Data Exploration and Subsampling

November 6, 2019

```
In [1]: import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt
        from surprise import Dataset, evaluate
        from surprise import KNNBasic, KNNBaseline
        from surprise import Reader
        from surprise import accuracy
```

```
In [53]: rating_df=pd.read_csv('ml-20m/ratings.csv')
```

```
In [54]: rating_df=rating_df.drop(['timestamp'],axis=1)
```

```
In [42]: rating_df.head()
```

```
Out[42]:    userId  movieId  rating
         0       1        2     3.5
         1       1       29     3.5
         2       1       32     3.5
         3       1       47     3.5
         4       1       50     3.5
```

```
In [45]: print('maximum number of rating a movie has',max(rating_df['movieId'].value_counts())
         print('minimum number of rating a movie has',min(rating_df['movieId'].value_counts())
```

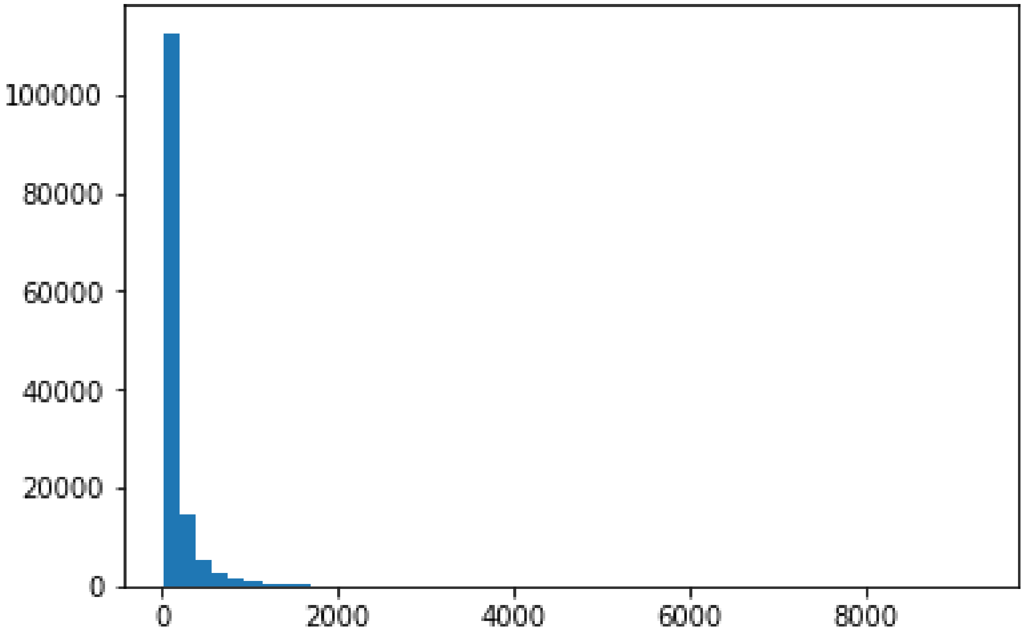
```
('maximum number of rating a movie has', 67310)
('minimum number of rating a movie has', 1)
```

```
In [46]: print('maximum number of movies a user rated',max(rating_df['userId'].value_counts())
         print('minimum number of movies a user rated',min(rating_df['userId'].value_counts())
```

```
('maximum number of movies a user rated', 9254)
('minimum number of movies a user rated', 20)
```

0.0.1 Plot rating distribution

```
In [47]: rating_freq=rating_df['userId'].value_counts()
         df = pd.DataFrame(rating_freq).reset_index()
         df.columns = ['userId', 'count']
         plt.hist(df['count'],bins=50)
         plt.show()
```



First, we delete those movies that has the number of ratings less than 5.

```
In [55]: movieid=rating_df['movieId'].value_counts()
         movieid = pd.DataFrame(movieid).reset_index()
         movieid.columns = ['movieId', 'count']
         movieId_5=movieid.loc[movieid['count']<=5]
         rating_del=rating_df.loc[~rating_df['movieId'].isin(movieId_5['movieId'])]
```

0.0.2 Since we need to subsample the dataset, we decide to choose up to 10000 users. We choose the number of ratings in different ranges based on the proportion of that range in total dataset.

```
In [56]: #rating_del=rating_df
         num_user=10000
         rating_freq=rating_del['userId'].value_counts()
         df = pd.DataFrame(rating_freq).reset_index()
         df.columns = ['userId', 'count']
         df_50=df.loc[(df['count']<50)&(40<=df['count'])]
```

```
        use_df_50=df.loc[df['count']<50]
        freq_50=len(use_df_50)/float(len(df['count']))
        print('frequency_of rate count between 40 and 50',freq_50)

        df_50_100=df.loc[(df['count']<100) & (50<=df['count'])]
        freq_50_100=len(df_50_100)/float(len(df['count']))
        print('frequency_of rate count between 50 and 100',freq_50_100)

        df_100_500=df.loc[(df['count']<500) & (100<=df['count'])]
        freq_100_500=len(df_100_500)/float(len(df['count']))
        print('frequency_of rate count between 100 and 500',freq_100_500)

        df_500_1000=df.loc[(df['count']<1000) & (500<=df['count'])]
        freq_500_1000=len(df_500_1000)/float(len(df['count']))
        print('frequency_of rate count between 500 and 1000',freq_500_1000)

        df_1000=df.loc[1000<=df['count']]
        freq_1000=len(df_1000)/float(len(df['count']))
        print('frequency_of rate count larger than 1000',freq_1000)

        df_trimmed_50=df_50.sample(n = int(num_user*freq_50))
        df_trimmed_50_100=df_50_100.sample(n = int(num_user*freq_50_100))
        df_trimmed_100_500=df_100_500.sample(n = int(num_user*freq_100_500))
        df_trimmed_500_1000=df_500_1000.sample(n = int(num_user*freq_500_1000))
        df_trimmed_1000=df_1000.sample(n = int(num_user*freq_1000))
        rating_50=rating_del.loc[rating_del['userId'].isin(df_trimmed_50['userId'])]
        rating_50_100=rating_del.loc[rating_del['userId'].isin(df_trimmed_50_100['userId'])]
        rating_100_500=rating_del.loc[rating_del['userId'].isin(df_trimmed_100_500['userId'])
        rating_500_1000=rating_del.loc[rating_del['userId'].isin(df_trimmed_500_1000['userId'
        rating_1000=rating_del.loc[rating_del['userId'].isin(df_trimmed_1000['userId'])]
        result = pd.concat([rating_50, rating_50_100,rating_100_500,rating_500_1000,rating_10
```

```
('frequency_of rate count between 40 and 50', 0.3841710411356531)
('frequency_of rate count between 50 and 100', 0.2361057959608067)
('frequency_of rate count between 100 and 500', 0.32567711003444216)
('frequency_of rate count between 500 and 1000', 0.04044247723711668)
('frequency_of rate count larger than 1000', 0.0136035756319814)
```

We also want to eliminate the number of minimum ratings a movie has, so we decide to delete those movies which have total number of ratings less than 20.

```
In [89]: movieid=result['movieId'].value_counts()
         movieid = pd.DataFrame(movieid).reset_index()
         movieid.columns = ['movieId', 'count']
         movieId_5=movieid.loc[movieid['count']<=20]
         final_df=result.loc[~result['movieId'].isin(movieId_5['movieId'])]
```

```
In [36]: import random
```

Then we randomly choose 3000 different movies in our current dataset.

```
In [90]: random.seed(10)
         movieid_count=final_df['movieId'].value_counts().reset_index()
         use_movieid=random.sample(movieid_count['index'], 3000)
         final_df_2=final_df.loc[final_df['movieId'].isin(use_movieid)]
```

0.0.3 we reindex the movieId and userId so the index starts from 1.

```
In [91]: ratings=final_df_2
```

```
In [92]: ratings['Rank'] = ratings.userId.rank(method='dense').astype(int)
         ratings['userId']=ratings['Rank']
         ratings=ratings.drop(['Rank'],axis=1)
         ratings['Rank'] = ratings.movieId.rank(method='dense').astype(int)
         ratings['movieId']=ratings['Rank']
         ratings=ratings.drop(['Rank'],axis=1)
```

```
/anaconda2/lib/python2.7/site-packages/ipykernel_launcher.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.htm
  """Entry point for launching an IPython kernel.
/anaconda2/lib/python2.7/site-packages/ipykernel_launcher.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.htm
```

```
In [93]: ratings=ratings.reset_index()
         ratings=ratings.drop(['index'],axis=1)
```

```
In [64]: ratings.head()
```

```
Out[64]:    userId  movieId  rating
         0       3        8     3.0
         1       3       16     4.0
         2       3       51     2.0
         3       3       56     3.0
         4       3       59     2.0
```

Let's check the current distribution of dataset.

```
In [65]: print('maximum number of rating a movie has',max(ratings['movieId'].value_counts()))
         print('minimum number of rating a movie has',min(ratings['movieId'].value_counts()))
```

```
('maximum number of rating a movie has', 5225)
('minimum number of rating a movie has', 21)
```

```
In [66]: print('maximum number of movies a user rated',max(ratings['userId'].value_counts()))
         print('minimum number of movies a user rated',min(ratings['userId'].value_counts()))
```

```
('maximum number of movies a user rated', 1497)
('minimum number of movies a user rated', 8)
```

```
In [76]: len(ratings['userId'].value_counts())
```

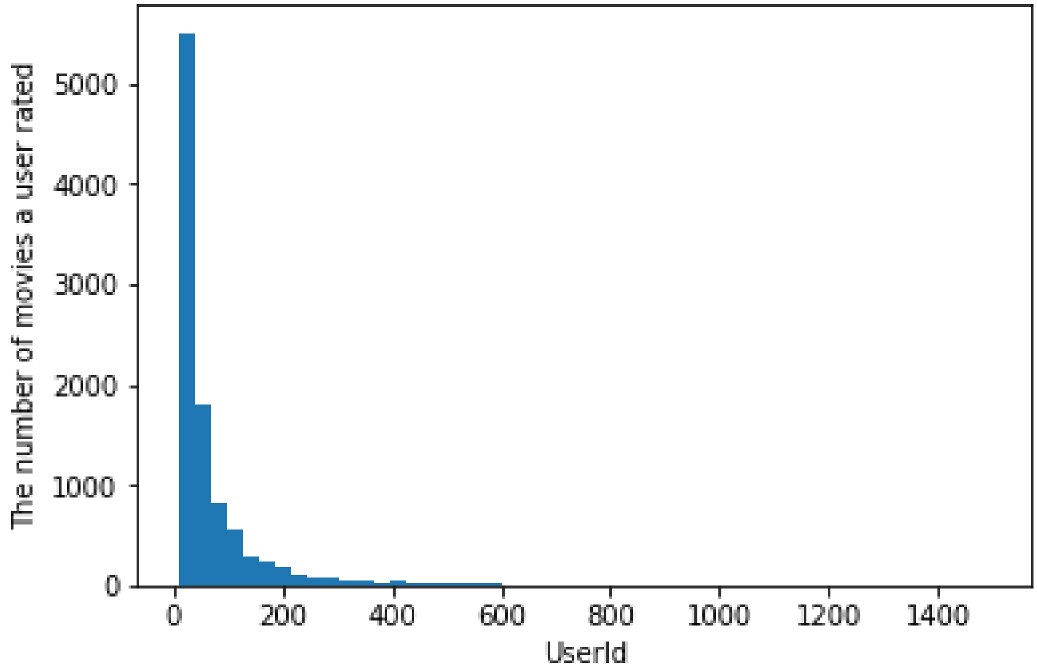
```
Out[76]: 9998
```

```
In [77]: len(ratings['movieId'].value_counts())
```

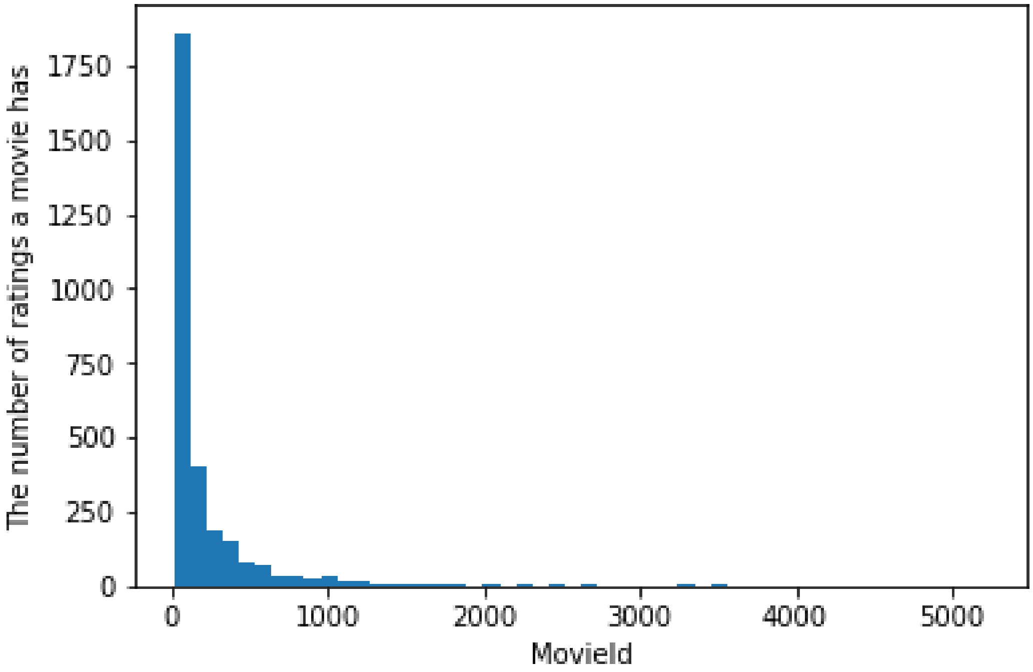
```
Out[77]: 3000
```

We have 9998 users and 3000 movies

```
In [72]: rating_freq_user=ratings['userId'].value_counts()
         df = pd.DataFrame(rating_freq_user).reset_index()
         df.columns = ['userId', 'count']
         plt.hist(df['count'],bins=50)
         plt.xlabel('UserId')
         plt.ylabel('The number of movies a user rated')
         plt.savefig('User.jpg')
         plt.show()
```



```
In [71]: rating_freq_user=ratings['movieId'].value_counts()
         df = pd.DataFrame(rating_freq_user).reset_index()
         df.columns = ['userId', 'count']
         plt.hist(df['count'],bins=50)
         plt.xlabel('MovieId')
         plt.ylabel('The number of ratings a movie has')
         plt.savefig('movie.jpg')
         plt.show()
```



we can see that the distribution of the number of movies a user rated is similar with the original dataset, so we preserve this distribution

```
In [38]: ratings.to_csv('subsample_data_3.csv',index=False)
```

```
In [78]: print('minimum_rating',min(ratings['rating']))
         print('maximum_rating',max(ratings['rating']))
```

```
('minimum_rating', 0.5)
('maximum_rating', 5.0)
```

```
In [84]: from sklearn.model_selection import train_test_split
In [94]: train, test= train_test_split(ratings, test_size=0.2, random_state=42)
```

```
In [96]: train.to_csv('train_data.csv',index=False)
         test.to_csv('test_data.csv',index=False)
```