Project1

1.Introduction

The dataset "Biopics" is derived from the story 'Straight Outta Compton' Is The Rare Biopic Not About White Dudes, as featured on FiveThirtyEight. The data originates from IMDb, a popular online database of films, television programs, and related content. This dataset encompasses information related to biographical films, commonly known as biopics, along with their attributes. The dataset primarily aims to explore and understand the diversity and characteristics of biographical films, particularly in terms of their subjects and subjects' backgrounds.

The dataset is stored in CSV format, containing both text and numeric data types. Through this dataset, we aim to research the following questions:

1. **Development of Biographical Film Box Office:** How has the box office of biographical films changed over the years?
2. **Gender Preferences:** Do biographical film subjects exhibit gender preferences? And does it changed over the years?
3. **Racial Preferences:** Do biographical film subjects exhibit racial preferences?

2.Data Summary

2.1 Data link

We acquired the data from this GitHub repository: https://github.com/fivethirtyeight/data/tree/master/biopics.

2.2 Data information

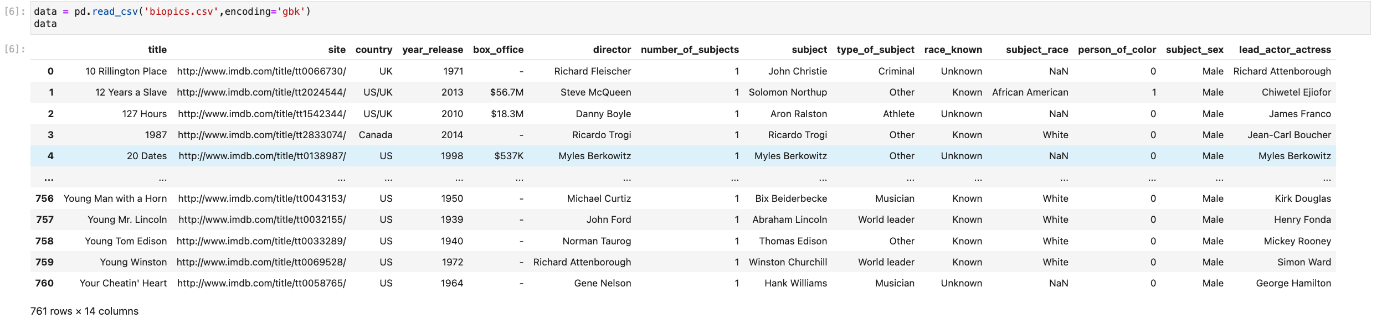
In DataSummary.py file, we write DataSummary class with the summary function.

To print the Data information in jupyter notebook we can get:

```
[4]: dataset_path = "biopics.csv"
     data_summary = DataSummary.DataSummary(dataset_path)
     num_cases, num_attributes, attribute_data_types = data_summary.get_summary()

     print(f"Number of Cases (Examples): {num_cases}")
     print(f"Number of Attributes: {num_attributes}")
     print("\nAttribute Data Types:")
     print(attribute_data_types)
```

```
Number of Cases (Examples): 761
Number of Attributes: 14

Attribute Data Types:
title                 object
site                  object
country               object
year_release           int64
box_office            object
director              object
number_of_subjects     int64
subject               object
type_of_subject       object
race_known            object
subject_race          object
person_of_color        int64
subject_sex           object
lead_actor_actress    object
dtype: object
```

By looking at the returned values, we can see that there are a total of 761 cases in the dataset, each having 14 attributes. The specific names and data types of each attribute are listed below, with 'object' indicating text data.



```
[6]: data = pd.read_csv('biopics.csv',encoding='gbk')
     data
```

[6]:

	title	site	country	year_release	box_office	director	number_of_subjects	subject	type_of_subject	race_known	subject_race	person_of_color	subject_sex	lead_actor_actress
0	10 Rillington Place	http://www.imdb.com/title/tt0066730/	UK	1971	-	Richard Fleischer	1	John Christie	Criminal	Unknown	NaN	0	Male	Richard Attenborough
1	12 Years a Slave	http://www.imdb.com/title/tt2024544/	US/UK	2013	$56.7M	Steve McQueen	1	Solomon Northup	Other	Known	African American	1	Male	Chiwetel Ejiofor
2	127 Hours	http://www.imdb.com/title/tt1542344/	US/UK	2010	$18.3M	Danny Boyle	1	Aron Ralston	Athlete	Unknown	NaN	0	Male	James Franco
3	1987	http://www.imdb.com/title/tt2833074/	Canada	2014	-	Ricardo Trogi	1	Ricardo Trogi	Other	Known	White	0	Male	Jean-Carl Boucher
4	20 Dates	http://www.imdb.com/title/tt0138987/	US	1998	$537K	Myles Berkowitz	1	Myles Berkowitz	Other	Unknown	NaN	0	Male	Myles Berkowitz
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
756	Young Man with a Horn	http://www.imdb.com/title/tt0043153/	US	1950	-	Michael Curtiz	1	Bix Beiderbecke	Musician	Known	White	0	Male	Kirk Douglas
757	Young Mr. Lincoln	http://www.imdb.com/title/tt0032155/	US	1939	-	John Ford	1	Abraham Lincoln	World leader	Known	White	0	Male	Henry Fonda
758	Young Tom Edison	http://www.imdb.com/title/tt0033289/	US	1940	-	Norman Taurog	1	Thomas Edison	Other	Known	White	0	Male	Mickey Rooney
759	Young Winston	http://www.imdb.com/title/tt0069528/	US	1972	-	Richard Attenborough	1	Winston Churchill	World leader	Known	White	0	Male	Simon Ward
760	Your Cheatin' Heart	http://www.imdb.com/title/tt0058765/	US	1964	-	Gene Nelson	1	Hank Williams	Musician	Unknown	NaN	0	Male	George Hamilton

761 rows × 14 columns

This is an overall overview of the data. In other words, it has 761 rows and 14 columns.

2.3 Attributes details

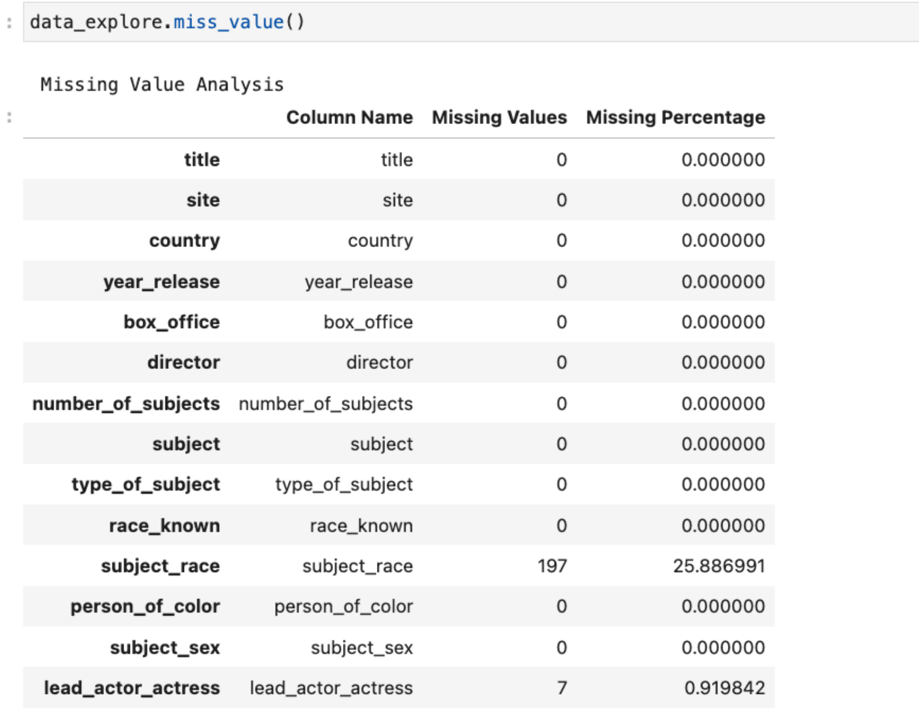
`biopics.csv` contains the following attributes:

Attributes	Definition
`title`	Title of the film.
`site`	URL from IMDB.
`country`	Country of origin.
`year_released`	Year of release.
`box_office`	Gross earnings at U.S. box office.
`director`	Director of film.
`number_of_subjects`	The number of subjects featured in the film.
`subject`	The actual name of the featured subject.
`type_of_subject`	The occupation of subject or reason for recognition.
`race_known`	Indicates whether the subject’s race was discernible based on background of self, parent, or grandparent.
`subject_race`	Race of the subject.
`person_of_color`	Dummy variable that indicates person of color.
`subject_sex`	Sex of subject.
`lead_actor_actress`	The actor or actress who played the subject.

3.Exploratory Data Analysis (EDA)

3.1 Summary statistics

Firstly we analysis the missing values in each attribute, with the miss_value function in DataExploration class. See details in DataAnalysis.py file, and the return results are:



```
data_explore.miss_value()
```

```
Missing Value Analysis
```

	Column Name	Missing Values	Missing Percentage
title	title	0	0.000000
site	site	0	0.000000
country	country	0	0.000000
year_release	year_release	0	0.000000
box_office	box_office	0	0.000000
director	director	0	0.000000
number_of_subjects	number_of_subjects	0	0.000000
subject	subject	0	0.000000
type_of_subject	type_of_subject	0	0.000000
race_known	race_known	0	0.000000
subject_race	subject_race	197	25.886991
person_of_color	person_of_color	0	0.000000
subject_sex	subject_sex	0	0.000000
lead_actor_actress	lead_actor_actress	7	0.919842

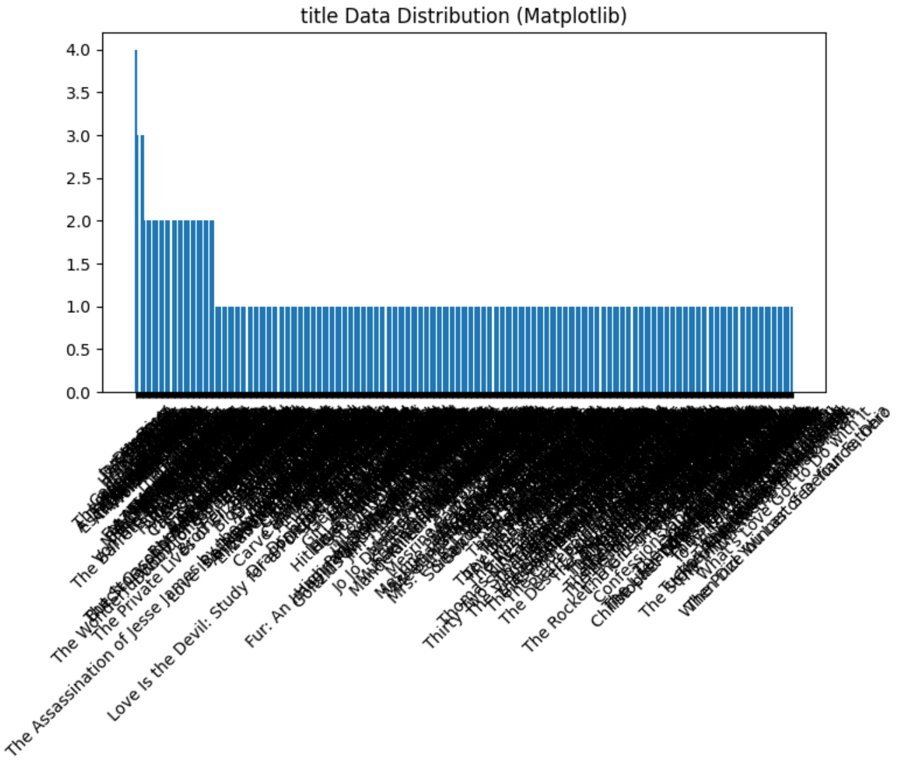
From the table above, there are 197 values missed in subject_race attribute and 7 values missed in lead_actor_actress attribute. Here the missing value means the data value is None.

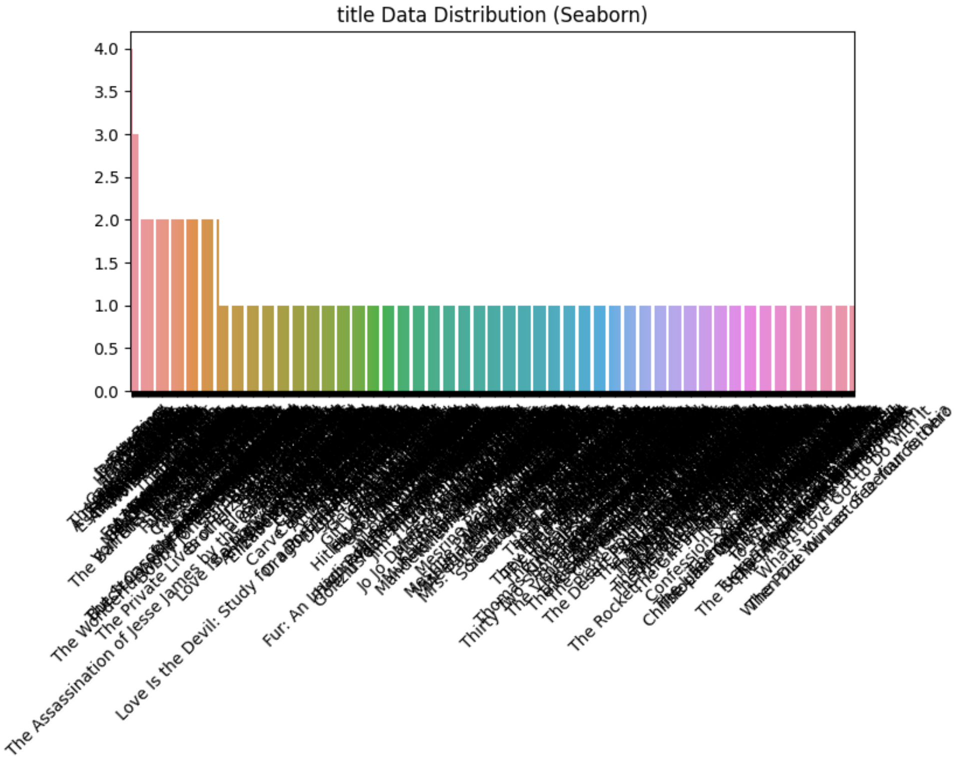
To provide the summary statistics for each attribute, we define a visualize_data function in DataExploration class. We counted the occurrences of each data value in each attribute and presented them in the form of histograms. We first used Matplotlib to create the plots and then used Seaborn. The results are analyzed in detail in Section 3.2.

```
def visualize_data(self,column_name):
  if column_name in self.dataset.columns:
    column_data = self.dataset[column_name]
    summary_stats = column_data.describe()

    if column_data.dtype == 'object':
      ## process the column with string(object) data type

      plt.figure(figsize=(8, 4))
      ## calculate frequency
      value_counts = column_data.value_counts().sort_values(ascending=False)

      ## visualize with Matplotlib
      plt.bar(value_counts.index, value_counts.values)
      plt.title(f"{column_name} Data Distribution (Matplotlib)")
      plt.xticks(rotation=45)
      plt.show()

      ## visualize with Seaborn
      plt.figure(figsize=(8, 4))
      sns.barplot(x=value_counts.index, y=value_counts.values)
      plt.title(f"{column_name} Data Distribution (Seaborn)")
      plt.xticks(rotation=45)
      plt.show()

    else:
      ## process the column with int data type
      ## visualize with Matplotlib
      plt.figure(figsize=(8, 4))
      plt.hist(column_data.dropna(), bins=20)
      plt.title(f"{column_name} Data Distribution (Matplotlib)")
      plt.show()

      ## visualize with Seaborn
      plt.figure(figsize=(8, 4))
      sns.histplot(data=column_data.dropna(), bins=20, kde=True)
      plt.title(f"{column_name} Data Distribution (Seaborn)")
      plt.show()

    else:
      summary_stats = None

      return summary_stats
```

3.2 Analysis for each attribute

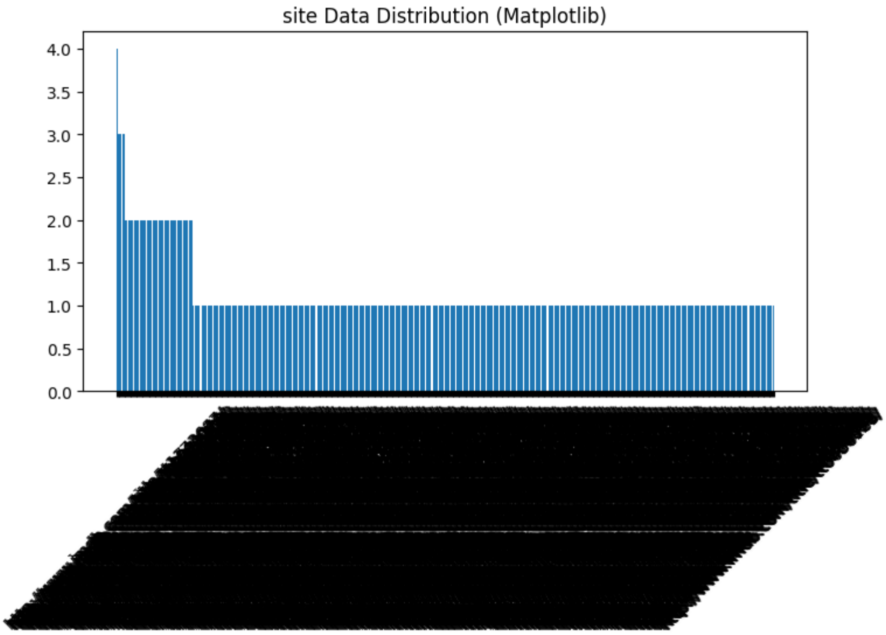
1. Title

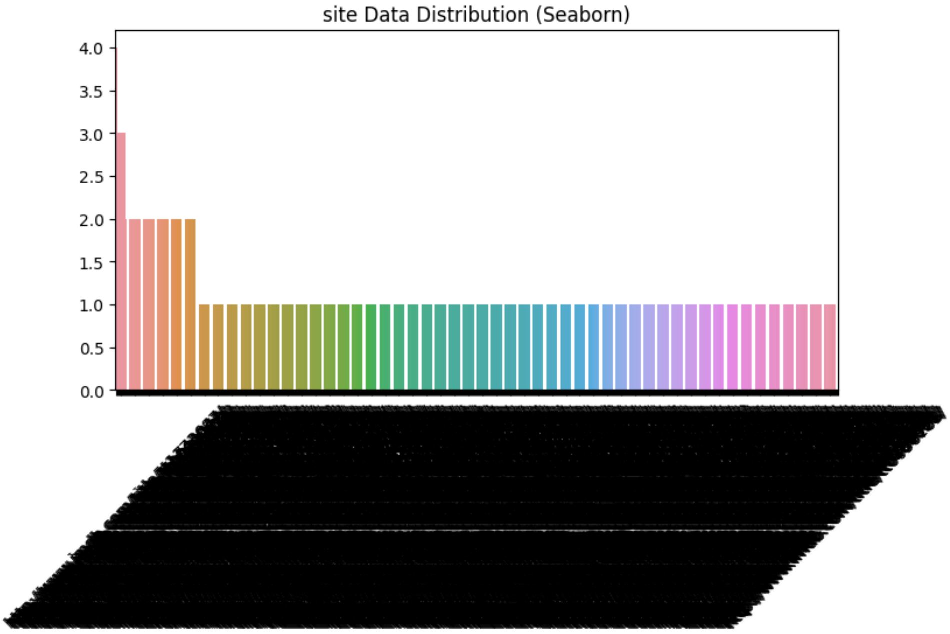




From the histogram, it can be observed that there are hardly any significant repetitions in the titles of biographical films.   The maximum number of overlaps is four times, with only a few occurrences of three or two repetitions.

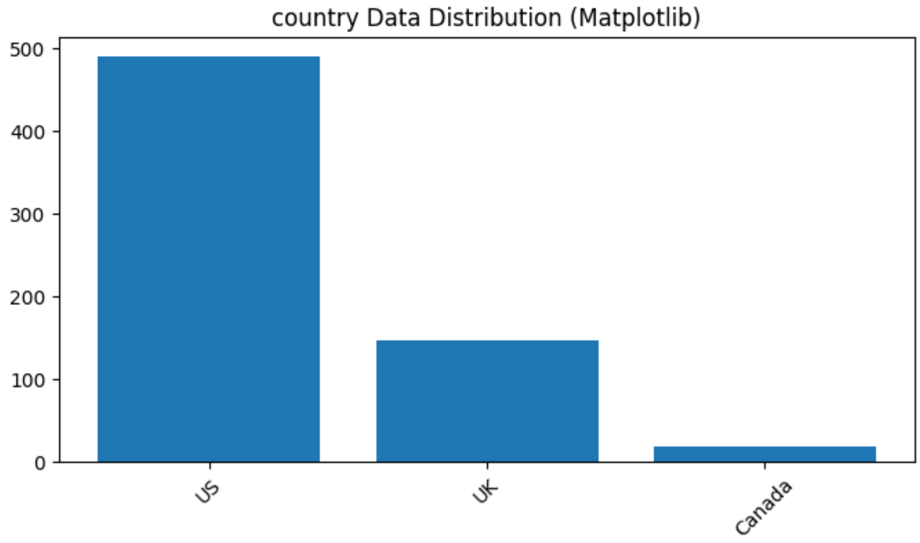
2. Site

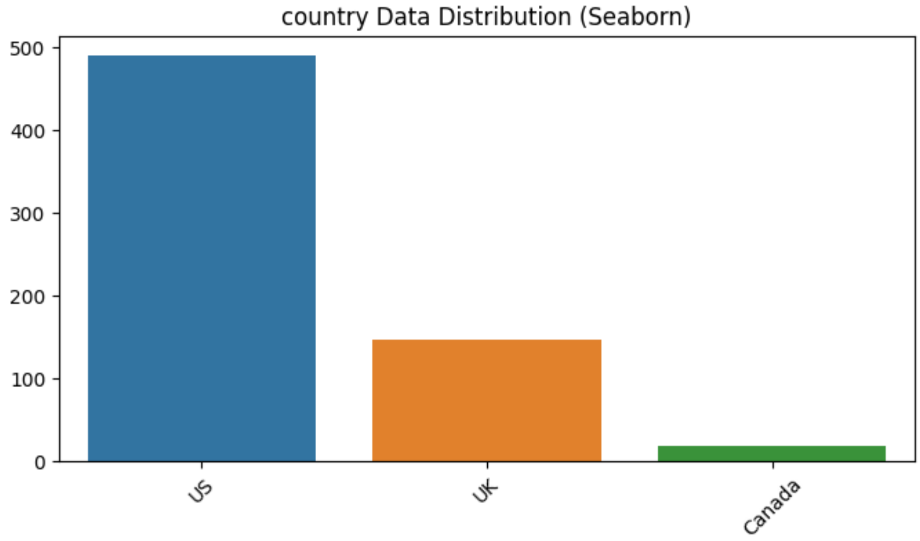




The site means the website link for the corresponding film, so the histgram of site attribute is the same as the one of title, which is illustrated above.

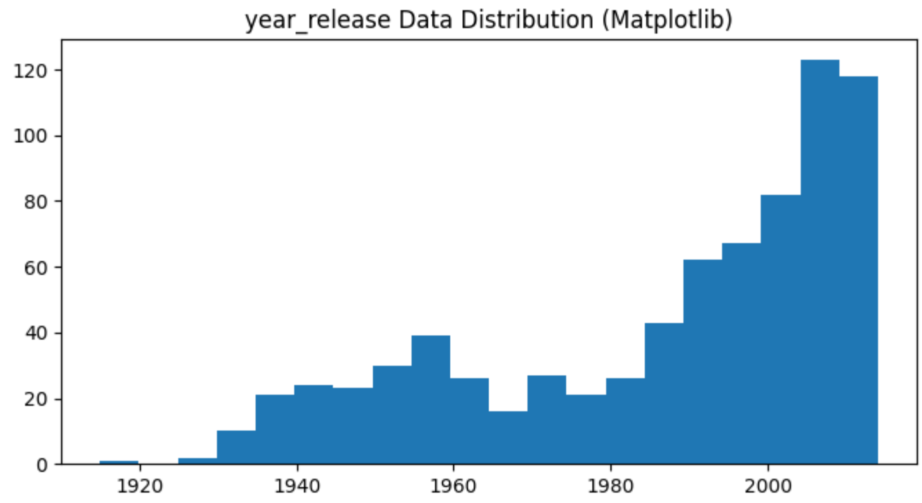
3. Country

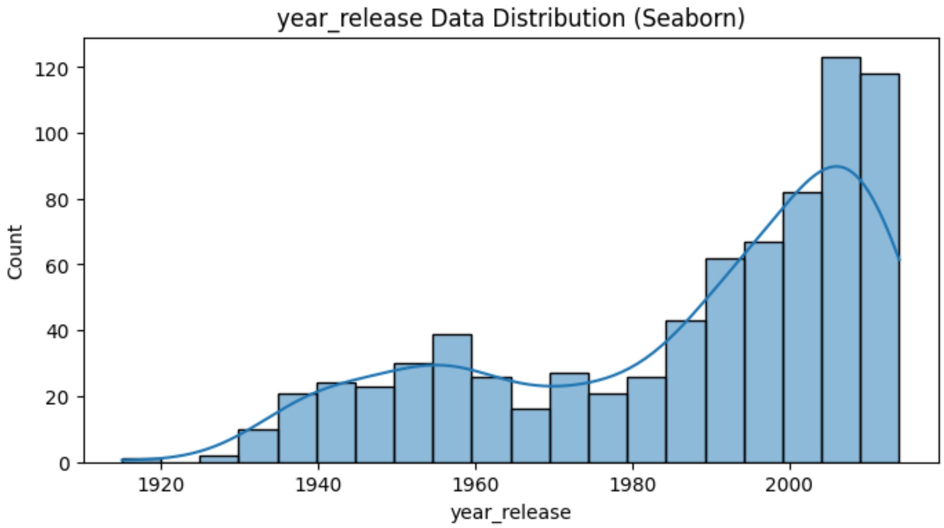




The main countries for biographical movies are the US, UK, and Canada. It can be seen that the number of biographical movies in the US far exceeds other countries, with nearly 500 films, while the dataset contains a total of over 700 movies. The quantity from the US accounts for well over half of the total.

4. Year_release

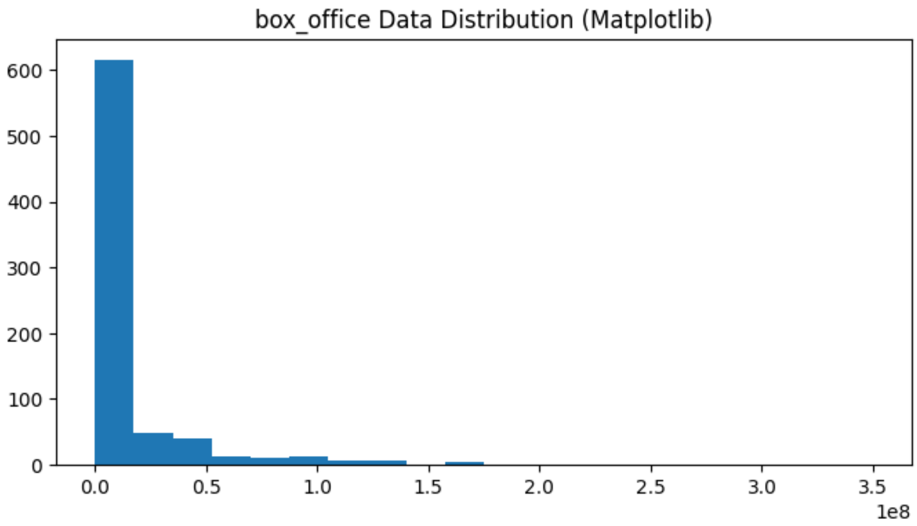


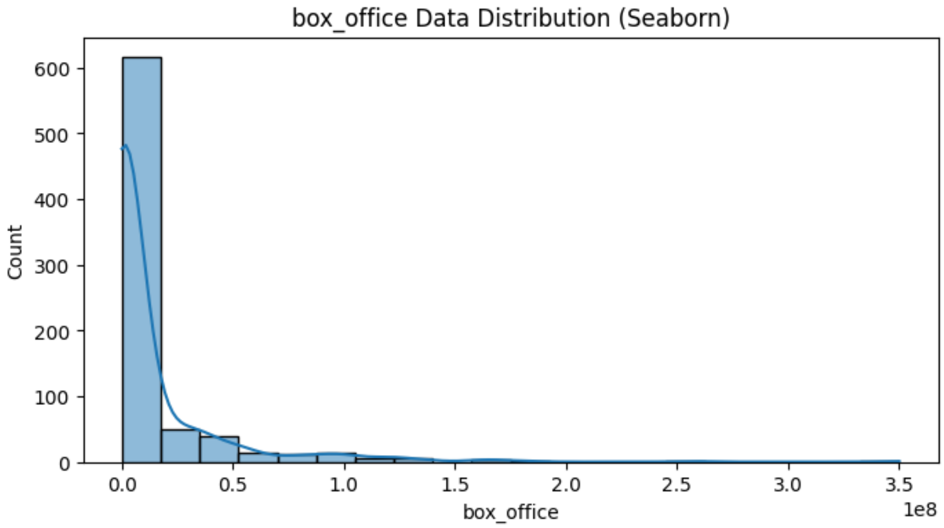


From the graph, it can be observed that the number of biographical movies generally increases year by year over time. After 2010, there are almost 120 biographical movies per year. The visual effect in Seaborn reveals two peaks, around 1958 and 2010, with a small dip in between, approximately around 1970.

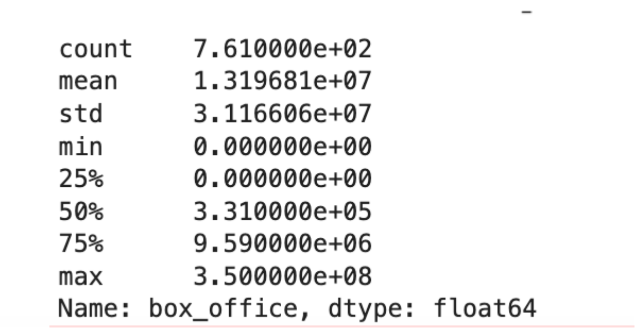
5. Box_office

The 'box_office' attribute means the gross earnings at U.S. box office. First, it is observed that the 'box_office' attribute in the dataset is of object (string) type, for example, '$56.7M' and '$537K'. Therefore, it needs to be preprocessed to be converted into an integer data type. The preprocessing function with the name of 'preprocess', is defined in the 'DataExploration' class in the 'DataAnalysis.py' file. For specific details, please refer to the code.



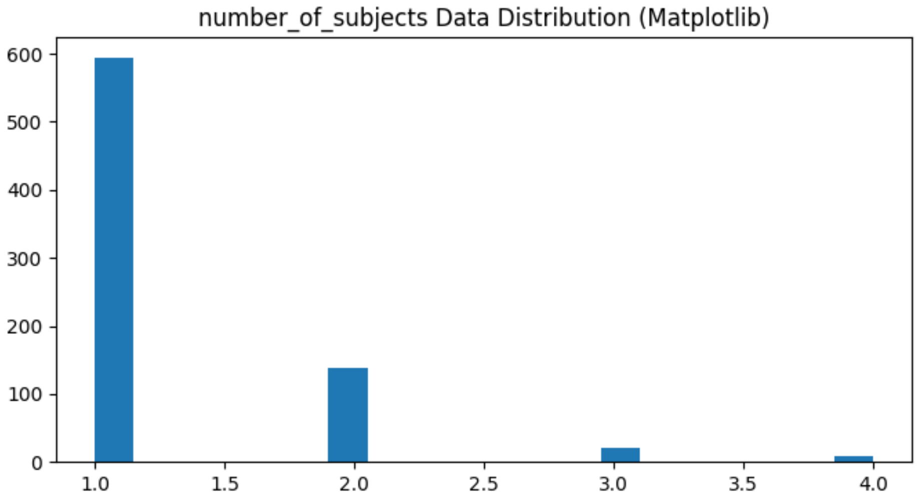


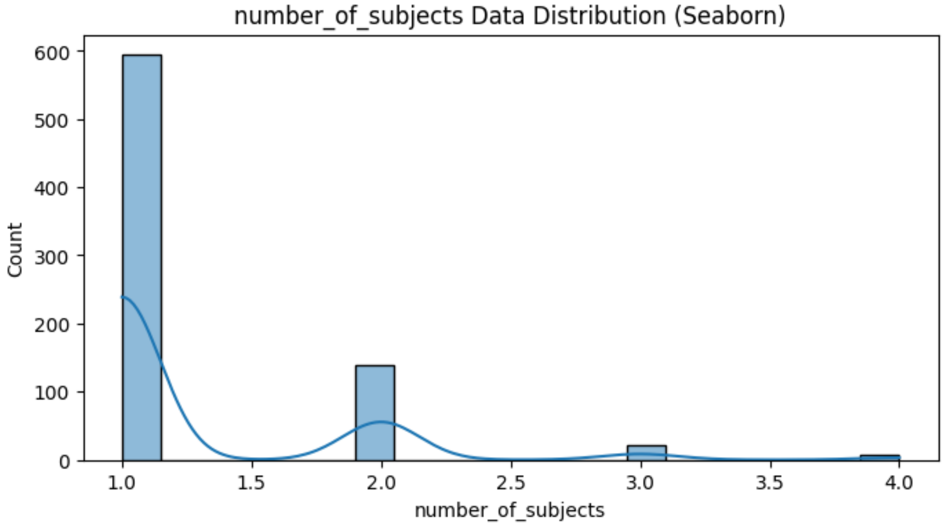
From the chart, it can be seen that the movie box office follows a long-tail distribution, which is highly uneven. The majority of movie box office figures are distributed below 50,000,000 dollars, with only a very small number of movies exceeding 150,000,000, and even 300,000,000 dollars. The following figure provides statistical information about movie box office, with movies having a value of 0 indicating that box office information was not available.



```
count    7.610000e+02
mean     1.319681e+07
std      3.116606e+07
min      0.000000e+00
25%      0.000000e+00
50%      3.310000e+05
75%      9.590000e+06
max      3.500000e+08
Name: box_office, dtype: float64
```

6. Number_of_subjects

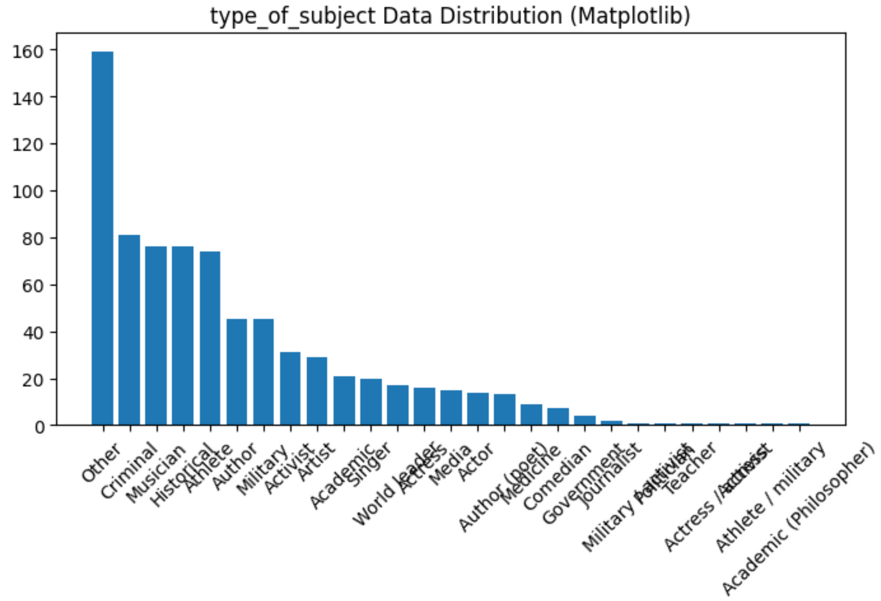


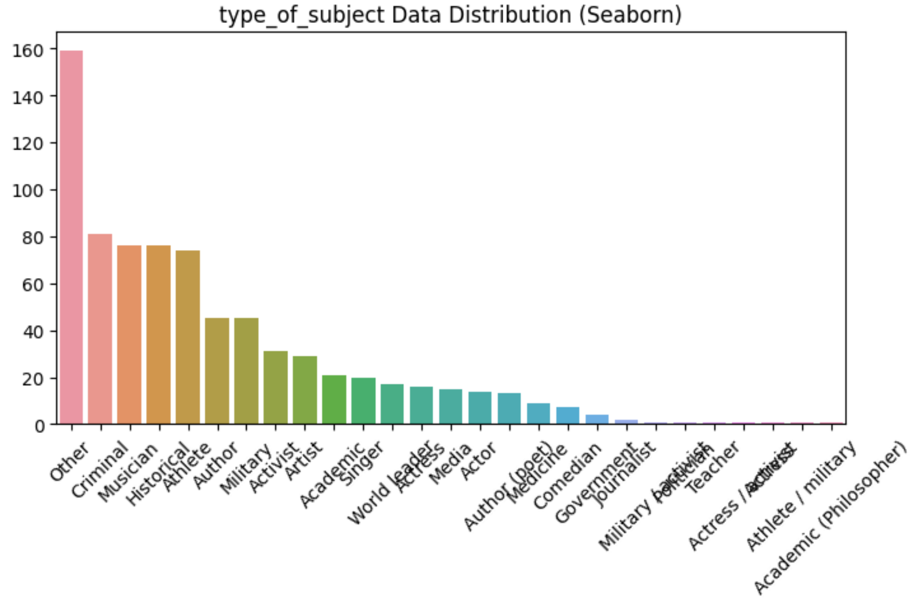


Most biographical movies feature only one subject, with very few having 3 or 4 subjects.

7. Type_of_subjects

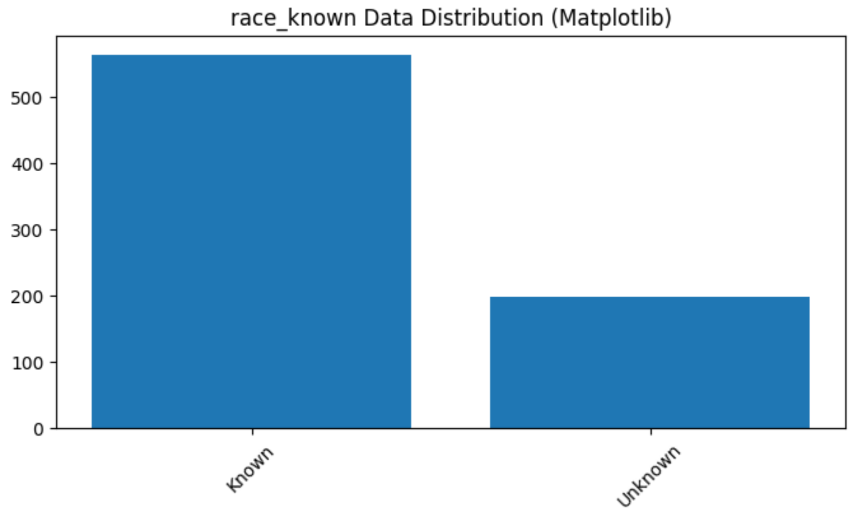
    The 'type_of_subjects' attribute means the occupation of subject or reason for recognition, like 'Criminal', 'Athlete', 'Musician', 'Academic', etc.

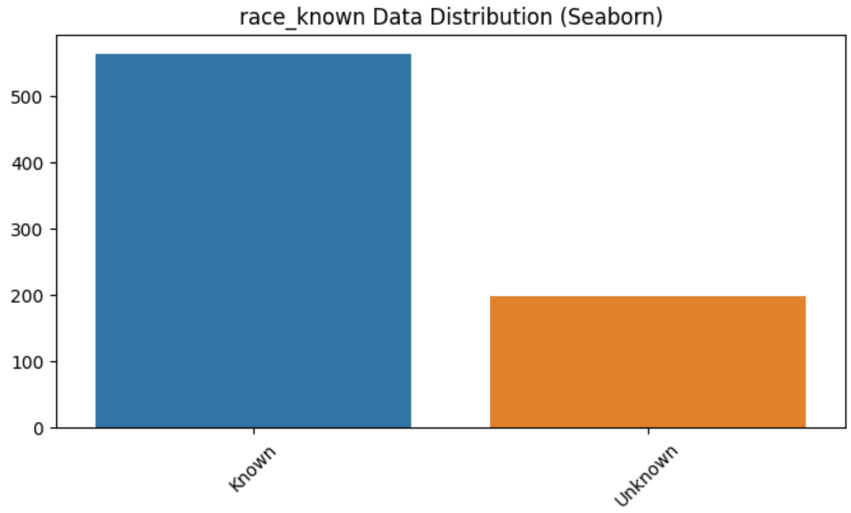




The most common subject types are "criminal," "musician," "historical," and "athlete." Following them in prevalence are "author," "military," and "artist."

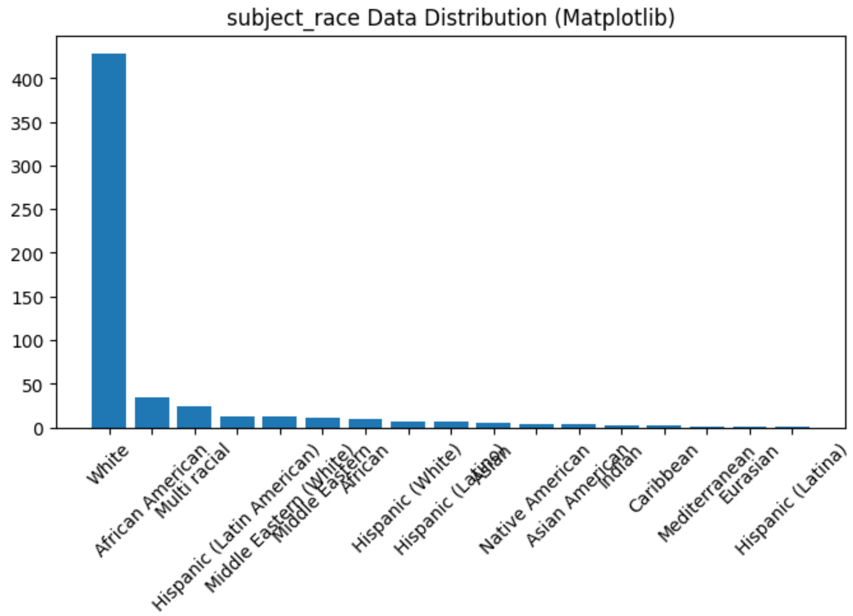
8. Race_known

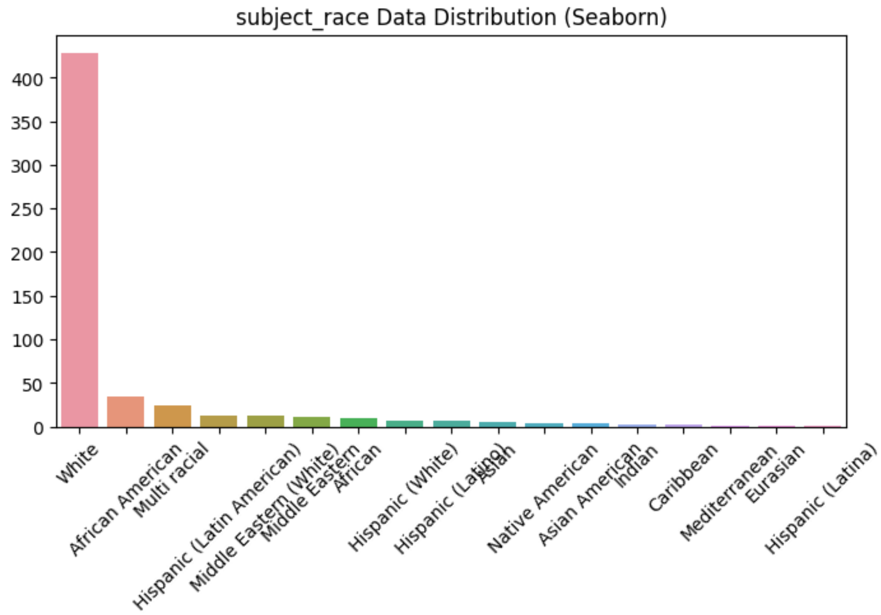




The 'race_known' attribute indicates whether a movie has a clearly defined 'race' attribute value. There are approximately 200 movies in which the 'race' attribute is not explicitly known. We can use the 500+ movies with clearly defined race attributes for the race analysis.

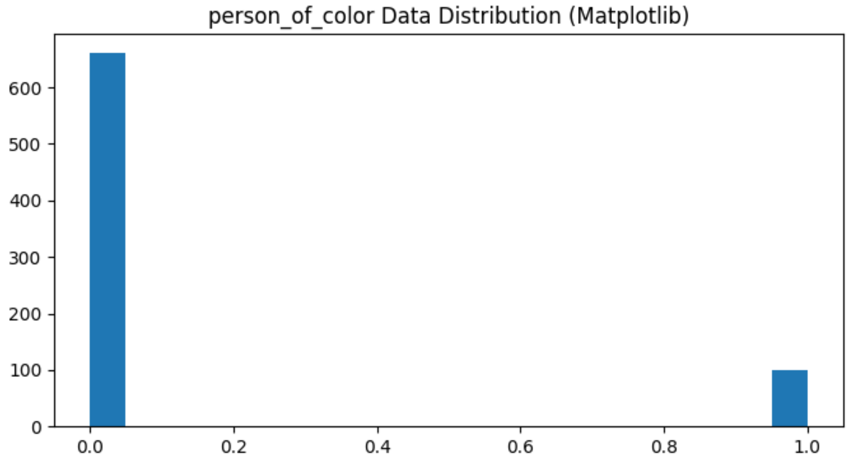
9. Subject_race

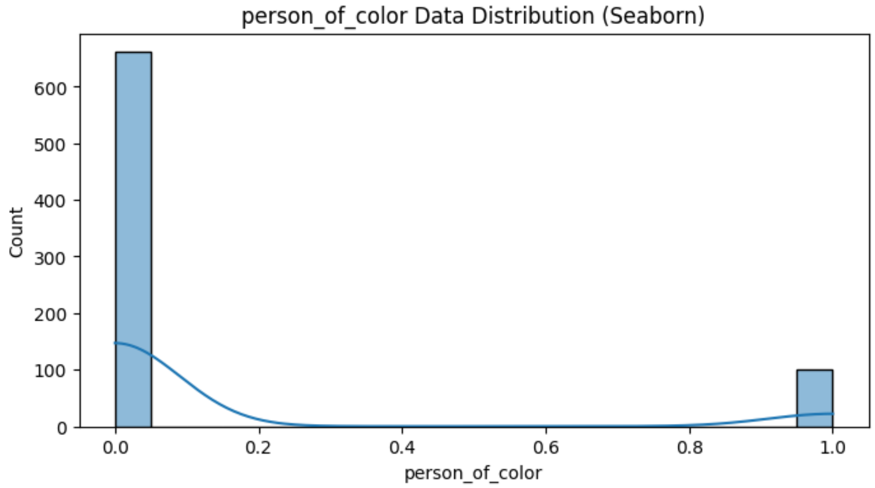




It can be observed that the number of biographical movies with the "White" racial category far exceeds other categories, dominating as the absolute majority, accounting for more than half of the total number of movies.

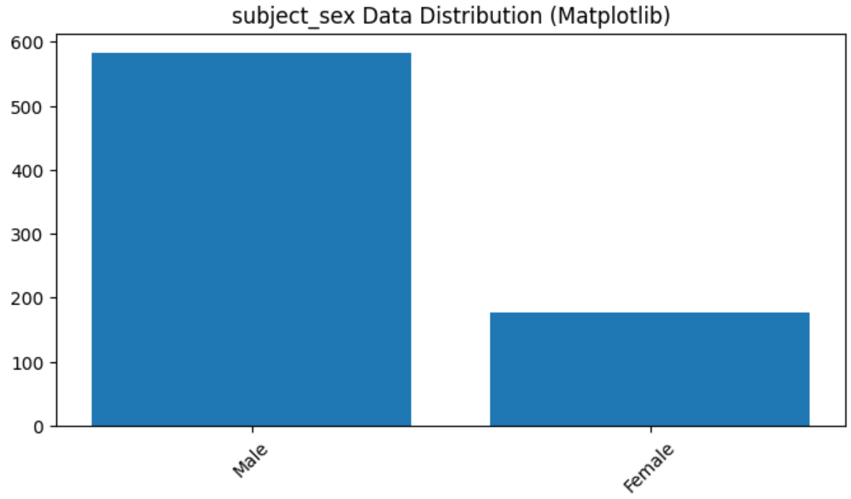
10. Person_of_color

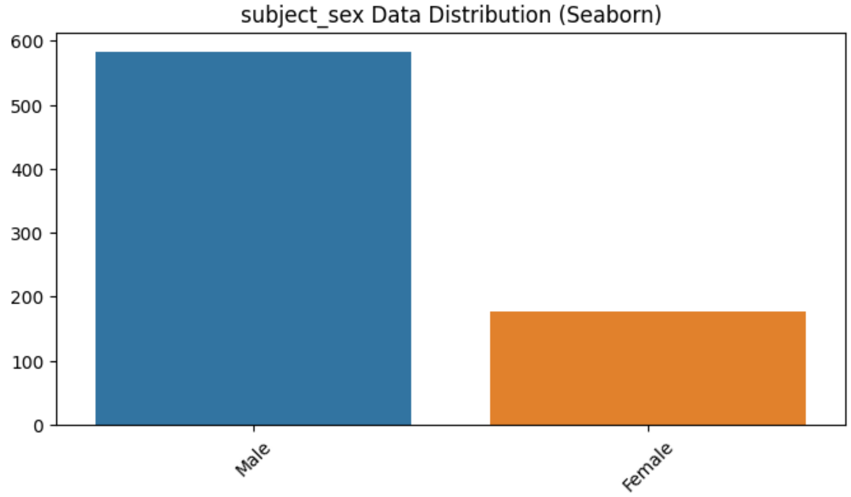




The 'person_of_color' attribute means dummy variable that indicates person of color. From the table, it can be seen that over 600 biographical movies do not feature characters of color, while there are only around 100 movies that are about characters of color.

11. Subject_sex



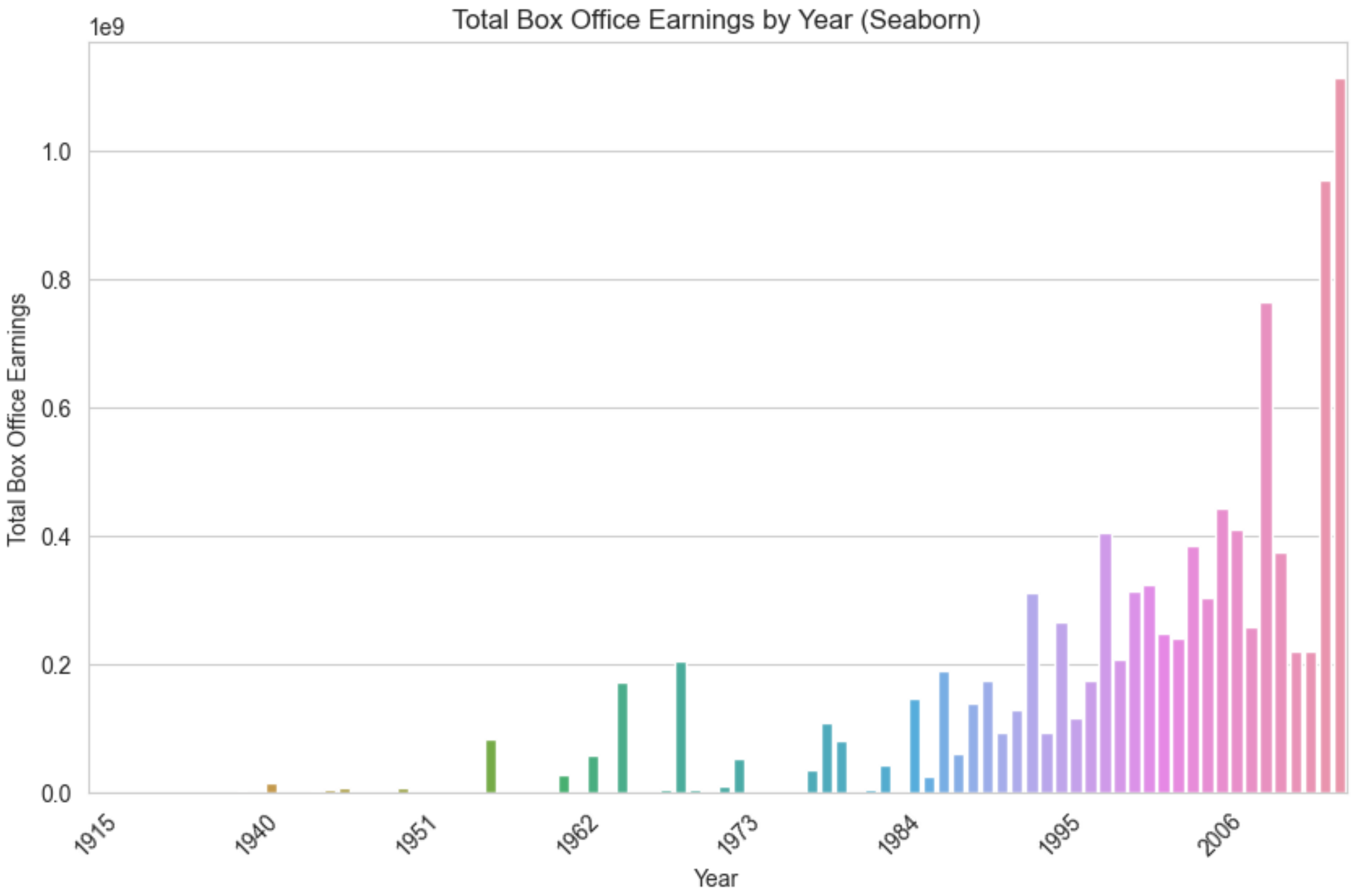


From the chart, it is evident that the number of biographical movies about males is nearly three times that of females, indicating a preference for male subjects in biographical movies with regard to gender.

4.Inference

4.1 Development of Biographical Film Box Office

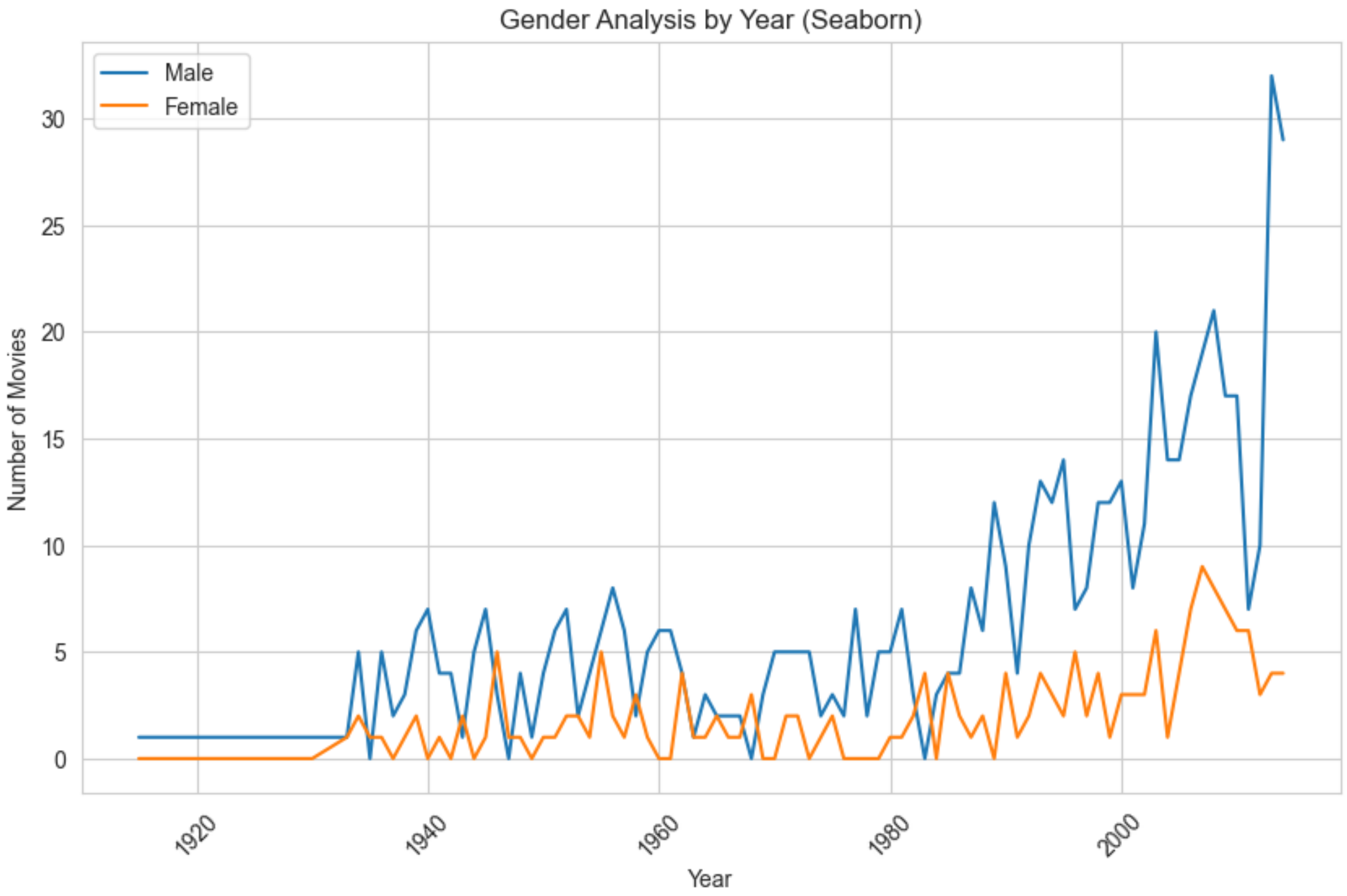
In order to calculate the trend of box office earnings for biographical movies over time, we have defined a function called 'box_year_analysis'. This function is located within the 'Inference' class in the 'Inference.py' file. It computes the total box office earnings for each year, and the results are as follows:



From the chart, it can be inferred that the total box office earnings of all biographical movies have been increasing year by year. Additionally, as the years have progressed, there is a denser concentration of years with high box office earnings. This suggests that consumer interest in biographical movies is gradually rising.

4.2 Gender Preferences

In Section 3.2, we found that biographical movies exhibit a gender preference towards males. To assess if the degree of this preference has changed over time, we separately counted the number of biographical movies about males and females each year, and the results are shown in the following chart. We have defined a function called 'gender_analysis_by_year', locating within the 'Inference' class in the 'Inference.py' file.



It can be observed that in earlier decades, the gender preference for biographical movies was not particularly evident, with slightly more male-focused biographical movies than female-focused ones. However, in recent years, as the number of biographical movies has rapidly increased, this difference has become increasingly significant, with male-focused movies being two to three times more prevalent than female-focused ones.

4.3 Racial Preferences

In 3.2 Section, the analysis of 'subject_race' and 'Person_of_color' attributes indicates the biographical film subjects exhibiting racial preferences, with much more preference to 'White' race than any other race.

5.Conclusion

This analysis of biographical movies revealed several key findings:

1. There is a consistent increase in the number of biographical movies over time, with notable peaks in the late 1950s and early 2000s.
2. Box office earnings for these movies exhibit a long-tail distribution, with most movies earning less than $500,000.
3. There is a strong preference for White subjects in biographical movies, with the majority of movies focusing on male subjects.
4. Gender preferences have become more pronounced in recent years, with male-focused movies outnumbering female-focused ones.

In summary, this analysis provides valuable insights into the trends and preferences within the biographical movie genre.

Reference

Molin S. Hands-On Data Analysis with Pandas: Efficiently perform data collection, wrangling, analysis, and visualization using Python[M]. Packt Publishing Ltd, 2019.