Shifts in ratings over the time since film release

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Dataset(s)

- For this project i’m going to use IMDB Movie DataSet

Motivation

Whenever we are looking at IMDB top-something choosing new film to watch or wondering if this series on TV worth spending a time on it we may see that those tops are always mix of all time hits and some brand new films. And of course those all time hits are almost always the same and the new ones usually keeps rotating.

In this work I'm trying to understand what's the reason behind it. Is it because all film's ratings deflate over time? Or it's just blockbusters affected by massive advertising campaign just after release deflate in the following years? Or maybe there is no connection at all and it's just so many good films released lately?

Research Question(s)

Do films tend to be rated lower with time passing since the release date?

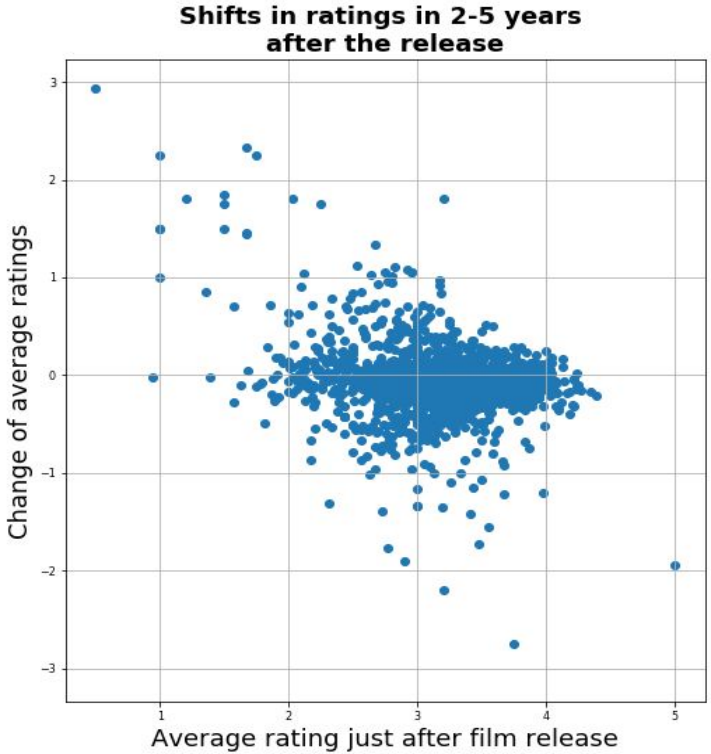
Findings

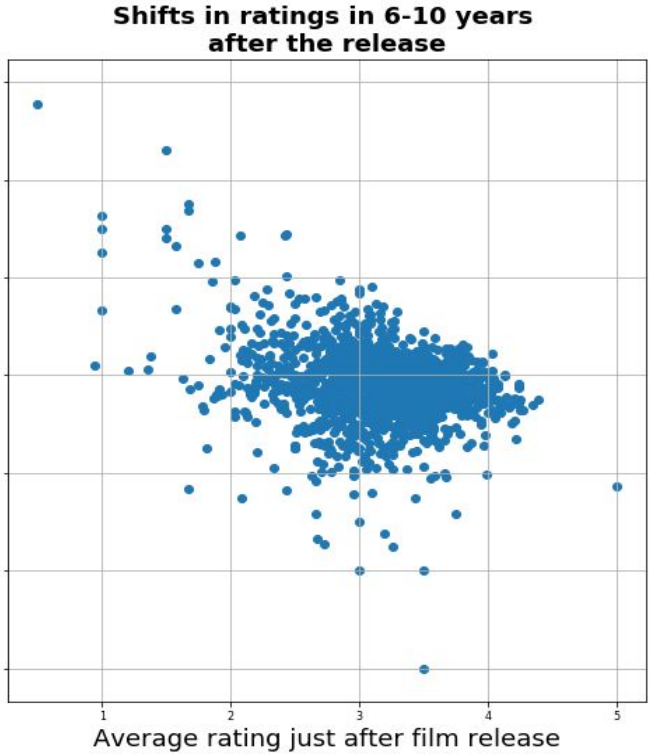
To explore data for each relevant movie I compute 3 statistics: average rating for the year of release and the next one, average rating for 2-5 years and 6-10 years after release. The results are shown on the scatter plots on the next slide.

From the scatter plots we may suggest that

1. On average there is slight shift below 0 on both plots. Meaning on average we can expect ratings to be slightly worse with time passing by since release date
2. Looks like there is negative correlation between starting rating and following shift. In fact correlation turns out to be around -0.3 for both chart.

It looks like there is a little shift down on average

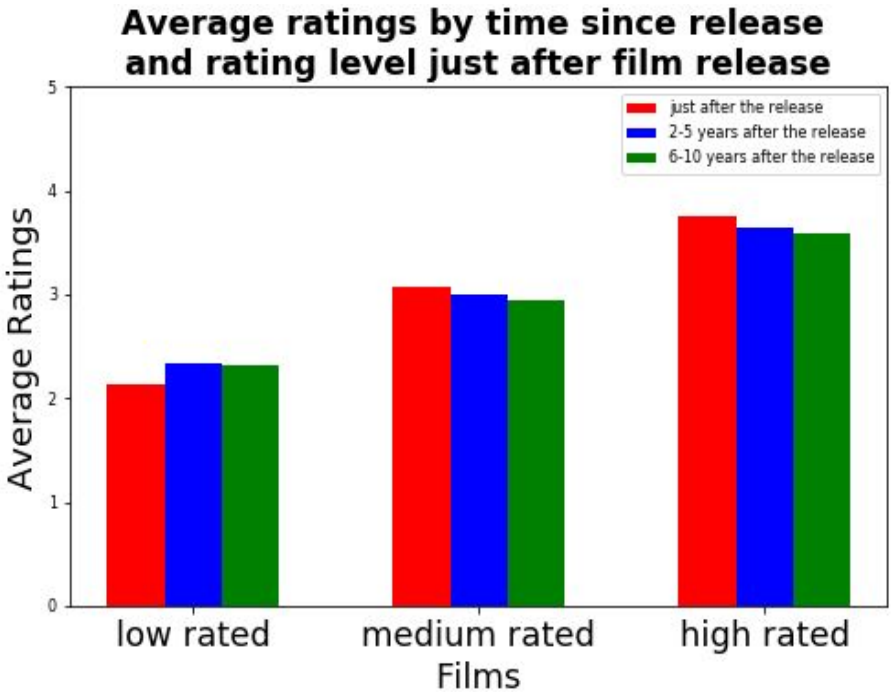




Ratings become less extreme with time passing by

Further exploration of the data shows that time shifts in ratings differs for low rated films and high rated ones.

The diagram on the right illustrate that user's ratings on average becomes less extreme with the time passing from the film release



Additional comments on scatter plots

Even though correlations for plot of 2-5 years and plot of 6-10 years turns out almost the same -0.27 and -0.28 accordingly the shapes of the scatters tell a bit different story. The bulk of the data on 2-5 years plot looks quite horizontal and it seems that negative correlation originates mostly from outliers. On the other hand the bulk on 6-10 years plot looks more like negative correlated.

In other words more explorations needed to confirm or alternate our findings and definitely statistical testing of the hypothesis by resampling should be done but it’s beyond the scale of this project.

Acknowledgements

Thanks to my wonderful wife for ideas on improving formatting and overall looking of this presentation.

References

I did this work on my own with limited help from Google search engine and Python documentation.

MiniProject for DataScience UCSD

October 20, 2018

1 Topic

1.1 In this notebook I explore shifts in ratings over the time since film release

1.1.1 Import libraries

```
In [1]: import pandas as pd
        import numpy as np
```

1.1.2 Load Data

```
In [2]: !ls ../Week-4-Pandas/movielens
```

```
Icon?             genome-scores.csv links.csv         ratings.csv
README.txt        genome-tags.csv   movies.csv        tags.csv
```

```
In [3]: movies = pd.read_csv('../Week-4-Pandas/movielens/movies.csv', sep=',')
        movies.head(2)
```

```
Out[3]:    movieId            title                                        genres
        0        1  Toy Story (1995)  Adventure|Animation|Children|Comedy|Fantasy
        1        2    Jumanji (1995)                 Adventure|Children|Fantasy
```

```
In [4]: movies['year'] = movies['title'].str.extract('.*\((.*)\).*', expand=True)
        movies.head(2)
```

```
Out[4]:    movieId            title                                        genres  \
        0        1  Toy Story (1995)  Adventure|Animation|Children|Comedy|Fantasy
        1        2    Jumanji (1995)                 Adventure|Children|Fantasy

           year
        0  1995
        1  1995
```

```
In [5]: ratings = pd.read_csv('../Week-4-Pandas/movielens/ratings.csv', sep=',')
        ratings.head(2)
```

```
Out[5]:    userId  movieId  rating   timestamp
        0       1        2     3.5  1112486027
        1       1       29     3.5  1112484676
```

2 Inintial data adjusting

```
In [6]: rating_tags = ratings[['movieId','rating']].groupby('movieId', as_index=False).count()
        rating_tags.head(), rating_tags.shape
```

```
Out[6]: (   movieId  rating
         0        1   49695
         1        2   22243
         2        3   12735
         3        4    2756
         4        5   12161, (26744, 2))
```

Interested only in frequently rated movies

```
In [7]: is_frequently_rated = rating_tags['rating'] >=500
        freq_rated = rating_tags[is_frequently_rated]
        freq_rated.shape
```

```
Out[7]: (4489, 2)
```

Only the year of rating needed and getting time range of ratings in the data

```
In [8]: ratings['parsed_time'] = pd.to_datetime(ratings['timestamp'], unit = 's')
        ratings.head()
```

```
Out[8]:    userId  movieId  rating   timestamp         parsed_time
        0       1        2     3.5  1112486027 2005-04-02 23:53:47
        1       1       29     3.5  1112484676 2005-04-02 23:31:16
        2       1       32     3.5  1112484819 2005-04-02 23:33:39
        3       1       47     3.5  1112484727 2005-04-02 23:32:07
        4       1       50     3.5  1112484580 2005-04-02 23:29:40
```

```
In [28]: min(ratings['parsed_time']), max(ratings['parsed_time'])
```

```
Out[28]: (Timestamp('1995-01-09 11:46:44'), Timestamp('2015-03-31 06:40:02'))
```

```
In [9]: ratings['year_of_rating'] = ratings['parsed_time'].map(lambda x: x.year)
        ratings.head(2)
```

```
Out[9]:    userId  movieId  rating   timestamp         parsed_time  year_of_rating
        0       1        2     3.5  1112486027 2005-04-02 23:53:47            2005
        1       1       29     3.5  1112484676 2005-04-02 23:31:16            2005
```

```
In [10]: del ratings['timestamp']
         ratings.head(2)
```

```
Out[10]:    userId  movieId  rating         parsed_time  year_of_rating
         0       1        2     3.5 2005-04-02 23:53:47            2005
         1       1       29     3.5 2005-04-02 23:31:16            2005
```

```
In [11]: del ratings['parsed_time']
         ratings.shape

Out[11]: (20000263, 4)

In [12]: ratings_by_years = ratings.groupby(['movieId', 'year_of_rating'], as_index=False).cou
         ratings_by_years[50:60]
```

Out[12]:

	movieId	year_of_rating	userId	rating
50	3	2006	621	621
51	3	2007	275	275
52	3	2008	245	245
53	3	2009	141	141
54	3	2010	110	110
55	3	2011	116	116
56	3	2012	182	182
57	3	2013	39	39
58	3	2014	31	31
59	3	2015	24	24

```
In [13]: ratings_ave_by_years = ratings.groupby(['movieId', 'year_of_rating'], as_index=False)
         ratings_ave_by_years.head()
```

Out[13]:

	movieId	year_of_rating	userId	rating
0	1	1996	69576.517645	4.132270
1	1	1997	69509.712369	3.875424
2	1	1998	68057.284012	3.885799
3	1	1999	69238.311586	3.974688
4	1	2000	70310.863602	4.142609

```
In [14]: ratings_by_years['average_rating'] = ratings_ave_by_years['rating']
         ratings_by_years[50:60]
```

Out[14]:

	movieId	year_of_rating	userId	rating	average_rating
50	3	2006	621	621	2.758454
51	3	2007	275	275	2.990909
52	3	2008	245	245	3.112245
53	3	2009	141	141	3.102837
54	3	2010	110	110	2.986364
55	3	2011	116	116	3.051724
56	3	2012	182	182	2.799451
57	3	2013	39	39	3.064103
58	3	2014	31	31	3.048387
59	3	2015	24	24	2.854167

```
In [15]: ratings_by_years = ratings_by_years.rename(index=str, columns={'rating': 'count'})
         ratings_by_years.columns

Out[15]: Index(['movieId', 'year_of_rating', 'userId', 'count', 'average_rating'], dtype='obje
```

```
In [16]: ratings_by_years.isnull().any()
```

```
Out[16]: movieId           False
         year_of_rating    False
         userId            False
         count             False
         average_rating    False
         dtype: bool
```

```
In [59]: int(movies[:1]['year'])
```

```
Out[59]: 1995
```

2.1 Defining function to get average rating for different periods of time for each film

```
In [21]: def getAverageR(df):
             if sum(df['count']) == 0:
                 return -1
             return sum(df['count'] * df['average_rating'])/sum(df['count'])


         def getAverageRatings(row, ratings):
             '''
             input:
             row - line of movies table
             ratings - dataFrames of ratings
             output:
             return list of average ratings for the film from row, where
                 brand_new - average rating for the year of release and the next one
                 new - average rating for the first 2-5 years after release
                 old - average rating for the first 6-10 years after release
             '''
             issued = int(row['year'])
             movieId = int(row['movieId'])
             brand_new_filter = ((ratings['year_of_rating'] >= issued)
                                 & (ratings['year_of_rating'] < issued + 3))
             new_filter =       ((ratings['year_of_rating'] - issued > 2)
                                 & (ratings['year_of_rating'] - issued < 6))
             old_filter =       ((ratings['year_of_rating'] - issued > 5)
                                 & (ratings['year_of_rating'] - issued < 11))
             movie_ratings = ratings[(ratings['movieId'] == movieId)]

             brand_new = getAverageR(movie_ratings[brand_new_filter])
             new = getAverageR(movie_ratings[new_filter])
             old = getAverageR(movie_ratings[old_filter])
             return [brand_new, new, old]

         def getRatings(row):
             return getAverageRatings(row, ratings_by_years)
```

```
In [22]: getAverageRatings(movies[:1], ratings_by_years)

/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:18: UserWarning: Boolean Series ke
/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:19: UserWarning: Boolean Series ke
/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:20: UserWarning: Boolean Series ke


Out[22]: [4.0066344559025024, 4.049508740589511, 3.9167867435158503]
```

3 Cleaning data

```
In [19]: movies.isnull().any()

Out[19]: movieId    False
         title      False
         genres     False
         year        True
         dtype: bool

In [24]: movies = movies.dropna()
         movies.shape

Out[24]: (27261, 4)

In [25]: movies = movies[movies['year'].str.isnumeric()]
         movies.shape

Out[25]: (27255, 4)
```

Only movies from 1995 till 2005 could have all needed ratings

```
In [26]: relevant_movies_filter = movies['year'].apply(int).between(1995, 2005, inclusive=True)
         movies[relevant_movies_filter].shape

Out[26]: (6634, 4)

In [27]: movies_data = movies[relevant_movies_filter]

         movies_data.shape

Out[27]: (6634, 4)

In [28]: is_enough_rated = movies_data['movieId'].map(lambda x: x in freq_rated['movieId'])
         movies_enough_rated = movies_data[is_enough_rated]
         movies_enough_rated.shape

Out[28]: (1508, 4)

In [31]: getRatings(movies_enough_rated[100:101])
```

```
/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:18: UserWarning: Boolean Series ke
/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:19: UserWarning: Boolean Series ke
/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:20: UserWarning: Boolean Series ke
```

```
Out[31]: [2.6666666666666665, 2.2, 2.6666666666666665]
```

```
In [32]: my_ratings = movies_enough_rated.apply(lambda x: getRatings(x), axis =1, result_type=
```

```
/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:18: UserWarning: Boolean Series ke
/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:19: UserWarning: Boolean Series ke
/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:20: UserWarning: Boolean Series ke
```

Getting statistics for research

```
In [33]: my_ratings.head()
```

```
Out[33]:          0         1         2
         0  4.006634  4.049509  3.916787
         1  3.554019  3.165625  2.945473
         2  3.339769  3.014898  2.868125
         3  3.033424  2.708709  2.653105
         4  3.224019  3.001889  2.822001
```

And more cleaning

```
In [34]: my_filter = (my_ratings[0] > 0) & (my_ratings[1] > 0) & (my_ratings[2] > 0)
         my_ratings[my_filter].shape
```

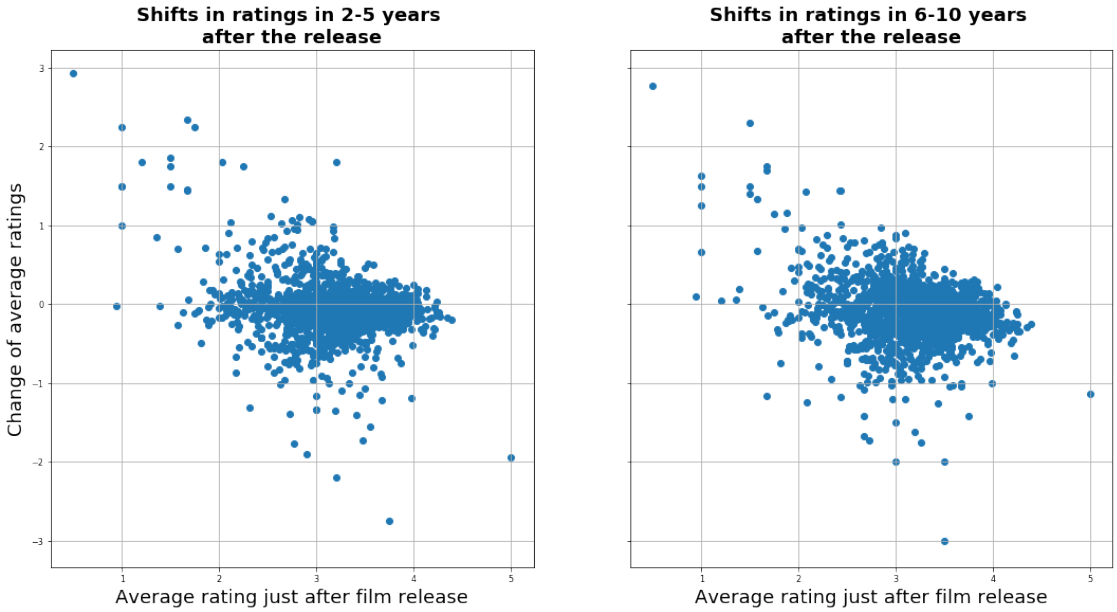
```
Out[34]: (1426, 3)
```

```
In [35]: my_ratings_clean = my_ratings[my_filter]
```

```
In [98]: %matplotlib inline
         import matplotlib.pyplot as plt
```

```
In [108]: fig, ax = plt.subplots(1, 2, figsize=(18,9), sharey = True)
          ax0, ax1 = ax.flatten()
          ax0.scatter(my_ratings_clean[0],my_ratings_clean[1] - my_ratings_clean[0])
          ax0.set_title('Shifts in ratings in 2-5 years \nafter the release', fontweight='bold
          ax1.scatter(my_ratings_clean[0],my_ratings_clean[2] - my_ratings_clean[0])
          ax1.set_title('Shifts in ratings in 6-10 years \nafter the release', fontweight='bol
          ax0.grid(True)
          ax1.grid(True)
          ax0.set_ylabel('Change of average ratings', fontsize=18)
          ax0.set_xlabel('Average rating just after film release', fontsize=18)
          ax1.set_xlabel('Average rating just after film release', fontsize=18)
          fig.savefig('shifts_scatters.png')
          plt.show
```

```
Out[108]: <function matplotlib.pyplot.show(*args, **kw)>
```




```
In [38]: data = my_ratings_clean

In [40]: corr1 = data[0].corr(data[1] - data[0])
         corr2 = data[0].corr(data[2] - data[0])
         corr3 = data[1].corr(data[2] - data[1])
         corr1, corr2, corr3

Out[40]: (-0.2677447890808909, -0.27955792624715126, -0.32190225452063653)
```

3.1 Another visualisation

Let's divide films into three categories based on ratings it got in the year of issue and the year after.

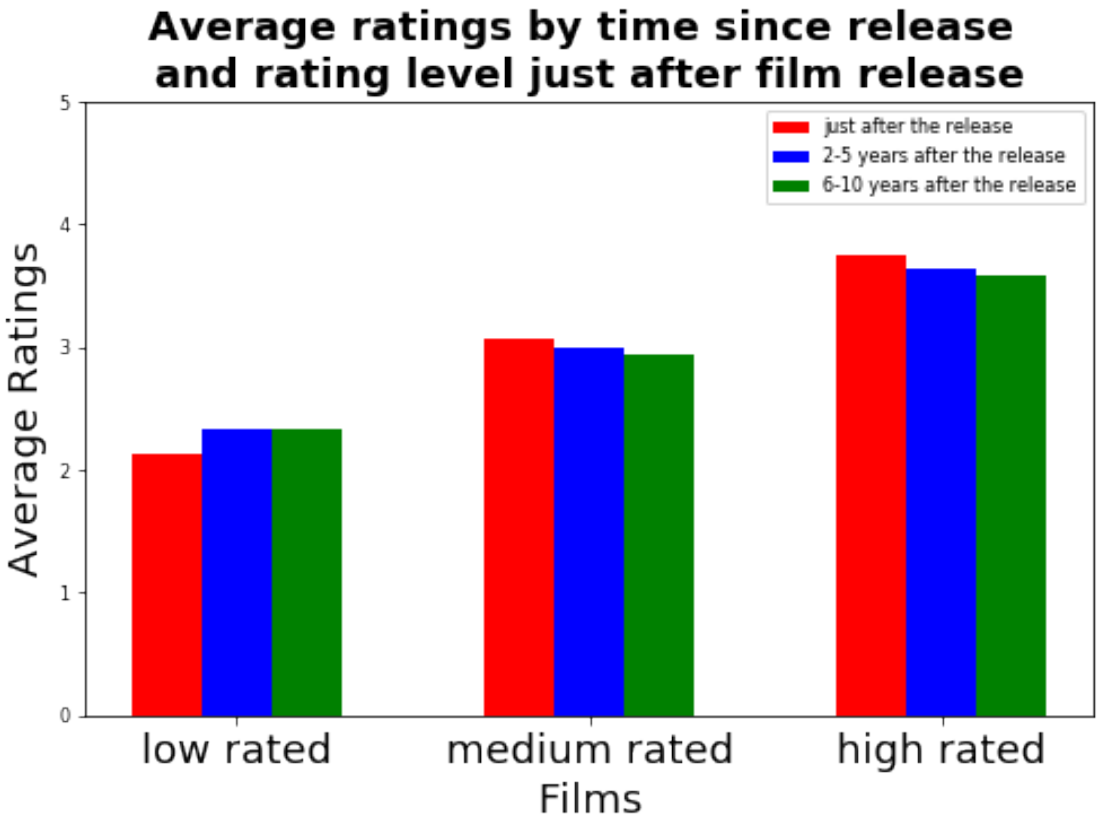
```
In [112]: low_filter = data[0] < 2.5
          high_filter = data[0] > 3.5
          medium_filter = (data[0] >= 2.5) & (data[0] <= 3.5)
          data[low_filter].shape, data[high_filter].shape, data[middle_filter].shape

Out[112]: ((160, 3), (369, 3), (897, 3))

In [51]: data.mean()

Out[51]: 0    3.143164
         1    3.085676
         2    3.036718
         dtype: float64
```

In [114]:
```
bar_data_dict ={'low rated films': data[low_filter].mean(),
                'medium rated films': data[medium_filter].mean(),
                'high rated films': data[high_filter].mean()}
bar_data=pd.DataFrame(bar_data_dict)
bar_data.T
```

Out[114]:

	0	1	2
low rated films	2.126896	2.327953	2.326546
medium rated films	3.074447	2.992614	2.940659
high rated films	3.750867	3.640453	3.578159

In [115]:
```
fig, ax = plt.subplots(figsize = (8, 5))

n_groups = 3
index = np.arange(n_groups)
bar_width = 0.2

rects1 = ax.bar(index, bar_data.T[0], bar_width,
                color='r',
                label='just after the release')

rects2 = ax.bar(index + bar_width, bar_data.T[1], bar_width,
                color='b',
                label='2-5 years after the release')

rects3 = ax.bar(index + 2 * bar_width, bar_data.T[2], bar_width,
                color='g',
                label='6-10 years after the release')

ax.set_xlabel('Films', fontsize=18)
ax.set_ylabel('Average Ratings', fontsize=18)
ax.set_title('Average ratings by time since release \nand rating level just after fi
ax.set_xticks(index + bar_width)
ax.set_xticklabels(('low rated', 'medium rated', 'high rated'), fontsize=18)
ax.set_ylim(0, 5)
ax.legend()

fig.savefig('average_ratings.png')
plt.show()
```


Average ratings by time since release and rating level just after film release
just after the release
2-5 years after the release
6-10 years after the release
Average Ratings
0
1
2
3
4
5
low rated
medium rated
high rated
Films