Investigate_a_Dataset

August 17, 2021

1 Project: Investigate a TMDb Data set

1.1 Table of Contents

## Introduction

This data set contains information about 10,000 movies collected from The Movie Database (TMDb), including user ratings and revenue.

## Questions

Which genres are most popular from year to year?
Which year is the most productive year in movies?
Which are the top 10 highest and lowest budget movies?
What is more favorable: a long time length movie or a short one?

```
In [35]: # Use this cell to set up import statements for all of the packages that you
         #   plan to use.

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

## Data Wrangling

1.1.1 General Properties

```
In [36]: # Before begining, I will change pandas to display large values and small values in exp
         #   just to ease things up :).

         pd.options.display.float_format = '{:.2f}'.format
```

```
In [37]: # Load your data and print out a few lines. Perform operations to inspect data
         #   types and look for instances of missing or possibly errant data.
```

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

```
Out[37]:
       id    imdb_id  popularity     budget     revenue  \
0  135397  tt0369610       32.99  150000000  1513528810   
1   76341  tt1392190       28.42  150000000   378436354   
2  262500  tt2908446       13.11  110000000   295238201   
3  140607  tt2488496       11.17  200000000  2068178225   
4  168259  tt2820852        9.34  190000000  1506249360   

               original_title  \
0              Jurassic World   
1          Mad Max: Fury Road   
2                   Insurgent   
3  Star Wars: The Force Awakens   
4                   Furious 7   

                                                cast  \
0  Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...   
1  Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...   
2  Shailene Woodley|Theo James|Kate Winslet|Ansel...   
3  Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...   
4  Vin Diesel|Paul Walker|Jason Statham|Michelle ...   

                                            homepage          director  \
0                      http://www.jurassicworld.com/   Colin Trevorrow   
1                        http://www.madmaxmovie.com/     George Miller   
2     http://www.thedivergentseries.movie/#insurgent  Robert Schwentke   
3  http://www.starwars.com/films/star-wars-episod...       J.J. Abrams   
4                           http://www.furious7.com/         James Wan   

                         tagline      ...         \
0              The park is open.      ...          
1             What a Lovely Day.      ...          
2     One Choice Can Destroy You      ...          
3  Every generation has a story.      ...          
4              Vengeance Hits Home      ...          

                                            overview runtime  \
0  Twenty-two years after the events of Jurassic ...     124   
1  An apocalyptic story set in the furthest reach...     120   
2  Beatrice Prior must confront her inner demons ...     119   
3  Thirty years after defeating the Galactic Empi...     136   
4  Deckard Shaw seeks revenge against Dominic Tor...     137   

                                      genres  \
0  Action|Adventure|Science Fiction|Thriller   
1  Action|Adventure|Science Fiction|Thriller   
```

```
2          Adventure|Science Fiction|Thriller
3    Action|Adventure|Science Fiction|Fantasy
4                       Action|Crime|Thriller

                                production_companies release_date vote_count  \
0  Universal Studios|Amblin Entertainment|Legenda...       6/9/15       5562
1  Village Roadshow Pictures|Kennedy Miller Produ...      5/13/15       6185
2  Summit Entertainment|Mandeville Films|Red Wago...      3/18/15       2480
3          Lucasfilm|Truenorth Productions|Bad Robot     12/15/15       5292
4  Universal Pictures|Original Film|Media Rights ...       4/1/15       2947

   vote_average  release_year   budget_adj   revenue_adj
0          6.50          2015 137999939.28 1392445892.52
1          7.10          2015 137999939.28  348161292.49
2          6.30          2015 101199955.47  271619025.41
3          7.50          2015 183999919.04 1902723129.80
4          7.30          2015 174799923.09 1385748801.47

[5 rows x 21 columns]
```

```
In [38]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10866 entries, 0 to 10865
Data columns (total 21 columns):
id                      10866 non-null int64
imdb_id                 10856 non-null object
popularity              10866 non-null float64
budget                  10866 non-null int64
revenue                 10866 non-null int64
original_title          10866 non-null object
cast                    10790 non-null object
homepage                2936 non-null object
director                10822 non-null object
tagline                 8042 non-null object
keywords                9373 non-null object
overview                10862 non-null object
runtime                 10866 non-null int64
genres                  10843 non-null object
production_companies    9836 non-null object
release_date            10866 non-null object
vote_count              10866 non-null int64
vote_average            10866 non-null float64
release_year            10866 non-null int64
budget_adj              10866 non-null float64
revenue_adj             10866 non-null float64
dtypes: float64(4), int64(6), object(11)
memory usage: 1.7+ MB
```

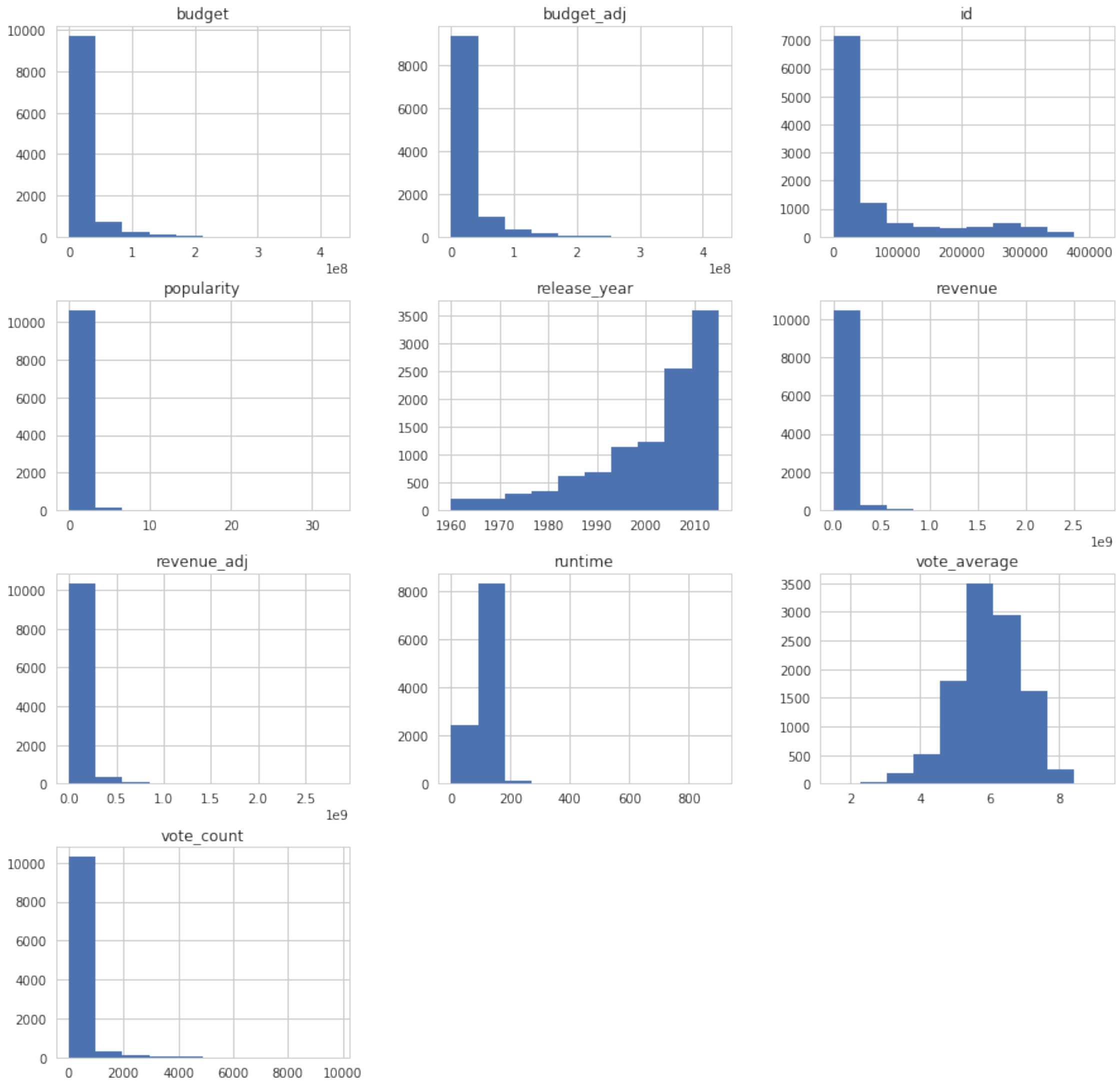
```
In [39]: print('This Dataframe contains {} rows and {} columns'.format(df.shape[0], df.shape[1])
```

```
This Dataframe contains 10866 rows and 21 columns
```

```
In [40]: df.describe()
```

```
Out[40]:               id  popularity       budget       revenue  runtime  vote_count  \
         count  10866.00    10866.00     10866.00      10866.00 10866.00    10866.00
         mean   66064.18        0.65  14625701.09   39823319.79   102.07      217.39
         std    92130.14        1.00  30913213.83  117003486.58    31.38      575.62
         min        5.00        0.00         0.00          0.00     0.00       10.00
         25%    10596.25        0.21         0.00          0.00    90.00       17.00
         50%    20669.00        0.38         0.00          0.00    99.00       38.00
         75%    75610.00        0.71  15000000.00   24000000.00   111.00      145.75
         max   417859.00       32.99 425000000.00 2781505847.00   900.00     9767.00

                vote_average  release_year   budget_adj   revenue_adj
         count      10866.00      10866.00     10866.00      10866.00
         mean           5.97       2001.32  17551039.82   51364363.25
         std            0.94         12.81  34306155.72  144632485.04
         min            1.50       1960.00         0.00          0.00
         25%            5.40       1995.00         0.00          0.00
         50%            6.00       2006.00         0.00          0.00
         75%            6.60       2011.00  20853251.08   33697095.72
         max            9.20       2015.00 425000000.00 2827123750.41
```

```
In [41]: #  I will make histogram versions of the dataframe content to estimate how many zero va
         #  and to see what is the trend of each column.

         df.hist( figsize = (15, 15) );
```



1.2 Discussing problems in this data set

There are many problems in this data set to start with, whether they are in values or in format. I'm going to mention every problem needed to be solved, then in **Data Cleaning** section I will solve them in **order one by one**

1.2.1 First: Null Values and Zero Values

I'm going to change zero values in this data set to Null values and drop all nulls. It's clear after checking **df.describe() and df.hist()** that many rows include zero values and these columns are:

revenue_adj

revenue

budget_adj
budget
runtime

1.2.2 Second: Dropping non important columns (won’t be used in analysis)

These columns are:
homepage
overview
release_date
imdb_id
tagline

1.2.3 Third: Rows containing this sign ’|’

I will remove this sign to present data in rows clearly without any extras or issues in analysis. Columns that have these issue are:
cast
director
genres
production_companies
keywords

1.2.4 Data Cleaning

First: Null Values and Zero Values

```
In [42]: # Changing zeros into nulls

         df['revenue_adj'].replace(0, np.NAN, inplace=True)
         df['revenue'].replace(0, np.NAN, inplace=True)
         df['budget_adj'].replace(0, np.NAN, inplace=True)
         df['budget'].replace(0, np.NAN, inplace=True)
         df['runtime'].replace(0, np.NAN, inplace=True)

         # Dropping all rows that contain nulls in the dataframes (including zeros that are chan

         df.dropna(axis=0, inplace=True)
```

Second: Dropping non important columns (won’t be used in analysis)

```
In [43]: df = df.drop( ['homepage', 'overview', 'release_date', 'imdb_id', 'tagline'], axis = 1
```

Third: Rows containing this sign '|' I'm going to clean rows containing this sign by a special way. For example a column like 'cast' will be divided into a Dataframe with multiple columns (which will be joined by its original Dataframe after the orginal cast column being dropped) taking each value seperated by '|' into a seperated column in this new cast dataframe, so ,by doing this, I've cleared my way to deal with 'cast' column easily or we can say all columns that contain rows with values seperated by this sign('|').

```
In [44]: # expand = true to replace the delimeter with none
         # and rename the column with its name followed by underscore and its iteration

         cast = (df['cast'].str.split('|', expand=True).rename(columns=lambda x: f"cast_{x+1}"))
         director = (df['director'].str.split('|', expand=True).rename(columns=lambda x: f"direc
         genres = (df['genres'].str.split('|', expand=True).rename(columns=lambda x: f"genres_{x
         production_companies = (df['production_companies'].str.split('|', expand=True).rename(c
         keywords = (df['keywords'].str.split('|', expand=True).rename(columns=lambda x: f"keywo
```

```
In [45]: # I will drop original columns of cast, director, genres, production_companies, and key


         df = df.drop(['cast', 'director', 'genres', 'production_companies', 'keywords'], axis=1
```

```
In [46]: # Checking my output

         cast.head()
```

```
Out[46]:             cast_1               cast_2            cast_3  \
         0      Chris Pratt  Bryce Dallas Howard       Irrfan Khan
         1        Tom Hardy      Charlize Theron  Hugh Keays-Byrne
         2  Shailene Woodley          Theo James      Kate Winslet
         3    Harrison Ford          Mark Hamill     Carrie Fisher
         4       Vin Diesel          Paul Walker     Jason Statham

                        cast_4           cast_5
         0   Vincent D'Onofrio    Nick Robinson
         1      Nicholas Hoult      Josh Helman
         2        Ansel Elgort     Miles Teller
         3         Adam Driver     Daisy Ridley
         4  Michelle Rodriguez  Dwayne Johnson
```

```
In [47]: director.head()
```

```
Out[47]:          director_1 director_2 director_3 director_4 director_5 director_6
         0   Colin Trevorrow       None       None       None       None       None
         1     George Miller       None       None       None       None       None
         2  Robert Schwentke       None       None       None       None       None
         3       J.J. Abrams       None       None       None       None       None
         4         James Wan       None       None       None       None       None
```

```
In [72]: genres.head()
```

```
Out[72]:     genres_1         genres_2         genres_3  genres_4 genres_5
         0     Action        Adventure  Science Fiction  Thriller     None
         1     Action        Adventure  Science Fiction  Thriller     None
         2  Adventure  Science Fiction         Thriller      None     None
         3     Action        Adventure  Science Fiction   Fantasy     None
         4     Action            Crime         Thriller      None     None
```

```
In [49]: production_companies.head()
```

```
Out[49]:       production_companies_1      production_companies_2  \
         0          Universal Studios        Amblin Entertainment
         1  Village Roadshow Pictures  Kennedy Miller Productions
         2       Summit Entertainment            Mandeville Films
         3                  Lucasfilm       Truenorth Productions
         4         Universal Pictures               Original Film

              production_companies_3   production_companies_4 production_companies_5
         0       Legendary Pictures  Fuji Television Network                 Dentsu
         1                     None                     None                   None
         2  Red Wagon Entertainment                  NeoReel                   None
         3                Bad Robot                     None                   None
         4      Media Rights Capital                   Dentsu         One Race Films
```

```
In [50]: keywords.head()
```

```
Out[50]:        keywords_1  keywords_2         keywords_3    keywords_4  \
         0         monster         dna  tyrannosaurus rex  velociraptor
         1          future       chase    post-apocalyptic      dystopia
         2  based on novel  revolution            dystopia        sequel
         3         android   spaceship                jedi   space opera
         4        car race       speed             revenge      suspense

                 keywords_5
         0           island
         1        australia
         2  dystopic future
         3               3d
         4              car
```

```
In [51]: # Output is correct like what I expected!
         #    , so I will join the modified columns

         df = df.join([cast, director, genres, production_companies, keywords])
```

```
In [52]: df.duplicated().sum()
```

```
Out[52]: 0
```

No duplicates therefore it's already cleaned from duplicates
Now after cleaning, I will check how many rows and columns rest in the Dataset

```
In [53]: print('This Dataframe contains {} rows and {} columns'.format(df.shape[0], df.shape[1])
```

```
This Dataframe contains 1287 rows and 37 columns
```

```
In [54]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 1287 entries, 0 to 10760
Data columns (total 37 columns):
id                          1287 non-null int64
popularity                  1287 non-null float64
budget                      1287 non-null float64
revenue                     1287 non-null float64
original_title              1287 non-null object
runtime                     1287 non-null float64
vote_count                  1287 non-null int64
vote_average                1287 non-null float64
release_year                1287 non-null int64
budget_adj                  1287 non-null float64
revenue_adj                 1287 non-null float64
cast_1                      1287 non-null object
cast_2                      1285 non-null object
cast_3                      1285 non-null object
cast_4                      1283 non-null object
cast_5                      1278 non-null object
director_1                  1287 non-null object
director_2                  110 non-null object
director_3                  11 non-null object
director_4                  1 non-null object
director_5                  1 non-null object
director_6                  1 non-null object
genres_1                    1287 non-null object
genres_2                    1092 non-null object
genres_3                    722 non-null object
genres_4                    270 non-null object
genres_5                    83 non-null object
production_companies_1      1287 non-null object
production_companies_2      1096 non-null object
production_companies_3      817 non-null object
production_companies_4      526 non-null object
production_companies_5      324 non-null object
keywords_1                  1287 non-null object
keywords_2                  1248 non-null object
keywords_3                  1199 non-null object
keywords_4                  1122 non-null object
keywords_5                  1036 non-null object
dtypes: float64(7), int64(3), object(27)
```

```
memory usage: 422.1+ KB
```

Perfect!! Now I'm ready to explore this Dataset after the huge reduction from the cleaning I did in the previous steps.

## Exploratory Data Analysis

1.2.5 Research Question 1 (Which genres are most popular from year to year?)

```
In [55]: # Selecting only genres and joining release_year with them to freely analyze them caref

         df_gen = df.loc[:, 'genres_1': 'genres_5' ]
         df_gen_year = df_gen.join(df['release_year'])
```

```
In [56]: # Creating an array containing all years in the dataframe

         years = df_gen_year['release_year'].unique()
         years.sort()
         years
```

```
Out[56]: array([1961, 1962, 1963, 1964, 1965, 1967, 1969, 1971, 1972, 1973, 1974,
                1975, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986,
                1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997,
                1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008,
                2009, 2010, 2011, 2012, 2013, 2014, 2015])
```

```
In [57]: # Creating a tuple that will store the output genres in it

         popular_gen = []
```

```
In [59]: # Loop on years to know which genres from year to year are the most popular.

         for year in years:

             # Getting the specific year we want from dataframe

             df_this_year = df_gen_year[df_gen_year['release_year'] == year]

             # Dropping release_year column as we know we already selected specific year from th
             #         , and to use stack to count only genres

             genres_of_this_year = df_this_year.drop(['release_year'], axis = 1)

             # counts from genres_1 to genres_5 in one year, then store the most frequent one in

             most_popular_genre_by_production = genres_of_this_year.stack().value_counts().idxma

             # Getting original dataframe to get attribute vote_average from it
```

```
    df_tmp = df[df['release_year'] == year]

    # Getting the mean of vote_average and store the index of maximum value

    most_popular_gen_by_voting = df_tmp.groupby(['genres_1'])['vote_average'].mean().id

    #Comparing between people's vote on most popular genres and most popular genres by

    if most_popular_genre_by_production == most_popular_gen_by_voting:
        flag = 'Same'
    else:
        flag = 'Different'

    # fill tuple with output

    popular_gen.append((year, most_popular_genre_by_production, most_popular_gen_by_vot
```

```
In [60]: # creating dataframe of the output of the question

         df_most_popular_gen_this_year = pd.DataFrame( popular_gen, columns = ['release_year', '
         df_most_popular_gen_this_year
```

```
Out[60]:     release_year most_popular_genre_by_production  \
         0           1961                           Family
         1           1962                         Thriller
         2           1963                         Thriller
         3           1964                           Action
         4           1965                         Thriller
         5           1967                         Thriller
         6           1969                         Thriller
         7           1971                         Thriller
         8           1972                            Drama
         9           1973                         Thriller
         10          1974                         Thriller
         11          1975                           Horror
         12          1977                           Action
         13          1978                         Thriller
         14          1979                  Science Fiction
         15          1980                  Science Fiction
         16          1981                        Adventure
         17          1982                  Science Fiction
         18          1983                        Adventure
         19          1984                           Action
         20          1985                        Adventure
         21          1986                           Action
         22          1987                  Science Fiction
         23          1988                  Science Fiction
         24          1989                        Adventure
```

```
25          1990                           Action
26          1991                           Family
27          1992                            Drama
28          1993                        Adventure
29          1994                            Drama
30          1995                         Thriller
31          1996                            Drama
32          1997                            Drama
33          1998                           Comedy
34          1999                            Drama
35          2000                         Thriller
36          2001                           Comedy
37          2002                           Action
38          2003                         Thriller
39          2004                            Drama
40          2005                            Drama
41          2006                            Drama
42          2007                            Drama
43          2008                            Drama
44          2009                            Drama
45          2010                            Drama
46          2011                            Drama
47          2012                           Comedy
48          2013                           Action
49          2014                            Drama
50          2015                            Drama

   most_popular_genere_by_voting    results
0                         Comedy  Different
1                      Adventure  Different
2                         Action  Different
3                      Adventure  Different
4                      Adventure  Different
5                         Action  Different
6                      Adventure  Different
7                         Action  Different
8                          Drama       Same
9                          Drama  Different
10                     Adventure  Different
11                     Adventure  Different
12                     Adventure  Different
13                        Horror  Different
14                         Drama  Different
15                     Adventure  Different
16                     Adventure       Same
17                        Horror  Different
18                      Thriller  Different
19                       Fantasy  Different
```

```
20                     Adventure       Same
21                     Adventure  Different
22                         Drama  Different
23                        Action  Different
24                     Adventure       Same
25                        Comedy  Different
26                       Romance  Different
27                     Animation  Different
28                     Adventure       Same
29                        Family  Different
30                     Animation  Different
31                         Crime  Different
32                         Drama       Same
33                         Drama  Different
34                       Fantasy  Different
35                       Mystery  Different
36                       Fantasy  Different
37                   Documentary  Different
38                     Animation  Different
39                       Romance  Different
40                       Romance  Different
41                         Crime  Different
42                     Adventure  Different
43                           War  Different
44                   Documentary  Different
45                   Documentary  Different
46                   Documentary  Different
47                        Family  Different
48                       Romance  Different
49                       History  Different
50                       Western  Different
```

1.2.6 Research Question 2 (Which year is the most productive year in movies?)

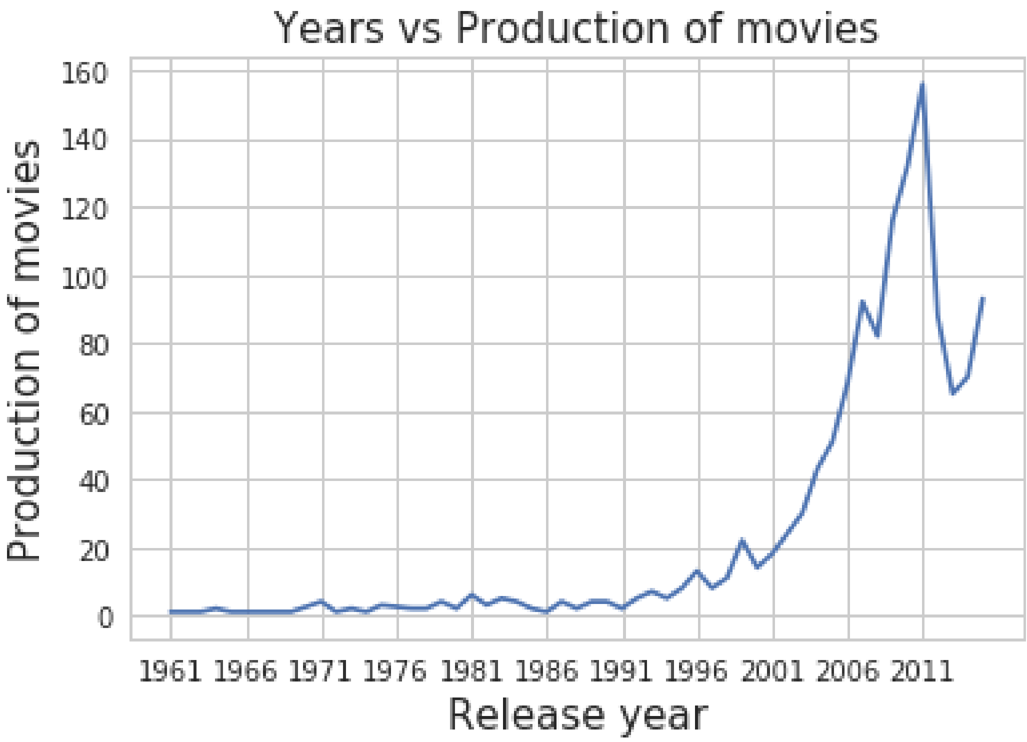
```
In [61]: # Counting production of movies each year.

         most_productive_year_in_movies = df.groupby('release_year').count()['id']
         most_productive_year_in_movies
```

```
Out[61]: release_year
         1961      1
         1962      1
         1963      1
         1964      2
         1965      1
         1967      1
         1969      1
         1971      4
```

```
1972      1
1973      2
1974      1
1975      3
1977      2
1978      2
1979      4
1980      2
1981      6
1982      3
1983      5
1984      4
1985      2
1986      1
1987      4
1988      2
1989      4
1990      4
1991      2
1992      5
1993      7
1994      5
1995      8
1996     13
1997      8
1998     11
1999     22
2000     14
2001     18
2002     24
2003     30
2004     43
2005     51
2006     68
2007     92
2008     82
2009    116
2010    132
2011    156
2012     88
2013     65
2014     70
2015     93
Name: id, dtype: int64
```

```
In [62]: # Plotting the output

         most_productive_year_in_movies.plot(xticks = np.arange(1961,2015,5), fontsize = 10)
```

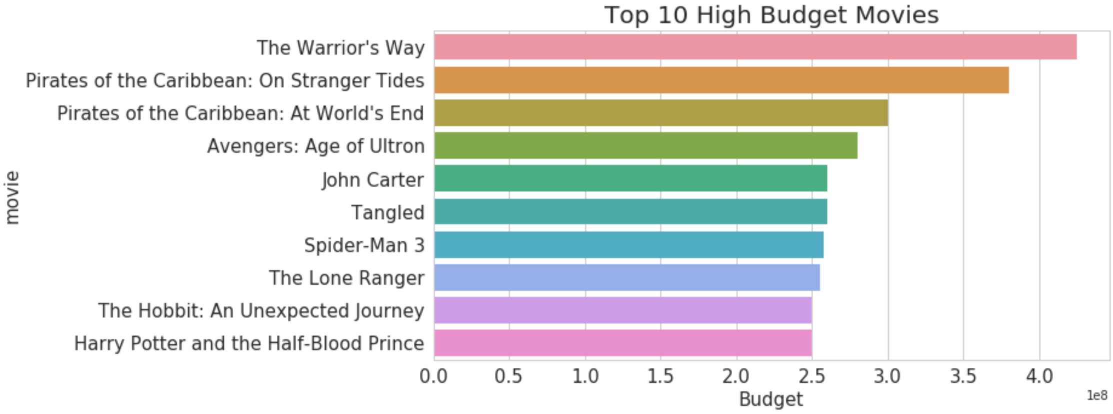
```
sns.set(rc={'figure.figsize' : (10,5)})

plt.title("Years vs Production of movies",fontsize = 15)

plt.xlabel('Release year',fontsize = 15)

plt.ylabel('Production of movies',fontsize = 15)

sns.set_style("whitegrid")
```



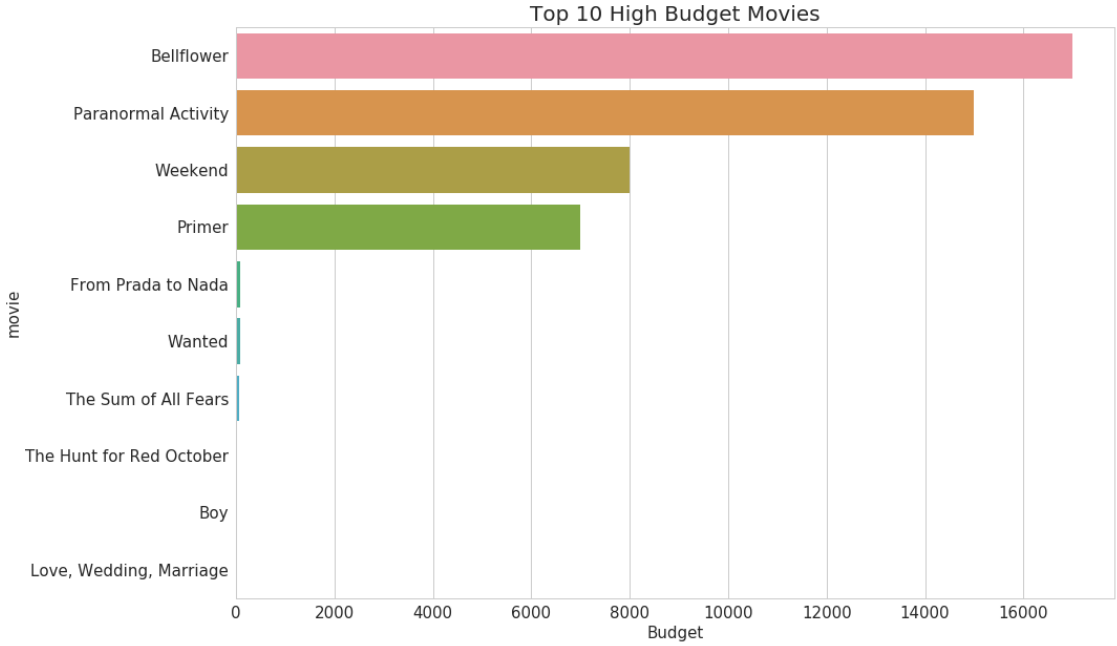
1.2.7 Research Question 3 (Which are the top 10 highest and lowest budget movies?)

```
In [63]: # Sorting budgets descendingly and joining them with their movie titles to get top 10 e

         budgets = pd.DataFrame(df['budget'].sort_values(ascending = False))
         budgets['original_title'] = df['original_title']

         #changing budgets' titles from objects to string and store them as a list

         titles = list(map(str,(budgets['original_title'])))

         # assigning x and y lists to label x and y axes
         x = list(titles[:10])
         y = list(budgets['budget'][:10])
```

```
In [64]: # Plotting the output

         def plot (x , y) :
             plot = sns.barplot(x = y, y = x)
             sns.set(rc={'figure.figsize' : (15,10)})
             plot.set_title("Top 10 High Budget Movies", fontsize = 20)
             plot.set_xlabel("Budget", fontsize = 15)
             plot.set_ylabel("movie", fontsize = 15)
             plt.yticks(fontsize = 15)
             plt.xticks(fontsize = 15)
             sns.set_style("whitegrid")

         plot(x,y)
```



```
In [65]: # Budget for the lowest 10 as well

         # assigning x and y lists to label x and y axes

         x = list(titles[-10:])
         y = list(budgets['budget'][-10:])

         # Plotting the output and using function manually created called plot()

         plot(x,y)
```



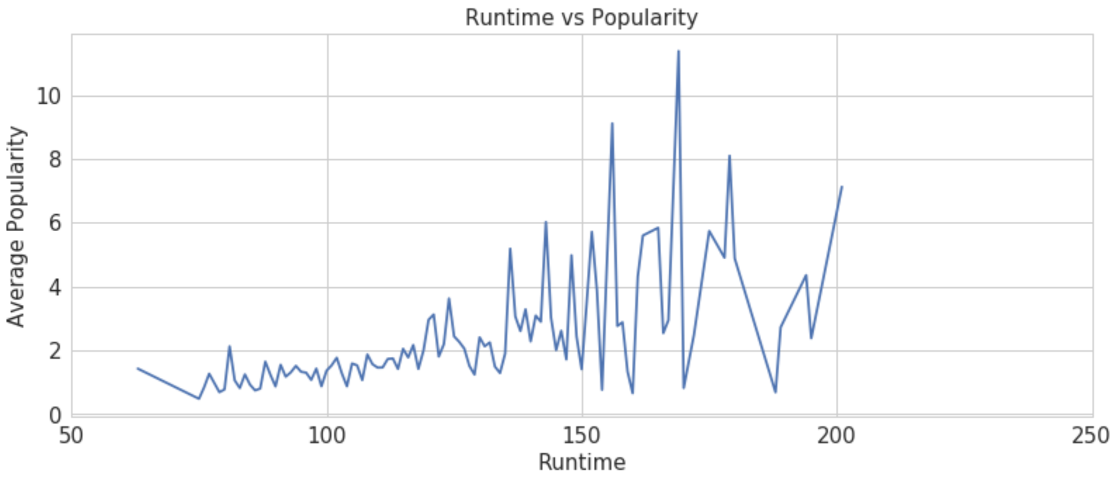
1.2.8 Research Question 4 (What is more favorable: a long time length movie or a short one?)

```
In [66]: # Getting output from original dataframe by grouping runtime with the popularity and ge

         output = df.groupby('runtime')['popularity'].mean()
         output.tail(50)
```

```
Out[66]: runtime
         127.00    2.05
         128.00    1.51
         129.00    1.24
         130.00    2.41
         131.00    2.12
         132.00    2.25
         133.00    1.49
         134.00    1.29
         135.00    1.90
         136.00    5.19
         137.00    3.06
         138.00    2.60
         139.00    3.28
         140.00    2.28
         141.00    3.09
         142.00    2.90
         143.00    6.02
         144.00    3.02
```

```
145.00    2.01
146.00    2.61
147.00    1.71
148.00    4.98
149.00    2.44
150.00    1.40
151.00    3.51
152.00    5.71
153.00    3.87
154.00    0.76
156.00    9.11
157.00    2.76
158.00    2.88
159.00    1.33
160.00    0.65
161.00    4.31
162.00    5.60
165.00    5.84
166.00    2.54
167.00    2.94
169.00   11.38
170.00    0.82
172.00    2.48
175.00    5.74
178.00    4.90
179.00    8.10
180.00    4.88
188.00    0.68
189.00    2.72
194.00    4.36
195.00    2.38
201.00    7.12
Name: popularity, dtype: float64
```

```
In [67]: # Plotting the output

         output.plot(figsize = (13,5),xticks=np.arange(50,300,50))

         # Adjusting the figure and its athetics

         plt.xticks(fontsize = 15)
         plt.yticks(fontsize = 15)
         plt.title("Runtime vs Popularity",fontsize = 15)
         plt.xlabel('Runtime',fontsize = 15)
         plt.ylabel('Average Popularity',fontsize = 15)
         sns.set(rc={'figure.figsize':(15,10)})
         sns.set_style("whitegrid")
```



## Conclusions

1.2.9 by the order of questions:

From what we can see in the first question's output, people opinions are biased, because when people tend to vote for the movie they love, it doesn't mean that genres of this movies are the most popular, that's why in the results I had many different values at results' column, which makes a realistic sense.

We can deduce from second question's output that 2011 was the year most productive with 156 movies produced followed by 2010 with 132 movies produced and followed by 2009 by 116 movies produced, however this might be untrue as we will discuss in limitations.

We can deduce from third question's output that the movie that has highest budget is The Warrior's way with 425000000 dollars and the lowest is Love, Wedding, Marrige with 1 dollar.

We can deduce from last (Fourth) question's output that people like movies from 143 mins to 201 mins any shorter than this range will be less favored for people, and due to limitations that will be discussed in next section I can't know whether people like to watch more than 201 mins movie or not. However we can know that more than 143 mins is favored to watch which is considered to be a long movie, so people enjoy watching long ones.

1.2.10 Limitations

I had only 2 limitations in this project. First the na values, some of them can be placed by 0 or the mean but others cannot so dropping all will be the best solution I see in this case as to not replace original data by wrong inputs. I wished that author of the data set gave me just a hint from where to get the missing values so that I can deal with them not just ignoring and dropping. Second the zero budgets, it seems too wrong or misplaced to have budgets' of movies with 0, it's impossible to have something like that, so it is all dropped too to avoid failing to get real results from this data set, and also like the first problem I wished they were never there and the author of this data set would justify why a budget would have to be 0, just to skip and don't drop many values there. Due to these limitations, in question's 2 answer it was 2011 the year most productive in movies but still because I dropped too many na (missing values) and zero values, any year after 2011 could be greater in production than 2011 itself or any year before too. Same case in question 4, I dropped many rows of na and zero values so I don't know whether people like films more than 201 mins or not.

1.2.11 About additional research

Lastly there are many additional research questions that can be included and explored from its attributes like production companies, cast and directors. Each attribute mentioned can have many questions on that can be asked additionaly like what is the best production company, who is the most productive director, who is the most popular actor from cast, and so on.

Changing notebook from (.ipynb) to (.html)

```
In [71]: from subprocess import call
         call(['python', '-m', 'nbconvert', 'Investigate_a_Dataset.ipynb'])

Out[71]: 0
```