Breakdown of this Notebook:

```
Importing Libraries
Loading dataset
Data Cleaning:

Deleting redundant columns.
Dropping duplicates.
Cleaning individual columns.
Remove the NaN values from the dataset
Some Transformations

Data Visualization: Using plots to find relations between the features.
    Type: Movie and TV Shows
    Rating
    Relation between Type and Rating
Word Cloud
    genre
    stars
Classification
Analysis

This dataset contains information concerning TV Shows and Movies added
to the Netflix catalog, including:

General information: id, title, type (TV Show or Movie), stars and a
brief description.
Date fields: When the show was released and when it was added to the
catalog.
Categorization: Rating and votes in which the show is listed.
```

Introduction

Netflix! What is believed to have started in 1997 as a DVD rental service has since exploded into the largest entertainment/media company by market capitalization, boasting over 200 million subscribers as of January 2021.

Given the large number of movies and series available on the platform, it is a perfect opportunity to flex our data manipulation skills and dive into the entertainment industry. Our friend has also been brushing up on their Python skills and has taken a first crack at a CSV file containing Netflix data. For their first order of business, they have been performing some analyses, and they believe that the average duration of movies has been declining.

If we're going to be working with this data, we know a good place to start would be to probably start working with pandas.

About the Dataset

Context

This data is all about Movies That are available on Netflix Website movies title, cast of the movie,desc of movies, duration, rating on IMDB, voted by people, year, genre, certificate

Source

This dataset originates from the IMDB website data and is collected using web scraping

Importing libreries and Loading the dataset

Alright, we now have a pandas, the most common way to work with tabular data in Python. Now back to the task at hand. We want to follow up on our friend's assertion that movie lengths have been decreasing over time. A great place to start will be a visualization of the data.

Given that the data is continuous, a line plot would be a good choice, with the dates represented along the x-axis and the average length in minutes along the y-axis. This will allow us to easily spot any trends in movie durations. There are many ways to visualize data in Python, but matploblib.pyplot is one of the most common packages to do so.

Note: In order for us to correctly test your plot, you will need to initalize a matplotlib.pyplot Figure object, which we have already provided in the cell below. You can continue to create your plot as you have learned in Intermediate Python.

In [95]:

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

In [96]:

```
pip install xlrd
```

```
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: xlrd in /home/dsm/.local/lib/python3.10/site-packages (2.
0.1)
Note: you may need to restart the kernel to use updated packages.
```

Inspect the dataset

Well, it looks like there is something to the idea that movie lengths have decreased over the past ten years! But equipped only with our friend's aggregations, we're limited in the further explorations we can perform. There are a few questions about this trend that we are currently unable to answer, including:

```
What does this trend look like over a longer period of time?
Is this explainable by something like the genre of entertainment?
```

Upon asking our friend for the original CSV they used to perform their analyses, they gladly oblige and send it. We now have access to the CSV file, available at the path "n_movies.csv". Let's create another DataFrame, this time with all of the data. Given the length of our friend's data, printing the whole DataFrame is probably not a good idea, so we will inspect it by printing only the first five rows.

In [97]:

```
# Load and read the dataset
netflix = pd.read_csv('n_movies.csv')
netflix.head(5)
```

Out[97]:

	title	year	certificate	duration	genre	rating	description	stars	votes
0	Cobra Kai	(2018–)	TV-14	30 min	Action, Comedy, Drama	8.5	Decades after their 1984 All Valley Karate Tou...	['Ralph Macchio, ', 'William Zabka, ', 'Courtn...	177,031
1	The Crown	(2016–)	TV-MA	58 min	Biography, Drama, History	8.7	Follows the political rivalries and romance of...	['Claire Foy, ', 'Olivia Colman, ', 'Imelda St...	199,885
2	Better Call Saul	(2015–2022)	TV-MA	46 min	Crime, Drama	8.9	The trials and tribulations of criminal lawyer...	['Bob Odenkirk, ', 'Rhea Seehorn, ', 'Jonathan...	501,384
3	Devil in Ohio	(2022)	TV-MA	356 min	Drama, Horror, Mystery	5.9	When a psychiatrist shelters a mysterious cult...	['Emily Deschanel, ', 'Sam Jaeger, ', 'Gerardo...	9,773
4	Cyberpunk: Edgerunners	(2022–)	TV-MA	24 min	Animation, Action, Adventure	8.6	A Street Kid trying to survive in a technology...	['Zach Aguilar, ', 'Kenichiro Ohashi, ', 'Emi ...	15,413

Observations

Columns like (descripton) are irrelevant to our analysis and need to be dropped

There isn't many NaN values in the most important columns though df.describe() shows alot of 0 values the release_date column are the wrong type

Shape of the Dataset

In [98]:

```
# show the shape of the dataset
netflix.shape
```

Out[98]:

```
(9957, 9)
```

In [99]:

```
# columns
netflix.columns
```

Out[99]:

```
Index(['title', 'year', 'certificate', 'duration', 'genre', 'rating',
       'description', 'stars', 'votes'],
      dtype='object')
```

Clean and wrangle the dataset

In [100…

```
# check for null values
netflix.isnull().sum()
```

Out[100]:

```
title             0
year            527
certificate    3453
duration       2036
genre            73
rating         1173
description       0
stars             0
votes          1173
dtype: int64
```

In [101…

```
# check for duplicate values
```

```
netflix.duplicated().sum()
```

```
Out[101]: 0
```

```
In [102…  # check for unique values
          netflix.nunique()
```

```
Out[102]: title          7912
          year            498
          certificate      20
          duration        291
          genre           569
          rating           79
          description    9433
          stars          8615
          votes          4862
          dtype: int64
```

```
In [103…  # creating a copy of the dataset
          df = netflix.copy()
```

```
In [104…  # current shape
          df.shape
```

```
Out[104]: (9957, 9)
```

```
In [105…  # dropping null values
          df=df.dropna()
          df.shape
```

```
Out[105]: (5754, 9)
```

```
In [106…  #droping description column because it's not important
          df.drop(columns=['description'],inplace=True)
```

```
In [107…  # current dataset
          df.head(10)
```

Out[107]:

	title	year	certificate	duration	genre	rating	stars	votes
0	Cobra Kai	(2018–)	TV-14	30 min	Action, Comedy, Drama	8.5	['Ralph Macchio, ', 'William Zabka, ', 'Courtn...	177,031
1	The Crown	(2016–)	TV-MA	58 min	Biography, Drama, History	8.7	['Claire Foy, ', 'Olivia Colman, ', 'Imelda St...	199,885
2	Better Call Saul	(2015–2022)	TV-MA	46 min	Crime, Drama	8.9	['Bob Odenkirk, ', 'Rhea Seehorn, ', 'Jonathan...	501,384
3	Devil in Ohio	(2022)	TV-MA	356 min	Drama, Horror, Mystery	5.9	['Emily Deschanel, ', 'Sam Jaeger, ', 'Gerardo...	9,773
4	Cyberpunk: Edgerunners	(2022–)	TV-MA	24 min	Animation, Action, Adventure	8.6	['Zach Aguilar, ', 'Kenichiro Ohashi, ', 'Emi ...	15,413
5	The Sandman	(2022–)	TV-MA	45 min	Drama, Fantasy, Horror	7.8	['Tom Sturridge, ', 'Boyd Holbrook, ', 'Patton...	116,358
6	Rick and Morty	(2013–)	TV-MA	23 min	Animation, Adventure, Comedy	9.2	['Justin Roiland, ', 'Chris Parnell, ', 'Spenc...	502,160
7	Breaking Bad	(2008–	TV-MA	49 min	Crime, Drama,	9.5	['Bryan Cranston, ',	1,831,340

		2013)			Thriller		'Aaron Paul, ', 'Anna Gun...	
8	The Imperfects	(2022–)	TV-MA	45 min	Action, Adventure, Drama	6.3	['Morgan Taylor Campbell, ', 'Italia Ricci, ',...	3,123
9	Blonde	(2022)	NC-17	166 min	Biography, Drama, Mystery	6.2	['Andrew Dominik', '| ', ' Stars:', 'Ana de...	935

Data visualization

In [108…

```
df.columns
```

Out[108]:

```
Index(['title', 'year', 'certificate', 'duration', 'genre', 'rating', 'stars',
       'votes'],
      dtype='object')
```

In [109…

```
#Deleting duplicates depending on max number of them
genre_df=pd.DataFrame(df.groupby("genre").max()['votes'])
genre_df.shape
genre_df
```

Out[109]:

	votes
genre	
Action	796
Action, Adventure	33,388
Action, Adventure, Biography	49,337
Action, Adventure, Comedy	8,638
Action, Adventure, Crime	98,315
...	...
Sport	1,597
Talk-Show	5,702
Thriller	993
Western	566
Western, Adventure	1,408

455 rows × 1 columns

In [110…

```
genre_df.loc["Action, Adventure, Biography",'votes']
```

Out[110]:

```
'49,337'
```

In [111…

```
# Create a DataFrame from the dictionary
durations_df = pd.DataFrame(df)

# Print the DataFrame
durations_df
```

Out[111]:

	title	year	certificate	duration	genre	rating	stars	votes
0	Cobra Kai	(2018–)	TV-14	30 min	Action, Comedy, Drama	8.5	['Ralph Macchio, ', 'William Zabka, ', 'Courtn...	177,031

1	The Crown	(2016–)	TV-MA	58 min	Biography, Drama, History	8.7	['Claire Foy, ', 'Olivia Colman, ', 'Imelda St...	199,885
2	Better Call Saul	(2015–2022)	TV-MA	46 min	Crime, Drama	8.9	['Bob Odenkirk, ', 'Rhea Seehorn, ', 'Jonathan...	501,384
3	Devil in Ohio	(2022)	TV-MA	356 min	Drama, Horror, Mystery	5.9	['Emily Deschanel, ', 'Sam Jaeger, ', 'Gerardo...	9,773
4	Cyberpunk: Edgerunners	(2022–)	TV-MA	24 min	Animation, Action, Adventure	8.6	['Zach Aguilar, ', 'Kenichiro Ohashi, ', 'Emi ...	15,413
...	...	...	...	...	...	...	...	...
9952	The Imperfects	(2022–)	TV-MA	45 min	Action, Adventure, Drama	6.3	['Morgan Taylor Campbell, ', 'Italia Ricci, ',...	3,130
9953	The Walking Dead	(2010–2022)	TV-MA	44 min	Drama, Horror, Thriller	8.1	['Andrew Lincoln, ', 'Norman Reedus, ', 'Melis...	970,067
9954	The Crown	(2016–)	TV-MA	58 min	Biography, Drama, History	8.7	['Claire Foy, ', 'Olivia Colman, ', 'Imelda St...	199,898
9955	Supernatural	(2005–2020)	TV-14	44 min	Drama, Fantasy, Horror	8.4	['Jared Padalecki, ', 'Jensen Ackles, ', 'Jim ...	439,601
9956	Devil in Ohio	(2022)	TV-MA	356 min	Drama, Horror, Mystery	5.9	['Emily Deschanel, ', 'Sam Jaeger, ', 'Gerardo...	9,786

5754 rows × 8 columns

In [112…

```
# Select only the columns of interest
netflix_movies_col_subset = df[['title', 'genre', 'year', 'duration']]

# Select only the columns of interest
netflix_movies_col_subset_v = df[['votes']]

# Print the first five rows of the new DataFrame
netflix_movies_col_subset[0:20]
```

Out[112]:

	title	genre	year	duration
0	Cobra Kai	Action, Comedy, Drama	(2018–)	30 min
1	The Crown	Biography, Drama, History	(2016–)	58 min
2	Better Call Saul	Crime, Drama	(2015–2022)	46 min
3	Devil in Ohio	Drama, Horror, Mystery	(2022)	356 min
4	Cyberpunk: Edgerunners	Animation, Action, Adventure	(2022–)	24 min
5	The Sandman	Drama, Fantasy, Horror	(2022–)	45 min
6	Rick and Morty	Animation, Adventure, Comedy	(2013–)	23 min
7	Breaking Bad	Crime, Drama, Thriller	(2008–2013)	49 min
8	The Imperfects	Action, Adventure, Drama	(2022–)	45 min
9	Blonde	Biography, Drama, Mystery	(2022)	166 min
10	Stranger Things	Drama, Fantasy, Horror	(2016–)	51 min
11	End of the Road	Action, Crime, Drama	(II) (2022)	89 min
12	The Walking Dead	Drama, Horror, Thriller	(2010–2022)	44 min
13	Glass Onion: A Knives Out Mystery	Crime, Drama, Mystery	(2022)	139 min

14	Do Revenge	Comedy	(2022)	118 min
15	I Came By	Thriller	(2022)	110 min
16	No Limit	Drama, Romance, Sport	(2022)	118 min
18	Peaky Blinders	Crime, Drama	(2013–2022)	60 min
20	The Lord of the Rings: The Fellowship of the Ring	Action, Adventure, Drama	(2001)	178 min
21	Grey's Anatomy	Drama, Romance	(2005–)	41 min

Creating a Scatter Plot

This is already much more informative than the simple plot we created when our friend first gave us some data. We can also see that, while newer movies are overrepresented on the platform, many short movies have been released in the past two decades.

Upon further inspection, something else is going on. Some of these films are under an hour long! Let's filter our DataFrame for movies with a duration under 60 minutes and look at the genres. This might give us some insight into what is dragging down the average.

Okay, now we're getting somewhere. We've read in the raw data, selected rows of movies, and have limited our DataFrame to our columns of interest. Let's try visualizing the data again to inspect the data over a longer range of time.

This time, we are no longer working with aggregates but instead with individual movies. A line plot is no longer a good choice for our data, so let's try a scatter plot instead. We will again plot the year of release on the x-axis and the movie duration on the y-axis.

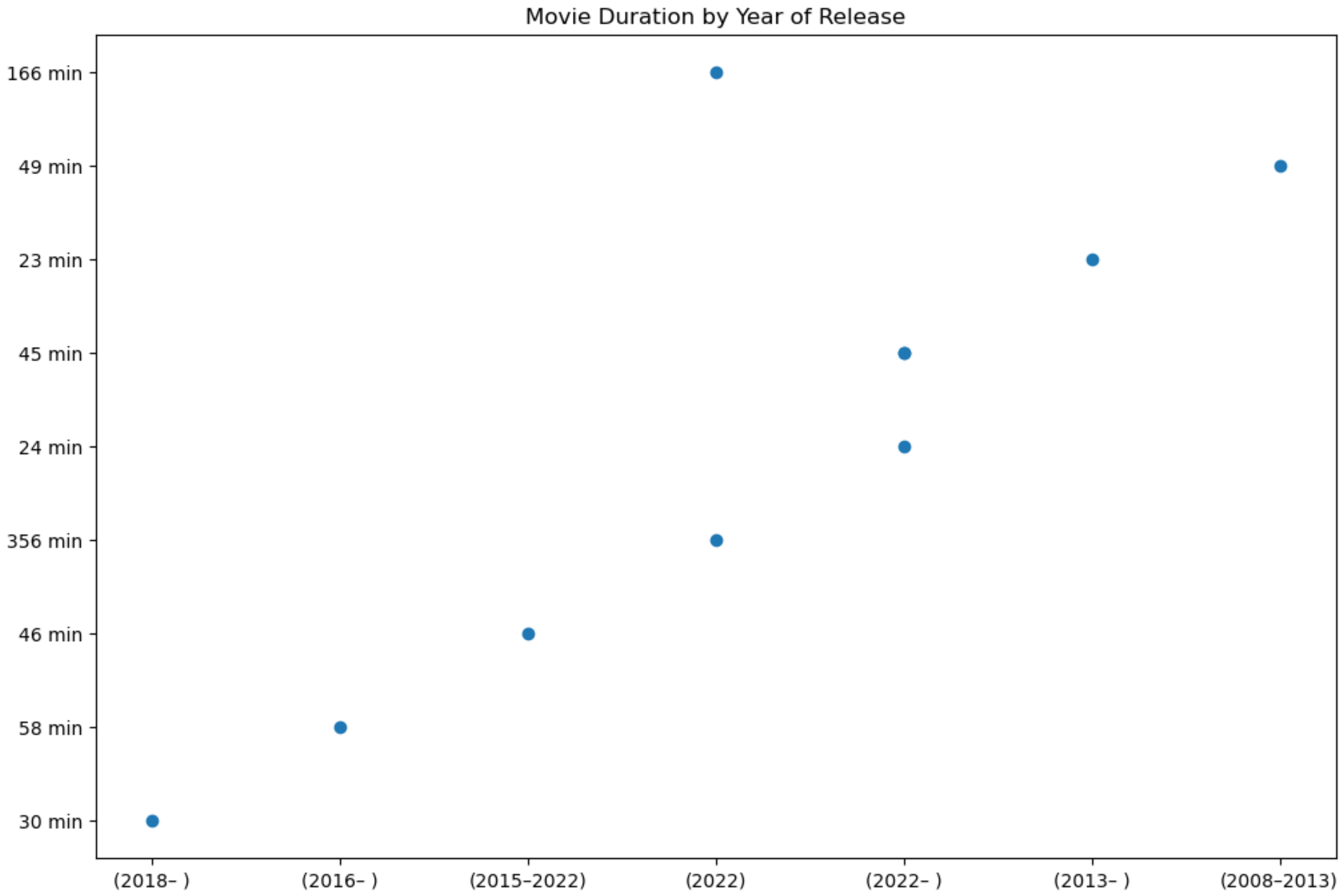
In [113…

```python
# Create a figure and increase the figure size
fig = plt.figure(figsize=(12,8))

# Create a scatter plot of duration versus year
plt.scatter(netflix_movies_col_subset[0:10]["year"], netflix_movies_col_subset[0:10]["du

# Create a title
plt.title("Movie Duration by Year of Release")

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

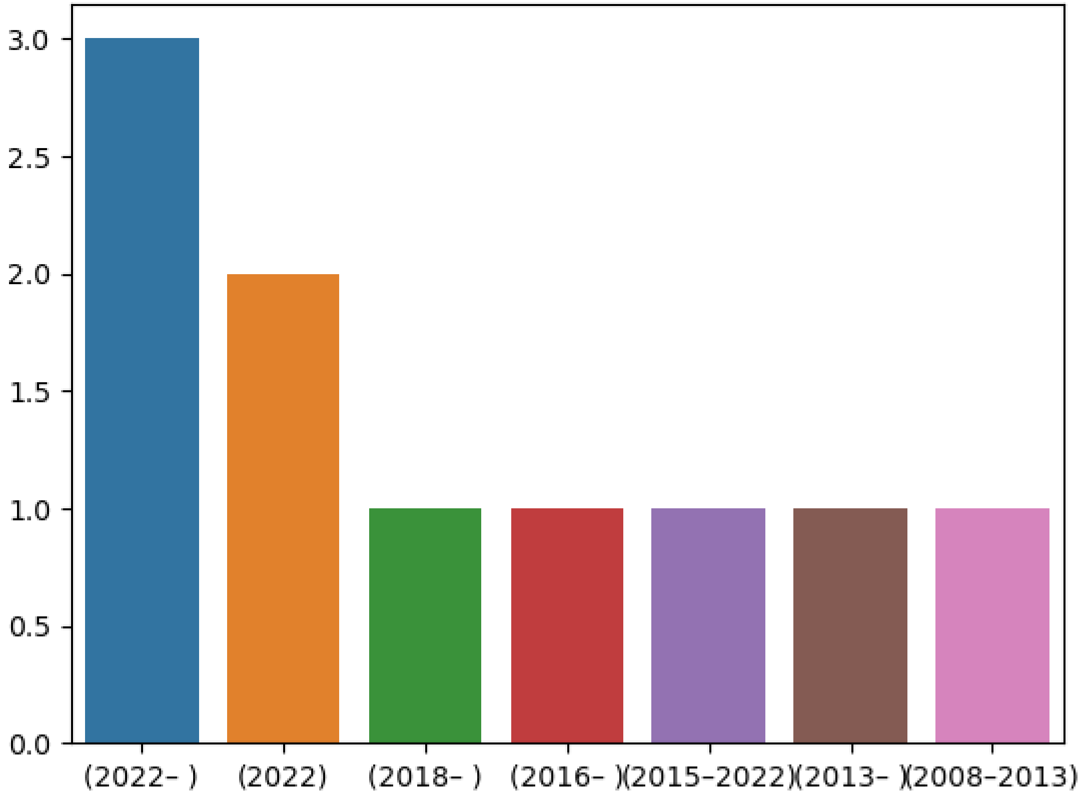


In [114…

```
sns.barplot(x=netflix_movies_col_subset[0:10]['year'].value_counts().index,y=netflix_mov
```

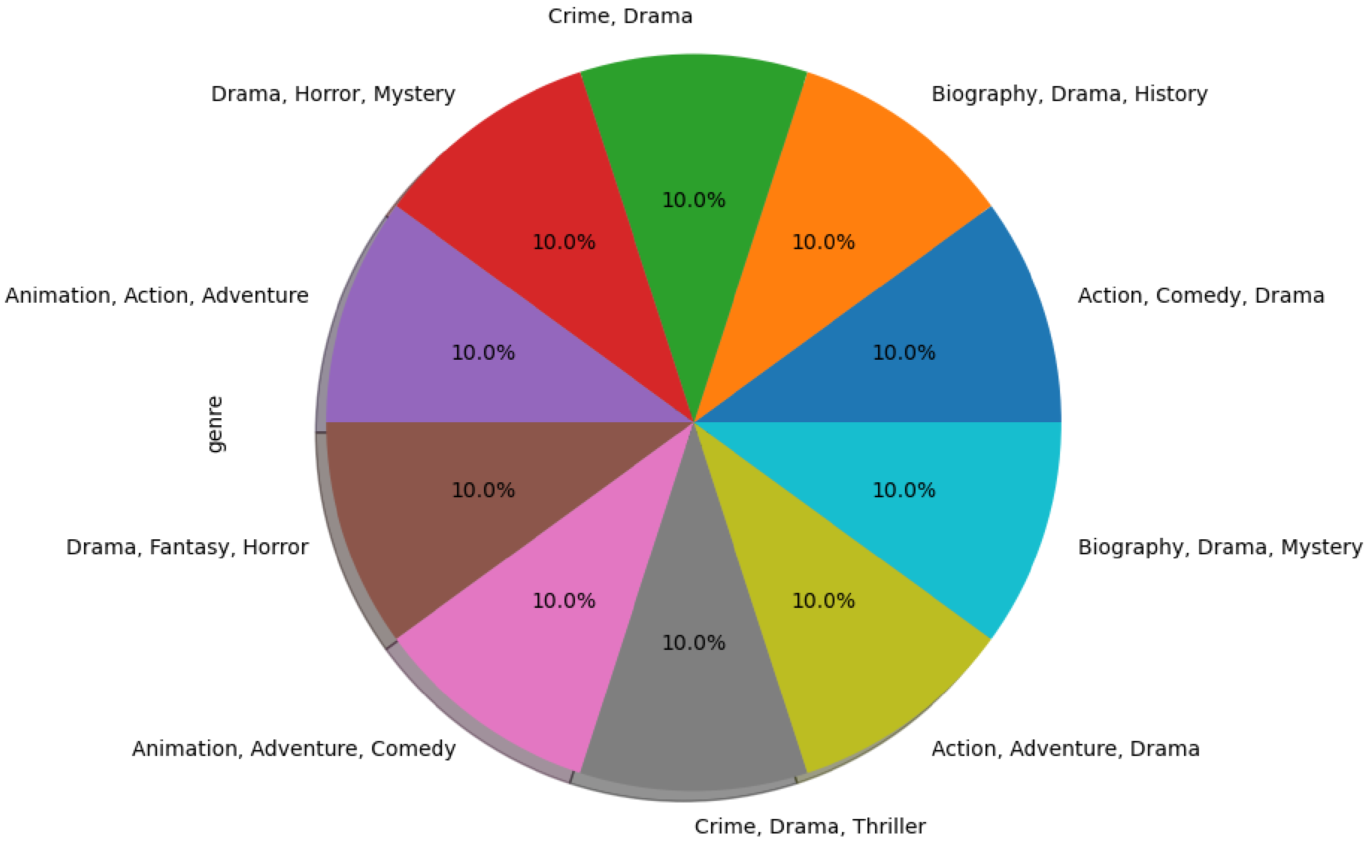
Out[114]:

```
<AxesSubplot:>
```



In [115…

```
# Piechart visual
netflix_movies_col_subset[0:10]['genre'].value_counts().plot.pie(autopct='%1.1f%%',shadow
plt.show()
```



What is the average rating?

In [116…

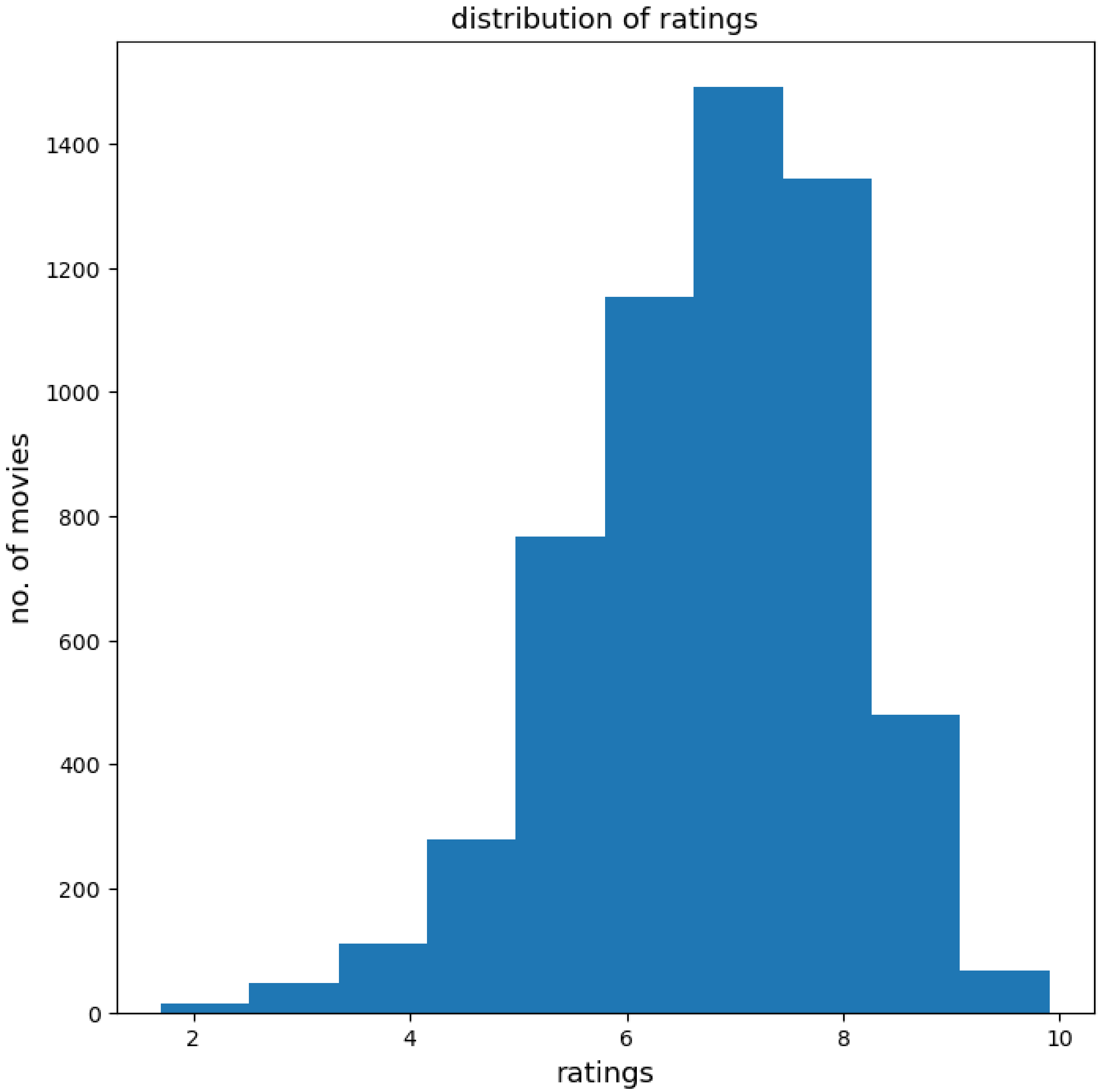
```
runtime_avg = df['rating'].mean() #average runtime of movies
runtime_avg
```

Out[116]:

```
6.792822384428223
```

In [117…

```
plt.hist(df['rating'])
plt.gcf().set_size_inches(8, 8)
plt.xlabel('ratings',fontsize=13)
plt.ylabel('no. of movies', fontsize=13)
plt.title('distribution of ratings', fontsize=13);
```



In [118…

```
pip install wordcloud
```

```
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: wordcloud in /home/dsm/.local/lib/python3.10/site-package
s (1.8.2.2)
Requirement already satisfied: numpy>=1.6.1 in /usr/lib/python3/dist-packages (from word
cloud) (1.21.5)
Requirement already satisfied: matplotlib in /usr/lib/python3/dist-packages (from wordcl
oud) (3.5.1)
Requirement already satisfied: pillow in /usr/lib/python3/dist-packages (from wordcloud)
(9.0.1)
Note: you may need to restart the kernel to use updated packages.
```

Show number of stars involved in the cast

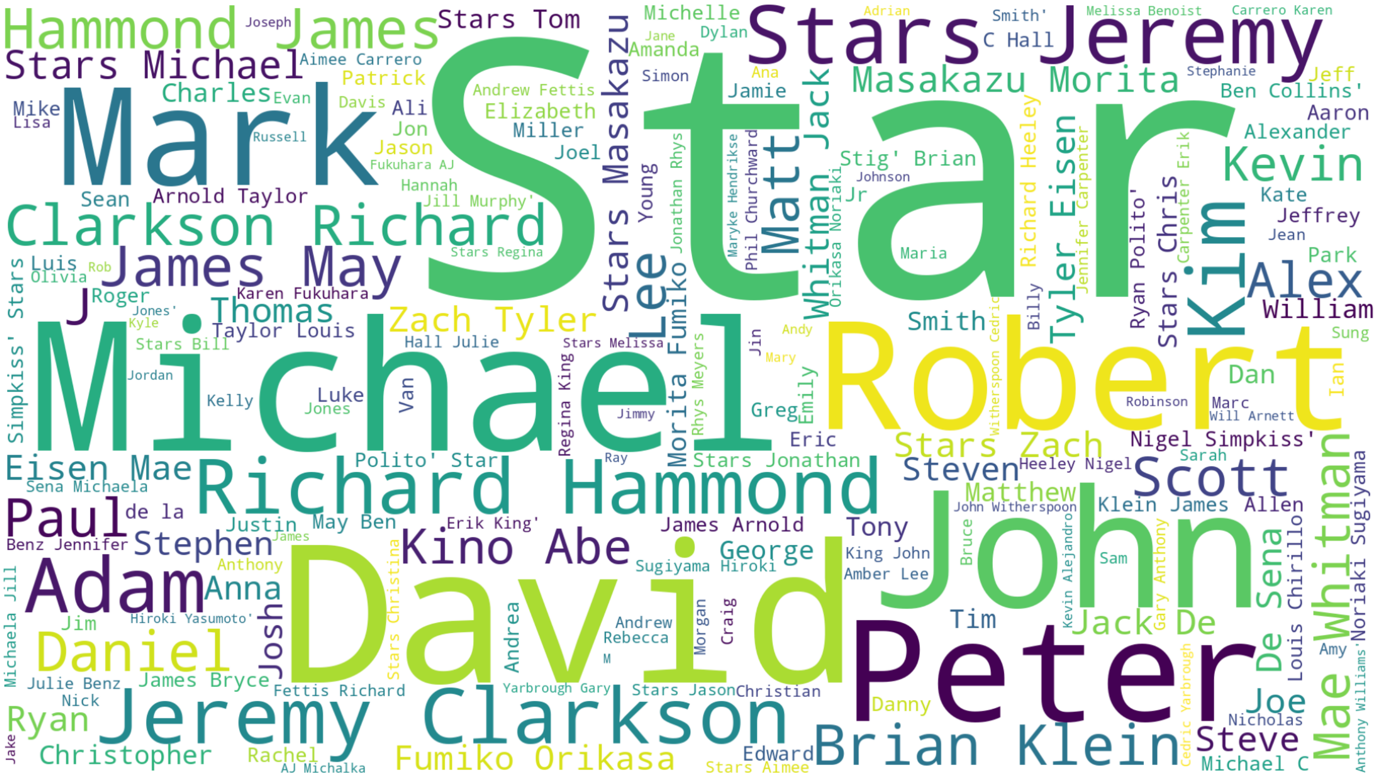
In [119…

```
from wordcloud import WordCloud
from IPython.core.display import HTML

#text = df.stars[9]
```

```
plt.subplots(figsize=(25,15))
wordcloud = WordCloud(
                          background_color='white',
                          width=1920,
                          height=1080
                         ).generate(" ".join(df.stars))
plt.imshow(wordcloud)
plt.axis('off')
plt.savefig('stars.png')
plt.show()


#wc=WordCloud(use_tfidf=False,stopwords=ENGLISH_STOP_WORDS)
#don't randomize color, show only top 50
#embed_code=wc.get_embed_code(text=texts,random_color=False,topn=50)
#HTML(embed_code)
```



In [120…

```
from wordcloud import WordCloud
from IPython.core.display import HTML

#text = df.stars[9]


plt.subplots(figsize=(25,15))
wordcloud = WordCloud(
                          background_color='white',
                          width=1920,
                          height=1080
                         ).generate(" ".join(df.genre))
plt.imshow(wordcloud)
plt.axis('off')
plt.savefig('genre.png')
plt.show()
```

Documentary Biography
Animation Drama
Adventure Action
Drama Adventure
Adventure Comedy
Action Crime
Biography Drama
Family Fantasy
Animation Adventure
Comedy Romance
Game Show
Thriller Crime
Animation Short
Mystery Sci
Western
Action Adventure
War
Family Talk
Family
Biography
Thriller Animation
Talk Show
Adventure Animation
Drama History
Reality TV
Horror Mystery
Documentary Music
Documentary Sport
Mystery Thriller
Film Noir
Romance Comedy
Crime Crime
News Documentary
Comedy Drama
Comedy Reality
TV Reality
Documentary
Comedy Family
Sci Fi
Drama Drama
Documentary Short
Drama Crime
Drama Horror
Comedy Action
Action Documentary
Documentary Adventure
Horror Thriller
Romance
Crime Action
Animation Action
Documentary Crime
Drama Thriller
Drama Mystery
Adventure Thriller
Thriller Documentary
Horror Sci
Drama Family
Sport
Documentary Drama
Crime Adventure
Thriller Adventure
Music
Drama Reality
Action Drama
Crime Drama
Drama
Comedy
Fantasy Horror
Drama Fantasy
Show Reality
Drama Comedy
Comedy Adventure
TV Adventure
Comedy Mystery
Crime Comedy
Musical
Short Adventure
History
Comedy Thriller
History War
History Romance
Adventure Adventure

Building a Training models

In [121…

```
df.replace('min', '')
df.replace(',','', regex=True, inplace=True)
df.replace(',','', regex=True, inplace=True)
```

In [122…

```
c = df.select_dtypes(object).columns
df[c] = df[c].apply(pd.to_numeric,errors='coerce')
```

In [123…

```
df
```

Out[123]:

	title	year	certificate	duration	genre	rating	stars	votes
0	NaN	NaN	NaN	NaN	NaN	8.5	NaN	177031
1	NaN	NaN	NaN	NaN	NaN	8.7	NaN	199885
2	NaN	NaN	NaN	NaN	NaN	8.9	NaN	501384
3	NaN	NaN	NaN	NaN	NaN	5.9	NaN	9773
4	NaN	NaN	NaN	NaN	NaN	8.6	NaN	15413
...	...	...	...	...	...	...	...	...
9952	NaN	NaN	NaN	NaN	NaN	6.3	NaN	3130
9953	NaN	NaN	NaN	NaN	NaN	8.1	NaN	970067
9954	NaN	NaN	NaN	NaN	NaN	8.7	NaN	199898
9955	NaN	NaN	NaN	NaN	NaN	8.4	NaN	439601
9956	NaN	NaN	NaN	NaN	NaN	5.9	NaN	9786

5754 rows × 8 columns

Training the Test Split

In [124…

```
## Train Test Split

from sklearn.model_selection import train_test_split
feature_columns = df['rating']
predicted_class = df['votes']
```

In [125…

```
X = feature_columns.values
y = predicted_class.values
```

In [126…

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.30, random_state
```

In [145…

```
print(X_train[0:10])
print(X_test[0:10])
print(y_train[0:10])
print(y_test[0:10])
```

```
[7.3 8.2 5.7 5.8 5.9 5.  5.8 7.3 4.8 8.3]
[6.5 7.5 5.9 6.6 6.9 8.2 7.1 8.  5.2 4.4]
[50086   767 85193 11438  4547  3889 21221  7337 49602  3275]
[62142  8553  3115  1364 10474  5273   985  9520 35855  5339]
```

In [149…

```
import pandas as pd
from sklearn.linear_model import LinearRegression
import numpy as np
x = np.array([7.3, 8.2, 5.7, 5.8, 5.9, 5.0,  5.8, 7.3, 4.8, 8.3])
y = np.array([50086, 767, 85193, 11438, 4547, 3889, 21221, 7337, 49602, 3275])
```

In [170…

```
lr = LinearRegression()
lr.fit(x.reshape(-1, 1), y)

print(lr.predict(X_test.reshape(-1,1)))
```

```
[23054.05910444 15482.49359817 27596.99840819 ... 23054.05910444
 22296.90255381 14725.33704755]
```

In [172…

```
from sklearn.svm import SVC
svm = SVC()
svm.fit(x.reshape(-1, 1), y)
print('Accuracy of SVM classifier on training set: {:.2f}'
     .format(svm.score(x.reshape(-1,1), y)))
print('Accuracy of SVM classifier on test set: {:.2f}'
     .format(svm.score(X_test.reshape(-1,1), y_test)))
```

```
Accuracy of SVM classifier on training set: 0.80
Accuracy of SVM classifier on test set: 0.00
```

NB

A big portion of the data was dropped inorder to avoid affecting the results due to the 0 values filling the data so the analysis might not be error proof.

Conclusion

The average ratings for the movies is 6.79 scores

The model has a prediction accuracy of 0.80

The amount of movies produced over the years had a high trend of increasing in now and during the start of 2022

Well, as we suspected, non-typical genres such as children's movies and documentaries are all clustered around the bottom half of the plot. But we can't know for certain until we perform additional analyses.

we've performed an exploratory analysis and classification of some entertainment data, and there are lots of fun ways to develop your skills as a Pythonic data scientist. These include learning how to analyze data further with statistics, creating more advanced visualizations, and perhaps most importantly, learning more advanced ways of working with data in pandas.

Limitations

Finally, we must add that all the above results are limited to the given database, adding that during the past two years and according to the COVID-19 pandemic, there has been a significant change in all production industries which naturally affects the film industry.

In [ ]:

```
```