rating-prediction-codsoft-task-2

October 30, 2023

Movie Rating Prediction

[40]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.linear_model import LinearRegression, Ridge
from sklearn.ensemble import RandomForestRegressor
from sklearn.tree import DecisionTreeRegressor
from sklearn.model_selection import train_test_split, cross_val_score, KFold,␣
↪GridSearchCV
from sklearn.metrics import mean_squared_error, mean_absolute_error,r2_score
```

[41]:
```
df= pd.read_csv('/content/IMDb Movies India.csv',encoding='ISO-8859-1')
df.head()
```

[41]:

	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

[42]:
```
df.shape
```

[42]: (15509, 10)

[43]:
```
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
```

EDA

Missing Datas

[44]:
```
df.isnull().sum()
```

[44]:
```
Name           0
Year         528
Duration    8269
Genre       1877
Rating      7590
Votes       7589
Director     525
Actor 1     1617
Actor 2     2384
Actor 3     3144
dtype: int64
```

[45]:
```
missing_count = df.isnull().sum().sort_values(ascending=False)
missing_percent = (round(df.isnull().sum() / len(df) * 100, 2)).
 ↪sort_values(ascending=False)
missing_data = pd.concat([missing_count, missing_percent], axis=1,␣
 ↪keys=['Missing Count', 'Missing Percentage'])
missing_data
```

[45]:

	Missing Count	Missing Percentage
Duration	8269	53.32
Rating	7590	48.94
Votes	7589	48.93
Actor 3	3144	20.27
Actor 2	2384	15.37
Genre	1877	12.10
Actor 1	1617	10.43
Year	528	3.40
Director	525	3.39
Name	0	0.00

[46]:
```
df.dropna(subset=['Rating'], inplace=True)

missing_percent = (round(df.isnull().sum() / len(df) * 100, 4)).
 ↪sort_values(ascending=False)
print(missing_percent)
```

```
Duration    26.1144
Actor 3      3.6873
Actor 2      2.5256
Actor 1      1.5785
Genre        1.2880
Director     0.0631
Name         0.0000
Year         0.0000
Rating       0.0000
Votes        0.0000
dtype: float64
```

[47]:
```
df.dropna(subset=['Director', 'Actor 1', 'Actor 2', 'Actor 3', 'Genre'],␣
 ↪inplace=True)

(round(df.isnull().sum()/df.isnull().count(), 4)*100).
 ↪sort_values(ascending=False)
```

[47]:

Duration	25.13
Name	0.00
Year	0.00
Genre	0.00
Rating	0.00
Votes	0.00
Director	0.00
Actor 1	0.00
Actor 2	0.00
Actor 3	0.00

dtype: float64

[48]:
```
df['Duration'] = pd.to_numeric(df['Duration'].str.strip(' min'))
df['Duration'].fillna(df['Duration'].mean(), inplace=True)

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

[48]:
```
Name        0
Year        0
Duration    0
Genre       0
Rating      0
Votes       0
Director    0
Actor 1     0
Actor 2     0
Actor 3     0
dtype: int64
```

[49]:
```
df.drop_duplicates(inplace=True)
df.shape
```

[49]:
```
(7558, 10)
```

[50]:
```
df['Year'] = df['Year'].apply(lambda x: x.split(')')[0])

year_lst = []
for val in df['Year']:
    if len(val.split('(')) == 1:
        year_lst.append(val.split('(')[0])
    elif len(val.split('(')) > 1:
        year_lst.append(val.split('(')[1])
df['Year'] = year_lst
```

[51]:
```
df['Votes'] = df['Votes'].str.replace(',', '').astype(int)
df['Year'] = df['Year'].astype(int)
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   int64
 2   Duration  7558 non-null   float64
 3   Genre     7558 non-null   object
 4   Rating    7558 non-null   float64
 5   Votes     7558 non-null   int64
```

```
 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(2), int64(2), object(6)
memory usage: 649.5+ KB
```

[52]:
```
df['Year'].unique()
```

[52]:
```
array([2019, 1997, 2005, 2012, 2014, 2004, 2016, 1991, 2018, 2010, 1958,
       2021, 2017, 2009, 1993, 2002, 1946, 2008, 1994, 2007, 2013, 2003,
       1998, 1979, 1974, 2015, 2006, 1981, 2020, 1985, 2011, 1988, 1995,
       1987, 1999, 1973, 1968, 1953, 1986, 1982, 1977, 1950, 1969, 1948,
       1967, 1970, 1990, 1989, 1947, 2001, 2000, 1971, 1978, 1944, 1963,
       1992, 1976, 1984, 1975, 1980, 1966, 1972, 1956, 1960, 1964, 1952,
       1959, 1951, 1954, 1962, 1961, 1957, 1965, 1996, 1933, 1955, 1983,
       1936, 1949, 1940, 1945, 1938, 1941, 1942, 1932, 1935, 1937, 1931,
       1943, 1917, 1939, 1934])
```

[53]:
```
(df['Duration']>180).sum()
```

[53]:
```
113
```

[54]:
```
(df['Duration']<60).sum()
```

[54]:
```
27
```

[55]:
```
df[['Rating', 'Duration', 'Votes']].describe(percentiles=[0.75,0.8, 0.9, 0.95,␣
↪0.98])
```

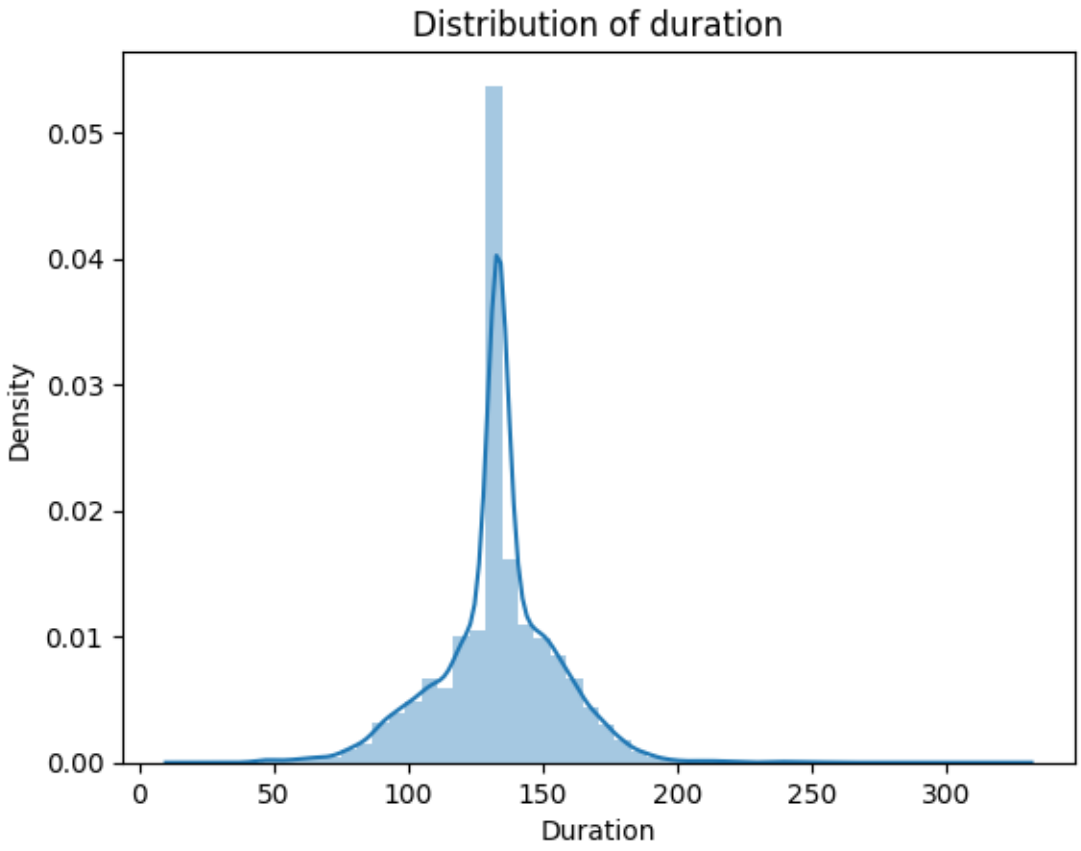
[55]:

	Rating	Duration	Votes
count	7558.000000	7558.000000	7558.000000
mean	5.811127	133.439124	2029.123842
std	1.368255	21.908841	11868.695754
min	1.100000	21.000000	5.000000
50%	6.000000	133.439124	61.000000
75%	6.800000	144.000000	456.000000
80%	7.000000	149.000000	797.600000
90%	7.400000	160.000000	3182.900000
95%	7.800000	169.000000	8662.150000
98%	8.200000	180.000000	21935.900000
max	10.000000	321.000000	591417.000000

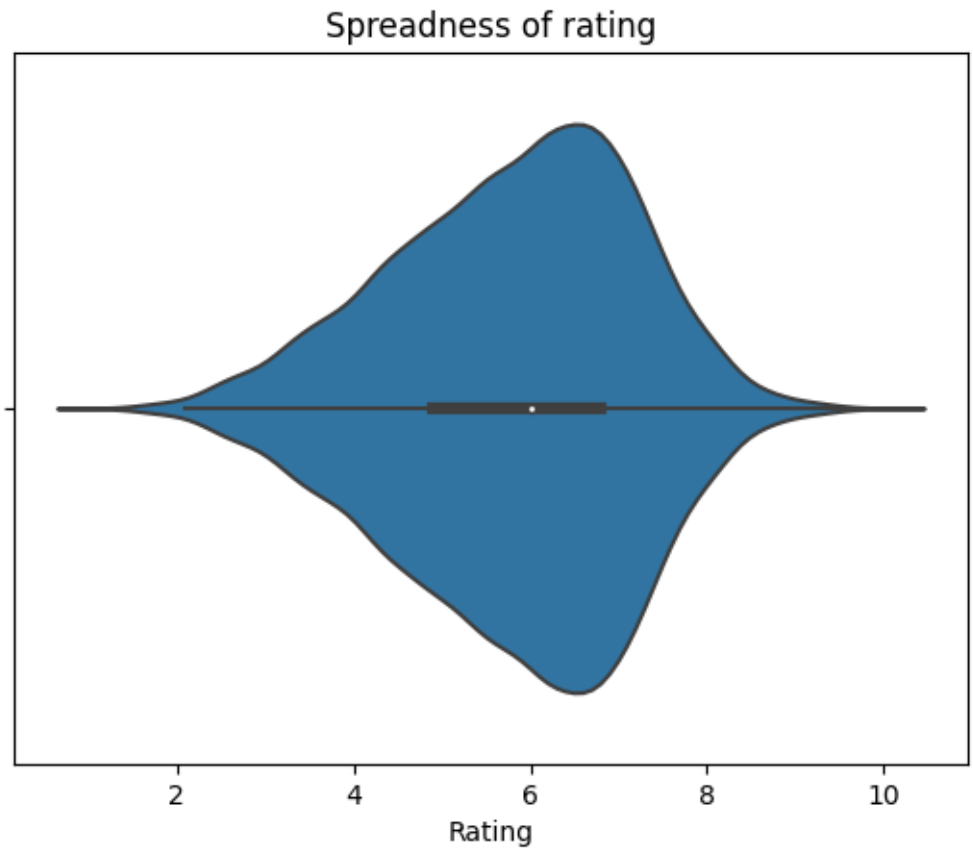
[56]:
```
sns.distplot(df['Duration'])
plt.title('Distribution of duration')
plt.show()
```

```
<ipython-input-56-ddd93c71405b>:1: UserWarning:
```

```
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(df['Duration'])
```

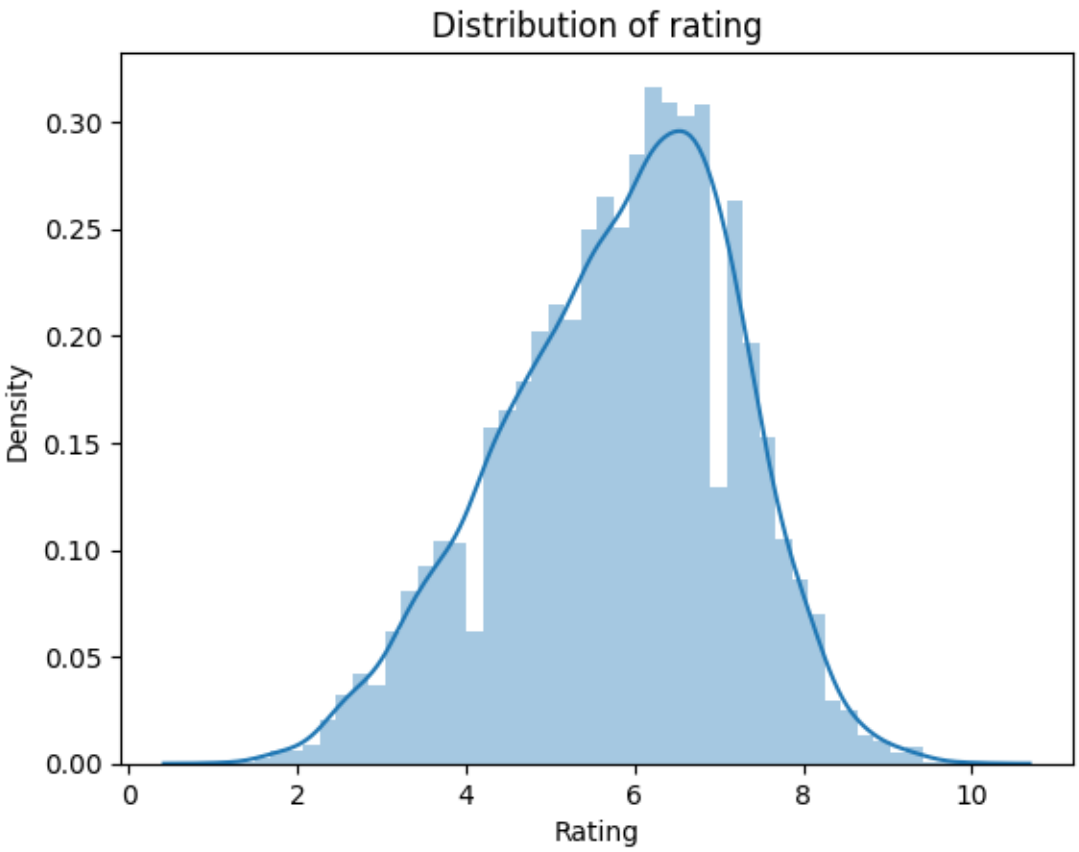


[57]:
```
sns.violinplot(x=df['Rating'])
plt.title('Spreadness of rating')
plt.show()
```



[58]:
```
sns.distplot(df['Rating'])
plt.title('Distribution of rating')
plt.show()
```

```
<ipython-input-58-32fb841ddc43>:1: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(df['Rating'])
```



[59]:
```
df[df['Votes']>100000]
```

[59]:

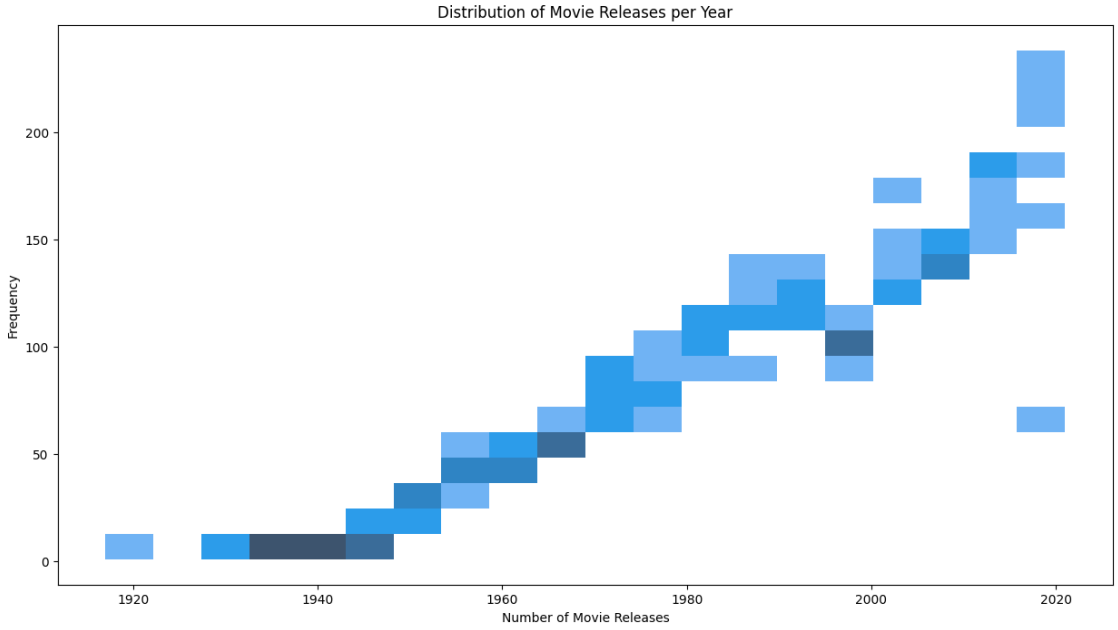
	Name	Year	Duration	Genre	Rating	Votes	Director
75	3 Idiots	2009	170.0	Comedy, Drama	8.4	357889	Rajkumar Hirani
3410	Dangal	2016	161.0	Action, Biography, Drama	8.4	165074	Nitesh Tiwari
3829	Dil Bechara	2020	101.0				
4848	Gandhi	1982	191.0				
8035	Lagaan: Once Upon a Time in India	2001	224.0				
8219	Life of Pi	2012	127.0				
8228	Like Stars on Earth	2007	165.0				
8233	Lion	2016	118.0				
9764	My Name Is Khan	2010	165.0				
10882	PK	2014	153.0				
11463	Radhe	2021	135.0				
11725	Rang De Basanti	2006	167.0				
14038	The Darjeeling Limited	2007	91.0				

3829	Comedy, Drama, Romance	6.6	117377	Mukesh Chhabra
4848	Biography, Drama, History	8.0	220118	Richard Attenborough
8035	Drama, Musical, Sport	8.1	107234	Ashutosh Gowariker
8219	Adventure, Drama, Fantasy	7.9	591417	Ang Lee
8228	Drama, Family	8.4	175810	Aamir Khan
8233	Biography, Drama	8.0	220526	Garth Davis
9764	Drama	8.0	101014	Karan Johar
10882	Comedy, Drama, Musical	8.1	168150	Rajkumar Hirani
11463	Action, Crime, Thriller	1.8	162455	Prabhu Deva
11725	Comedy, Crime, Drama	8.1	114446	Rakeysh Omprakash Mehra
14038	Adventure, Comedy, Drama	7.2	185127	Wes Anderson

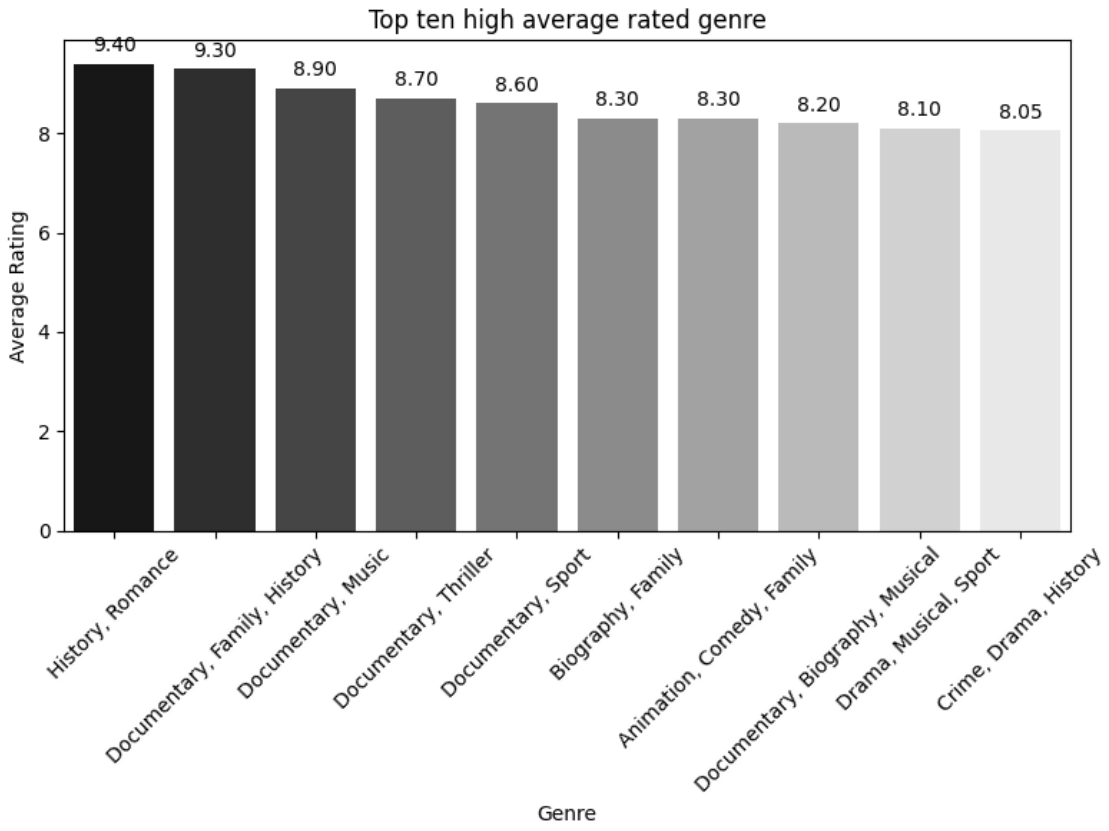
	Actor 1	Actor 2	Actor 3
75	Aamir Khan	Madhavan	Mona Singh
3410	Aamir Khan	Sakshi Tanwar	Fatima Sana Shaikh
3829	Sushant Singh Rajput	Sanjana Sanghi	Sahil Vaid
4848	Ben Kingsley	John Gielgud	Rohini Hattangadi
8035	Aamir Khan	Raghuvir Yadav	Gracy Singh
8219	Suraj Sharma	Irrfan Khan	Adil Hussain
8228	Amole Gupte	Darsheel Safary	Aamir Khan
8233	Dev Patel	Nicole Kidman	Rooney Mara
9764	Shah Rukh Khan	Kajol	Sheetal Menon
10882	Aamir Khan	Anushka Sharma	Sanjay Dutt
11463	Salman Khan	Disha Patani	Randeep Hooda
11725	Aamir Khan	Soha Ali Khan	Siddharth
14038	Owen Wilson	Adrien Brody	Jason Schwartzman

[60]:
```
year_count = df.groupby('Year').agg({'Name':'count'}).rename(columns={'Name':
↪'count'}).\
                                        sort_values(by='count',␣
↪ascending=False).reset_index()
```

[61]:
```
plt.figure(figsize=(15, 8))
sns.histplot(data=year_count, x='Year', y='count',bins=20, kde=True)
plt.title('Distribution of Movie Releases per Year')
plt.xlabel('Number of Movie Releases')
plt.ylabel('Frequency')
plt.show()
```

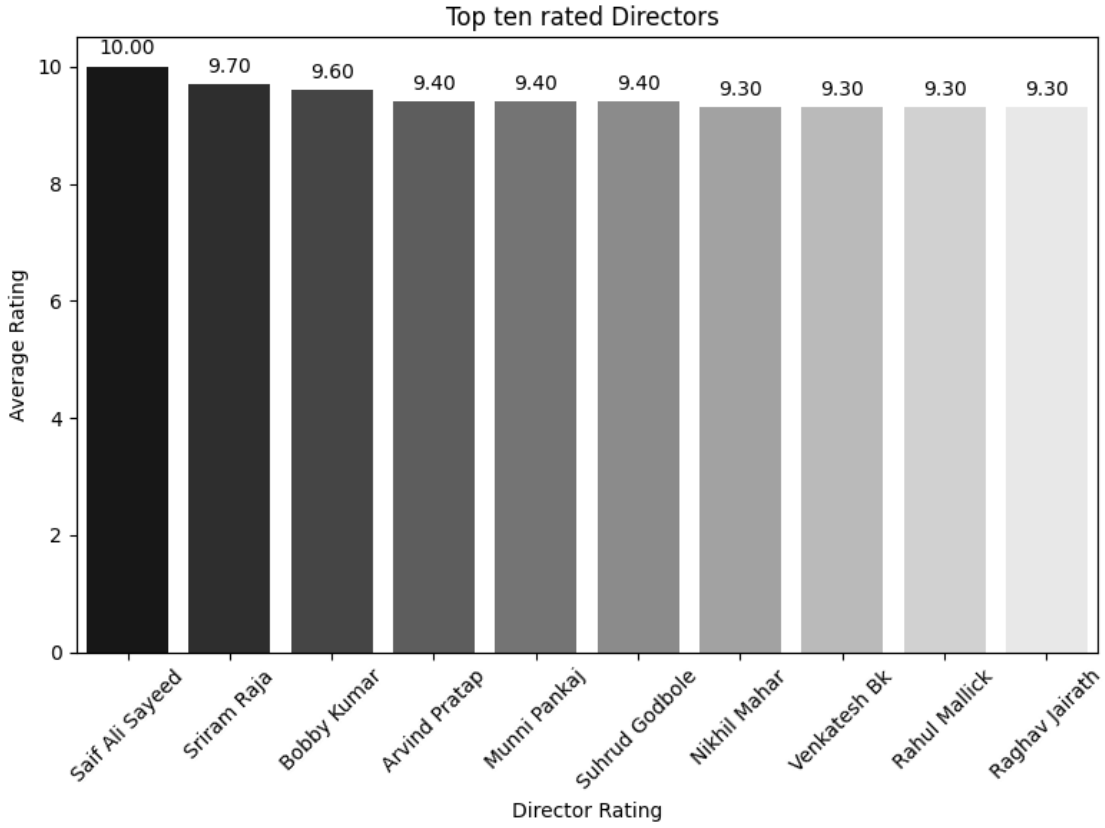


[62]:
```
genre_rate = df.groupby('Genre').agg({'Rating':'mean'}).
  ↪sort_values(by='Rating', ascending=False).reset_index().head(10)

plt.figure(figsize=(8, 6))


ax = sns.barplot(data=genre_rate, y='Rating', x='Genre', palette='gist_gray')

for p in ax.patches:
    ax.annotate(format(p.get_height(), '.2f'),
                (p.get_x() + p.get_width() / 2., p.get_height()),
                ha = 'center', va = 'center',
                xytext = (0, 9),
                textcoords = 'offset points')


plt.title('Top ten high average rated genre')
plt.xlabel('Genre')
plt.ylabel('Average Rating')


plt.xticks(rotation=45)

plt.tight_layout()
plt.show()
```



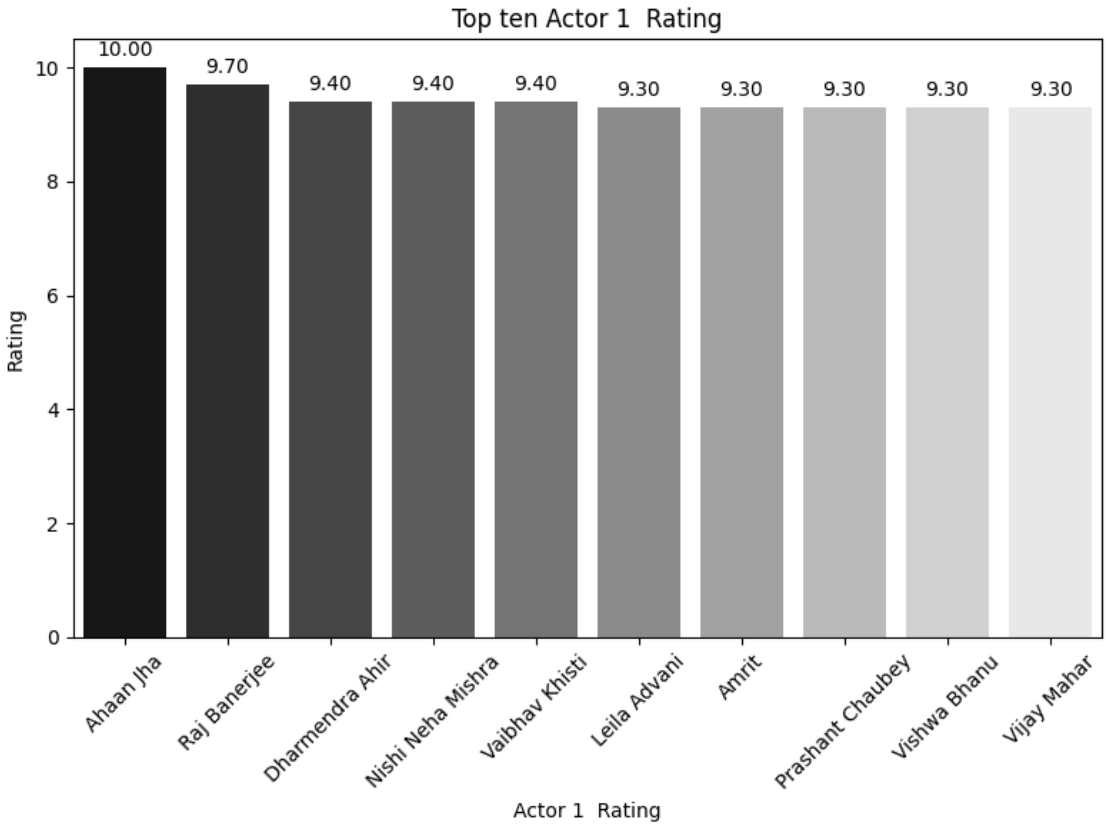
[63]:
```
director_rate = df.groupby('Director').agg({'Rating':'mean'}).
 ↪sort_values(by='Rating', ascending=False)\
                                        .reset_index().head(10)

plt.figure(figsize=(8, 6))


ax = sns.barplot(data=director_rate, y='Rating', x='Director', palette='gray')

for p in ax.patches:
    ax.annotate(format(p.get_height(), '.2f'),
                (p.get_x() + p.get_width() / 2., p.get_height()),
                ha = 'center', va = 'center',
                xytext = (0, 9),
                textcoords = 'offset points')


plt.title('Top ten rated Directors ')
plt.xlabel('Director Rating')
plt.ylabel('Average Rating')
```

```
plt.xticks(rotation=45)

plt.tight_layout()
plt.show()
```

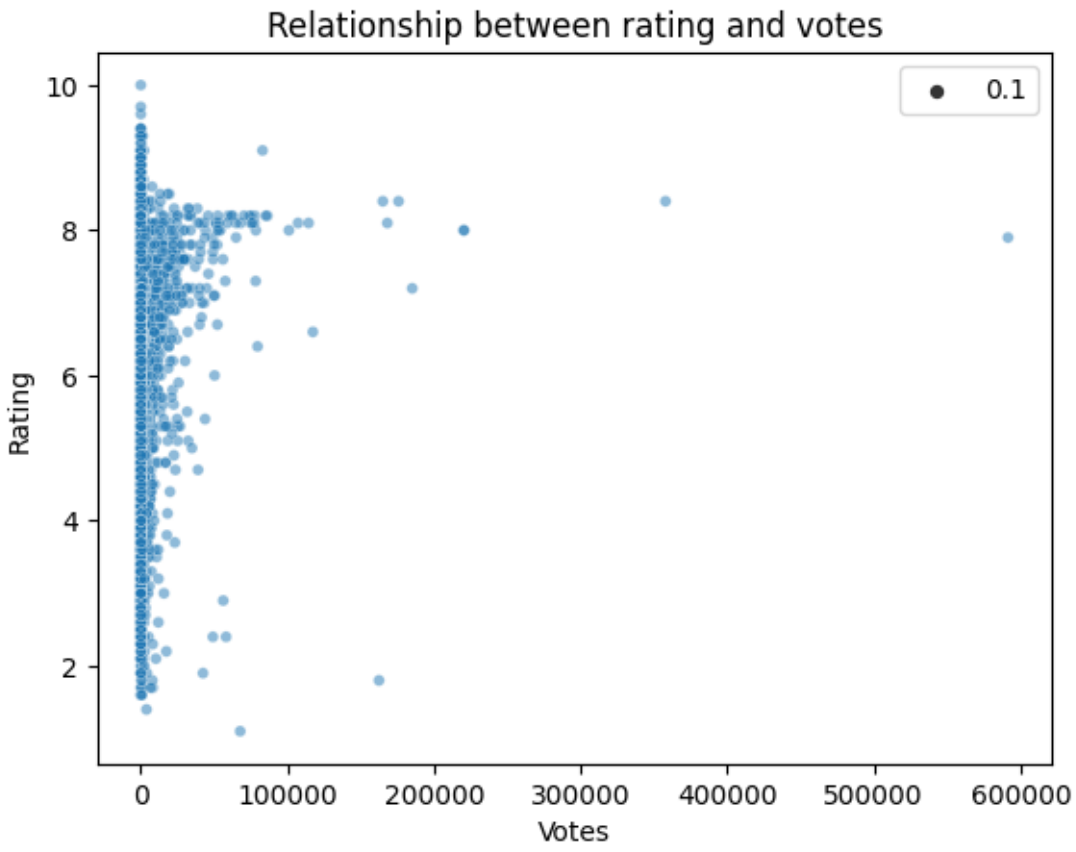


[64]:
```
actor1_rate = df.groupby('Actor 1').agg({'Rating':'mean'}).
 ↪sort_values(by='Rating', ascending=False)\
                                        .reset_index().head(10)
plt.figure(figsize=(8, 6))


ax = sns.barplot(data=actor1_rate, y='Rating', x='Actor 1', palette='gray')

for p in ax.patches:
    ax.annotate(format(p.get_height(), '.2f'),
                (p.get_x() + p.get_width() / 2., p.get_height()),
                ha = 'center', va = 'center',
                xytext = (0, 9),
```

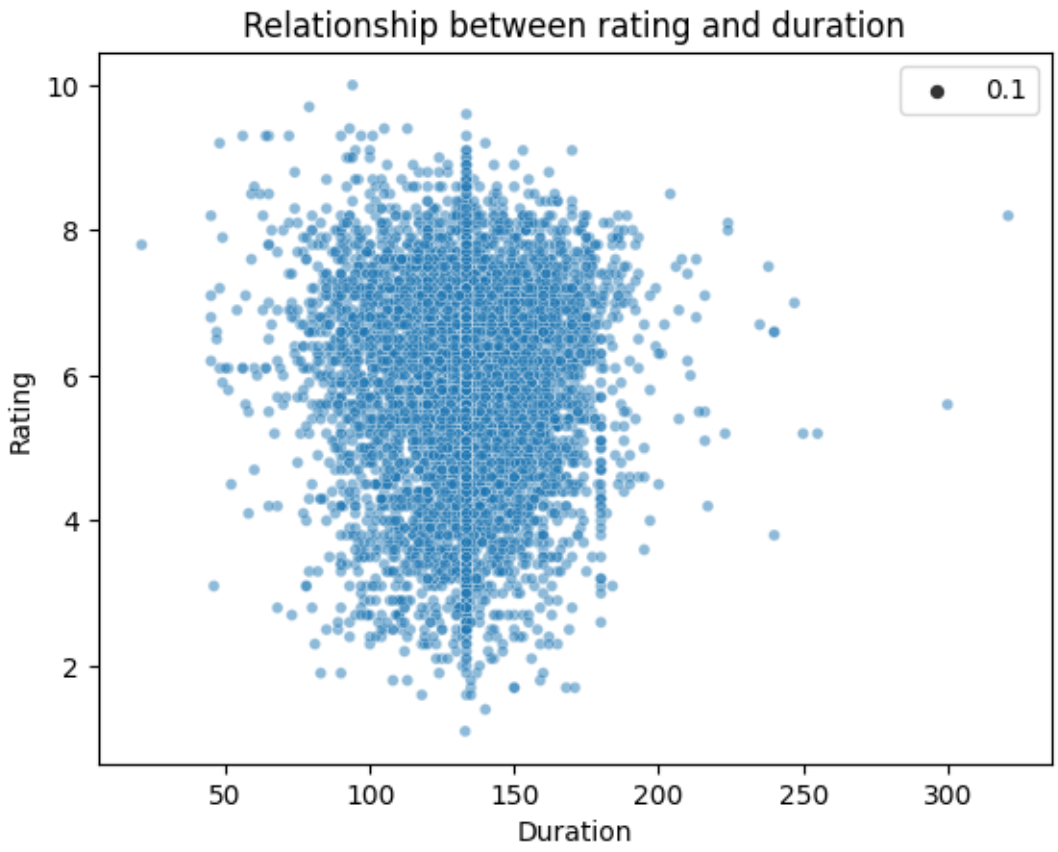
```
                textcoords = 'offset points')


plt.title('Top ten Actor 1  Rating')
plt.xlabel('Actor 1  Rating')
plt.ylabel('Rating')


plt.xticks(rotation=45)

plt.tight_layout()
plt.show()
```



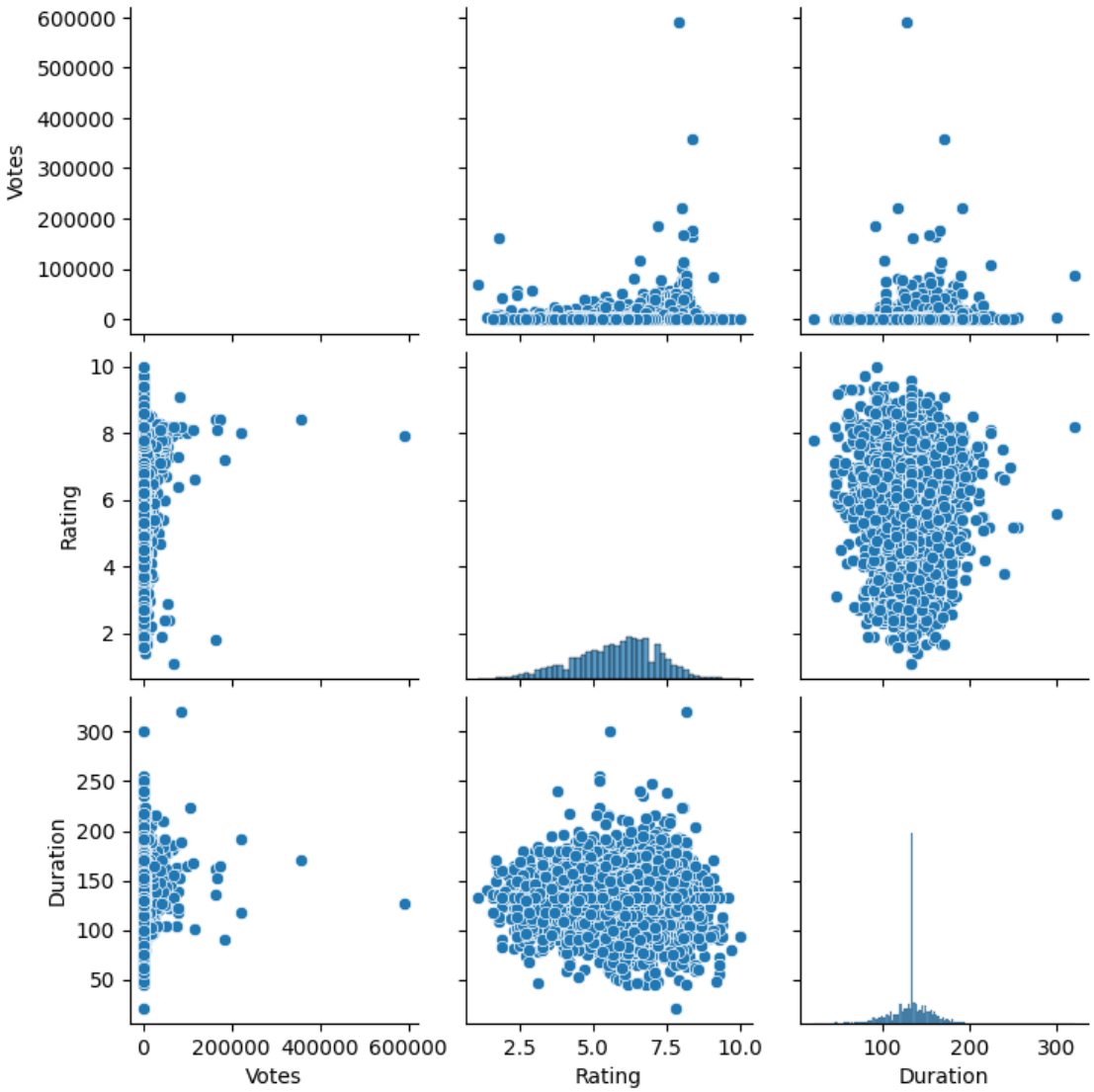
[65]:
```
sns.scatterplot(data=df, x='Votes', y='Rating', size=0.1, alpha=0.5)
plt.title('Relationship between rating and votes')
plt.show()
```



[66]:
```
sns.scatterplot(data=df, x='Duration', y='Rating', size=0.1, alpha=0.5)
plt.title('Relationship between rating and duration')
plt.show()
```



[67]:
```
sns.pairplot(df[['Votes', 'Rating', 'Duration']]);
```



[68]:
```
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   int64
 2   Duration  7558 non-null   float64
 3   Genre     7558 non-null   object
 4   Rating    7558 non-null   float64
 5   Votes     7558 non-null   int64
```

```
 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(2), int64(2), object(6)
memory usage: 649.5+ KB
```

[69]:
```
categorical_vars = ['Actor 1', 'Actor 2', 'Actor 3', 'Director', 'Genre']

encoding_maps = {}

for var in categorical_vars:
    encoding_map = df.groupby(var)['Rating'].mean().to_dict()
    encoding_maps[var] = encoding_map
```

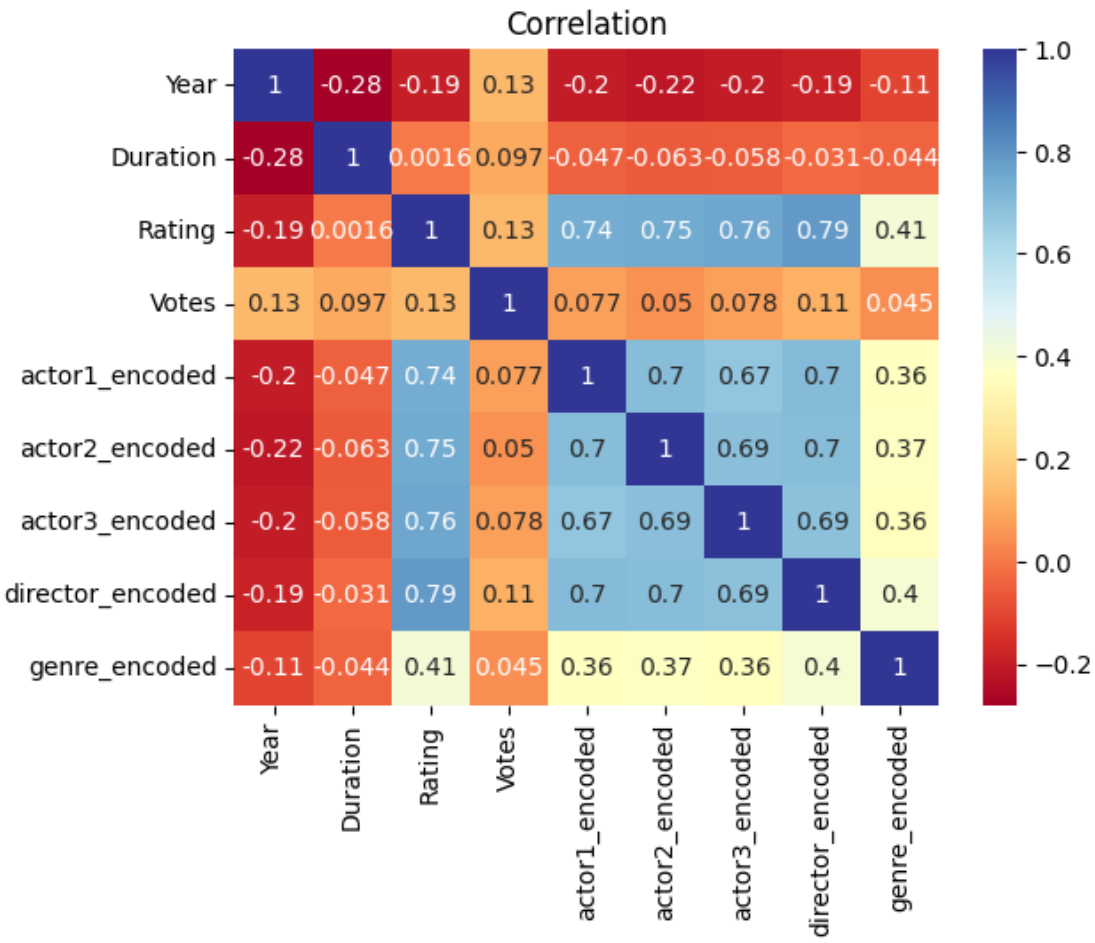
[70]:
```
df['actor1_encoded'] = round(df['Actor 1'].map(encoding_maps['Actor 1']), 1)
df['actor2_encoded'] = round(df['Actor 2'].map(encoding_maps['Actor 2']), 1)
df['actor3_encoded'] = round(df['Actor 3'].map(encoding_maps['Actor 3']), 1)
df['director_encoded'] = round(df['Director'].map(encoding_maps['Director']), 1)
df['genre_encoded'] = round(df['Genre'].map(encoding_maps['Genre']), 1)
```

[71]:
```
df.drop(['Name','Actor 1','Actor 2', 'Actor 3', 'Director', 'Genre'], axis=1,␣
 ↪inplace=True)
df.head()
```

[71]:

	Year	Duration	Rating	Votes	actor1_encoded	actor2_encoded	actor3_encoded	director_encoded	genre_encoded
1	2019	109.0	7.0	8	6.8	7.0	7.0	7.0	6.3
3	2019	110.0	4.4	35	5.4	4.4	4.4	4.4	5.7
5	1997	147.0	4.7	827	4.8	5.8	5.8	5.4	6.2
6	2005	142.0	7.4	1086	5.3	6.0	6.5	7.5	6.8
8	2012	82.0	5.6	326	5.6	5.9	5.6	5.6	5.5

[72]:
```
sns.heatmap(df.corr(), annot=True, cmap='RdYlBu')
plt.title('Correlation')
plt.show()
```



[73]:
```
X = df.drop('Rating', axis=1)
y = df['Rating']

X.head()
```

[73]:

	Year	Duration	Votes	actor1_encoded	actor2_encoded	actor3_encoded	director_encoded	genre_encoded
1	2019	109.0	8	6.8	7.0	7.0	7.0	6.3
3	2019	110.0	35	5.4	4.4	4.4	4.4	5.7
5	1997	147.0	827	4.8	5.8	5.8	5.4	6.2
6	2005	142.0	1086	5.3	6.0	6.5	7.5	6.8
8	2012	82.0	326	5.6	5.9	5.6		

```
8              5.6            5.5
```

[74]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state=42)
```

[75]:
```
print('Shape of training features: ', X_train.shape)
print('Shape of training target: ', y_train.shape)
print('Shape of testing features: ', X_test.shape)
print('Shape of testing target: ', y_test.shape)
```

```
Shape of training features:  (6046, 8)
Shape of training target:  (6046,)
Shape of testing features:  (1512, 8)
Shape of testing target:  (1512,)
```

Model Construction & Evaluation

[76]:
```
LR = LinearRegression()
LR.fit(X_train, y_train)

print('Coefficient of determination: ', LR.score(X_train, y_train))
y_pred_LR = LR.predict(X_test)
```

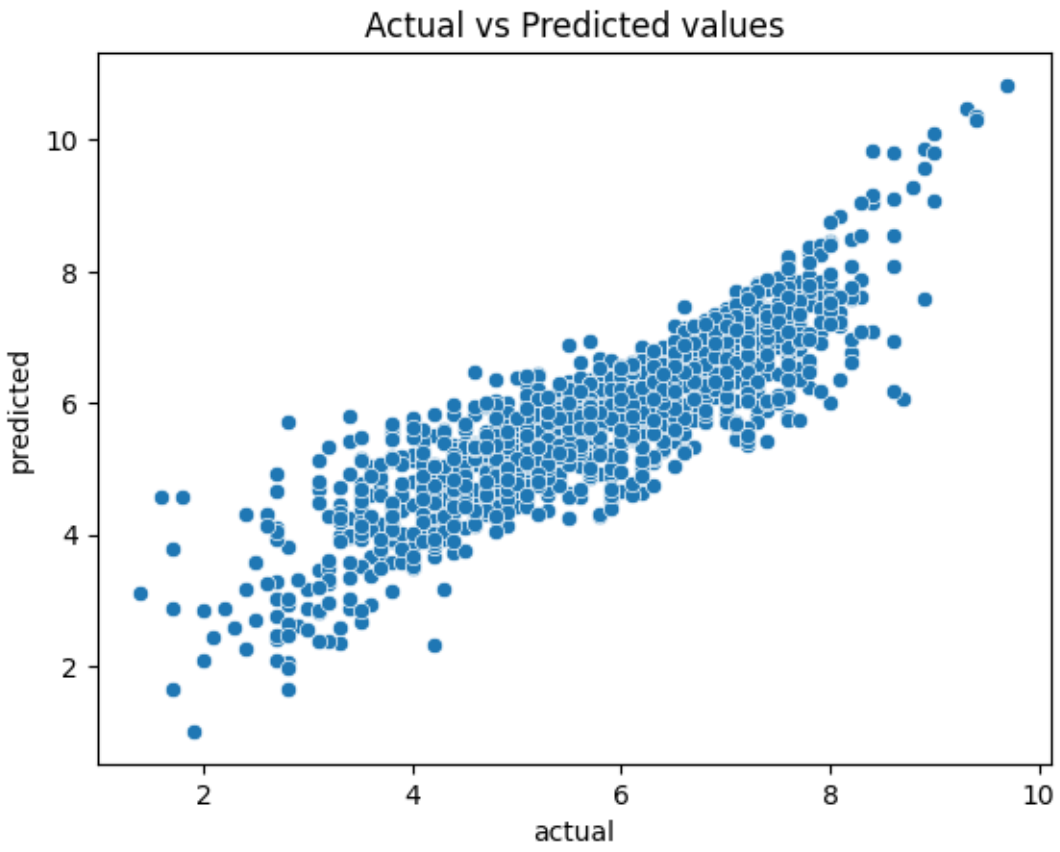
```
Coefficient of determination:  0.7613579123839522
```

[77]:
```
results = pd.DataFrame({'actual': y_test,
                        'predicted': y_pred_LR.ravel(),
                        'residual': y_test - y_pred_LR}
                       )
results.head()
```

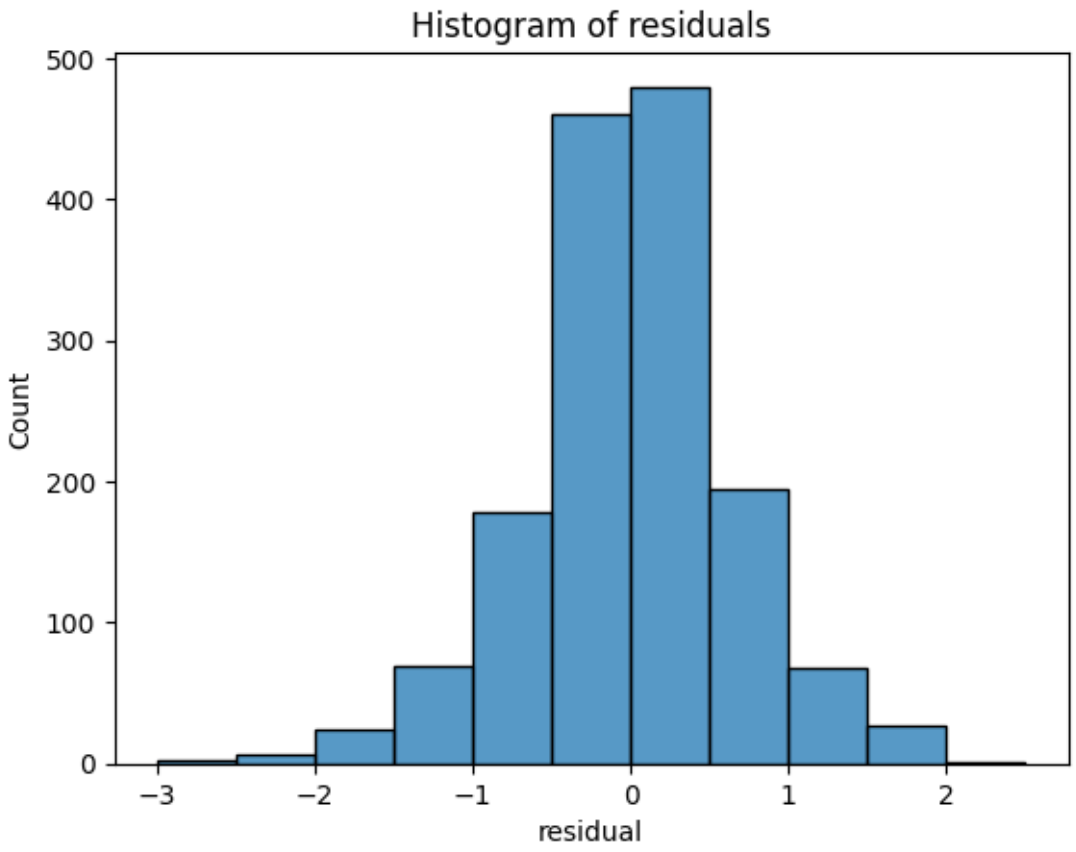
[77]:

	actual	predicted	residual
6241	7.4	6.617484	0.782516
3321	4.9	5.485182	-0.585182
6117	6.5	6.324062	0.175938
5975	5.7	5.552979	0.147021
6653	7.0	6.973330	0.026670

[78]:
```
sns.scatterplot(x=results['actual'], y=results['predicted'])
plt.title('Actual vs Predicted values')
plt.show()
```



[79]:
```
sns.histplot(results['residual'], bins=np.arange(-3,3,0.5))
plt.title('Histogram of residuals')
plt.show()
```



[80]:
```
results['residual'].mean()
```

[80]:
```
-0.0029143071545875408
```

Linear Regression

[81]:
```
LR_cv = LinearRegression()

k = 5 # Number of folds
cv = KFold(n_splits=k, shuffle=True, random_state=42)

scores = cross_val_score(LR_cv, X, y, cv=cv, scoring='r2')

print("R^2 scores:", scores)
print("Mean R^2:", scores.mean())
print("Standard Deviation of R^2:", scores.std())
```

```
R^2 scores: [0.75805291 0.7593615  0.76172776 0.75988008 0.76146141]
Mean R^2: 0.7600967351040422
Standard Deviation of R^2: 0.0013628876140524494
```

Decision Tree

[82]:
```
tree = DecisionTreeRegressor(random_state=0)
# Define the hyperparameter grid
param_grid = {'max_depth': [None, 10, 20, 30]}
# Create a grid search object
grid_search_tree = GridSearchCV(tree, param_grid, cv=5, scoring='r2')
# Fit the grid search to your data
grid_search_tree.fit(X_train, y_train)

grid_search_tree.best_params_
```

[82]:
```
{'max_depth': 10}
```

[83]:
```
y_pred_tree = grid_search_tree.predict(X_test)

print('R^2: ', r2_score(y_test, y_pred_tree))
print('MAE: ',mean_absolute_error(y_test, y_pred_tree))
print('MSE: ', mean_squared_error(y_test, y_pred_tree))
print('RMSE: ', np.sqrt(mean_squared_error(y_test, y_pred_tree)))
```

```
R^2:  0.707626058940163
MAE:  0.5106472740736313
MSE:  0.5417213695856643
RMSE:  0.7360172345710828
```

- The years 1948, 1940, and 1950 had high average movie ratings.
- The trend of the number of movie releases per year has increased from 1917 to 2020.

The top rated genres are:

- (History, Romance)
- (Documentary, History, Family)
- (Documentary, Music)

The top rated directors are: * Saif Ali Sayeed * Sriram Raja * Bobby Kumar

The top rated actors are:

- Ahaan Jha
- Raj Banerjee
- Dharmendra Ahir

Insights about relation: * Movie rating and movie votes are not highly correlated. * There is no correlation between movie rating and movie duration. * The linear regression model results in an R^2 of 0.758 on the test data. * The linear regression model after cross-validation results in an R^2 of 0.76. *The decision tree model results in an R^2 of 0.70 on the test data.

Thank you!!