Investigate_a_Dataset

March 10, 2021

1 Project: Investigate a Dataset (TMDb movie data)

1.1 Table of Contents

Introduction

The data set analized here contains data of 10,000 movies collected from The Movie Database(TMDb), including budget, revenue, ratings, etc. Each movie was rated from 0-10. Some columns, like 'casts', contain '|' to separate multiple values. The last two columns contain '_adj' show the adjusted budget and revenue in terms of 2010, due to inflation over time. For this reason, I will use budjet_adj and revenue_adj for comparison of different movie from different years.The following questions are what I would like to find out the answers from this dataset.

Question 1:Does rating have a positive correlation to revenue?

Question 2:Which director's movie get the highest rating in average?

Question 3:Which companies get the biggest profits(revenue_adj - budget_adj)?

Question 4:Which genres are most popular over the time?

Question 5:What attributes are accociated with better revenue?

In [1]:
```
# Import liabraries that are needed in this project

# Remember to include a 'magic word' so that your visualizations are plotted
#   inline with the notebook. See this page for more:
#   http://ipython.readthedocs.io/en/stable/interactive/magics.html

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

Data Wrangling

1.1.1 General Properties

In [2]:
```
# Assess data and show a few lines of the samples
df = pd.read_csv('tmdb-movies.csv')
df.head()
```

Out[2]:

```
      id    imdb_id  popularity     budget     revenue  \
0  135397  tt0369610   32.985763  150000000  1513528810
1   76341  tt1392190   28.419936  150000000   378436354
2  262500  tt2908446   13.112507  110000000   295238201
3  140607  tt2488496   11.173104  200000000  2068178225
4  168259  tt2820852    9.335014  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           6.5          2015  1.379999e+08  1.392446e+09
1           7.1          2015  1.379999e+08  3.481613e+08
2           6.3          2015  1.012000e+08  2.716190e+08
3           7.5          2015  1.839999e+08  1.902723e+09
4           7.3          2015  1.747999e+08  1.385749e+09

[5 rows x 21 columns]
```

In [3]:
```
#Show numbers of entries and columns in the dataset
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
```

1.1.2 Data Cleaning (Drop columns that are not relevant to the questions and rows with missing values)

```
In [4]: #Drop rows that are not relevant to the questions.
        #Based on the questions asked in Introduction, columns like homepage, tagline, keywords,
        #release_date, vote_count are not relevant, so they could be dropped
        df.drop(['homepage','tagline','keywords','overview','release_date'],axis=1,inplace=True)

        #Confirm changes
        df.head(1)
```

Out[4]:

	id	imdb_id	popularity	budget	revenue	original_title	cast	director	runtime	genres	production_companies	vote_count	vote_average	release_year	budget_adj	revenue_adj
0	135397	tt0369610	32.985763	150000000	1513528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Universal Studios|Amblin Entertainment|Legenda...	5562	6.5	2015	1.379999e+08	1.392446e+09

```
In [5]: # Drop rows with missing values
        df.dropna(inplace=True)

        #Confirm changes
        df.isnull().sum()
```

```
Out[5]: id                    0
        imdb_id               0
        popularity            0
        budget                0
        revenue               0
        original_title        0
        cast                  0
        director              0
        runtime               0
        genres                0
        production_companies  0
        vote_count            0
```

```
vote_average            0
release_year            0
budget_adj              0
revenue_adj             0
dtype: int64
```

Now all the entries with null values are cleaned.

```
In [6]: #Overview of the cleaned datast
        df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 9771 entries, 0 to 10865
Data columns (total 16 columns):
id                      9771 non-null int64
imdb_id                 9771 non-null object
popularity              9771 non-null float64
budget                  9771 non-null int64
revenue                 9771 non-null int64
original_title          9771 non-null object
cast                    9771 non-null object
director                9771 non-null object
runtime                 9771 non-null int64
genres                  9771 non-null object
production_companies    9771 non-null object
vote_count              9771 non-null int64
vote_average            9771 non-null float64
release_year            9771 non-null int64
budget_adj              9771 non-null float64
revenue_adj             9771 non-null float64
dtypes: float64(4), int64(6), object(6)
memory usage: 1.3+ MB
```

```
In [7]: #Unique value of each attribute in the cleaned dataset
        df.nunique()
```

```
Out[7]: id                      9770
        imdb_id                 9770
        popularity              9733
        budget                   533
        revenue                 4611
        original_title          9510
        cast                    9721
        director                4504
        runtime                  223
        genres                  1916
        production_companies    7406
        vote_count              1289
```

```
vote_average            68
release_year            56
budget_adj            2549
revenue_adj           4742
dtype: int64
```

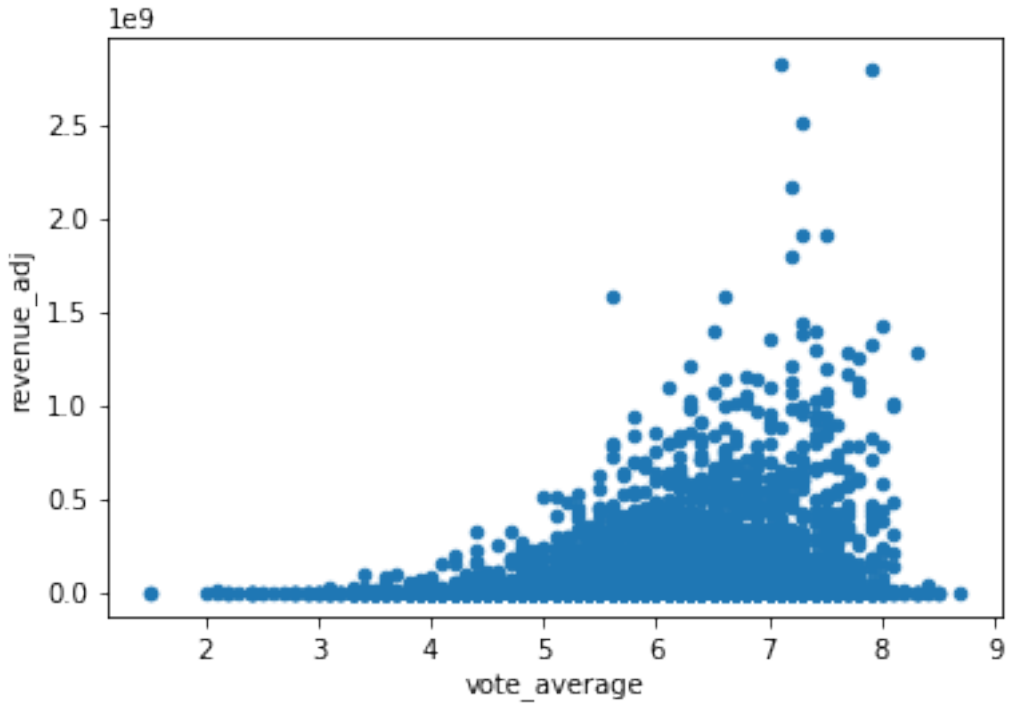
Exploratory Data Analysis

Tip: Now that you've trimmed and cleaned your data, you're ready to move on to exploration. Compute statistics and create visualizations with the goal of addressing the research questions that you posed in the Introduction section. It is recommended that you be systematic with your approach. Look at one variable at a time, and then follow it up by looking at relationships between variables.

1.1.3 Research Question 1: Does rating have a positive correlation to revenue?

In [8]:
```
# Visualize the correlation of rating and revenue_adj with a scatter plot
df.plot.scatter(x='vote_average',y='revenue_adj')
```

Out[8]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f2734b59be0>
```



It seems that there are movies made zero revenue. Despite that, the ratings(vote_average) seems to have a positive correlations with the revenue(revenue_adj).

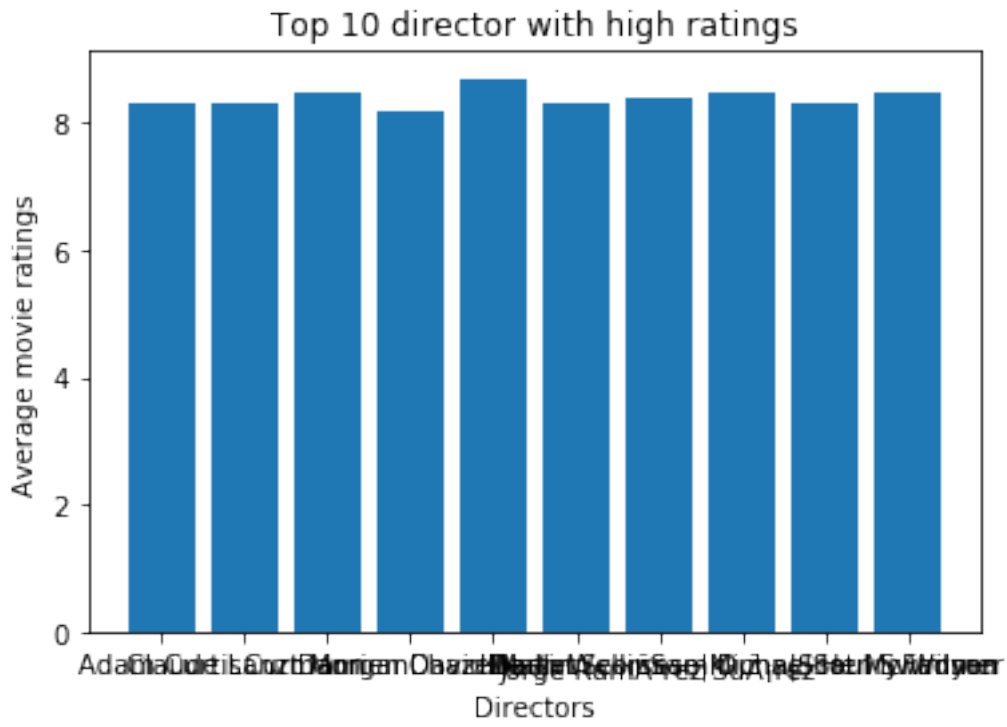
1.1.4 Research Question 2 Which director's movie get the highest rating in average?

In [9]:
```
#Caculate the average rating of movies for each director
av_rating = df.groupby('director').vote_average.mean()

#Sort the ratings
av_rating.sort_values(ascending=False,inplace=True)

#Pick the top ten directors and show them
av_rating_top10 = av_rating[:10]
av_rating_top10
```

Out[9]:
```
director
David Mallet                                8.7
Martin Scorsese|Michael Henry Wilson        8.5
Curt Morgan                                 8.5
Saul Swimmer                                8.5
Jorge RamÃŋrez SuÃąrez                      8.4
Claude Lanzmann                             8.3
Dean Wellins                                8.3
Sam Dunn|Scot McFadyen                      8.3
Adam Curtis                                 8.3
Damien Chazelle                             8.2
Name: vote_average, dtype: float64
```

In [10]:
```
#Visualize the top 10 directors with bar chart
plt.bar(av_rating_top10.index,av_rating_top10)
plt.figsize = (50,50)
plt.title('Top 10 director with high ratings')
plt.xlabel('Directors')
plt.ylabel('Average movie ratings')
```

Out[10]:
```
Text(0,0.5,'Average movie ratings')
```



The director who got the highest average rating from year to year is David Mallet, with an average rating of 8.7

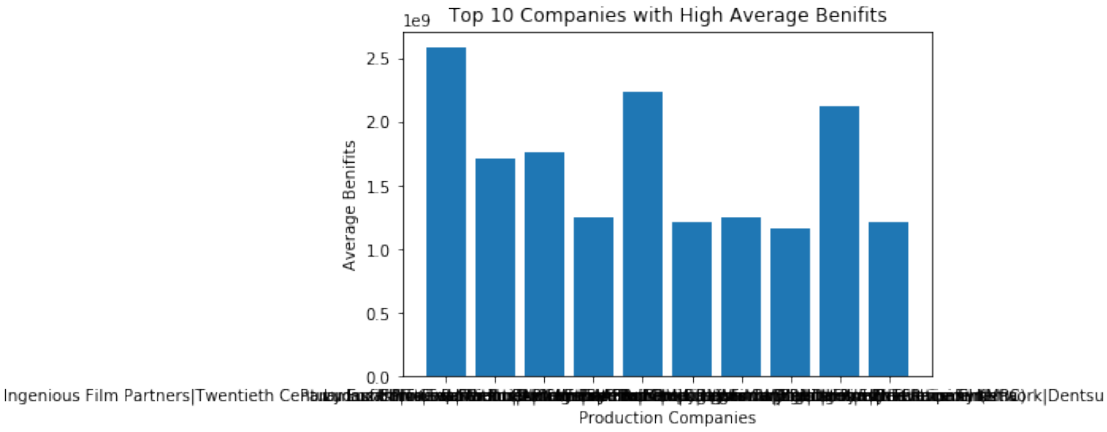
1.1.5 Research Question 3 What companies get the biggest profits(revenue_adj - budget_adj)?

```
In [11]: #Calculate the averate profit for each company(ies)
         revenue_m = df.groupby('production_companies').revenue_adj.mean()
         budget_m = df.groupby('production_companies').budget_adj.mean()
         profit = revenue_m - budget_m

         #Sort the profit in descending order and show the top 10 list
         profit.sort_values(ascending=False,inplace=True)
         profit_top10 = profit[:10]
         profit_top10

Out[11]: production_companies
         Ingenious Film Partners|Twentieth Century Fox Film Corporation|Dune Entertainment|Light
         Paramount Pictures|Twentieth Century Fox Film Corporation|Lightstorm Entertainment
         Warner Bros.|Hoya Productions
         Lucasfilm|Twentieth Century Fox Film Corporation
         Lucasfilm|Truenorth Productions|Bad Robot
         Universal Studios|Amblin Entertainment|Legendary Pictures|Fuji Television Network|Dents
         Paramount Pictures|Alfran Productions
         WingNut Films|New Line Cinema
```

```
Universal Pictures|Original Film|Media Rights Capital|Dentsu|One Race Films
Warner Bros.|Heyday Films|Moving Picture Company (MPC)
dtype: float64
```

```
In [12]: #Visualize the top 10 companies with bar chart
         plt.bar(profit_top10.index,profit_top10)
         plt.figsize = (50,50)
         plt.title('Top 10 Companies with High Average Benifits')
         plt.xlabel('Production Companies')
         plt.ylabel('Average Benifits')
```

```
Out[12]: Text(0,0.5,'Average Benifits')
```



The companies that make the best profit in average are Ingenious Film Partners, Twentieth Century Fox Film Corporation, Dune Entertainment, Lightstorm Entertainment.

1.1.6 Research Question 4 Which genres are most popular over the time?

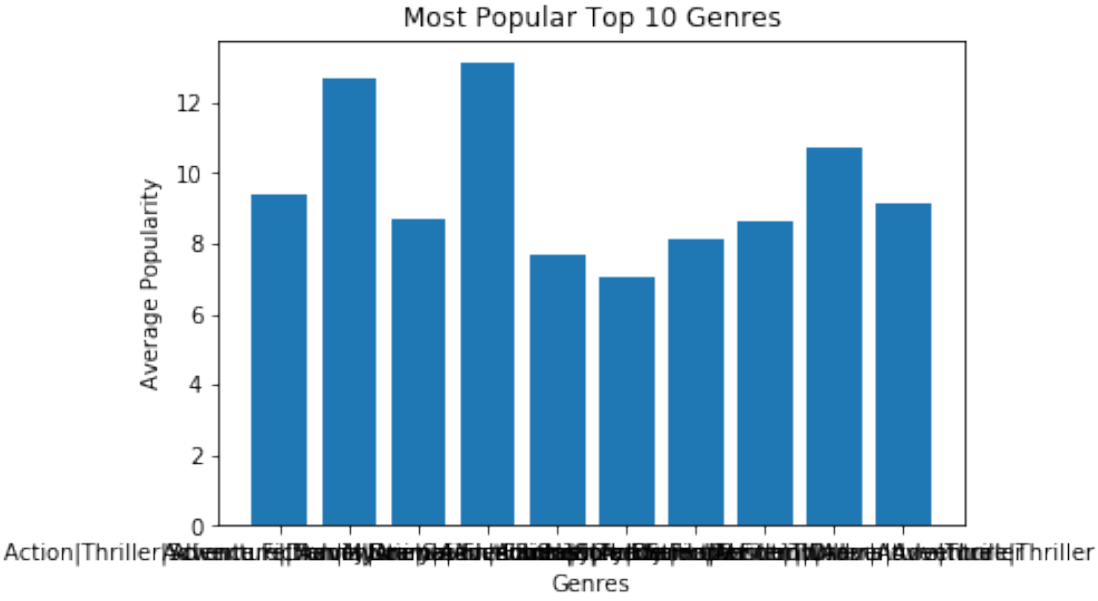
```
In [13]: #Calculate the average popularity for each genres group
         pop = df.groupby('genres').popularity.mean()

         #Sort the popularity in descending order, and show the top 10 list.
         pop.sort_values(ascending=False,inplace=True)
         pop_top10 = pop[:10]
         pop_top10
```

```
Out[13]: genres
         Adventure|Science Fiction|Thriller                  13.112507
         Adventure|Drama|Science Fiction                     12.699699
         Science Fiction|Adventure|Thriller                  10.739009
         Action|Thriller|Science Fiction|Mystery|Adventure    9.363643
         Western|Drama|Adventure|Thriller                     9.110700
```

```
Adventure|Family|Animation|Action|Comedy                8.691294
Science Fiction|Action|Thriller|Adventure               8.654359
History|Drama|Thriller|War                              8.110711
Drama|Adventure|Science Fiction                         7.667400
Fantasy|Action|Horror                                   7.031452
Name: popularity, dtype: float64
```

In [14]:
```
#Visualize the top 10 genres with bar chart
plt.bar(pop_top10.index,pop_top10)
plt.figsize = (50,50)
plt.title('Most Popular Top 10 Genres')
plt.xlabel('Genres')
plt.ylabel('Average Popularity')
```

Out[14]:
```
Text(0,0.5,'Average Popularity')
```



The most popular genres of movies are those in adventure, science fiction and thriller.

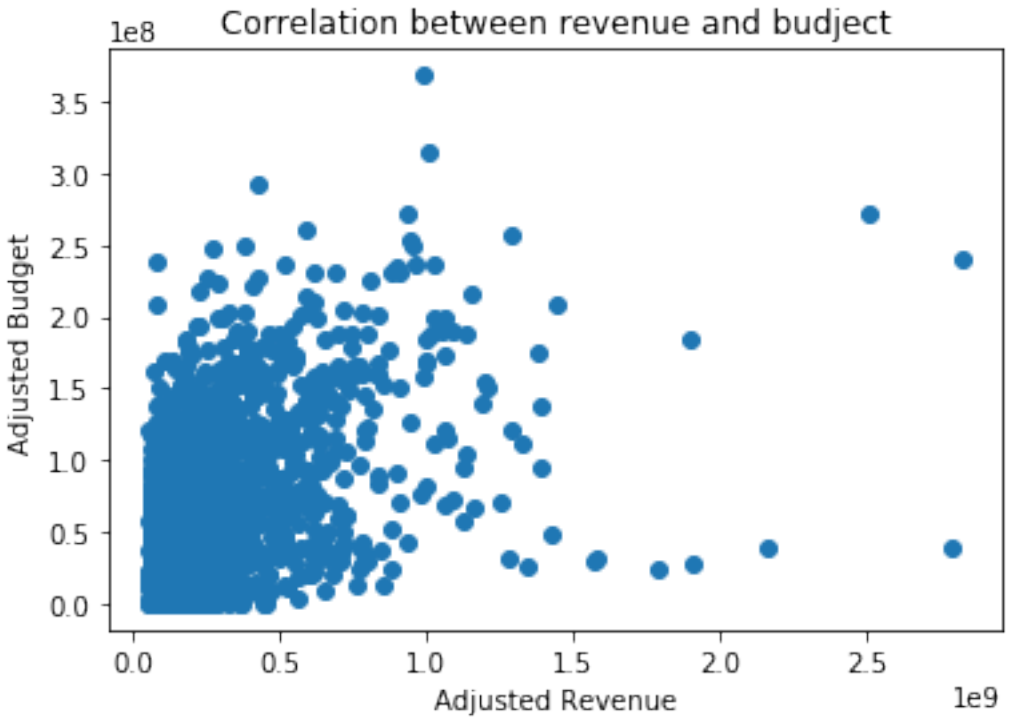
1.1.7 Research Question 5 What attributes are associated with better revenue?

Get the correlation between revenues and other attributes, like budget, popularity, average votes, etc. We could first query out the entries with revenue above median

In [15]:
```
#Query the entries with revenue_adj above the average
rev_m = df['revenue_adj'].mean()
df_h = df.query('revenue_adj > @rev_m')
```

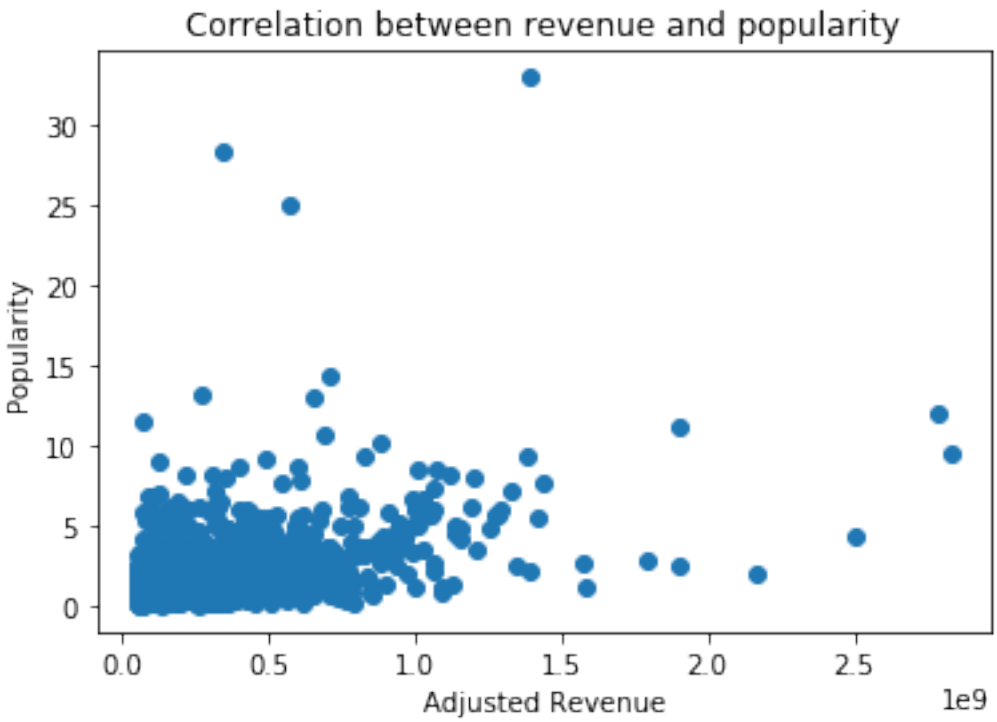
In [16]:
```
#Scatter plot between revenue_adj and budjet_adj
plt.scatter(df_h['revenue_adj'], df_h['budget_adj'])
plt.title('Correlation between revenue and budject')
plt.xlabel('Adjusted Revenue')
plt.ylabel('Adjusted Budget')
```

Out[16]:
```
Text(0,0.5,'Adjusted Budget')
```

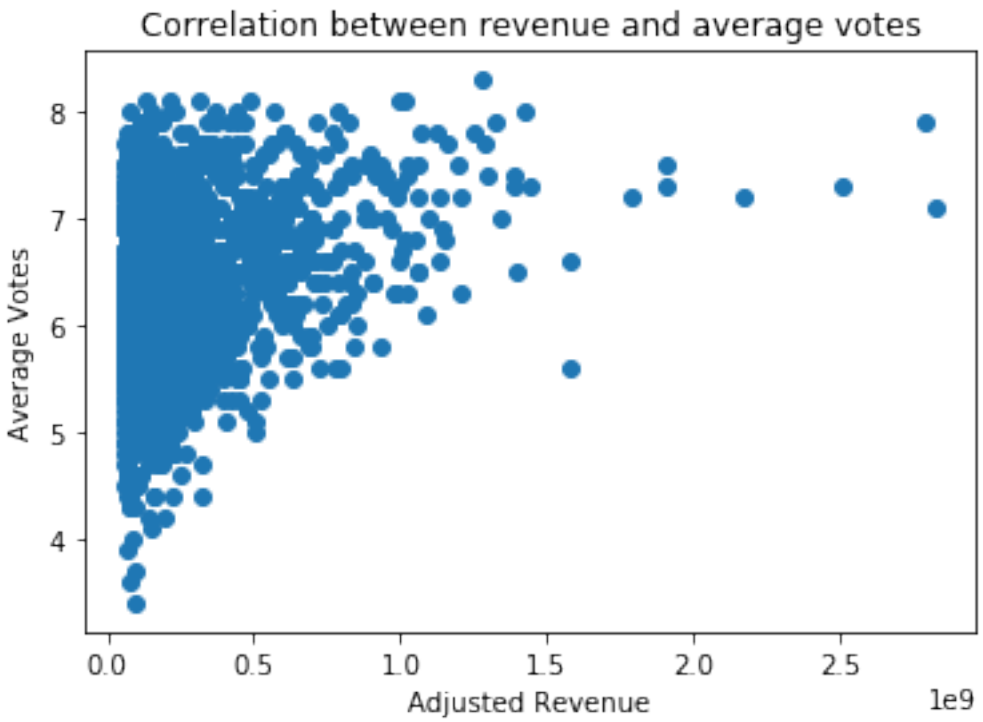


In [17]:
```
#Scatter plot between revenue_adj and popularity
plt.scatter(df_h['revenue_adj'], df_h['popularity'])
plt.title('Correlation between revenue and popularity')
plt.xlabel('Adjusted Revenue')
plt.ylabel('Popularity')
```

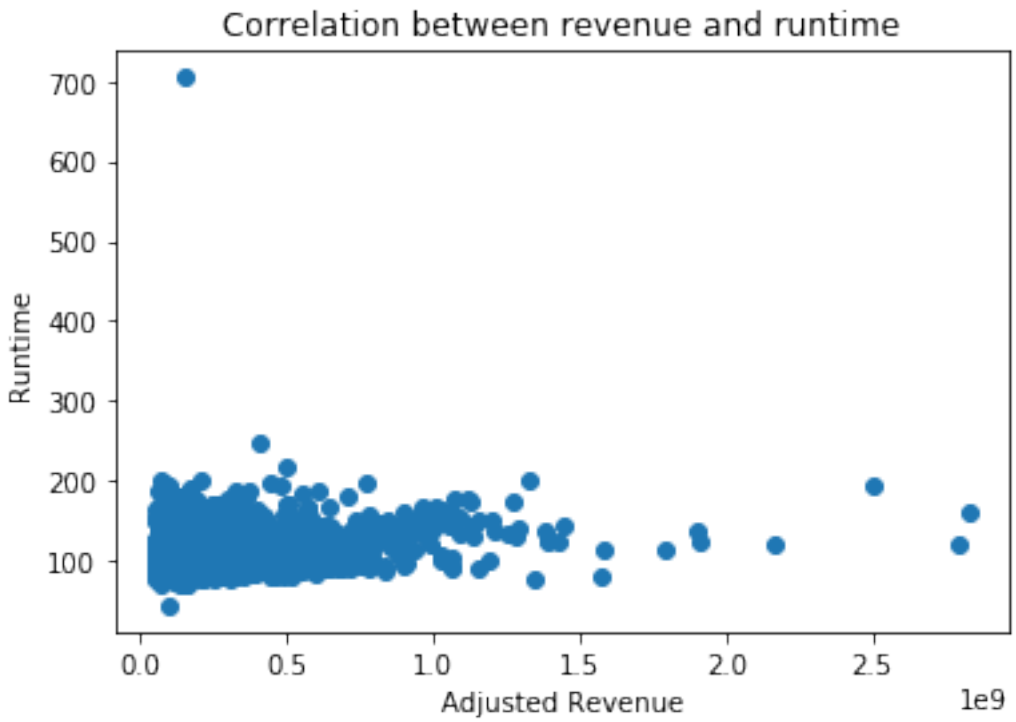
Out[17]:
```
Text(0,0.5,'Popularity')
```



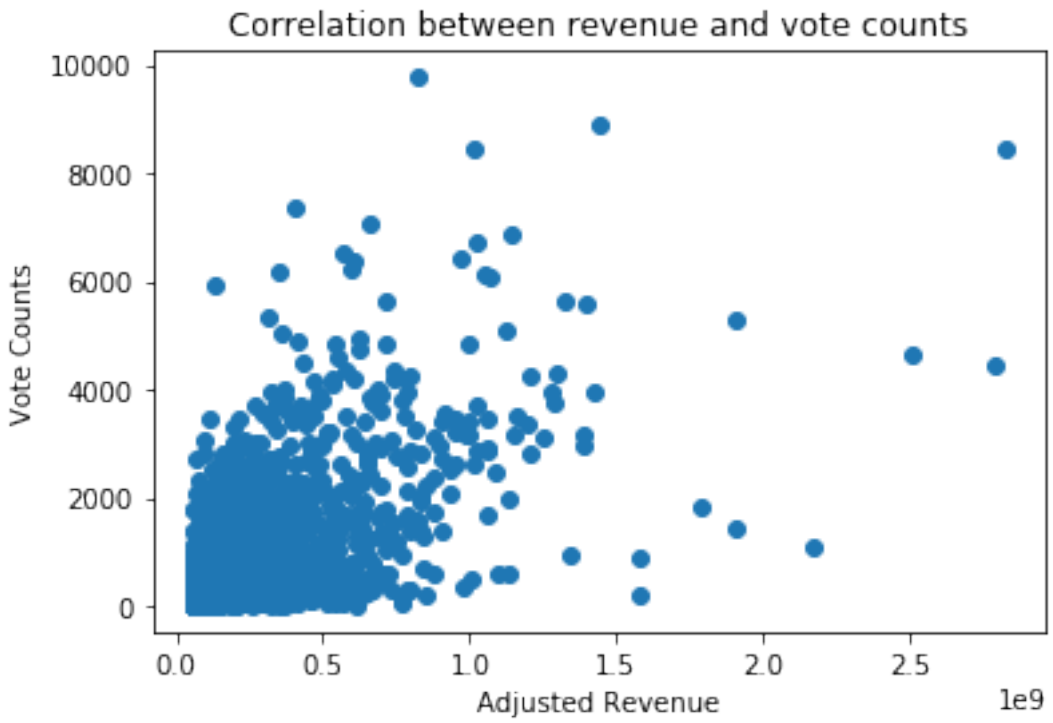

```
In [18]: #Scatter plot between revenue_adj and average votes
         plt.scatter(df_h['revenue_adj'], df_h['vote_average'])
         plt.title('Correlation between revenue and average votes')
         plt.xlabel('Adjusted Revenue')
         plt.ylabel('Average Votes')

Out[18]: Text(0,0.5,'Average Votes')
```




```
In [19]: #Scatter plot between revenue_adj and run time
         plt.scatter(df_h['revenue_adj'], df_h['runtime'])
         plt.title('Correlation between revenue and runtime')
         plt.xlabel('Adjusted Revenue')
         plt.ylabel('Runtime')

Out[19]: Text(0,0.5,'Runtime')
```




```
In [20]: #Scatter plot between revenue_adj and vote counts
         plt.scatter(df_h['revenue_adj'], df_h['vote_count'])
         plt.title('Correlation between revenue and vote counts')
         plt.xlabel('Adjusted Revenue')
         plt.ylabel('Vote Counts')

Out[20]: Text(0,0.5,'Vote Counts')
```



From the scatter plots, it is easy to see that budget, average rating and vote counts are the most associated with high revenues.

Conclusions

There are three conclusions that I could draw from the analysis process and results:

1) The director who wins the highest rating in average from all the movie s/he made is David Mallet.

2) The production companies that produce movies with the highest profit in average are Ingenious Film Partners, Twentieth Century Fox Film Corporation, Dune Entertainment, Lightstorm Entertainment.Here profit is calcualte as revenue minus budget.

3) The most popular genres of movies are adventure, science fiction and thriller.

4) People's votes have a positive correlation with revenue

5) Budget, average rating and vote counts have the most contribution to high revenues.

Different groups of people could benefit from this analysis results. For example, Audience could pick which director's movie to watch. Movie makers could see which type of movies has potential to get high popularity. Last but not least, invester will know which production company that they invest will most likely bring them considerable profit.

1.2 Submitting your Project

Before you submit your project, you need to create a .html or .pdf version of this notebook in the workspace here. To do that, run the code cell below. If it worked correctly, you should get a return code of 0, and you should see the generated .html file in the workspace directory (click on the orange Jupyter icon in the upper left).

Alternatively, you can download this report as .html via the **File** > **Download as** submenu, and then manually upload it into the workspace directory by clicking on the orange Jupyter icon in the upper left, then using the Upload button.

Once you've done this, you can submit your project by clicking on the "Submit Project" button in the lower right here. This will create and submit a zip file with this .ipynb doc and the .html or .pdf version you created. Congratulations!

```
In [21]: from subprocess import call
         call(['python', '-m', 'nbconvert', 'Investigate_a_Dataset.ipynb'])
```

```
Out[21]: 0
```

```
In [ ]:
```