles')
plt.ylabel('Country')
plt.show()
```



Now we will explore the countries with the most content on Netflix. Films typically are available in multiple countries as shown in the original dataset. Therefore, we need to seperate all countries within a film before we can analyze the data. After seperating countries and removing titles with no countries available, we can plot a Top 20 list to see which countries have the highest availability of films on Netflix. Unsurprisingly, the United States stands out on top since Netflix is an American company. India surprisingly comes in second followed by the UK and Canada. China interestingly is not even close to the top even though it has about 18% of the world's population. Reasons for this could be for political reasons and the banning of certain applications which isn't uncommon between the United States and China.

Popular Genres

```
filtered_genres = netflix_titles_df.set_index('title').listed_in.str.split(', ', expanc

plt.figure(figsize=(7,9))
g = sns.countplot(y = filtered_genres, order=filtered_genres.value_counts().index[:20])
plt.title('Top 20 Genres on Netflix')
plt.xlabel('Titles')
plt.ylabel('Genres')
plt.show()
```



In terms of genres, international movies takes the cake surprisingly followed by dramas and comedies. Even though the United States has the most content available, it looks like Netflix has decided to release a ton of international movies. The reason for this could be that most Netflix subscribers aren't actually in the United States, but rather the majority of viewers are actually international subscribers.

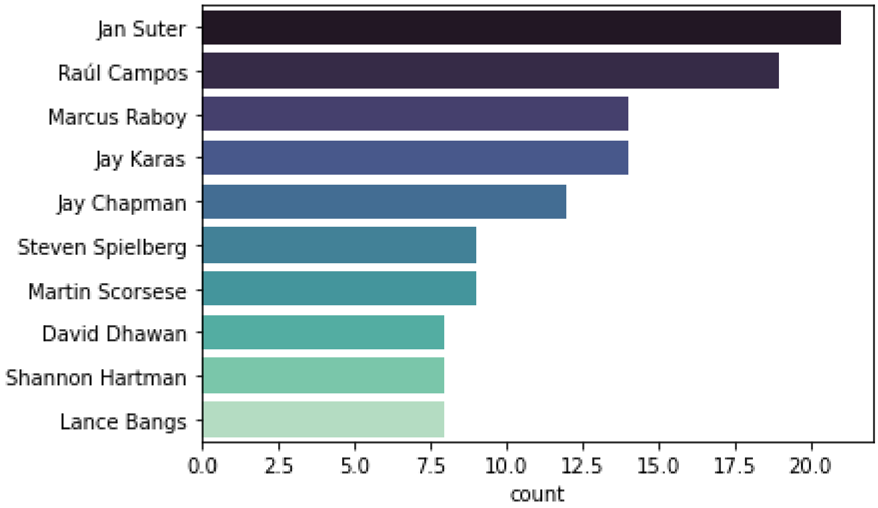
```
jovian.commit(project='netflix-movies-and-tv-shows-project')
```

```
[jovian] Attempting to save notebook..
[jovian] Detected Kaggle notebook...
[jovian] Please enter your API key ( from https://jovian.ml/ ):
API KEY: ········
[jovian] Uploading notebook to https://jovian.ml/allenkong221/netflix-movies-and-tv-
shows-project
```

Asking and Answering Questions

Who are the top 10 directors on Netflix with the most releases?

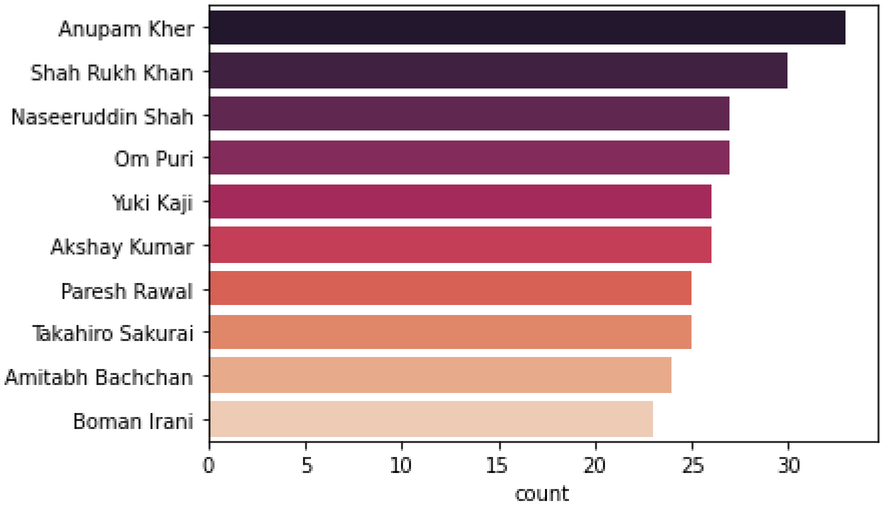
```
filtered_directors = netflix_titles_df[netflix_titles_df.director != 'No Director'].set
sns.countplot(y = filtered_directors, order=filtered_directors.value_counts().index[:10
plt.show()
```



As stated previously regarding the top genres, it's no surprise that the most popular directors on Netflix with the most titles are mainly international as well.

Who are the top 10 actors on Netflix based on number of titles?

```
filtered_cast = netflix_titles_df[netflix_titles_df.cast != 'No Cast'].set_index('title
sns.countplot(y = filtered_cast, order=filtered_cast.value_counts().index[:10], palette
plt.show()
```

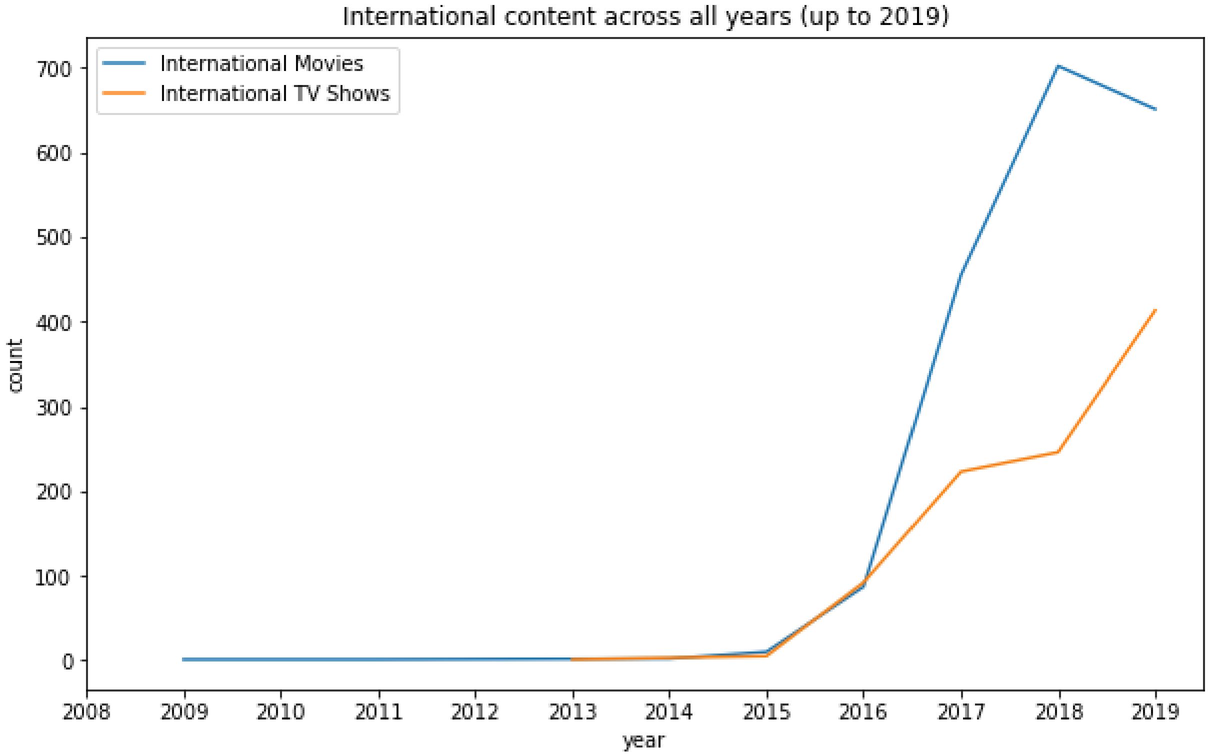


In this list, we can see that the most popular actors on Netflix based on the number of titles are all international as well. This reinforces the sentiment that the majority of Netflix subscribers are international.

How does the timeline look like for the addition of International Movies compared to International TV Shows?

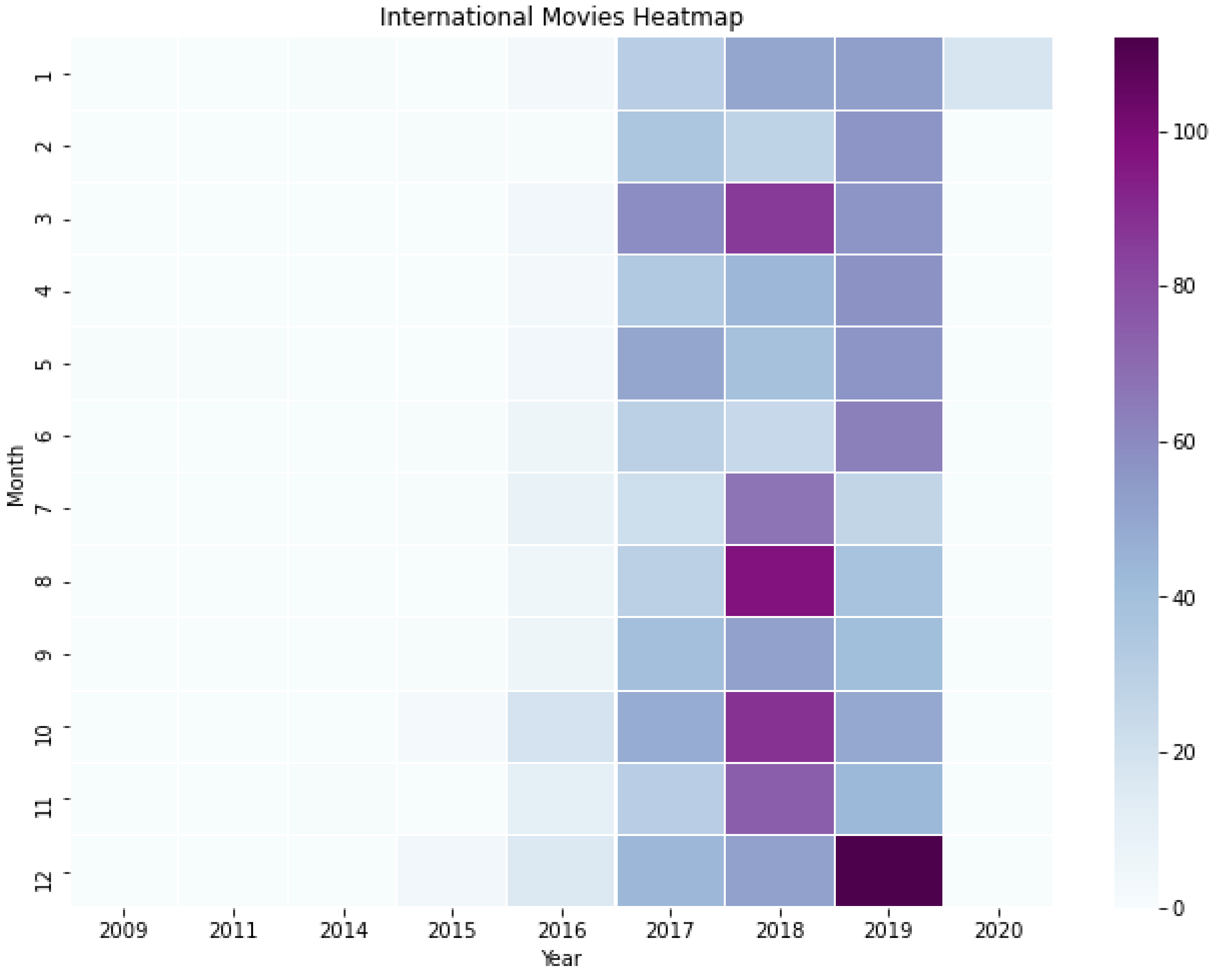
```
international_movies = netflix_titles_df[netflix_titles_df['listed_in'].str.contains('I
intmov_year = international_movies['year_added'].value_counts().to_frame().reset_index(
intmov_year = intmov_year[intmov_year.year != 2020]

international_shows = netflix_titles_df[netflix_titles_df['listed_in'].str.contains('In
intshow_year = international_shows['year_added'].value_counts().to_frame().reset_index(
intshow_year = intshow_year[intshow_year.year != 2020]
```

```
fig, ax = plt.subplots(figsize=(10, 6))
sns.lineplot(data=intmov_year, x='year', y='count')
sns.lineplot(data=intshow_year, x='year', y='count')
ax.set(xticks=np.arange(2008, 2020, 1))
plt.title("International content across all years (up to 2019)")
plt.legend(['International Movies','International TV Shows'])
plt.show()
```



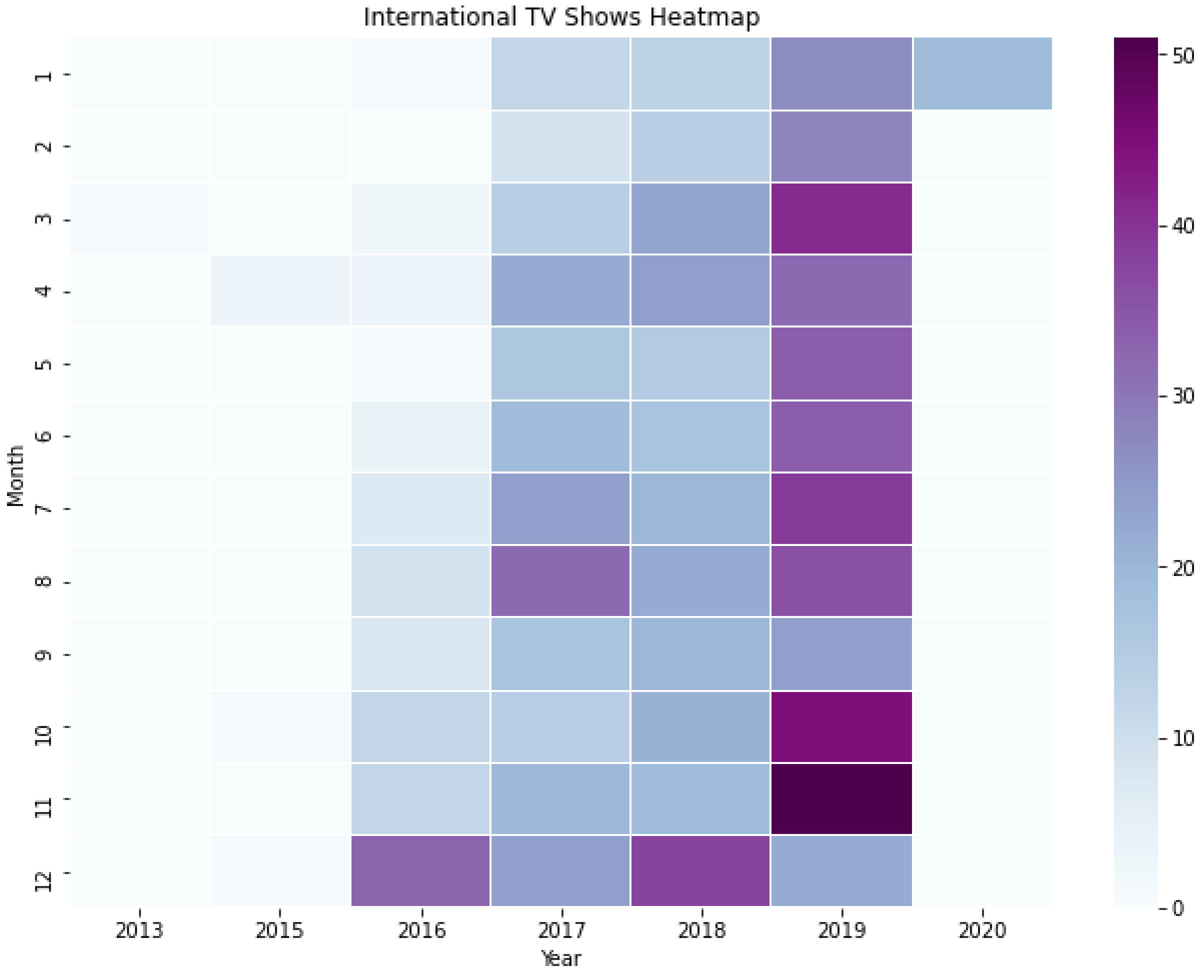
Based on the timeline, we can see that there are far more international movie releases than there are international tv show releases. However, near 2018, the growth of international movies started to decline while international tv shows constantly showed significant growth in the past few years.

```
intmov_month_year_df = international_movies.groupby('year_added')['month_added'].value_

fig, ax = plt.subplots(figsize=(11, 8))
sns.heatmap(intmov_month_year_df, linewidths=0.025, cmap="BuPu")
plt.title("International Movies Heatmap")
plt.ylabel("Month")
plt.xlabel("Year")
plt.show()
```



In the heatmap above, we can see that a majority of international movies were added throughout the year in 2018. Then in December 2019, Netflix added the most international movie content.

```
intsho_month_year_df = international_shows.groupby('year_added')['month_added'].value_c

fig, ax = plt.subplots(figsize=(11, 8))
sns.heatmap(intsho_month_year_df, linewidths=0.025, cmap="BuPu")
plt.title("International TV Shows Heatmap")
plt.ylabel("Month")
plt.xlabel("Year")
plt.show()
```



In the above heatmap, we can see that the majority of international TV shows were added throughout the year 2019.

Inferences and Conclusion

It's clear that Netflix has grown over the years. We can see it from the data that the company took certain approaches in their marketing strategy to break into new markets around the world. Based on an article from Business Insider, Netflix had about 158 million subscribers worldwide with 60 million from the US and almost 98 million internationally. Netflix's original subscriber base was based solely in the United States following its IPO. A large part of its success was due to the decision to expand to international markets. The popular markets prioritizes what content the company will release. In this case, we can see that a good amount of international movies and TV shows were added over the years as part of Netflix's global expansion.

Future Work

- IMDB Ratings Analysis on Netflix Movies & TV Shows
- Recommender System
- More pretty seaborn graphs?

References

- https://www.kaggle.com/shivamb/netflix-shows
- https://www.businessinsider.com/netflix-growth-comes-from-international-markets-2019-10

```
jovian.commit(files=['../input/netflix-shows/netflix_titles.csv'], project='netflix-mov
```

```
[jovian] Attempting to save notebook..
[jovian] Detected Kaggle notebook...
[jovian] Uploading notebook to https://jovian.ml/allenkong221/netflix-movies-and-tv-shows-project
```