Project: Movie Data Analysis

Table of Contents

Introduction

In this project I will be analysing movie dataset. In particular, I will be interested in trying to find the most popular movie genre and how popularity of movie genres has been changing over years.

I will also check which genre has the highest release of movies.

In [1]:

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

Data Wrangling

After looking into data set, I will check which columns we are going to use and which we can remove from our data set. I will also check if there are any duplicated rows and missing values.

General Properties

At first, I will load my data and print out a few lines to see what the dataset looks like.

In [2]:

```
df=pd.read_csv('tmdb-movies.csv')
df.head(2)
```

Out[2]:

	id	imdb_id	popularity	budget	revenue	original_title	cast	
0	135397	tt0369610	32.985763	150000000	1513528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	http://ww
1	76341	tt1392190	28.419936	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	http://www

2 rows × 21 columns

Observation

```
In the dataset preview above, I can see some columns wich I don't need for
 this analysis (id,imdb_id, homepage, tagline, overview, release_date). I w
ill drop those columns later, in the cleaning section.*

In the 'genres' column we can see multiple genres assign to one movie in on
e row. We need to split it to receive one genre in each row.
```

Next, I need to see how many rows and columns the dataset has.

In [3]:

```
df.shape
```

Out[3]:

```
(10866, 21)
```

So we have 10866 movies and 21 columns. Let's have a look at the empty cells for each column:

In [4]:

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

Out[4]:

```
id                         0
imdb_id                   10
popularity                 0
budget                     0
revenue                    0
original_title             0
cast                      76
homepage                7930
director                  44
tagline                 2824
keywords                1493
overview                   4
runtime                    0
genres                    23
production_companies    1030
release_date               0
vote_count                 0
vote_average               0
```

As we can see above, there is a lot of data missing in colums: 'homepage', 'tagline', 'keywords' and 'production_companies'. I wasn't planning to use those columns and will drop them later anyway.

In my analysis I need genres column, and there is 23 values missing in that column. Let's have a look at this:

In [5]:

```
to_drop=df[df['genres'].isnull()==True]
to_drop
```

Out[5]:

	id	imdb_id	popularity	budget	revenue	original_title	cast
424	363869	tt4835298	0.244648	0	0	Belli di papÃ	Diego Abatantuono|Matilde Gioli|Andrea Pisani|...
620	361043	tt5022680	0.129696	0	0	All Hallows' Eve 2	NaN
997	287663	NaN	0.330431	0	0	Star Wars Rebels: Spark of Rebellion	Freddie Prinze Jr.|Vanessa Marshall|Steve Blum...

Because there is only 23 of those out of 10866, and it looks like those movies aren't very popular (which we can see in 'popularity' column and 'vote_count' column), I am going to drop those rows. But first I will check what are the mean values for 'popularity' and 'vote_count' columns:

In [6]:

```
df.popularity.describe()
```

Out[6]:

```
count    10866.000000
mean         0.646441
std          1.000185
min          0.000065
25%          0.207583
50%          0.383856
75%          0.713817
max         32.985763
Name: popularity, dtype: float64
```

Mean value for 'popularity' is 0.646446 and majority of values are between 0.207575 and 0.713817, which is higher than most of the entries above without specified movie genre.

In [7]:

```
df.vote_count.describe()
```

Out[7]:

```
count    10866.000000
mean       217.389748
std        575.619058
min         10.000000
25%         17.000000
50%         38.000000
75%        145.750000
max       9767.000000
Name: vote_count, dtype: float64
```

Mean value for 'vote_count' is 217.399632 and majority of values are between 17 and 9767, which is higher than most of the entries above without specified movie genre. I will drop those rows later.

Also we need to check if there are any duplicated rows:

In [8]:

```
df[df.duplicated()==True]
```

Out[8]:

	id	imdb_id	popularity	budget	revenue	original_title	cast	homepage
2090	42194	tt0411951	0.59643	30000000	967000	TEKKEN	Jon Foo|Kelly Overton|Cary-Hiroyuki Tagawa|Ian...	NaN

1 rows × 21 columns

There is one duplicated row (which means all the information for each column are duplicated), so I need to drop this row as well.

In [9]:

```
df.describe()
```

Out[9]:

	id	popularity	budget	revenue	runtime	vote_count
count	10866.000000	10866.000000	1.086600e+04	1.086600e+04	10866.000000	10866.000000
mean	66064.177434	0.646441	1.462570e+07	3.982332e+07	102.070863	217.389748
std	92130.136561	1.000185	3.091321e+07	1.170035e+08	31.381405	575.619058
min	5.000000	0.000065	0.000000e+00	0.000000e+00	0.000000	10.000000
25%	10596.250000	0.207583	0.000000e+00	0.000000e+00	90.000000	17.000000
50%	20669.000000	0.383856	0.000000e+00	0.000000e+00	99.000000	38.000000
75%	75610.000000	0.713817	1.500000e+07	2.400000e+07	111.000000	145.750000
max	417859.000000	32.985763	4.250000e+08	2.781506e+09	900.000000	9767.000000

Observation

```
    Drop duplicated row and rows with missing values in 'genre' column.
```

Data Cleaning

After observing the data and figuring out the questions we are going to analyse, we need to clean the data first.

We need to:

- remove not needed columns;
- remove duplicated and empty rows;
- split string in 'genres' column to get one genre in one row.

Removing not needed columns

As I mentioned above, in my analysis I do not need the folowing columns: 'id', 'imdb_id', 'homepage', 'keywords', 'tagline', 'cast','director','overview','release_date' and 'production_companies' so am going to clean those columns:

In [10]:

```
df.drop(['id','imdb_id','homepage', 'keywords','tagline','cast','director','overvie
```

Removing duplicated and epmty rows

I will also drop duplicated row, which we found earlier, and after that check if it worked by running df.duplicated again:

In [11]:

```
df=df.drop_duplicates()
df.duplicated().sum()
```

Out[11]:

```
0
```

Great, that worked and we do not have duplicated rows anymore.

We also need to drop rows with missing values in 'genres' column:

In [12]:

```
df.drop(to_drop.index, axis=0, inplace=True)
```

Let's double check if it worked

In [13]:

```
df[df['genres'].isnull()==True]
```

Out[13]:

popularity	budget	revenue	original_title	runtime	genres	vote_count	vote_average	releas

After droping those columns and rows, I will check what does it look like now:

In [14]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 10842 entries, 0 to 10865
Data columns (total 11 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   popularity      10842 non-null  float64
 1   budget          10842 non-null  int64  
 2   revenue         10842 non-null  int64  
 3   original_title  10842 non-null  object 
 4   runtime         10842 non-null  int64  
 5   genres          10842 non-null  object 
 6   vote_count      10842 non-null  int64  
 7   vote_average    10842 non-null  float64
 8   release_year    10842 non-null  int64  
 9   budget_adj      10842 non-null  float64
 10  revenue_adj     10842 non-null  float64
dtypes: float64(4), int64(5), object(2)
memory usage: 1016.4+ KB
```

As we can see we have 11 columns and 10842 movies now.

In [15]:

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

Out[15]:

```
popularity        0
budget            0
revenue           0
original_title    0
runtime           0
genres            0
vote_count        0
vote_average      0
release_year      0
budget_adj        0
revenue_adj       0
dtype: int64
```

Split string in 'genres' column to get one genre in one row

I will first check what data type is the 'genre' column.

In [16]:

```
type(df['genres'][0])
```

Out[16]:

```
str
```

'Genres' column is a string.

In the preview above I saw that there are multiple genre types assign to one movie title (separated by '|'). Let's have a look at those:

In [17]:

```
df_m=df[df['genres'].str.contains("\|")]
df_m
```

Out[17]:

	popularity	budget	revenue	original_title	runtime	genres	vote_count	vote_av
0	32.985763	150000000	1513528810	Jurassic World	124	Action|Adventure|Science Fiction|Thriller	5562	
1	28.419936	150000000	378436354	Mad Max: Fury Road	120	Action|Adventure|Science Fiction|Thriller	6185	
2	13.112507	110000000	295238201	Insurgent	119	Adventure|Science Fiction|Thriller	2480	
3	11.173104	200000000	2068178225	Star Wars: The Force Awakens	136	Action|Adventure|Science Fiction|Fantasy	5292	
4	9.335014	190000000	1506249360	Furious 7	137	Action|Crime|Thriller	2947	
...	...	...	...	...	...	...	...	
				The				

There is 8514 movies which has multiple genres type. To be able to check which genres are getting most popular I need to split it by '|', and have only one genre in one row.

Let's check what is the maximum number of genres assign to one movie (row):

In [18]:

```
df_m.genres.str.count('\|').max()
```

Out[18]:

```
4
```

Maximum of ' | ' occurances is 4, which means there is maximum of 5 genres assign to one movie.

I will create 5 copies of the dataframe:

In [19]:

```
df_1=df_m.copy()
df_2=df_m.copy()
df_3=df_m.copy()
df_4=df_m.copy()
df_5=df_m.copy()
```

Now I will spli string in 'genres' column

In [20]:

```
    df_1['genres']=df_1['genres'].str.split("\|").str[0]
    df_2['genres']=df_2['genres'].str.split("\|").str[1]
    df_3['genres']=df_3['genres'].str.split("\|").str[2]
    df_4['genres']=df_4['genres'].str.split("\|").str[3]
    df_5['genres']=df_5['genres'].str.split("\|").str[4]
```

Next, I will drop the original rows with multiple genres in one row:

In [21]:

```
df.drop(df_m.index, inplace=True)
```

In [22]:

```
df
```

Out[22]:

	popularity	budget	revenue	original_title	runtime	genres	vote_count	vote
25	4.566713	150000000	682330139	Mission: Impossible - Rogue Nation	131	Action	2349	
26	4.564549	68000000	215863606	Ted 2	115	Comedy	1666	
51	2.814802	35000000	194564672	The Intern	121	Comedy	1255	
55	2.584264	20000000	36606743	Burnt	100	Drama	631	
58	2.557859	15000000	64191523	The Danish Girl	120	Drama	867	
...	...	...	...	...	...	...	...	
10846	0.212716	0	0	Dracula: Prince of Darkness	90	Horror	16	
10852	0.227220	0	0	A Big Hand for the Little Lady	95	Western	11	
10860	0.087034	0	0	Carry On Screaming!	87	Comedy	13	
10861	0.080598	0	0	The Endless Summer	95	Documentary	11	
10865	0.035919	19000	0	Manos: The Hands of Fate	74	Horror	15	

2328 rows × 11 columns

Now we have to add in our newly separated rows:

In [23]:

```
    frames = [df_1, df_2, df_3,df_4, df_5]
    new_rows = pd.concat(frames)


    df=df.append(new_rows, ignore_index=True)
```

In [24]:

```
df['genres'].isnull().sum()
```

Out[24]:

```
17943
```

We have 17943 empty rows now so we have to drop them:

In [25]:

```
df.drop(df[df['genres'].isnull()==True].index, axis=0, inplace=True)
```

In [26]:

```
df['genres'].isnull().values.any()
```

Out[26]:

```
False
```

As we can see above, all the empty rows were dropped and now we don't have any left.

Next I will check if all the original rows with "/|" are gone:

In [27]:

```
df[df['genres'].str.contains("\|")]
```

Out[27]:

	popularity	budget	revenue	original_title	runtime	genres	vote_count	vote_average	releas

In [28]:

```
df
```

Out[28]:

	popularity	budget	revenue	original_title	runtime	genres	vote_count	vote_av
0	4.566713	150000000	682330139	Mission: Impossible - Rogue Nation	131	Action	2349	
1	4.564549	68000000	215863606	Ted 2	115	Comedy	1666	
2	2.814802	35000000	194564672	The Intern	121	Comedy	1255	
3	2.584264	20000000	36606743	Burnt	100	Drama	631	
4	2.557859	15000000	64191523	The Danish Girl	120	Drama	867	
...	...	...	...	...	...	...	...	
44866	0.410366	1377800	0	Batman	105	Crime	99	
44874	0.299911	12000000	20000000	The Sand Pebbles	182	Romance	28	
44880	0.252399	0	0	Khartoum	134	Action	12	
44886	0.202473	0	0	Harper	121	Mystery	14	
44887	0.342791	0	0	Born Free	95	Foreign	15	

26955 rows × 11 columns

There is no multiple genres in 'genres' column in our Dataframe anymore. Our dataframe has 26955 rows now.

Exploratory Data Analysis

Which genres are most popular from year to year?

As we can see on 'Jurassic Word' example, there is one genre assigned to one movie title in each row.

In [29]:

```
df.query('original_title=="Jurassic World"')
```

Out[29]:

	popularity	budget	revenue	original_title	runtime	genres	vote_count	vote_a
2328	32.985763	150000000	1513528810	Jurassic World	124	Action	5562	
10842	32.985763	150000000	1513528810	Jurassic World	124	Adventure	5562	
19356	32.985763	150000000	1513528810	Jurassic World	124	Science Fiction	5562	
27870	32.985763	150000000	1513528810	Jurassic World	124	Thriller	5562	

There is 20 unique genres.

In [30]:

```
df.genres.nunique()
```

Out[30]:

```
20
```

As we have no longer multiple genres in one row, now we can check what genres are getting more popular from year to year.

First, I will group the data by 'realease_year' and then 'genres' to check mean values:

In [31]:

```
year_pop=df.groupby(['release_year','genres']).mean()
year_pop
```

Out[31]:

		popularity	budget	revenue	runtime	vote_count	vote
release_year	**genres**						
1960	**Action**	0.590724	1.750000e+06	8.113125e+06	137.000000	65.875000	
	Adventure	0.700981	5.500000e+05	9.810000e+05	124.200000	82.000000	
	Comedy	0.396000	7.537500e+05	6.012500e+06	98.625000	44.875000	
	Crime	0.346480	0.000000e+00	0.000000e+00	119.000000	25.500000	
	Drama	0.566305	1.215919e+06	9.461538e+06	133.076923	138.153846	
...	**...**	...	...	...	...	...	
2015	**Science Fiction**	2.245603	2.850500e+07	1.118263e+08	94.930233	682.732558	
	TV Movie	0.260574	1.500000e+05	0.000000e+00	86.250000	25.700000	
	Thriller	1.401877	1.242135e+07	4.529045e+07	98.356725	343.403509	
	War	1.284511	2.377778e+07	7.845509e+07	104.000000	384.222222	
	Western	3.178796	4.196667e+07	1.148233e+08	124.666667	1178.666667	

1049 rows × 8 columns

Next I will group by 'release_year' again and find the largest popularity value for each year.

In [32]:

```
year_pop.groupby(['release_year']).popularity.nlargest(1)
```

Out[32]:

```
release_year  release_year  genres
1960          1960          Thriller           0.811910
1961          1961          Animation          2.631987
1962          1962          Adventure          0.942513
1963          1963          Animation          2.180410
1964          1964          War                0.930959
1965          1965          Music              0.968850
1966          1966          Animation          0.585717
1967          1967          Animation          1.348805
1968          1968          Mystery            1.519456
1969          1969          Crime              0.948020
1970          1970          Animation          1.127718
1971          1971          Family             1.530722
1972          1972          Crime              1.072768
1973          1973          Animation          0.956526
1974          1974          Mystery            0.702035
1975          1975          Adventure          0.880297
1976          1976          Crime              0.707249
1977          1977          Action             1.419319
1978          1978          Music              0.679805
1979          1979          Action             1.410014
1980          1980          Science Fiction    0.897143
1981          1981          Adventure          0.875815
1982          1982          War                1.143183
1983          1983          Adventure          0.900596
1984          1984          Family             0.823924
1985          1985          Family             0.924311
1986          1986          Adventure          0.798935
1987          1987          History            0.815643
1988          1988          Action             0.599017
1989          1989          Animation          1.177585
1990          1990          Adventure          0.801768
1991          1991          Animation          1.665002
1992          1992          Animation          1.286893
1993          1993          Fantasy            0.918601
1994          1994          Crime              1.297888
1995          1995          Animation          1.467780
1996          1996          Crime              0.976838
1997          1997          Science Fiction    1.140241
1998          1998          War                1.246619
1999          1999          Adventure          1.012306
2000          2000          Adventure          0.854593
2001          2001          Fantasy            1.565260
2002          2002          Fantasy            1.430465
2003          2003          Fantasy            1.747524
2004          2004          Fantasy            1.320568
2005          2005          Fantasy            1.117732
2006          2006          Fantasy            1.023134
2007          2007          Fantasy            0.957349
2008          2008          Adventure          1.008385
2009          2009          Adventure          1.138422
2010          2010          Adventure          1.360319
2011          2011          Western            1.175800
2012          2012          Western            1.732778
2013          2013          Adventure          1.260832
```

```
2014          2014          Adventure          2.430526
2015          2015          Adventure          3.283786
Name: popularity, dtype: float64
```

We have created a list of most popular genres in each year. As we can see above the most popular movie genre in the past 3 years is Advenure (from 2013 to 2015).

Next I will check how the popularity for each genre has been changing from year to year. To do that, let's group our original DataFrame by 'genres' and then by 'release_year' and check mean values:

In [33]:

```
genres_pop=df.groupby(['genres','release_year']).mean()
genres_pop
```

Out[33]:

		popularity	budget	revenue	runtime	vote_count	vote_a
genres	**release_year**						
Action	**1960**	0.590724	1.750000e+06	8.113125e+06	137.000000	65.875000	6
	1961	0.365913	2.285714e+06	4.742857e+06	134.000000	30.285714	6
	1962	0.708945	3.262500e+06	1.370000e+07	125.375000	100.250000	6
	1963	0.951729	7.225000e+06	2.222469e+07	136.000000	140.750000	6
	1964	0.813087	7.000000e+05	2.498000e+07	130.600000	145.600000	6
...	**...**	...	...	...	...	...	
Western	**2011**	1.175800	9.933333e+07	1.403902e+08	108.000000	931.000000	6
	2012	1.732778	2.925000e+07	1.063421e+08	108.250000	1884.750000	5
	2013	0.665255	8.733333e+07	3.010910e+07	113.333333	579.666667	5
	2014	0.673947	2.666667e+06	4.049982e+05	90.833333	227.166667	5
	2015	3.178796	4.196667e+07	1.148233e+08	124.666667	1178.666667	6

1049 rows × 8 columns

Now I will create an array of unique genres.

In [34]:

```
genre_list=df.genres.unique()
genre_list
```

Out[34]:

```
array(['Action', 'Comedy', 'Drama', 'Thriller', 'Horror', 'Documentar
y',
       'TV Movie', 'Animation', 'Crime', 'Adventure', 'Family', 'Roman
ce',
       'Science Fiction', 'Music', 'Western', 'Fantasy', 'War', 'Forei
gn',
       'History', 'Mystery'], dtype=object)
```

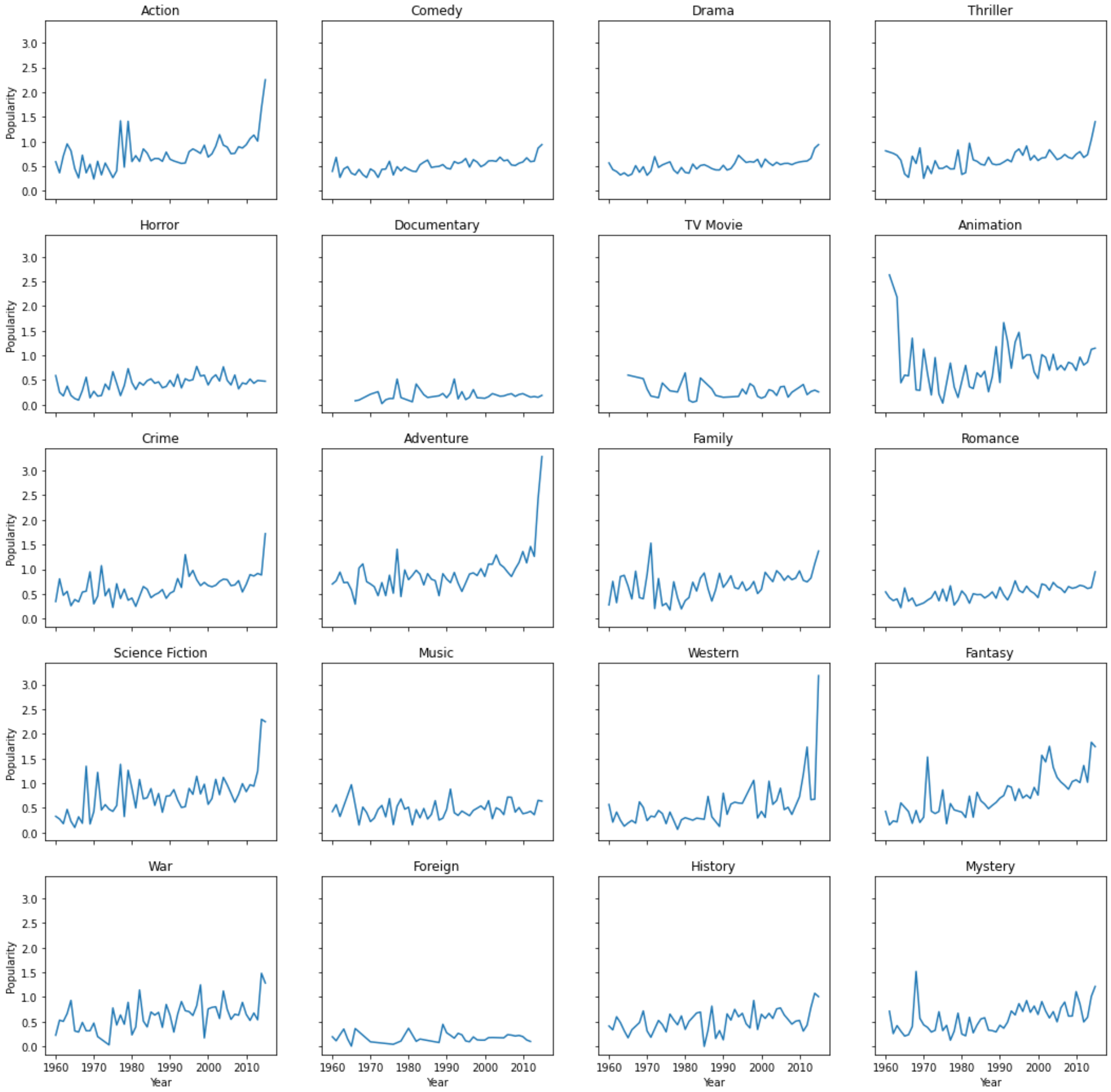
Next, create a plots for each genre to see how popularity for each genre has been changing over years.

In [35]:

```
fig, axs = plt.subplots(5,4, figsize=(18, 18), sharex=True, sharey=True)

for i, ax in enumerate(axs.flat):
    ax.plot(genres_pop.popularity[genre_list[i]])
    ax.set_title(genre_list[i])

plt.setp(axs[-1, :], xlabel='Year'); # I want to label only last row
plt.setp(axs[:, 0], ylabel='Popularity'); # just label firt column
```



As we can see above, in the past few years Adventure movies are very popular, which we have also seen in the table above. We can also see that back in early 60's Animation movies were very popular.

Which genre has the highest release of movies?

To check which genre has the highest release of movies, I am going to use value_counts:

In [36]:

```
genre_release=df.genres.value_counts()
genre_release
```

Out[36]:

```
Drama              4760
Comedy             3793
Thriller           2907
Action             2384
Romance            1712
Horror             1637
Adventure          1471
Crime              1354
Family             1231
Science Fiction    1229
Fantasy             916
Mystery             810
Animation           699
Documentary         520
Music               408
History             334
War                 270
Foreign             188
TV Movie            167
Western             165
Name: genres, dtype: int64
```

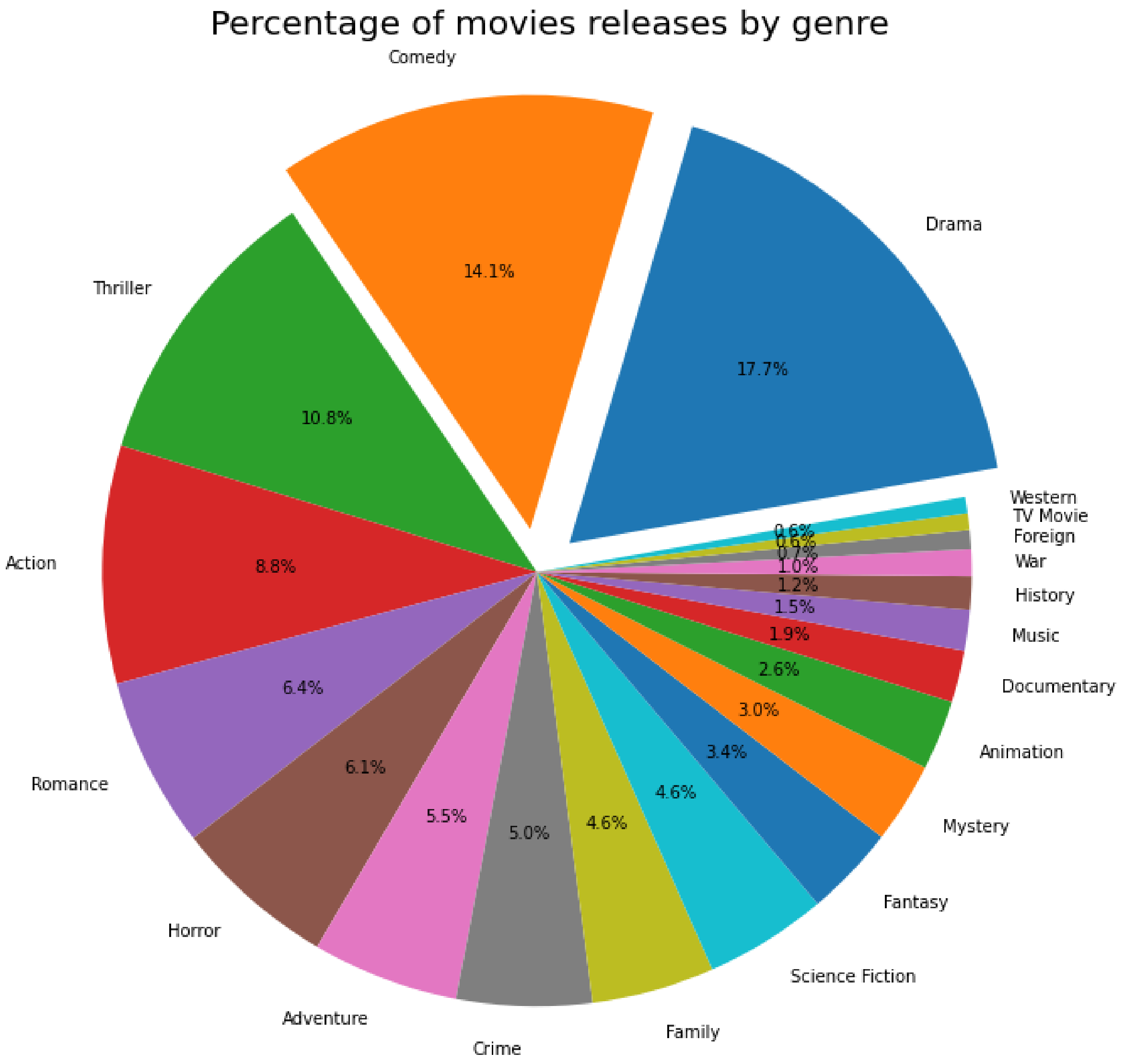
Next we will create the pie chart, and use percenatges on the visualisation.

In [37]:

```
labels = genre_release.index
sizes = genre_release
explode = (0.1, 0.1, 0, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)  # only "explode" the fi

fig, ax = plt.subplots(figsize = (11,11))
ax.pie(sizes,labels=labels, autopct='%1.1f%%', startangle=10, explode=explode)
ax.axis('equal')  # to be sure,that pie is drawn as a circle
ax.set_title('Percentage of movies releases by genre', fontsize=20)

plt.show()
```



As we can see above, Drama genre has the most releases, followed by Comedy genre.

Conclusions

- Advenure movies are the most popular genre;
- Drama and Comedy are the genres which have the most releases;

Limitations

In the original dataset there was many genres assigned to one movie title. In my analysis I had to split the genre column by ' | ', to get one genre per row. Because of that the dataset which I was working on had much more rows and it incressed the calculation time.