In [2]:

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

1.Cleaning and Inputing the Data

In [3]:

```
df = pd.read_csv('C:/Users/geeti/OneDrive/Desktop/IMDb Movies India.csv',encoding='latin
df.head()
```

Out[3]:

	Name	Year	Duration	Genre	Rating	Votes	Director	Actor 1	Actor 2	Actor 3
0		NaN	NaN	Drama	NaN	NaN	J.S. Randhawa	Manmauji	Birbal	Rajendra Bhatia
1	#Gadhvi (He thought he was Gandhi)	(2019)	109 min	Drama	7.0	8	Gaurav Bakshi	Rasika Dugal	Vivek Ghamande	Arvind Jangid
2	#Homecoming	(2021)	90 min	Drama, Musical	NaN	NaN	Soumyajit Majumdar	Sayani Gupta	Plabita Borthakur	Roy Angana
3	#Yaaram	(2019)	110 min	Comedy, Romance	4.4	35	Ovais Khan	Prateik	Ishita Raj	Siddhant Kapoor
4	...And Once Again	(2010)	105 min	Drama	NaN	NaN	Amol Palekar	Rajat Kapoor	Rituparna Sengupta	Antara Mali

In [4]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 15509 entries, 0 to 15508
Data columns (total 10 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   Name      15509 non-null  object 
 1   Year      14981 non-null  object 
 2   Duration  7240 non-null   object 
 3   Genre     13632 non-null  object 
 4   Rating    7919 non-null   float64
 5   Votes     7920 non-null   object 
 6   Director  14984 non-null  object 
 7   Actor 1   13892 non-null  object 
 8   Actor 2   13125 non-null  object 
 9   Actor 3   12365 non-null  object 
dtypes: float64(1), object(9)
memory usage: 1.2+ MB
```

In [5]:

```
missing_values = df.isna().sum()
percentages = (missing_values / len(df)) * 100
result_df = pd.DataFrame({
    'no of missing values': missing_values.values,
    'percentage': percentages.apply(lambda x: f'{x:.2f}%')  # Format percentages with 2
}, index=df.columns)
result_df
```

Out[5]:

	no of missing values	percentage
Name	0	0.00%
Year	528	3.40%

Duration	8269	53.32%
Genre	1877	12.10%
Rating	7590	48.94%
Votes	7589	48.93%
Director	525	3.39%
Actor 1	1617	10.43%
Actor 2	2384	15.37%
Actor 3	3144	20.27%

Rating will be the target variable for prediction so im dropping its null values

In [6]:

```
df.dropna(subset=['Rating'],inplace=True)
```

In [7]:

```
missing_values = df.isna().sum()
percentages = (missing_values / len(df)) * 100

result_df = pd.DataFrame({
    'no of missing values': missing_values.values,
    'percentage': percentages.apply(lambda x: f'{x:.2f}%')  # Format percentages with 2
}, index=df.columns)

result_df
```

Out[7]:

	no of missing values	percentage
Name	0	0.00%
Year	0	0.00%
Duration	2068	26.11%
Genre	102	1.29%
Rating	0	0.00%
Votes	0	0.00%
Director	5	0.06%
Actor 1	125	1.58%
Actor 2	200	2.53%
Actor 3	292	3.69%

Now for other column except genre the missing values are less than 4% so we will drop them

In [8]:

```
df.dropna(subset=['Actor 1','Actor 2','Actor 3','Director','Genre'],inplace=True)
```

In [9]:

```
missing_values = df.isna().sum()
percentages = (missing_values / len(df)) * 100

result_df = pd.DataFrame({
    'no of missing values': missing_values.values,
    'percentage': percentages.apply(lambda x: f'{x:.2f}%')  # Format percentages with 2
}, index=df.columns)

result_df
```

Out[9]:

	no of missing values	percentage
Name	0	0.00%
Year	0	0.00%
Duration	1899	25.13%
Genre	0	0.00%
Rating	0	0.00%
Votes	0	0.00%
Director	0	0.00%
Actor 1	0	0.00%
Actor 2	0	0.00%
Actor 3	0	0.00%

Before imputing duration values I will change years from (2019) to 2019 and convert votes to integer by removing comma in higher values for votes and duration is in min so to convert it into integer we will have to remove 'min' string

In [10]:

```
df['Votes']= df['Votes'].str.replace(',','').astype(int)
df['Year']= df['Year'].str.strip('()').astype(int)
df['Duration']=df['Duration'].str.strip(' min')
```

I will impute the Duration column with random imputation of values from 90 to 180 as our original distribution without imputation have most values in this range and after imputation the original shape is mantained rather than if i had filled with mean below graphs make this clear take a look

In [11]:

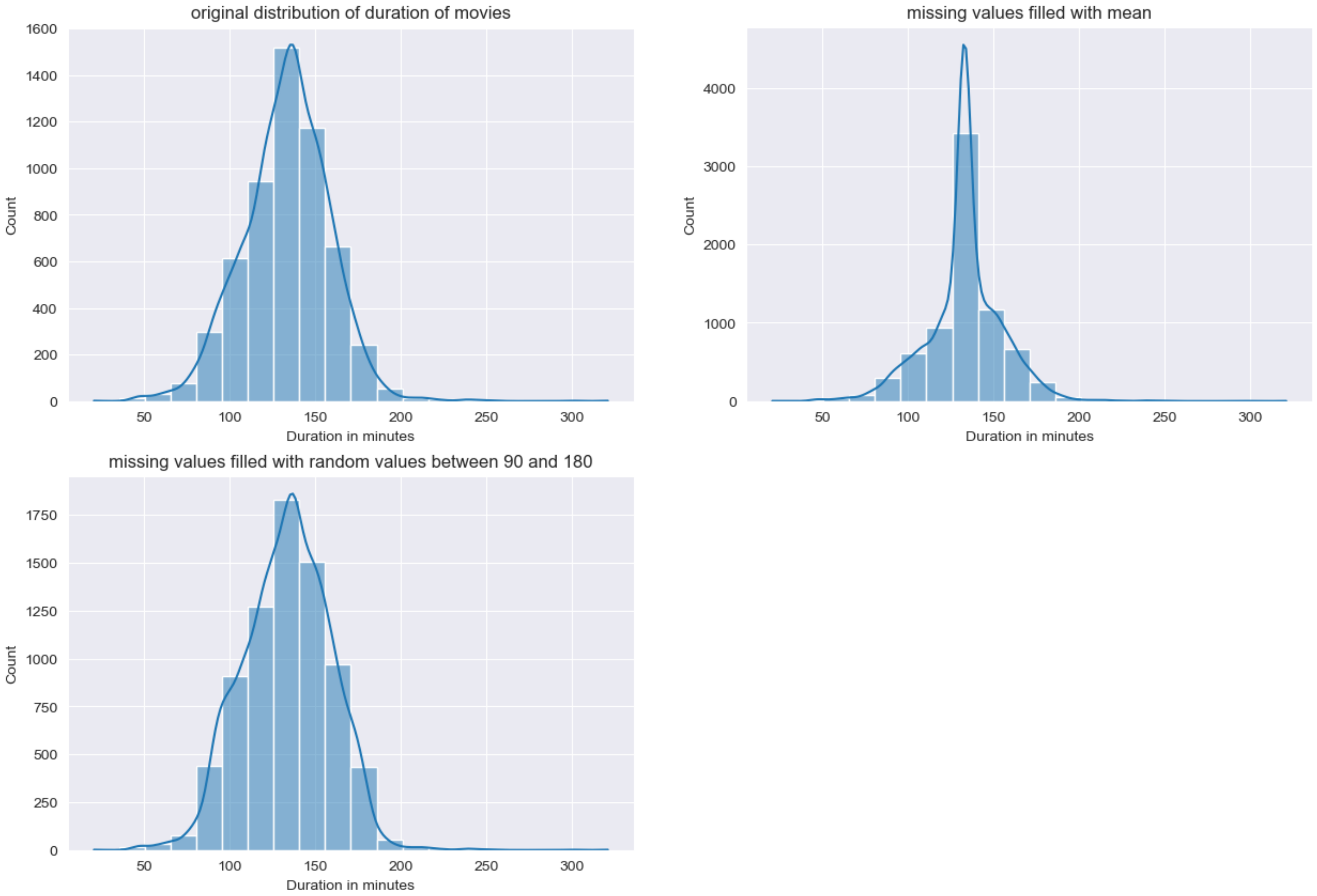
```
df['Duration_copy']=df['Duration']
mask = df['Duration'].isnull()
random_values = np.random.randint(90, 181, size=mask.sum())  # Generate random numbers
df['Duration'][mask] = random_values
org_duration = df.loc[~df['Duration_copy'].isnull(), 'Duration_copy'].astype(int)
df['Duration'] = df['Duration'].astype(int)
```

```
C:\Users\geeti\AppData\Local\Temp\ipykernel_7336\1778978848.py:4: SettingWithCopyWarnin
g:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  df['Duration'][mask] = random_values
```

In [12]:

```
sns.set_style('darkgrid')
fig,ax = plt.subplots(2,2,figsize=(15,10))
sns.histplot(data=org_duration,bins=20,kde=True,ax=ax[0][0])
sns.histplot(data=df,x=df['Duration_copy'].fillna(org_duration.mean()).astype(int),bins=
sns.histplot(data=df,x=df['Duration'],bins=20,kde=True,ax=ax[1][0])
ax[0][0].set_xlabel('Duration in minutes')
ax[0][1].set_xlabel('Duration in minutes')
ax[1][0].set_xlabel('Duration in minutes')
ax[0][0].set_title('original distribution of duration of movies')
ax[0][1].set_title('missing values filled with mean')
ax[1][0].set_title('missing values filled with random values between 90 and 180')
fig.delaxes(ax[1][1])
plt.show()
```



In [13]:

```
df.drop(columns=['Duration_copy'],inplace=True)
```

In [14]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 7558 entries, 1 to 15508
Data columns (total 10 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   Name      7558 non-null   object 
 1   Year      7558 non-null   int32  
 2   Duration  7558 non-null   int32  
 3   Genre     7558 non-null   object 
 4   Rating    7558 non-null   float64
 5   Votes     7558 non-null   int32  
 6   Director  7558 non-null   object 
 7   Actor 1   7558 non-null   object 
 8   Actor 2   7558 non-null   object 
 9   Actor 3   7558 non-null   object 
dtypes: float64(1), int32(3), object(6)
memory usage: 560.9+ KB
```

Now the data is cleaned and imputed

2. EDA

Top 10 rated movies

In [15]:

```
top_10_movies = df.loc[df['Rating'].sort_values(ascending=False)[:10].index]
top_10_movies
```

Out[15]:

	Name	Year	Duration	Genre	Rating	Votes	Director	Actor 1	Actor 2	Actor 3
8339	Love Qubool Hai	2020	94	Drama, Romance	10.0	5	Saif Ali Sayeed	Ahaan Jha	Mahesh Narayan	Rajasree Rajakumari
5410	Half Songs	2021	79	Music, Romance	9.7	7	Sriram Raja	Raj Banerjee	Emon Chatterjee	Purshottam Mulani
2563	Breed	2020	141	Drama	9.6	48	Bobby Kumar	Bobby Kumar	Ashfaq	Fasih Choudhry
14222	The Reluctant Crime	2020	113	Drama	9.4	16	Arvind Pratap	Dharmendra Ahir	Awanish Kotnal	Rakhi Mansha
5077	Gho Gho Rani	2019	105	History, Romance	9.4	47	Munni Pankaj	Nishi Neha Mishra	Pankaj Kamal	Akash Kumar
6852	June	2021	93	Drama	9.4	18	Suhrud Godbole	Vaibhav Khisti	Nilesh Divekar	Jitendra Joshi
12673	Secrets of Sinauli	2021	56	Documentary, History	9.3	1373	Raghav Jairath	Manoj Bajpayee	R.S. Bhist	K.N. Dixit
5125	God of gods	2019	90	Documentary	9.3	46	Venkatesh Bk	Tejaswini Manogna	Triyug Mantri	Raj Singh Verma
8344	Love Sorries	2021	101	Comedy, Drama, Romance	9.3	79	Gautam Joshi	Prashant Chaubey	Puneet Chouksey	Amitabh Gupta
1314	Ashok Vatika	2018	97	Drama	9.3	7	Rahul Mallick	Kunj Anand	Sanjay Bishnoi	Paras Zutshi

Below dataframe contains top rated movie for every year

In [16]:
```
df.groupby('Year').apply(pd.DataFrame.nlargest, n=1, columns=['Rating'])
```

Out[16]:

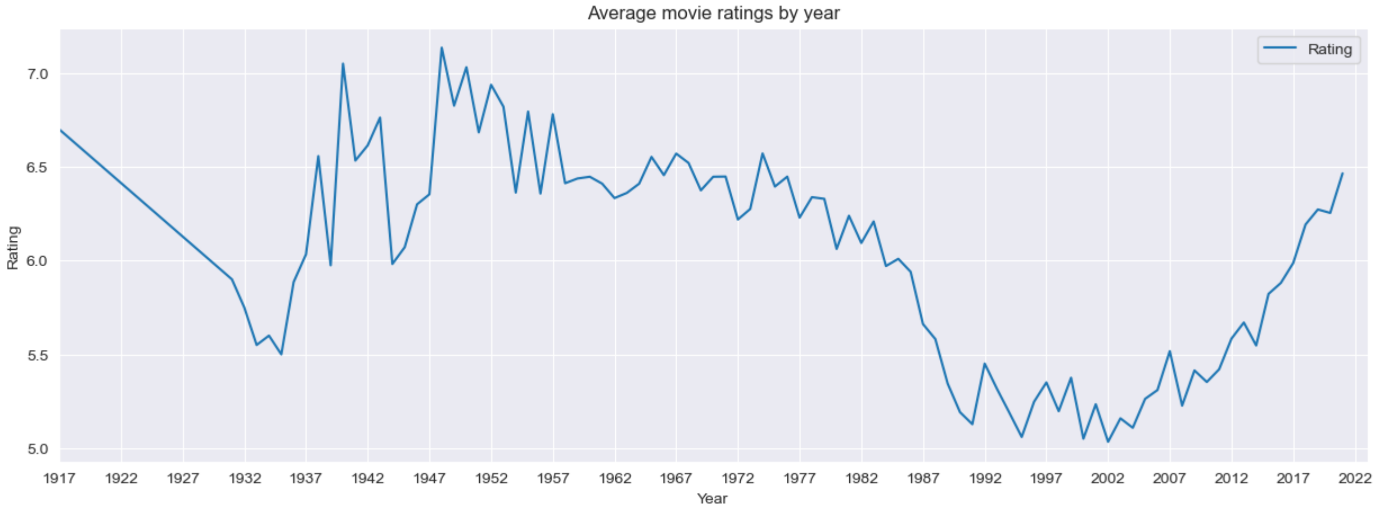
		Name	Year	Duration	Genre	Rating	Votes	Director	Actor 1	Actor 2	A
Year											
1917	**8146**	Lanka Dahan	1917	121	Adventure, Drama, Fantasy	6.7	22	Dhundiraj Govind Phalke	Anna Salunke	Ganpat G. Shinde	D.D.
1931	**7203**	Kalidas	1931	165	Drama, History, Musical	6.2	12	H.M. Reddy	T.P. Rajalakshmi	P.G. Venkatesan	L.V.
1932	**6073**	Indrasabha	1932	211	Musical, Romance	6.0	12	J.J. Madan	Nissar	Jehanara Kajjan	R
1933	**851**	Alif Laila	1933	137	Fantasy	7.2	37	Balwant Bhatt	Shanti Dave	Bashir Qawal	
1934	**9053**	Mazdoor	1934	155	Drama	8.5	6	Mohan Dayaram Bhavnani	Bibbo	S.B. Nayampalli	Paic
...	**...**	...	...	...	...	...	...	...	...	...	
2017	**11841**	Rediscovering India	2017	124	Documentary	9.0	62	Meenal Dixit	Benny John	Benny John	I
2018	**1314**	Ashok Vatika	2018	97	Drama	9.3	7	Rahul	Kunj Anand	Sanjay	

								Mallick		Bishnoi	
2019	**5077**	Gho Gho Rani	2019	105	History, Romance	9.4	47	Munni Pankaj	Nishi Neha Mishra	Pankaj Kamal	
2020	**8339**	Love Qubool Hai	2020	94	Drama, Romance	10.0	5	Saif Ali Sayeed	Ahaan Jha	Mahesh Narayan	R Raja
2021	**5410**	Half Songs	2021	79	Music, Romance	9.7	7	Sriram Raja	Raj Banerjee	Emon Chatterjee	Pursl

92 rows × 10 columns

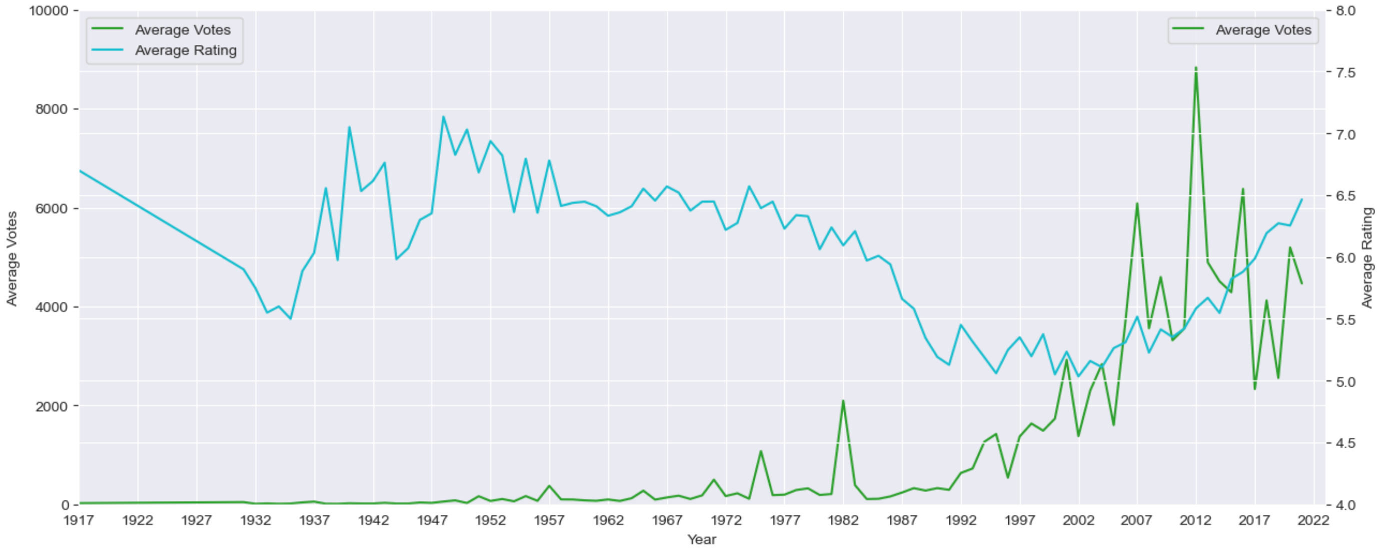
Below graph shows average rating for every year and according to it the year with best ratings should be 1948 and worst is 2002

```
In [17]:
sns.set_style('darkgrid')
df.groupby('Year')[['Rating']].mean().plot(figsize=(15,5))
plt.xlabel('Year')
plt.ylabel('Rating')
plt.title('Average movie ratings by year')
plt.xticks(np.arange(1917,2023,5))
plt.xlim(1917,2023)
plt.show()
```



Now below graph add more detail by also showing average votes for that rating in that year. It also show the relation that years with less votes have higher rating and rating drops as votes grow.

```
In [18]:
fig,ax1 = plt.subplots(figsize=(15,6))
sns.lineplot(data=df,x='Year',y='Votes',errorbar=None,ax=ax1,label='Average Votes',color
ax1.set_xlabel('Year')
ax1.set_ylabel('Average Votes')
ax1.set_xlim(1917,2023)
ax1.set_ylim(0,10000)
ax1.set_xticks(np.arange(1917,2023,5))
ax2 = ax1.twinx()
sns.lineplot(data=df,x='Year',y='Rating',errorbar=None,ax=ax2,color='#17becf',label='Ave
ax2.set_ylabel('Average Rating')
ax2.set_ylim(4,8)
lines, labels = ax1.get_legend_handles_labels()
lines2, labels2 = ax2.get_legend_handles_labels()
ax2.legend(lines + lines2, labels + labels2, loc='upper left')
plt.show()
```



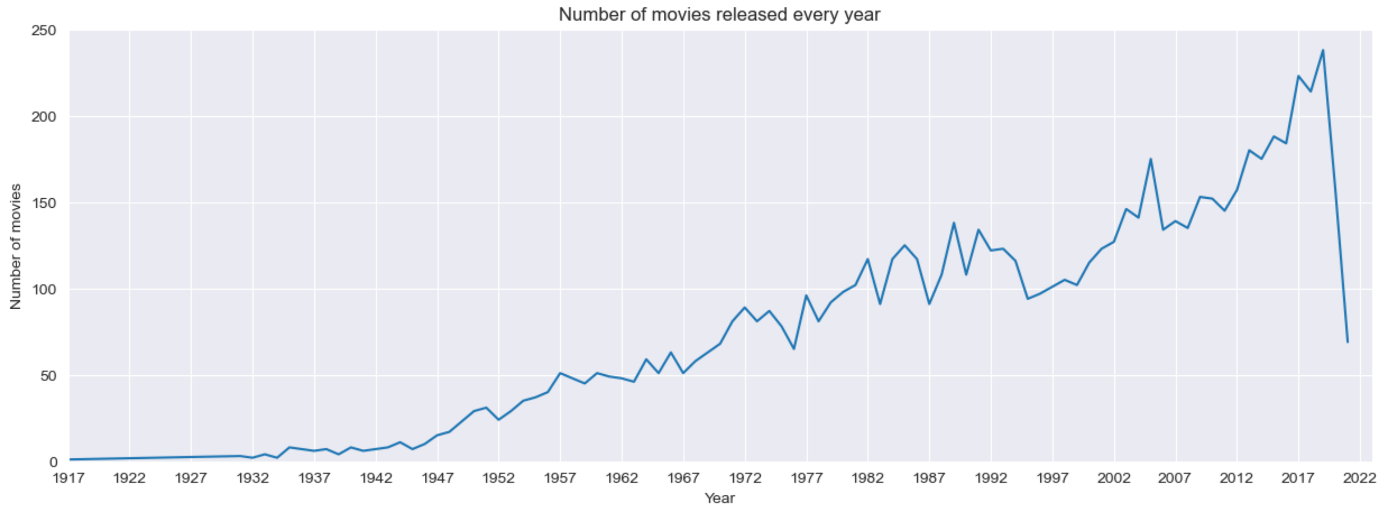
In [19]:

```
# sns.set_style('darkgrid')
# df.groupby('Year')[['Votes']].mean().plot(figsize=(15,5))
# plt.xlabel('Year')
# plt.ylabel('Average number of votes')
# plt.title('Average votes by year')
# plt.xticks(np.arange(1917,2023,5))
# plt.xlim(1917,2023)
# plt.show()
```

Below graph shows the average number of movies released each year which goes on increasing

In [20]:

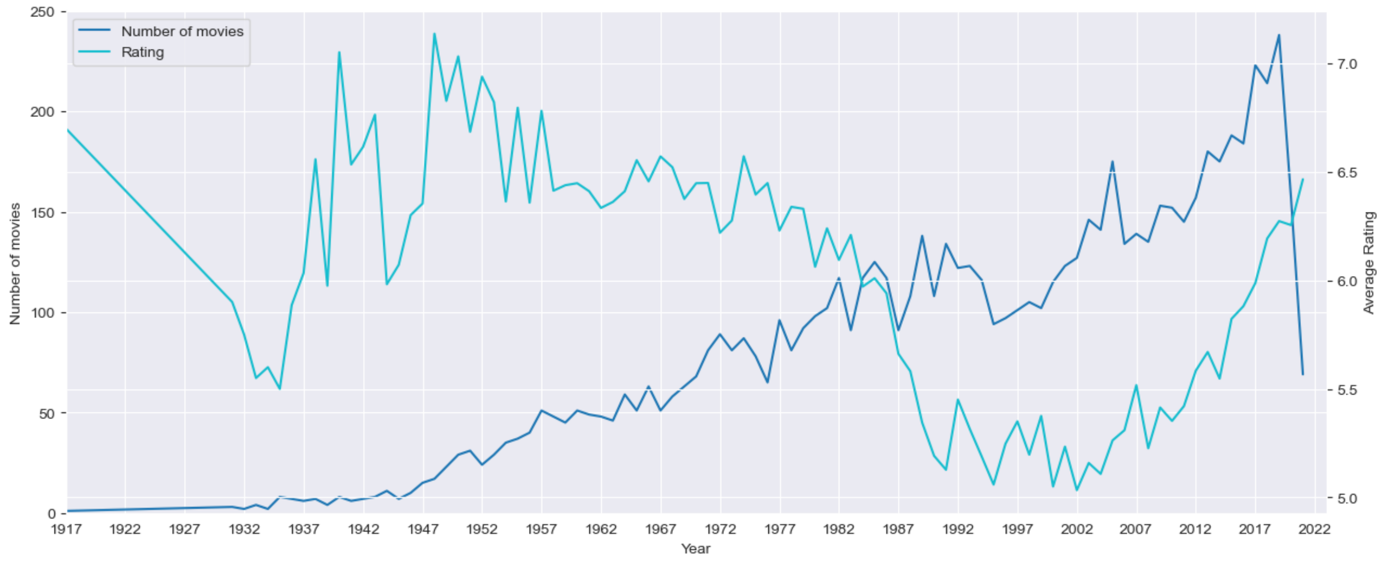
```
sns.set_style('darkgrid')
df.groupby(['Year'])['Name'].count().plot(figsize=(15,5))
plt.xlabel('Year')
plt.ylabel('Number of movies')
plt.title('Number of movies released every year')
plt.ylim(0,250)
plt.xlim(1917,2023)
plt.xticks(np.arange(1917,2023,5))
plt.show()
```



In [21]:

```
sns.set_style('darkgrid')
fig,ax1 = plt.subplots(figsize=(15,6))
df.groupby(['Year'])['Name'].count().plot(ax=ax1,label='Number of movies')
ax1.set_xlabel('Year')
ax1.set_ylabel('Number of movies')
ax1.set_ylim(0,250)
ax1.set_xlim(1917,2023)
ax1.set_xticks(np.arange(1917,2023,5))
```

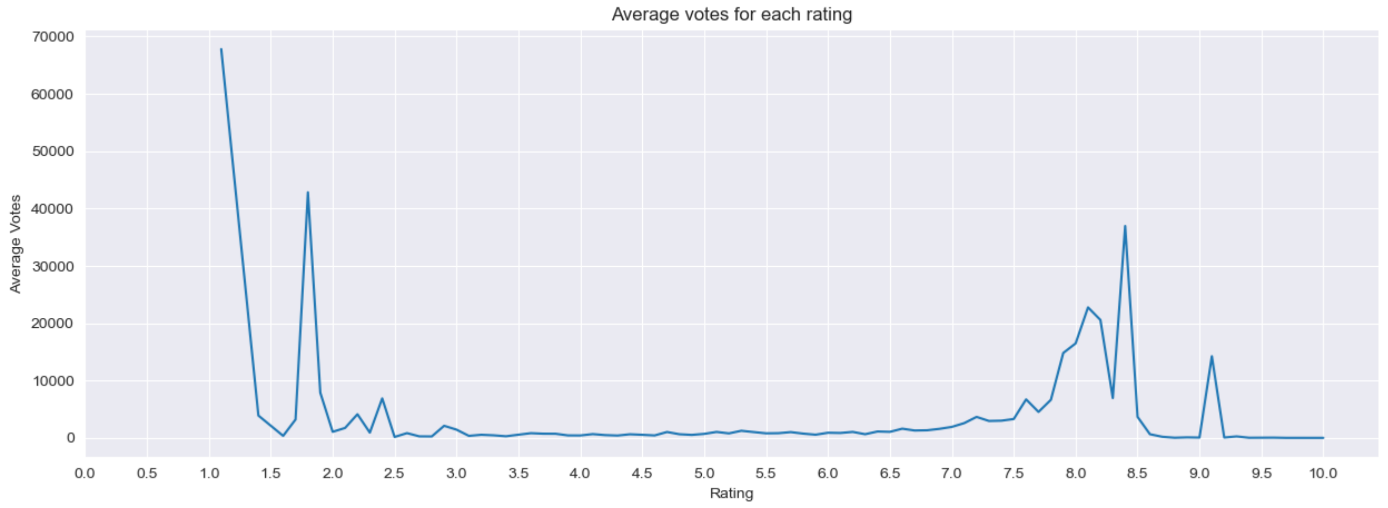
```
ax2=ax1.twinx()
df.groupby('Year')[['Rating']].mean().plot(ax=ax2,color='#17becf',label='Average rating'
ax2.set_ylabel('Average Rating')
lines, labels = ax1.get_legend_handles_labels()
lines2, labels2 = ax2.get_legend_handles_labels()
ax2.legend(lines + lines2, labels + labels2, loc='upper left')
plt.show()
```



Below graph shows us the average vots for each rating and we can see the movies rated 9.5-10 may drop in rating as the votes increase or they may retain their rating depends on your vote

In [22]:

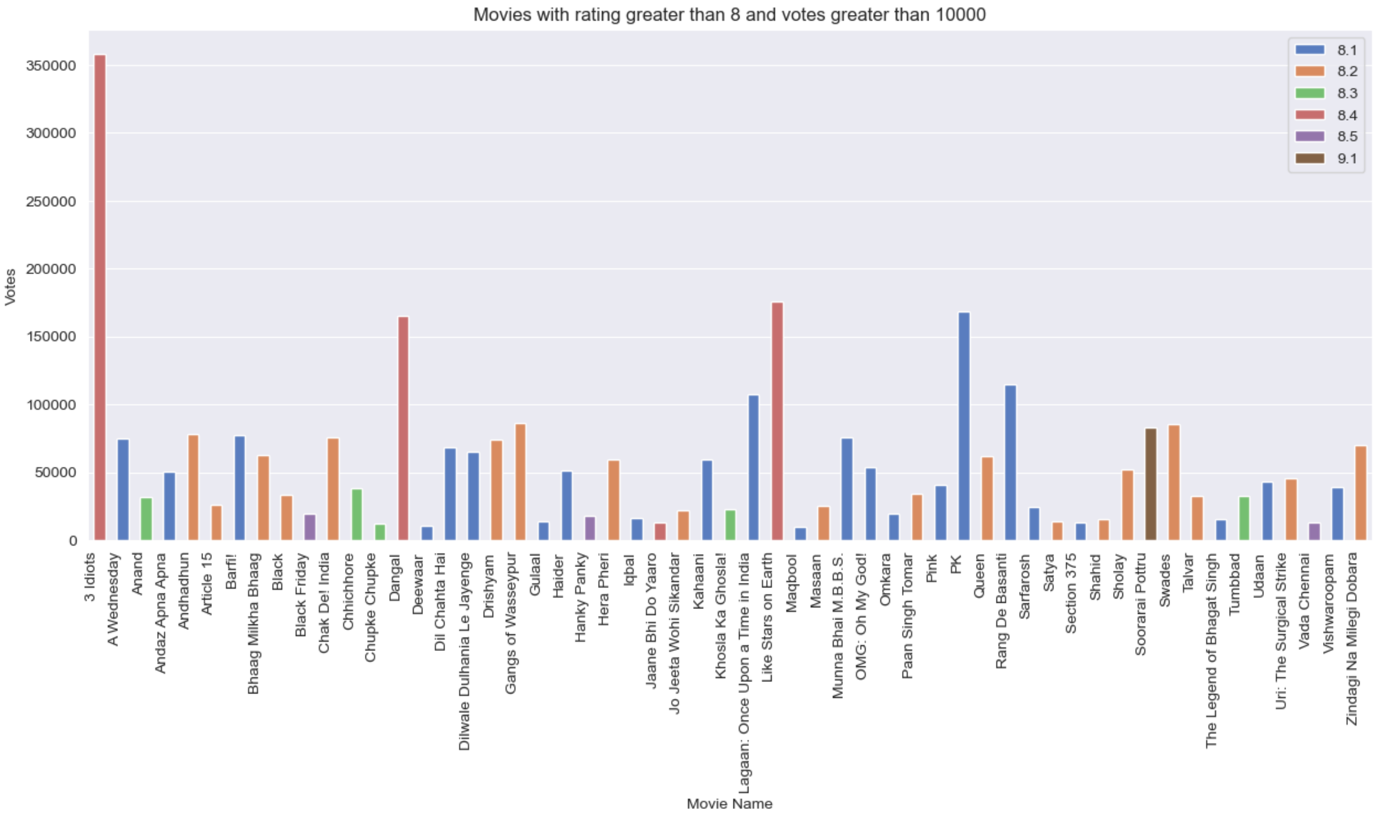
```
sns.set_style('darkgrid')
plt.figure(figsize=(15,5))
sns.lineplot(data=df,x='Rating',y='Votes',errorbar=None)
plt.xlabel('Rating')
plt.ylabel('Average Votes')
plt.xticks(np.arange(0,10.5,0.5))
plt.title('Average votes for each rating')
plt.show()
```



Below graph show top movies with raint greater than 8 and also more than 10000 votes so we can say that these movies are actually good. and certainly 3 idiots is a great movie you can see more below

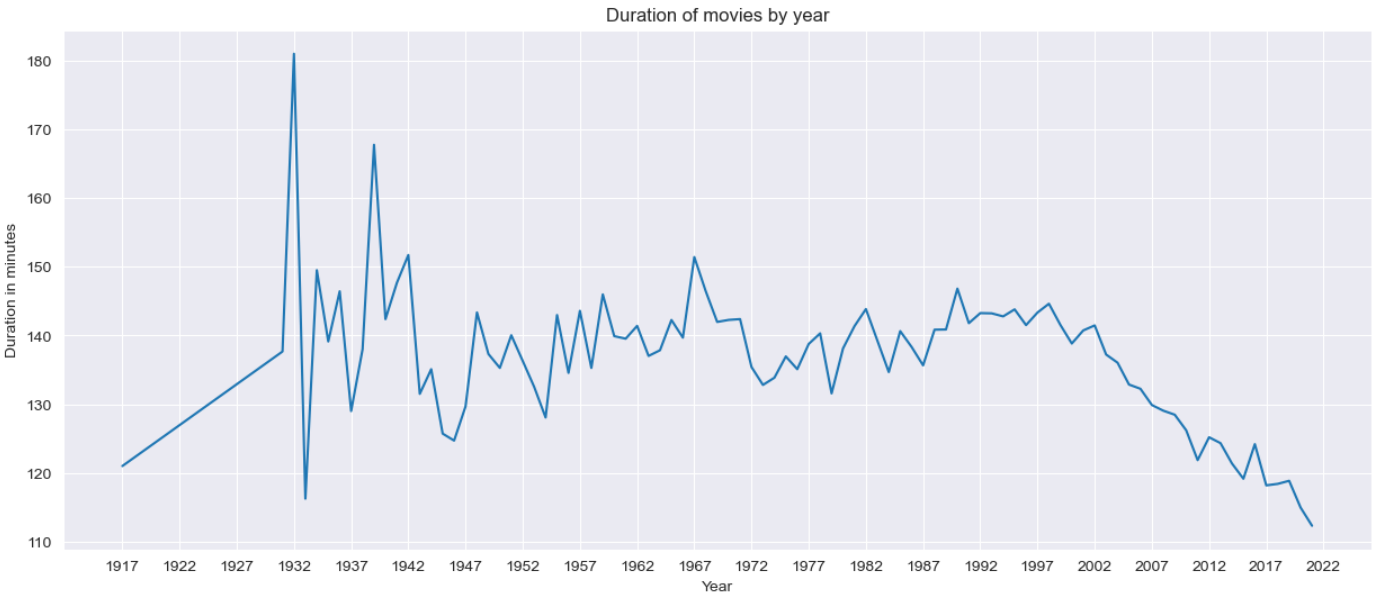
In [23]:

```
sns.set_style('darkgrid')
d = df.loc[(df['Rating']>8) & (df['Votes']>10000), ['Rating','Votes','Name']]
plt.figure(figsize=(15, 6))
ax=sns.barplot(data=d,x='Name',y='Votes',hue='Rating',dodge=False,width=0.5,palette='mut
ax.set_xticklabels(ax.get_xticklabels(), rotation=90, ha='right')
ax.legend(loc='upper right')
ax.set_xlabel('Movie Name')
ax.set_ylabel('Votes')
ax.set_title('Movies with rating greater than 8 and votes greater than 10000')
plt.show()
```



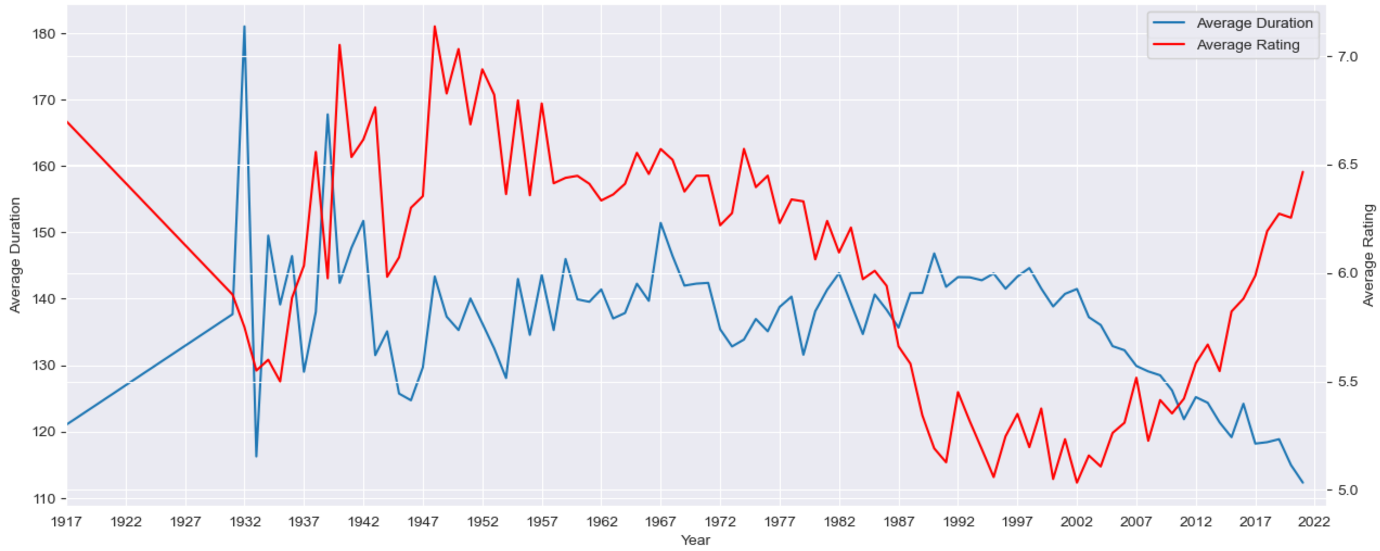
In [24]:

```
sns.set_style('darkgrid')
plt.figure(figsize=(15, 6))
sns.lineplot(data=df,x='Year',y='Duration',errorbar=None)
plt.xlabel('Year')
plt.ylabel('Duration in minutes')
plt.title('Duration of movies by year')
plt.xticks(np.arange(1917,2023,5))
plt.show()
```



Average duration have such a messy relation with rating

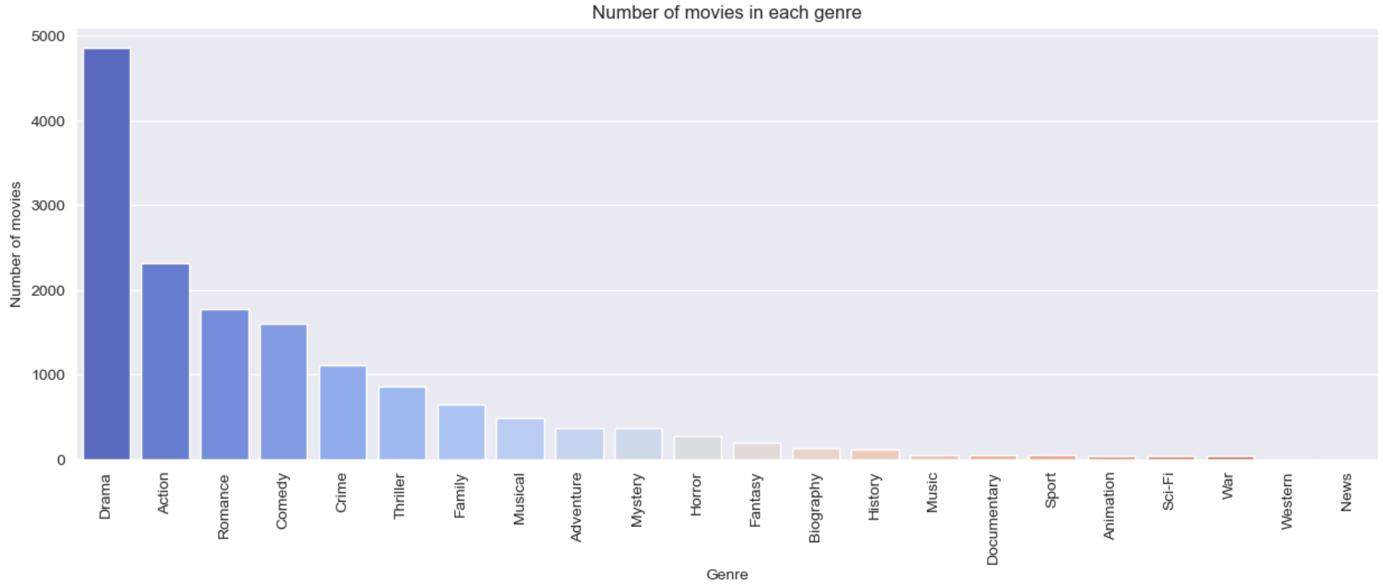
In [25]:
```
fig,ax1 = plt.subplots(figsize=(15,6))
sns.lineplot(data=df,x='Year',y='Duration',errorbar=None,ax=ax1,label='Average Duration'
ax1.set_xlabel('Year')
ax1.set_ylabel('Average Duration')
ax1.set_xlim(1917,2023)
ax1.set_xticks(np.arange(1917,2023,5))
ax2 = ax1.twinx()
sns.lineplot(data=df,x='Year',y='Rating',errorbar=None,ax=ax2,color='red',label='Average
ax2.set_ylabel('Average Rating')
lines, labels = ax1.get_legend_handles_labels()
lines2, labels2 = ax2.get_legend_handles_labels()
ax2.legend(lines + lines2, labels + labels2, loc='upper right')
plt.show()
```



Now i will perform EDA on every single genre

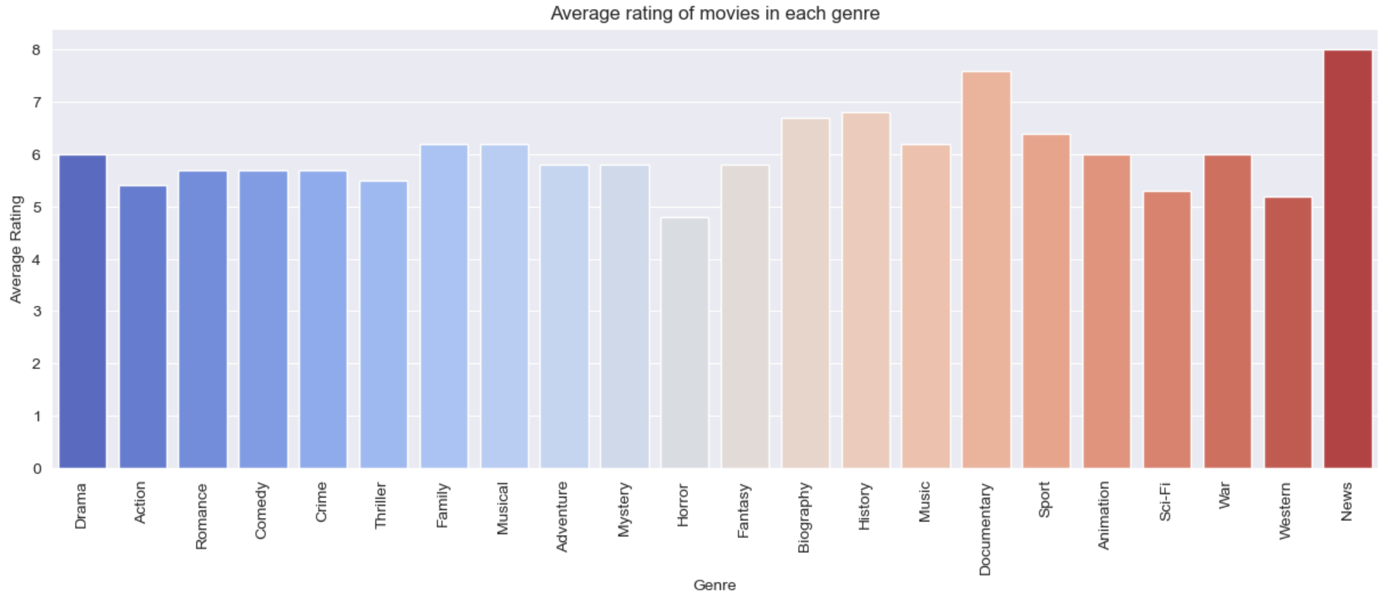
In [29]:
```
genre = df['Genre']
genre_stack = genre.str.split(',').apply(pd.Series).stack()
genre_stack.index = genre_stack.index.droplevel(-1)
g=[genre.str.split(',').apply(pd.Series)[i].str.strip().value_counts(dropna=False).to_di
# g_dict = {}
# for dic in g:
#     for k,v in dic.items():
#         if k in g_dict:
#             g_dict[k]+=v
#         else:
#             g_dict[k]=v
# below code does same job as above
g_dict = {k: sum(dic.get(k,0) for dic in g) for dic in g for k in dic}
genres_count = pd.Series(g_dict).sort_values(ascending=False).drop(np.nan)
# Now for average rating of each genre
# genre_rating = {}
# for i in genres_count.index:
#     genre_rating[i]=df.loc[df['Genre'].str.contains(i),'Rating'].mean().round(1)
genre_rating = {k:df.loc[df['Genre'].str.contains(k),'Rating'].mean().round(1) for k in
genre_rating = pd.Series(genre_rating).sort_values(ascending=False)
genres_single = pd.concat([genres_count,genre_rating],axis=1).sort_values(by=1,ascending
genres_single.sort_values(by='Movie count',ascending=False,inplace=True)
```

In [30]:
```
# genres_count = pd.Series(g_dict).sort_values(ascending=False).drop(np.nan)
sns.set_style('darkgrid')
plt.figure(figsize=(15,5))
sns.barplot(data=genres_single,x=genres_single.index.values,y='Movie count',palette='coo
plt.xlabel('Genre')
plt.ylabel('Number of movies')
plt.title('Number of movies in each genre')
plt.xticks(rotation=90)
plt.show()
```



Now below Graph shows the average rating for each genre but drama has more movies so it is logical for rating to drop as some movies may have performed bad

In [34]:
```
sns.set_style('darkgrid')
plt.figure(figsize=(15,5))
sns.barplot(data=genres_single,x=genres_single.index.values,y='Average rating',palette='
plt.xlabel('Genre')
plt.ylabel('Average Rating')
plt.title('Average rating of movies in each genre')
plt.xticks(rotation=90)
plt.show()
```



For prediction of rating I will replace every genre with its average rating for all the movies for that particular genres and I will do same for directors and actors

In [35]:
```
genre_df = df.groupby('Genre').agg({'Rating':['mean','count']})
genre_df.reset_index(inplace=True)
genre_df.columns = ['Genre','Average Rating','Movie Count']
genre_df['Average Rating'] = genre_df['Average Rating'].round(1)
genre_df
```

Out[35]:

```
                          Genre  Average Rating  Movie Count
  0                      Action             5.0          391
  1           Action, Adventure             5.6           24
  2  Action, Adventure, Biography           7.8            1
  3     Action, Adventure, Comedy           5.6           40
  4      Action, Adventure, Crime           5.6           16
...                         ...             ...          ...
411             Thriller, Action            4.3            1
412    Thriller, Musical, Mystery           7.1            1
413            Thriller, Mystery            6.5            3
414     Thriller, Mystery, Family           6.1            1
415                          War            4.3            3
```

416 rows × 3 columns

In [36]:

```python
# it will be used for mapping
genre_dict = dict(zip(genre_df['Genre'],genre_df['Average Rating']))
```

Directors Analysis

In [37]:

```python
directors  = df.groupby('Director').agg({'Rating':['mean','count']})
directors.columns = directors.columns.droplevel(0)
directors.reset_index(inplace=True)
directors.columns = ['Director','Average Rating','Movie count']
directors['Average Rating'] = directors['Average Rating'].round(1)
directors.sort_values(by='Movie count',ascending=False,inplace=True)
directors.head()
```

Out[37]:

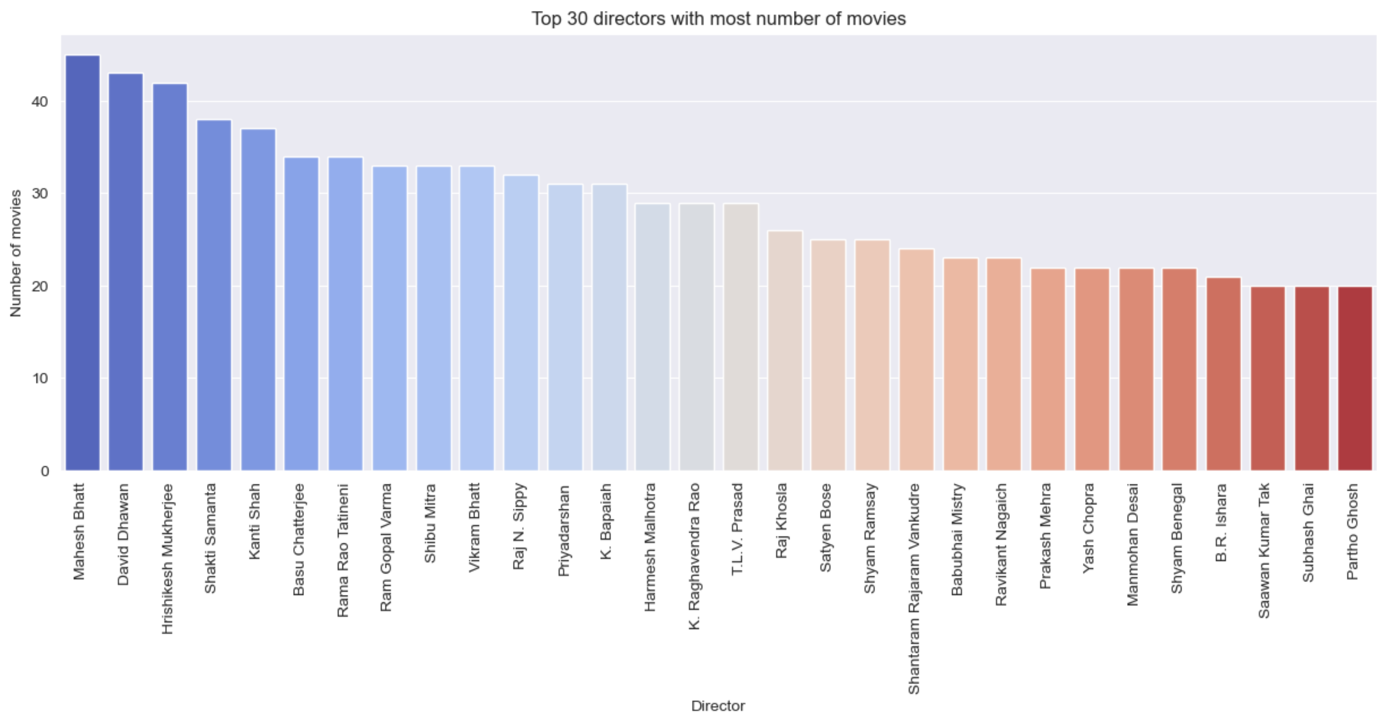
```
                Director  Average Rating  Movie count
1336        Mahesh Bhatt             5.5           45
 586        David Dhawan             5.2           43
 899  Hrishikesh Mukherjee           7.1           42
2408      Shakti Samanta             6.6           38
1155          Kanti Shah             4.9           37
```

In [38]:

```python
directors_dict = dict(zip(directors['Director'],directors['Average Rating']))
```

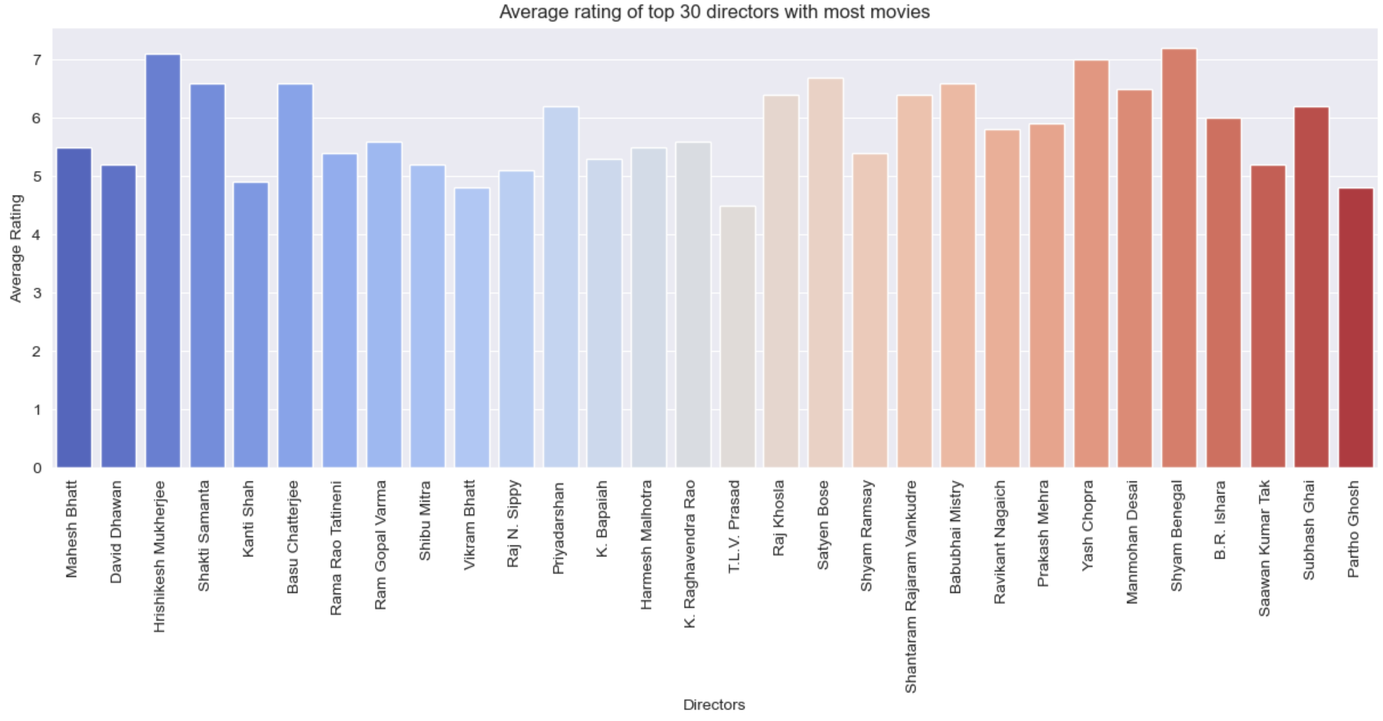
In [39]:

```python
plt.figure(figsize=(15,5))
sns.set_style('darkgrid')
sns.barplot(data=directors.head(30),x='Director',y='Movie count',palette='coolwarm')
plt.xlabel('Director')
plt.ylabel('Number of movies')
plt.xticks(rotation=90)
plt.title('Top 30 directors with most number of movies')
plt.show()
```



In [40]:

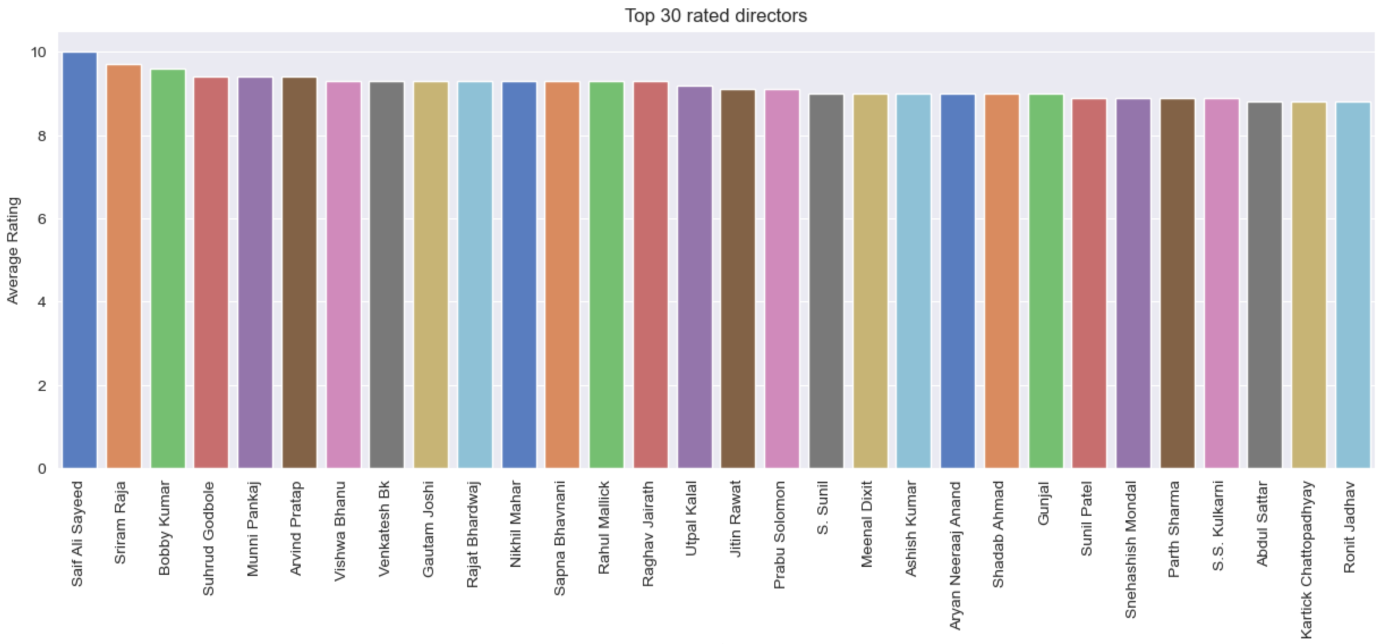
```
sns.set_style('darkgrid')
plt.figure(figsize=(15,5))
sns.barplot(data=directors.head(30),x='Director',y='Average Rating',palette='coolwarm')
plt.xticks(rotation=90)
plt.xlabel('Directors')
plt.ylabel('Average Rating')
plt.title('Average rating of top 30 directors with most movies')
plt.show()
```



Now below bar plot shows top rated directors

In [41]:

```
sns.set_style('darkgrid')
plt.figure(figsize=(15,5))
sns.barplot(data=directors.sort_values(by='Average Rating',ascending=False).head(30) ,x=
plt.xticks(rotation=90)
plt.xlabel('Directors')
plt.ylabel('Average Rating')
plt.title('Top 30 rated directors')
plt.show()
```



Actors Analysis

In [42]:

```
df_melted = df.melt(id_vars='Rating', value_name='actor', var_name='role', value_vars=['
actor_scores = df_melted.groupby('actor')['Rating'].agg(['mean', 'count'])
actor_scores.reset_index(inplace=True)
actor_scores.columns = ['Actor','Average Score', 'Number of movies']
actor_scores.sort_values('Number of movies', ascending=False, inplace=True)
actor_scores['Average Score']=actor_scores['Average Score'].round(1)
actor_scores
```

Out[42]:

	Actor	Average Score	Number of movies
2990	Mithun Chakraborty	5.3	231
1395	Dharmendra	5.8	217
2091	Jeetendra	5.4	179
821	Ashok Kumar	6.4	173
425	Amitabh Bachchan	6.2	162
...	...	...	...
2358	Kavitha	4.9	1
2357	Kavita Tripathi	6.8	1
2355	Kavita Kapoor	4.8	1
2354	Kavita Joshi	6.6	1
2980	Mirza	7.3	1

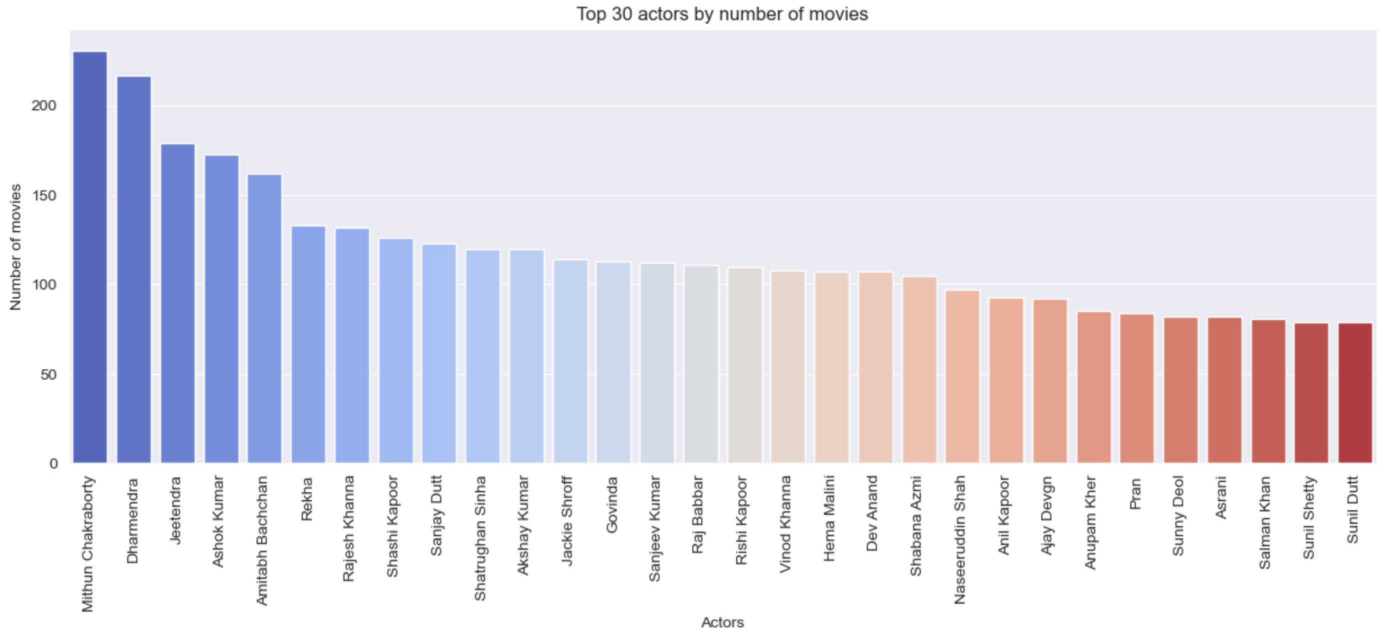
5960 rows × 3 columns

In [43]:

```
actor_score_dict = dict(zip(actor_scores['Actor'], actor_scores['Average Score']))
```

In [44]:

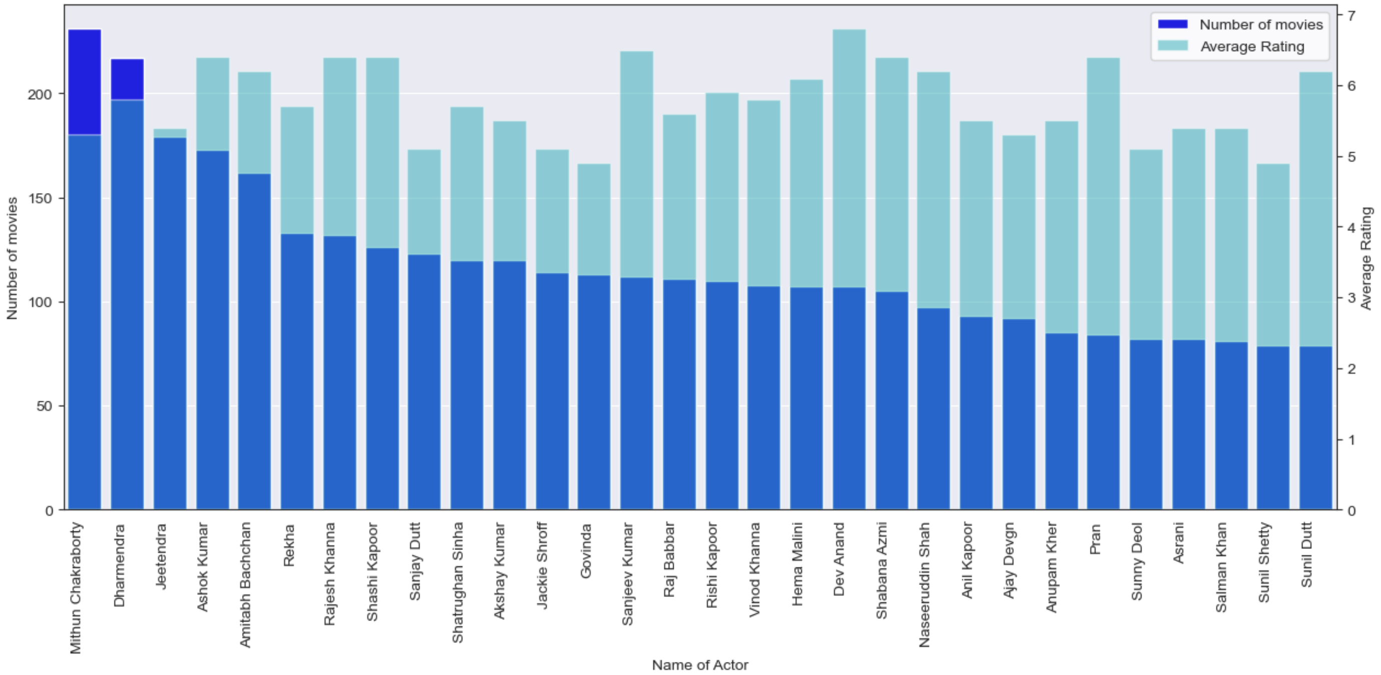
```
plt.figure(figsize=(15,5))
sns.barplot(data=actor_scores[:30],x='Actor',y='Number of movies',dodge=False,palette='c
plt.xticks(rotation=90)
plt.xlabel('Actors')
plt.ylabel('Number of movies')
plt.title('Top 30 actors by number of movies')
plt.show()
```



Below graph also shows their average rating

In [45]:

```
fig,ax1 = plt.subplots(figsize=(15,6))
sns.set_style('white')
sns.barplot(data=actor_scores[:30],x='Actor',y='Number of movies',dodge=True,ax=ax1,labe
ax1.set(xlabel='Name of Actor', ylabel='Number of movies')
ax1.set_xticklabels(ax1.get_xticklabels(), rotation=90, ha='right')
ax2 = ax1.twinx()
sns.barplot(data=actor_scores[:30],x='Actor',y='Average Score',dodge=True,ax=ax2,color='
ax2.set_ylabel('Average Rating')
lines, labels = ax1.get_legend_handles_labels()
lines2, labels2 = ax2.get_legend_handles_labels()
ax2.legend(lines + lines2, labels + labels2, loc='upper right')
plt.show()
```

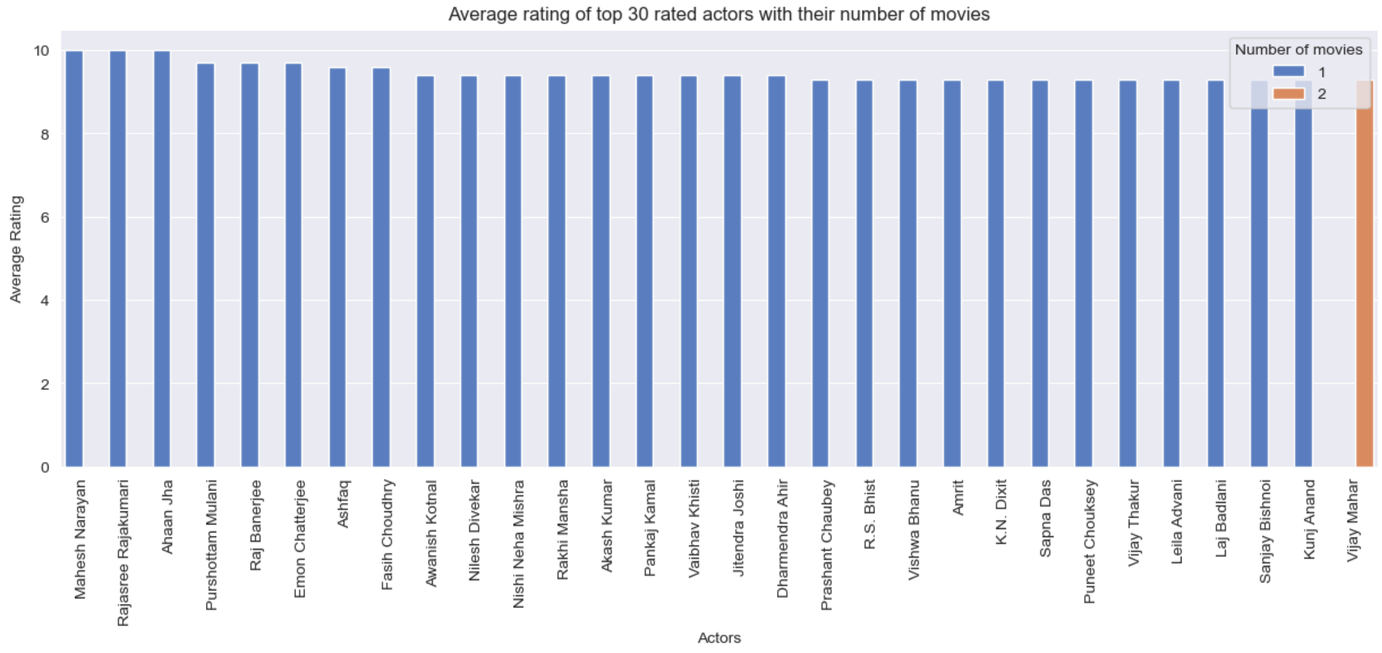


In [46]:

```
actor_scores.sort_values(by='Average Score',ascending=False,inplace=True)
```

In [47]:

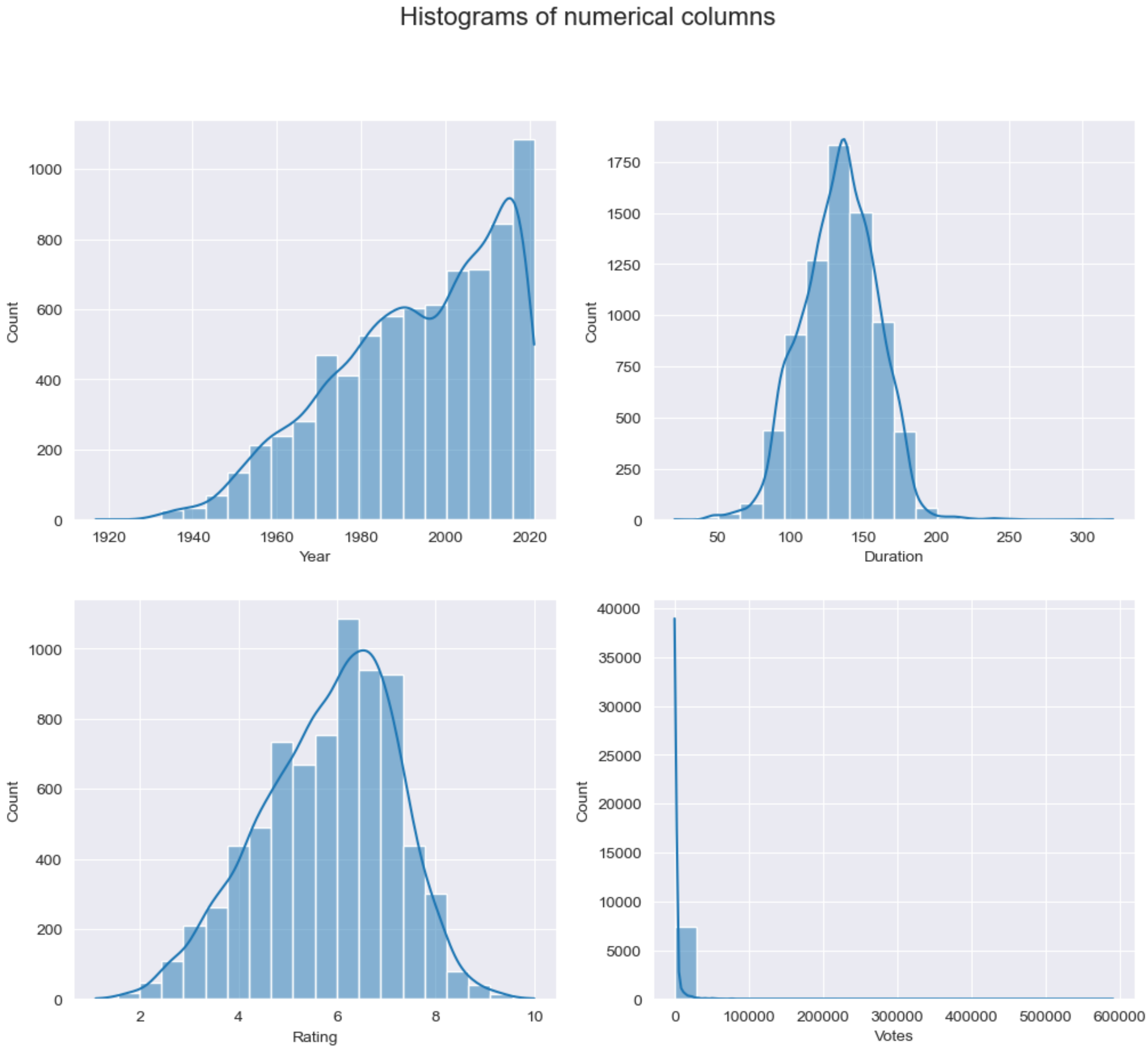
```
sns.set_style('darkgrid')
plt.figure(figsize=(15,5))
sns.barplot(data=actor_scores[:30],x='Actor',y='Average Score',dodge=True,hue='Number of
plt.xticks(rotation=90)
plt.xlabel('Actors')
plt.ylabel('Average Rating')
plt.title('Average rating of top 30 rated actors with their number of movies')
plt.show()
```



3. Data Preprocessing

In [48]:

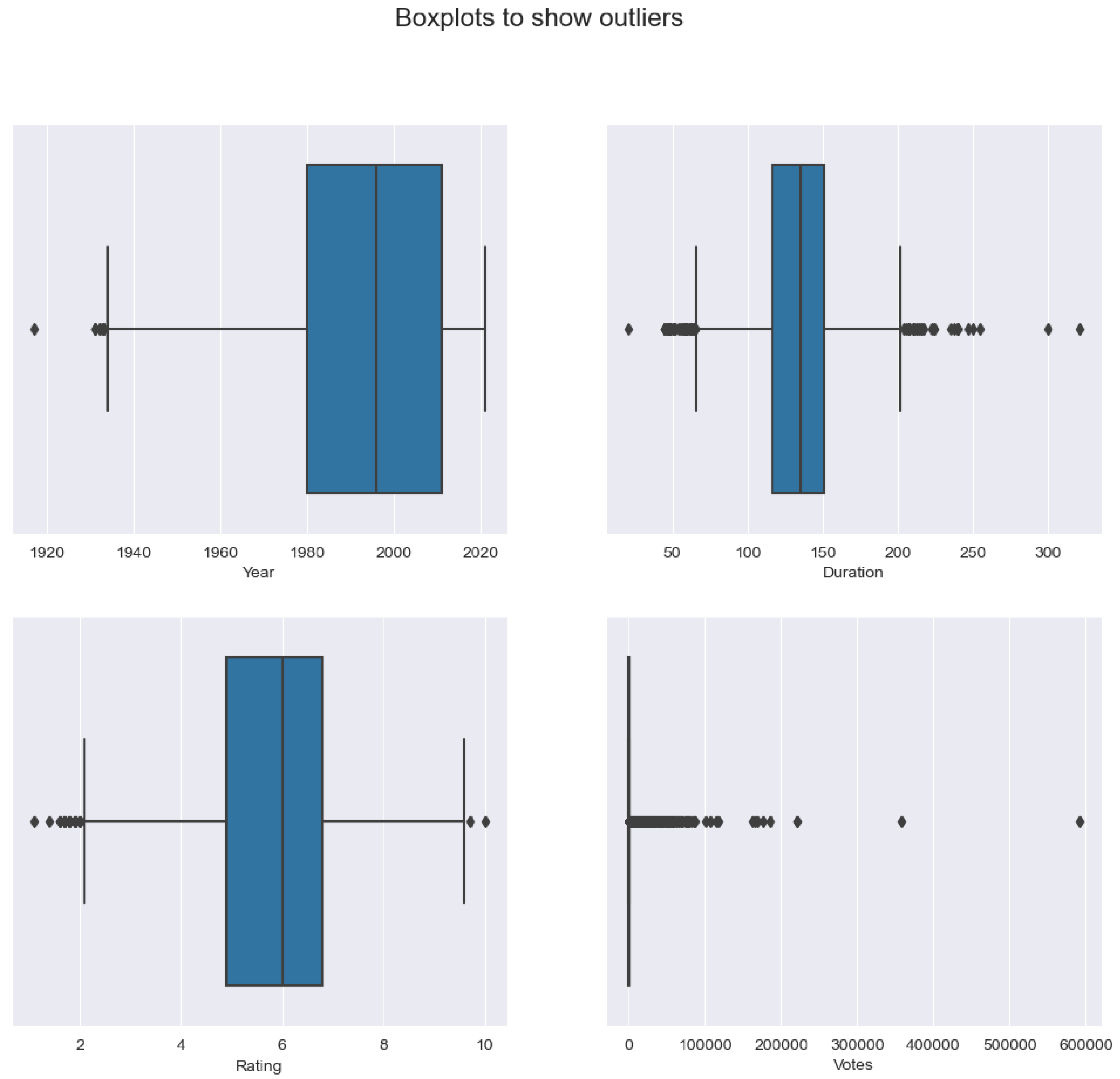
```
num_columns = list(df.select_dtypes(include=np.number).columns)
num=int(len(num_columns)/2) if int(len(num_columns)/2)>1 else 2
fig ,ax = plt.subplots(num,num,figsize=(12,10))
for j in range(num):
    for i in range(num):
        try:
            sns.histplot(data=df,x=num_columns[0],kde=True,bins=20,ax=ax[j][i])
            num_columns.pop(0)
        except:
            fig.delaxes(ax=ax[j][i])
fig.suptitle('Histograms of numerical columns', fontsize=16)
plt.show()
```



Histograms of numerical columns

In [49]:

```python
num_columns = list(df.select_dtypes(include=np.number).columns)
num=int(len(num_columns)/2) if int(len(num_columns)/2)>1 else 2
fig ,ax = plt.subplots(num,num,figsize=(12,10))
for j in range(num):
    for i in range(num):
        try:
            sns.boxplot(data=df,x=num_columns[0],ax=ax[j][i])
            num_columns.pop(0)
        except:
            fig.delaxes(ax=ax[j][i])
fig.suptitle('Boxplots to show outliers', fontsize=16)
plt.show()
```



In [50]:

```
from sklearn.preprocessing import StandardScaler,MinMaxScaler,FunctionTransformer,Robust
num_df = df.select_dtypes(include=np.number)
num_df
```

Out[50]:

	Year	Duration	Rating	Votes
1	2019	109	7.0	8
3	2019	110	4.4	35
5	1997	147	4.7	827
6	2005	142	7.4	1086
8	2012	82	5.6	326
...	...	...	...	...
15501	1992	93	5.3	135
15503	1989	125	5.8	44
15504	1988	115	4.6	11
15505	1999	129	4.5	655

15508	1998	130	6.2	20

7558 rows × 4 columns

I will use box cox method to transform my features to make distributions more normal and control outliers in data

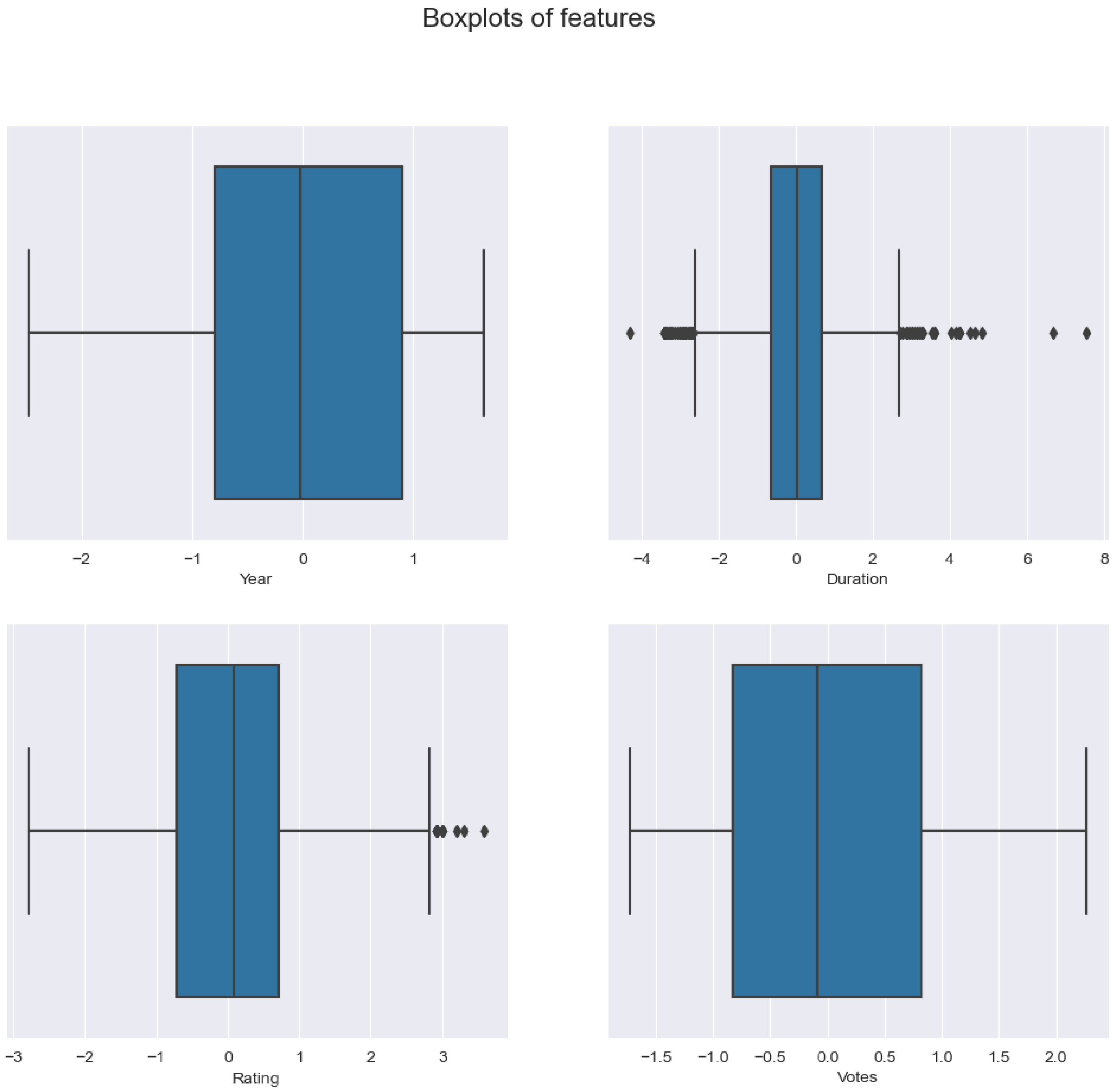
In [51]:

```
pt = PowerTransformer()
num_df_pt = pd.DataFrame(pt.fit_transform(num_df),columns=num_df.columns)
```

```
C:\Users\geeti\anaconda3\Lib\site-packages\numpy\core\_methods.py:239: RuntimeWarning: o
verflow encountered in multiply
  x = um.multiply(x, x, out=x)
```

In [52]:

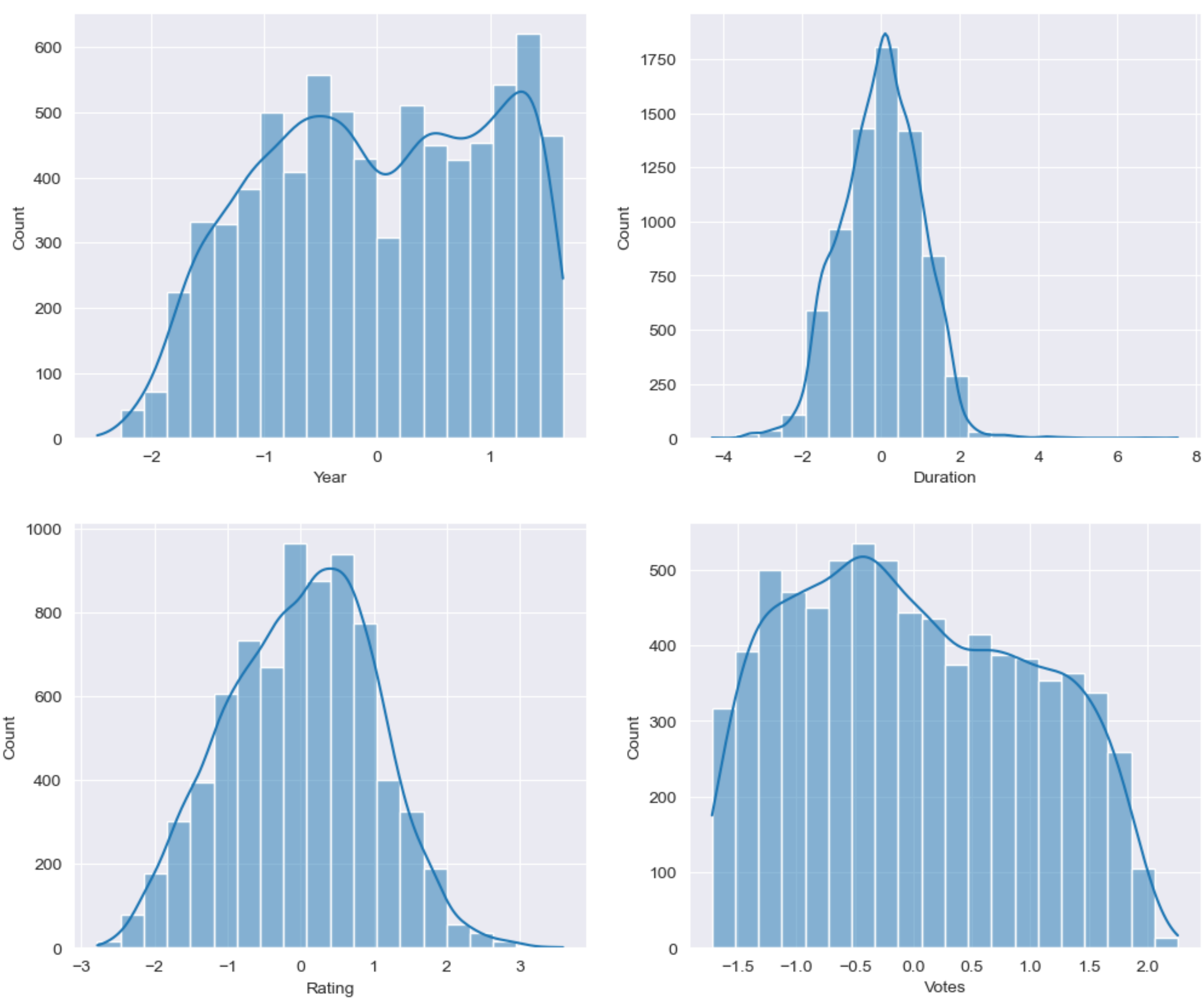
```
num_columns = list(num_df_pt.select_dtypes(include=np.number).columns)
num=int(len(num_columns)/2) if int(len(num_columns)/2)>1 else 2
fig ,ax = plt.subplots(num,num,figsize=(12,10))
for j in range(num):
    for i in range(num):
        try:
            sns.boxplot(data=num_df_pt,x=num_columns[0],ax=ax[j][i])
            num_columns.pop(0)
        except:
            fig.delaxes(ax=ax[j][i])
fig.suptitle('Boxplots of features', fontsize=16)
plt.show()
```



So it works well on Rating,Year and votes and decrease outliers except Duration

In [53]:

```
num_columns = list(num_df_pt.select_dtypes(include=np.number).columns)
num=int(len(num_columns)/2) if int(len(num_columns)/2)>1 else 2
fig ,ax = plt.subplots(num,num,figsize=(12,10))
for j in range(num):
    for i in range(num):
        try:
            sns.histplot(data=num_df_pt,x=num_columns[0],ax=ax[j][i],kde=True,bins=20)
            num_columns.pop(0)
        except:
            fig.delaxes(ax=ax[j][i])
fig.suptitle('Histograms of features', fontsize=16)
plt.show()
```



Histograms of features

In [54]:
```
df_2 = df.drop(['Name'],axis=1)
df_2['Genre'] = df_2['Genre'].map(genre_dict)
df_2['Director'] = df_2['Director'].map(directors_dict)
df_2['Actor 1'] = df_2['Actor 1'].map(actor_score_dict)
df_2['Actor 2'] = df_2['Actor 2'].map(actor_score_dict)
df_2['Actor 3'] = df_2['Actor 3'].map(actor_score_dict)
df_2
```

Out[54]:

	Year	Duration	Genre	Rating	Votes	Director	Actor 1	Actor 2	Actor 3
1	2019	109	6.3	7.0	8	7.0	6.6	7.0	7.0
3	2019	110	5.7	4.4	35	4.4	5.7	4.4	4.4
5	1997	147	6.2	4.7	827	5.4	4.9	5.9	6.5
6	2005	142	6.8	7.4	1086	7.5	5.6	5.4	6.7
8	2012	82	5.5	5.6	326	5.6	5.6	5.8	5.6
...	...	...	...	...	...	...	...	...	...
15501	1992	93	5.6	5.3	135	5.6	5.8	6.1	4.9
15503	1989	125	5.6	5.8	44	5.9	6.4	6.6	5.7

15504	1988	115	5.0	4.6	11	4.1	6.2	4.1	6.2
15505	1999	129	5.5	4.5	655	5.2	5.5	4.9	5.6
15508	1998	130	5.5	6.2	20	4.4	5.8	5.4	5.1

7558 rows × 9 columns

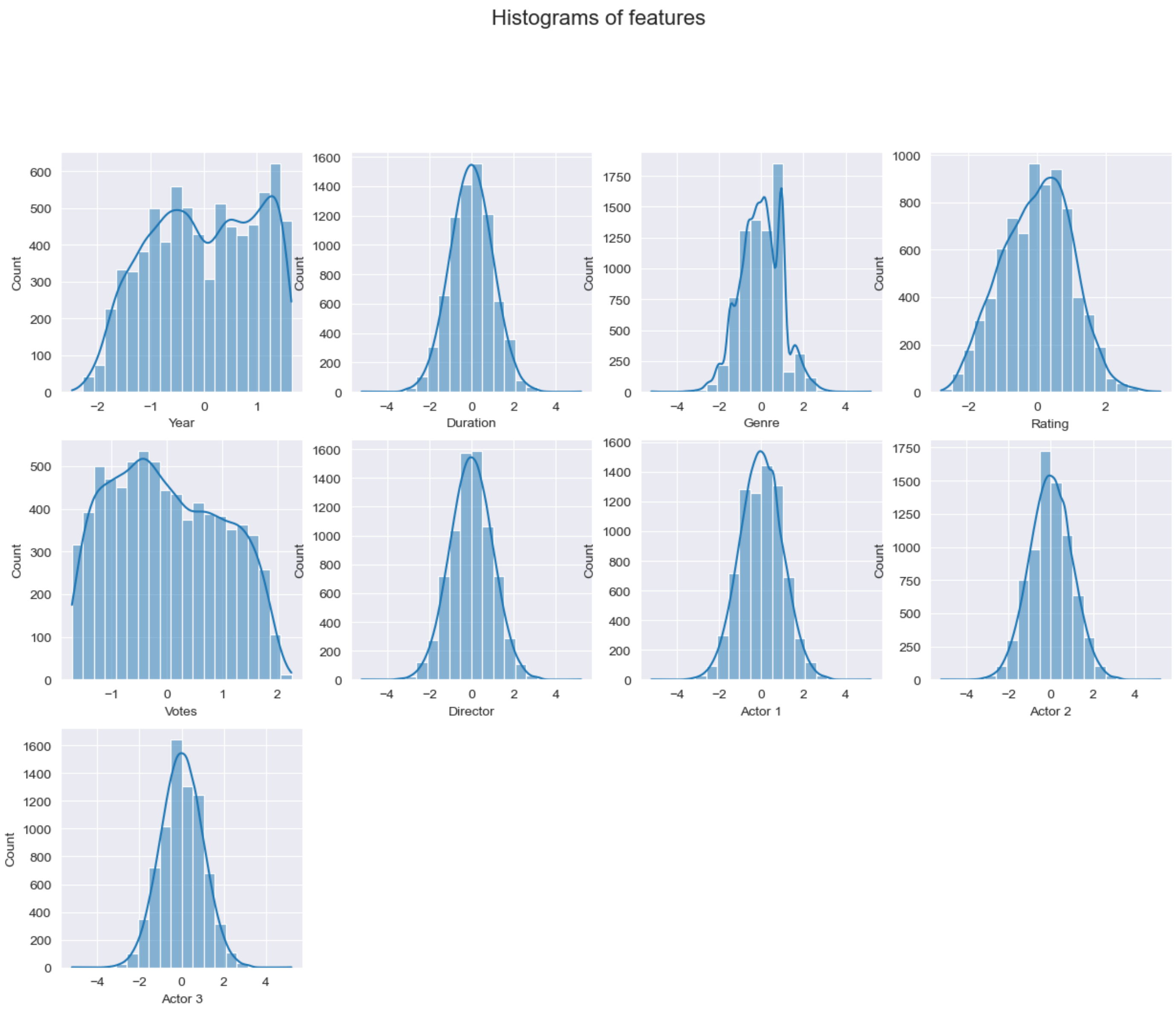
In [55]:

```
pt = PowerTransformer()
qt = QuantileTransformer(output_distribution='normal')
df_2[['Rating','Votes','Year']] = pt.fit_transform(df_2[['Rating','Votes','Year']])
df_2[['Genre','Director','Duration','Actor 1','Actor 2','Actor 3']] = qt.fit_transform(d
```

```
C:\Users\geeti\anaconda3\Lib\site-packages\numpy\core\_methods.py:239: RuntimeWarning: o
verflow encountered in multiply
  x = um.multiply(x, x, out=x)
```

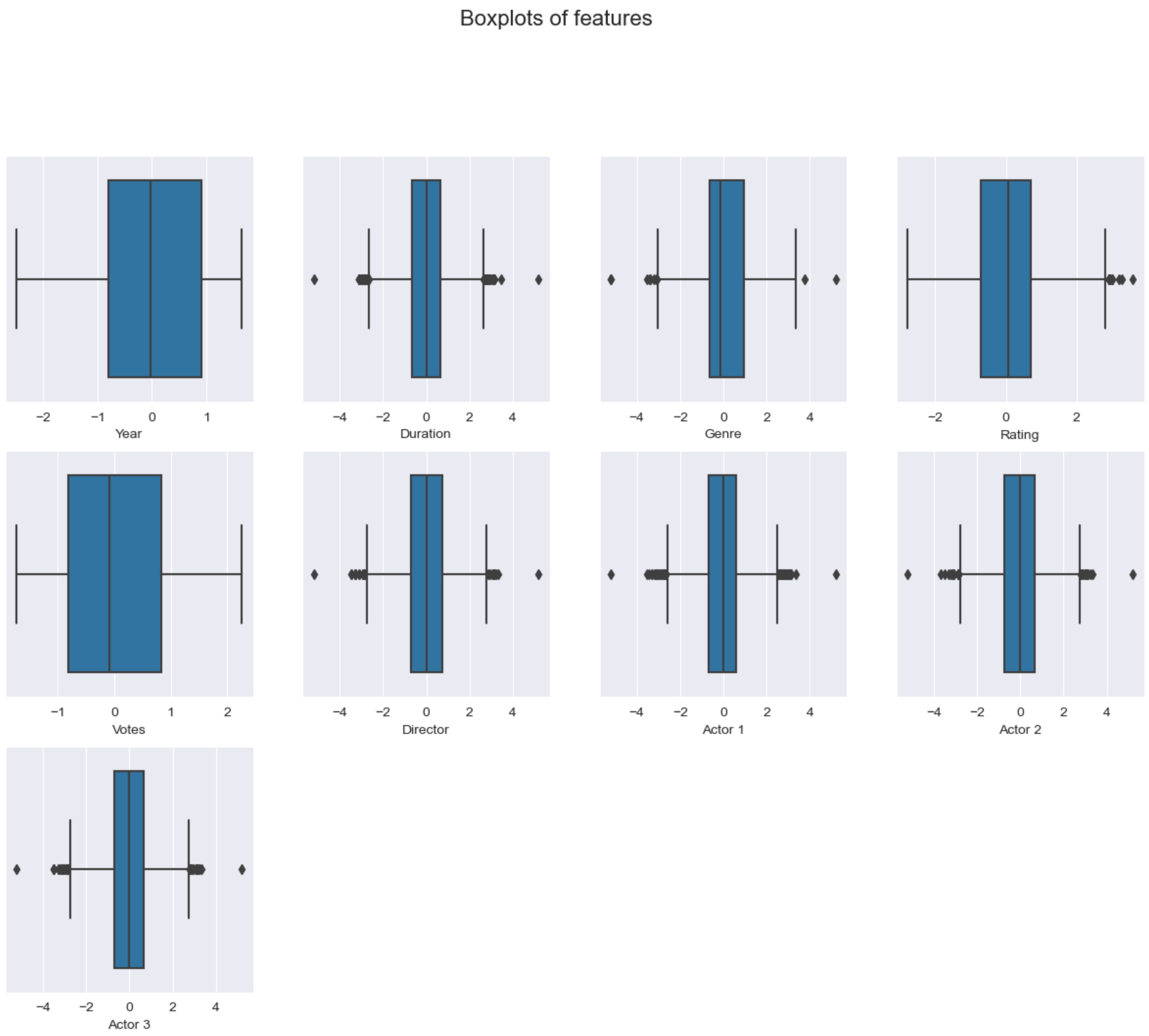
In [56]:

```
num_columns = list(df_2.select_dtypes(include=np.number).columns)
num=int(len(num_columns)/2) if int(len(num_columns)/2)>1 else 2
fig ,ax = plt.subplots(num,num,figsize=(15,15))
for j in range(num):
    for i in range(num):
        try:
            sns.histplot(data=df_2,x=num_columns[0],ax=ax[j][i],kde=True,bins=20)
            num_columns.pop(0)
        except:
            fig.delaxes(ax=ax[j][i])
fig.suptitle('Histograms of features', fontsize=16)
plt.show()
```



In [57]:

```
num_columns = list(df_2.select_dtypes(include=np.number).columns)
num=int(len(num_columns)/2) if int(len(num_columns)/2)>1 else 2
fig ,ax = plt.subplots(num,num,figsize=(15,15))
for j in range(num):
    for i in range(num):
        try:
            sns.boxplot(data=df_2,x=num_columns[0],ax=ax[j][i])
            num_columns.pop(0)
        except:
            fig.delaxes(ax=ax[j][i])
fig.suptitle('Boxplots of features', fontsize=16)
plt.show()
```



As you can see from above distributions this is so far as best I can do to make data more normal and control outliers

In [58]:

```
corr_df = df_2.corr(numeric_only=True)
corr_df['Rating'].sort_values(ascending=False)
```

Out[58]:

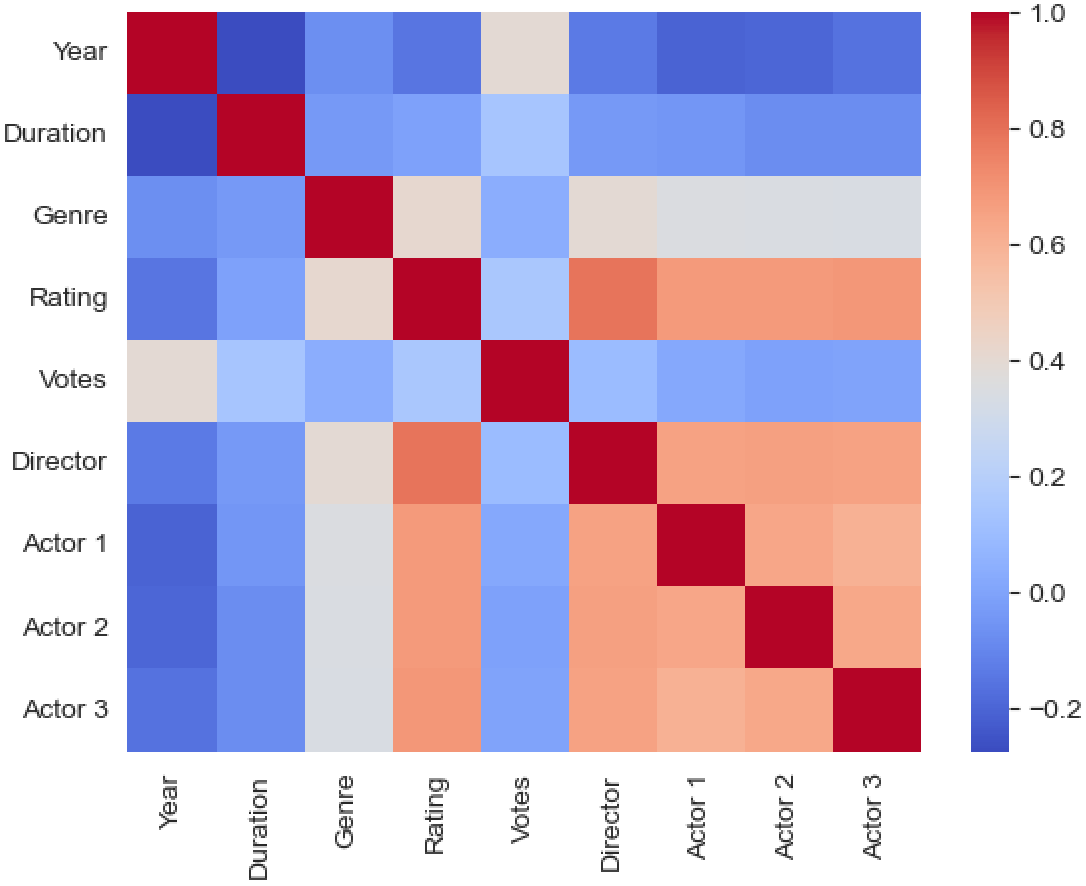
```
Rating      1.000000
Director    0.790873
Actor 3     0.688298
Actor 2     0.680154
Actor 1     0.677860
Genre       0.412430
Votes       0.149261
Duration   -0.007309
Year       -0.150249
Name: Rating, dtype: float64
```

In [59]:

```
sns.heatmap(corr_df,annot=False,cmap='coolwarm')
```

Out[59]:

```
<Axes: >
```



Now our transformed columns are much correlated with the target variable so we are ready to go

4. Model Building

In [60]:

```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error,mean_absolute_error,r2_score
```

In [61]:

```
X=df_2.drop('Rating',axis=1)
y=df_2['Rating']
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.2,random_state=42)
lr = LinearRegression()
lr.fit(X_train,y_train)
y_pred = lr.predict(X_test)
print('Mean squared error: ',mean_squared_error(y_test,y_pred))
print('Mean absolute error: ',mean_absolute_error(y_test,y_pred))
print('R2 score: ',r2_score(y_test,y_pred))
```

```
Mean squared error:  0.27125539074499533
Mean absolute error:  0.3900713372632757
R2 score:  0.7254734985863394
```

In [62]:

```
from sklearn.model_selection import cross_val_score
from sklearn import svm
X=df_2.drop('Rating',axis=1)
y=df_2['Rating']
# Assuming X and y are your data and labels
lr = LinearRegression()
scores = cross_val_score(lr, X, y, cv=5)
# print(scores)
print("%0.2f accuracy with a standard deviation of %0.2f" % (scores.mean(), scores.std()
```

```
0.73 accuracy with a standard deviation of 0.01
```

So 73 percent score after performing cross validation

In [63]:

```
from sklearn.ensemble import RandomForestRegressor
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import GridSearchCV

# Define the models
models = {
    'RandomForestRegressor': RandomForestRegressor()
    # ,'LinearRegression': LinearRegression()
}

# Define the parameters for grid search
params = {
    'RandomForestRegressor': { 'n_estimators': [75,100,125,150], 'max_features': ['sqrt'
    # ,'LinearRegression': {   }
}
```

In [ ]:

```
X = df_2.drop('Rating',axis=1)
y = df_2['Rating']
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.2,random_state=42)
for model_name, model in models.items():
    model_to_tune = GridSearchCV(model, params[model_name], cv=5)
    model_to_tune.fit(X_train, y_train)

    print(f"Best parameters for {model_name}: {model_to_tune.best_params_}")
    print(f"Best score for {model_name}: {model_to_tune.best_score_}")
```

So the maximum my model can reach is 77 percent

In [ ]:

```
X = df_2.drop('Rating',axis=1)
y = df_2['Rating']
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.2,random_state=42)
from sklearn.tree import DecisionTreeRegressor
dt = DecisionTreeRegressor(max_depth=7,random_state=42)
rf = LinearRegression()
rf.fit(X_train,y_train)
y_pred = rf.predict(X_train)
y_pred_test = rf.predict(X_test)
# print('Mean squared error: ',mean_squared_error(y_test,y_pred))
# print('Mean absolute error: ',mean_absolute_error(y_test,y_pred))
print('R2 scorefor training data: ',r2_score(y_train,y_pred))
print('R2 score for testing data: ',r2_score(y_test,y_pred_test))
```

So 72.5 is best score for Decision Tree regressor avoiding overfitting

I am a beginner and learning ML models so if you can suggest me some improvements or any mistake I made kindly tell me in the comments and if you like the notebook kindly upvote