cf-01-rzepinskip-ratings_analysis

January 21, 2019

1 Important

`make data` has to be run before running any notebook cell

2 Imports

```
In [1]: import pandas as pd
        import seaborn as sns
        import matplotlib.pyplot as plt
        import matplotlib
        import numpy as np
```

```
In [2]: book_df = pd.read_csv('../data/raw/book.csv')
        ratings_df = pd.read_csv('../data/raw/ratings.csv')
```

```
In [3]: ratings_df.head(1)
```

```
Out[3]:    user_id  book_id  rating
        0        1      258       5
```

Make sure there are no duplicates in ratings.

```
In [4]: ratings_df[ratings_df.duplicated(['user_id', 'book_id'], keep=False)]
```

```
Out[4]: Empty DataFrame
        Columns: [user_id, book_id, rating]
        Index: []
```

3 Visualization settings

```
In [5]: sns.set(context='paper', font_scale=1.2, style='ticks', palette='muted',
                rc={"axes.labelsize":16, "ytick.labelsize": 14, "xtick.labelsize":14,
                    "font.family": "sans-serif"})
```

4 Ratings user and book coverage

```
In [6]: ratings_df.groupby('user_id')['book_id'].count().describe()
```

```
Out[6]: count    53424.000000
        mean       111.868804
        std         26.071224
        min         19.000000
        25%         96.000000
        50%        111.000000
        75%        128.000000
        max        200.000000
        Name: book_id, dtype: float64
```

All users rated at least 19 books. Such situation is rarely encountered in similar datasets.

```
In [7]: ratings_df.groupby('book_id')['user_id'].count().describe()
```

```
Out[7]: count    10000.000000
        mean       597.647900
        std       1267.289788
        min          8.000000
        25%        155.000000
        50%        248.000000
        75%        503.000000
        max      22806.000000
        Name: user_id, dtype: float64
```

All books have been rated at least 8 times.

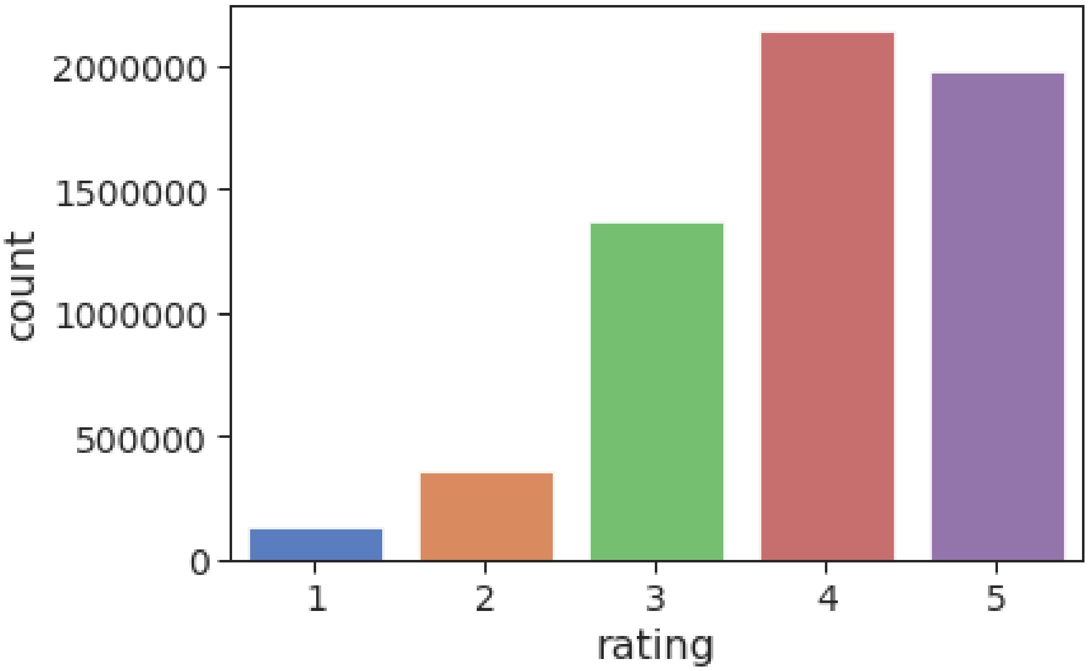
5 How users rate books?

```
In [8]: ratings_df['rating'].describe()
```

```
Out[8]: count    5.976479e+06
        mean     3.919866e+00
        std      9.910868e-01
        min      1.000000e+00
        25%      3.000000e+00
        50%      4.000000e+00
        75%      5.000000e+00
        max      5.000000e+00
        Name: rating, dtype: float64
```

```
In [9]: sns.countplot(ratings_df.rating)
```

```
Out[9]: <matplotlib.axes._subplots.AxesSubplot at 0x7f04c22dd320>
```



```
In [10]: ratings_df.groupby('user_id')['rating'].mean().describe()
```

```
Out[10]: count    53424.000000
         mean         3.928512
         std          0.449543
         min          1.000000
         25%          3.633929
         50%          3.920455
         75%          4.223214
         max          5.000000
         Name: rating, dtype: float64
```

```
In [11]: len(ratings_df.groupby('user_id').filter(lambda x: x['rating'].mean() ==
         0.0)['user_id'].unique())
```

```
Out[11]: 0
```

```
In [12]: len(ratings_df.groupby('user_id').filter(lambda x: x['rating'].mean() ==
         5.0)['user_id'].unique())
```

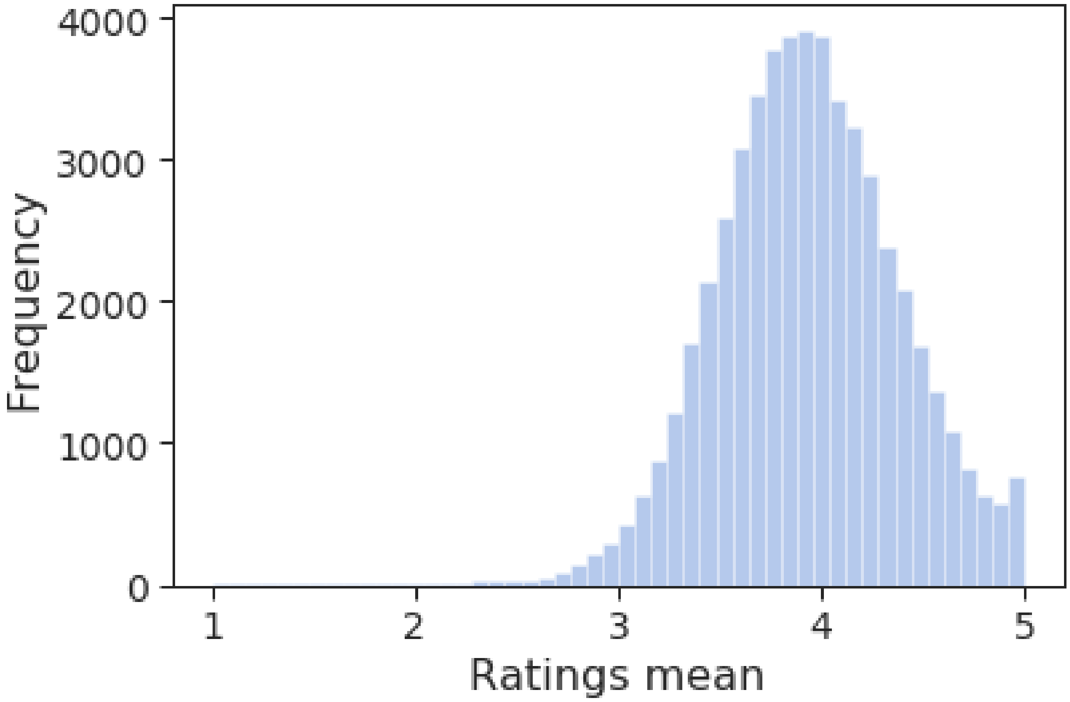
```
Out[12]: 266
```

```
In [13]: user_mean_ratings_plot = sns.distplot(ratings_df.groupby('user_id')['rating'].mean(),
         kde=False)
         user_mean_ratings_plot.set(xlabel='Ratings mean', ylabel='Frequency')
```

```
/home/rzepinskip/Documents/Inzynierka/Recommendation-system/rs-
venv/lib/python3.7/site-packages/scipy/stats/stats.py:1713: FutureWarning: Using a
non-tuple sequence for multidimensional indexing is deprecated; use `arr[tuple(seq)]`
```

```
instead of `arr[seq]`. In the future this will be interpreted as an array index,
`arr[np.array(seq)]`, which will result either in an error or a different result.
  return np.add.reduce(sorted[indexer] * weights, axis=axis) / sumval
```

```
Out[13]: [Text(0, 0.5, 'Frequency'), Text(0.5, 0, 'Ratings mean')]
```

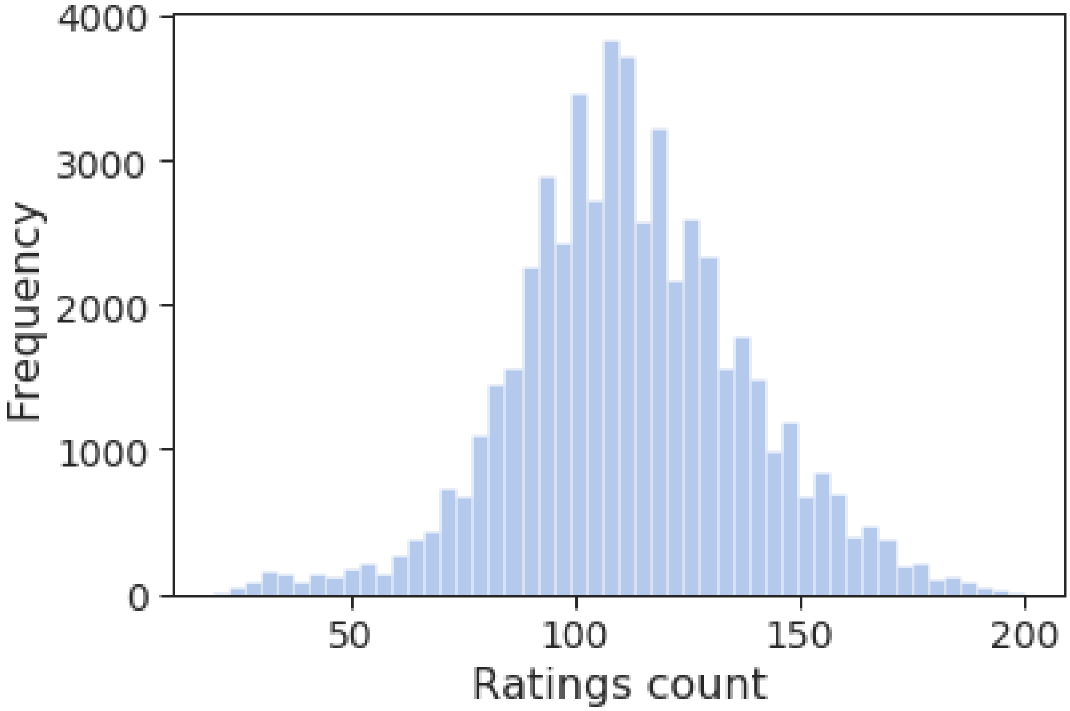


People rate differently - some give only 5 stars reviews, some are more harsh than others, for some only perfect book should get 5 star rating and so on. Generally, people tend to use only the upper part of the scale. Such tendencies can be observed on mean user rating distribution plot.

To correct for biases caused by varying mean ratings of different users and items(i.e. long or hard-to-watch movies can also be rated far lower than others) special factors are introduced in the form of `user bias`, `item bias` or `baseline`. [Section 5.2.1 Recommender Systems Handbook, Ricci]

```
In [14]: user_ratings_count_plot = sns.distplot(ratings_df.groupby('user_id')['rating'].count(),
         kde=False)
         user_ratings_count_plot.set(xlabel='Ratings count', ylabel='Frequency')
```

```
Out[14]: [Text(0, 0.5, 'Frequency'), Text(0.5, 0, 'Ratings count')]
```

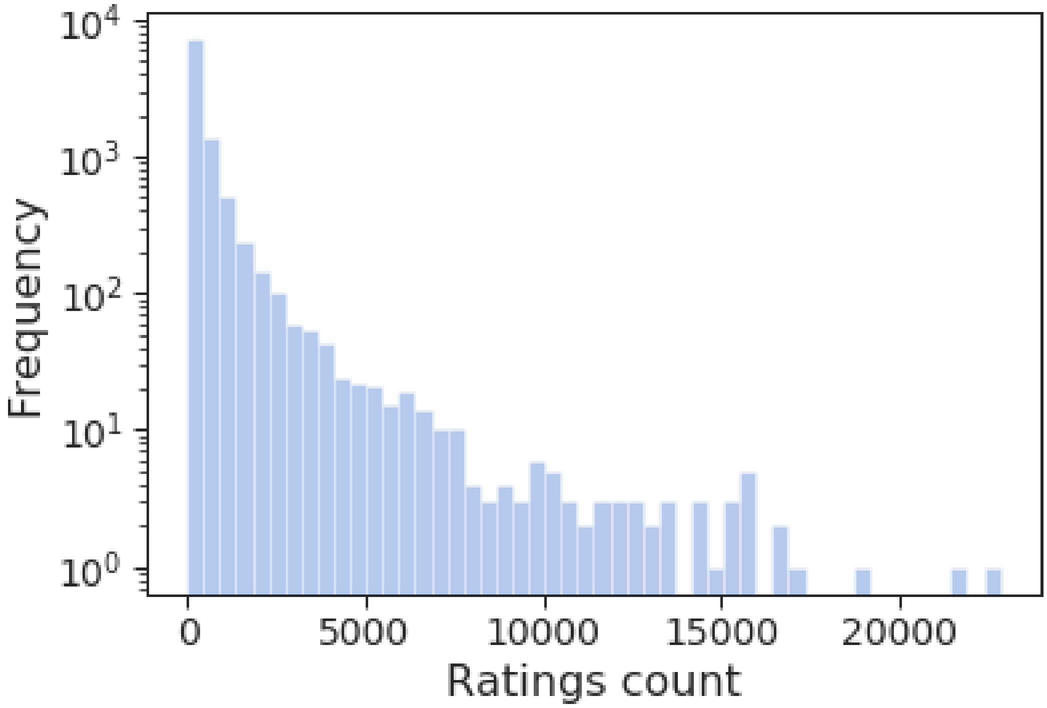


```
In [15]: len(ratings_df.groupby('book_id')['rating'].count()[ratings_df.groupby('book_id')['ratin
         g'].count() < 10000])
```

```
Out[15]: 9958
```

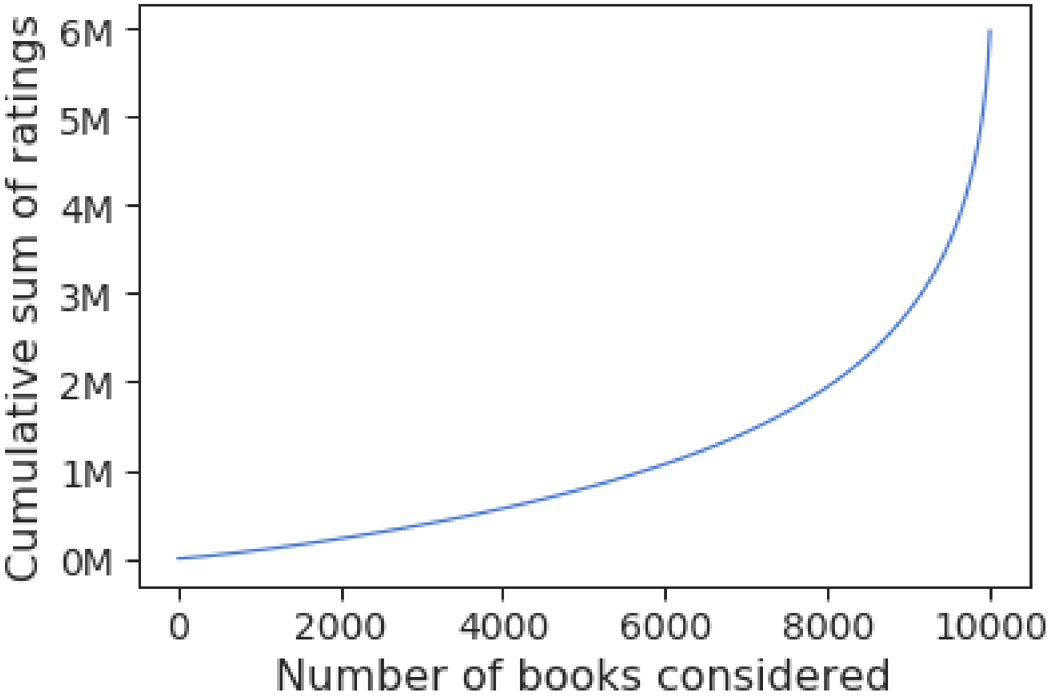
```
In [16]: book_ratings_count_plot = sns.distplot(ratings_df.groupby('book_id')['rating'].count(),
         kde=False)
         book_ratings_count_plot.set_yscale('log')
         book_ratings_count_plot.set(xlabel='Ratings count', ylabel='Frequency')
```

```
Out[16]: [Text(0, 0.5, 'Frequency'), Text(0.5, 0, 'Ratings count')]
```



```
In [17]: book_ratings_cum_count =
         ratings_df.groupby('book_id')['rating'].count().sort_values().cumsum()

In [18]: book_ratings_cum_count_plot = sns.lineplot(y=book_ratings_cum_count.values, x=[x+1 for x
         in range(0,10000)])
         book_ratings_cum_count_plot.set(xlabel='Number of books considered', ylabel='Cumulative
         sum of ratings')
         book_ratings_cum_count_plot.yaxis.set_major_formatter(
             matplotlib.ticker.FuncFormatter(lambda x, pos: '{:,.0f}'.format(x/(10**6)) + 'M'))
```



6 Train and test split

```
In [19]: from sklearn.model_selection import train_test_split
```

```
In [20]: train_df, test_df = train_test_split(ratings_df, test_size=0.1, random_state=44)
```

Some used methods do not generalize well for new(unseen) users and items, so we have to make sure that training test contains all users and items.

```
In [21]: set(train_df['user_id'].unique()) == set(ratings_df['user_id'].unique())
```

```
Out[21]: True
```

```
In [22]: set(train_df['book_id'].unique()) == set(ratings_df['book_id'].unique())
```

```
Out[22]: True
```

```
In [23]: train_df.groupby('user_id')['book_id'].count().describe()
```

```
Out[23]: count    53424.000000
         mean       100.681922
         std         23.671726
         min         17.000000
         25%         86.000000
         50%        100.000000
         75%        115.000000
         max        182.000000
         Name: book_id, dtype: float64
```

```
In [24]: train_df.groupby('book_id')['user_id'].count().describe()
```

```
Out[24]: count    10000.000000
         mean       537.883100
         std       1140.646885
         min          8.000000
         25%        140.000000
         50%        223.000000
         75%        454.250000
         max      20508.000000
         Name: user_id, dtype: float64
```