recommendation_engine (1)

August 19, 2022

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

[2]:
```
books = pd.read_csv('BX-Books.csv',encoding='latin-1')
books.head()
```

```
/usr/local/lib/python3.7/site-packages/IPython/core/interactiveshell.py:3063:
DtypeWarning: Columns (3) have mixed types.Specify dtype option on import or set
low_memory=False.
  interactivity=interactivity, compiler=compiler, result=result)
```

[2]:

	isbn	book_title	book_author	year_of_publication	publisher
0	195153448	Classical Mythology	Mark P. O. Morford	2002	Oxford University Press
1	2005018	Clara Callan	Richard Bruce Wright	2001	HarperFlamingo Canada
2	60973129	Decision in Normandy	Carlo D'Este	1991	HarperPerennial
3	374157065	Flu: The Story of the Great Influenza Pandemic…	Gina Bari Kolata	1999	Farrar Straus Giroux
4	393045218	The Mummies of Urumchi	E. J. W. Barber	1999	W. W. Norton & Company

[3]:
```
users = pd.read_csv('BX-Users.csv', encoding='latin-1')
users.head()
```

```
/usr/local/lib/python3.7/site-packages/IPython/core/interactiveshell.py:3063:
DtypeWarning: Columns (0) have mixed types.Specify dtype option on import or set
low_memory=False.
  interactivity=interactivity, compiler=compiler, result=result)
```

[3]:

	user_id	Location	Age
0	1	nyc, new york, usa	NaN
1	2	stockton, california, usa	18.0

```
2       3     moscow, yukon territory, russia   NaN
3       4           porto, v.n.gaia, portugal  17.0
4       5  farnborough, hants, united kingdom   NaN
```

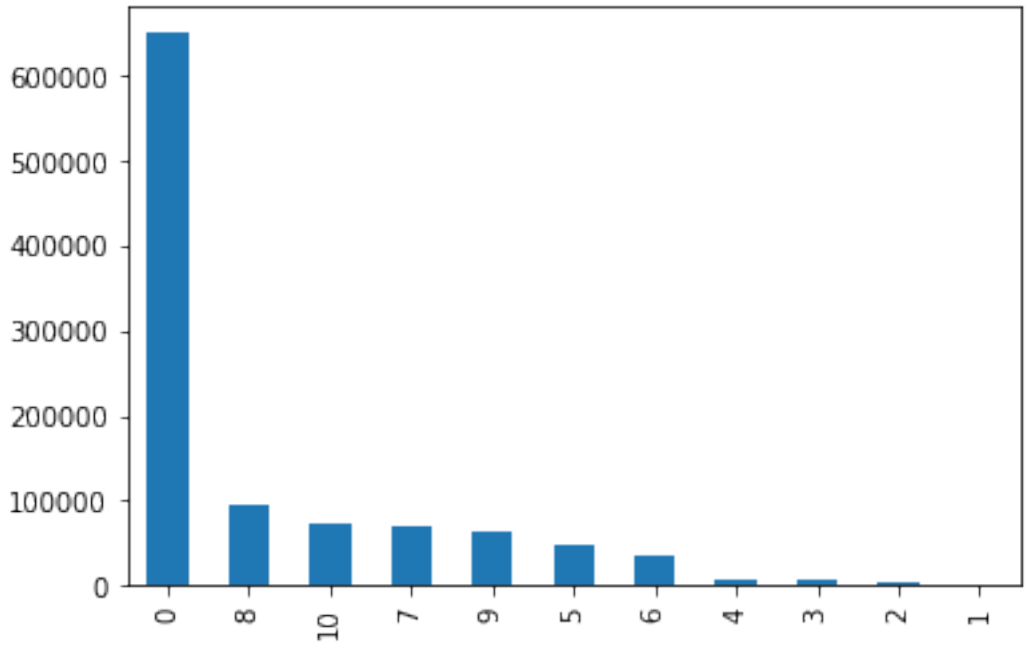
[4]:
```
ratings = pd.read_csv('BX-Book-Ratings.csv', encoding='latin-1')
ratings.head()
```

[4]:
```
   user_id        isbn  rating
0   276725  034545104X       0
1   276726   155061224       5
2   276727   446520802       0
3   276729  052165615X       3
4   276729   521795028       6
```

[5]:
```
books.shape,users.shape,ratings.shape
```

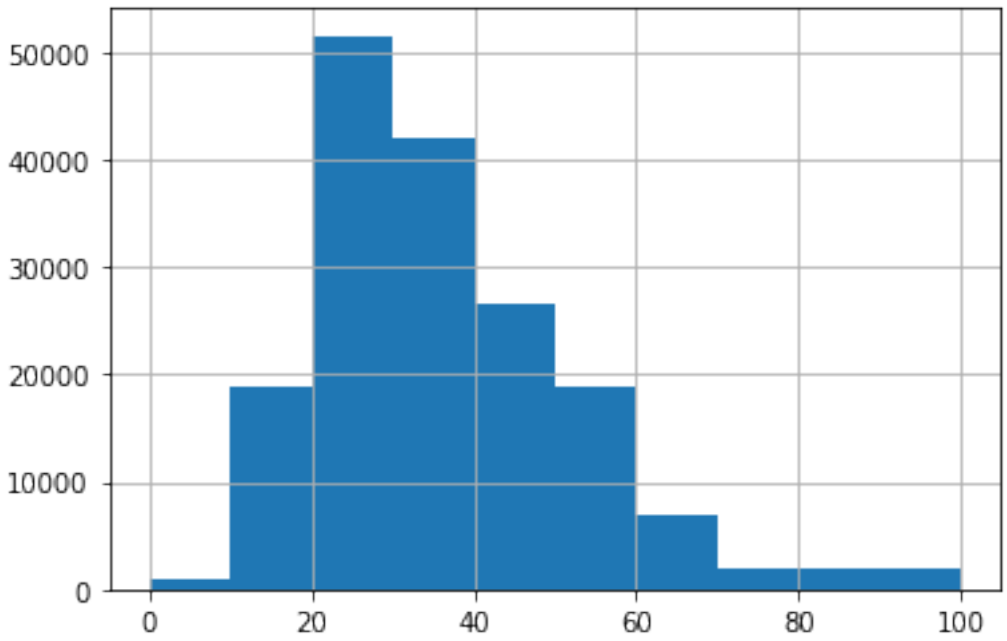
[5]:
```
((271379, 5), (278859, 3), (1048575, 3))
```

[6]:
```
ratings.rating.value_counts().plot(kind='bar');
```



Majority class belongs to zero

[7]:
```
users.Age.hist(bins=[0,10,20,30,40,50,60,70,100]).plot(kind='bar');
```



Most users are between 20-30

[8]:
```
ratings.head()
```

[8]:

	user_id	isbn	rating
0	276725	034545104X	0
1	276726	155061224	5
2	276727	446520802	0
3	276729	052165615X	3
4	276729	521795028	6

[9]:
```
# I want to know what number of ratings did each book receive
rating_count = pd.DataFrame(ratings.groupby('isbn')['rating'].count())
```

[10]:
```
rating_count = rating_count.sort_values('rating', ascending=False)
rating_count
```

[10]:

isbn	rating
971880107	2264
316666343	1164
385504209	813
312195516	668
60928336	662
…	…
3815820782	1

```
3815860032       1
3815860121       1
3816600603       1
º423350229       1

[322102 rows x 1 columns]
```

[11]:
```
books_rating_merged = pd.merge(rating_count,books,on='isbn')
books_rating_merged.head()
```

[11]:
```
         isbn  rating                                       book_title  \
0  971880107    2264                                     Wild Animus
1  316666343    1164                       The Lovely Bones: A Novel
2  385504209     813                                The Da Vinci Code
3  312195516     668             The Red Tent (Bestselling Backlist)
4   60928336     662  Divine Secrets of the Ya-Ya Sisterhood: A Novel

     book_author year_of_publication      publisher
0   Rich Shapero                2004        Too Far
1   Alice Sebold                2002  Little, Brown
2      Dan Brown                2003      Doubleday
3  Anita Diamant                1998    Picador USA
4  Rebecca Wells                1997      Perennial
```

[12]:
```
#I want to know the average ratings of maximum rated books
ratings_mean = pd.DataFrame(ratings.groupby('isbn')['rating'].mean())
ratings_mean['rating_count'] = pd.DataFrame(ratings.groupby('isbn')['rating'].
 ↪count())
ratings_mean.sort_values('rating_count', ascending = False).head()
```

[12]:
```
             rating  rating_count
isbn
971880107  1.032244          2264
316666343  4.457045          1164
385504209  4.691267           813
312195516  4.326347           668
60928336   3.462236           662
```

We will remove users with less than 200 ratings

We will also remove books with less than 100 ratings

[13]:
```
#select ratings of users who have rated more than 200 ratings

counts_user = ratings['user_id'].value_counts()
ratings = ratings[ratings['user_id'].isin(counts_user[counts_user >= 200].
 ↪index)]
```

[14]:
```
counts_books = ratings['rating'].value_counts()
ratings = ratings[ratings['rating'].isin(counts_books[counts_books >= 100].
 ↪index)]
# counts_books = counts_books[counts_books >= 100]
```

[15]:
```
ratings
```

[15]:
```
         user_id        isbn  rating
1456      277427  002542730X      10
1457      277427    26217457       0
1458      277427  003008685X       8
1459      277427    30615321       0
1460      277427    60002050       0
…            …           …     …
1048570   250764   451410777       0
1048571   250764   452264464       8
1048572   250764  048623715X       0
1048573   250764   486256588       0
1048574   250764   515069434       0

[483728 rows x 3 columns]
```

[16]:
```
ratings = ratings.drop_duplicates()
```

[17]:
```
ratings_pivot = ratings.reset_index().
 ↪pivot_table(index='user_id',columns='isbn').rating
```

[18]:
```
ratings_pivot.fillna(0,inplace=True)
ratings_pivot
```

[18]:
```
isbn      904492401X  *0515128325    0  0 00 612183 7  0 00 614494 2  \
user_id
254              0.0          0.0  0.0            0.0            0.0
2276             0.0          0.0  0.0            0.0            0.0
2766             0.0          0.0  0.0            0.0            0.0
2977             0.0          0.0  0.0            0.0            0.0
3363             0.0          0.0  0.0            0.0            0.0
…                …            …    …              …              …
250764           0.0          0.0  0.0            0.0            0.0
277427           0.0          0.0  0.0            0.0            0.0
277478           0.0          0.0  0.0            0.0            0.0
277639           0.0          0.0  0.0            0.0            0.0
278418           0.0          0.0  0.0            0.0            0.0

isbn     0 7336 1053 6  0 907 062 008  0.330241664  000104687X  000104799X  \
user_id
254                0.0            0.0          0.0         0.0         0.0
```

```
2276              0.0            0.0          0.0         0.0         0.0
2766              0.0            0.0          0.0         0.0         0.0
2977              0.0            0.0          0.0         0.0         0.0
3363              0.0            0.0          0.0         0.0         0.0
…                 …              …            …           …           …
250764            0.0            0.0          0.0         0.0         0.0
277427            0.0            0.0          0.0         0.0         0.0
277478            0.0            0.0          0.0         0.0         0.0
277639            0.0            0.0          0.0         0.0         0.0
278418            0.0            0.0          0.0         0.0         0.0

isbn     …  THEFLYINGACE  UNGRANDHOMMED  X000000000  YOUTELLEM,AND  \
user_id  …
254      …           0.0            0.0         0.0           0.0
2276     …           0.0            0.0         0.0           0.0
2766     …           0.0            0.0         0.0           0.0
2977     …           0.0            0.0         0.0           0.0
3363     …           0.0            0.0         0.0           0.0
…      …             …              …           …             …
250764   …           0.0            0.0         0.0           0.0
277427   …           0.0            0.0         0.0           0.0
277478   …           0.0            0.0         0.0           0.0
277639   …           0.0            0.0         0.0           0.0
278418   …           0.0            0.0         0.0           0.0

isbn     ZR903CX0003  \0432534220\""  \2842053052\""  b00005wz75  cn108465  \
user_id
254              0.0             0.0             0.0         0.0       0.0
2276             0.0             0.0             0.0         0.0       0.0
2766             0.0             0.0             0.0         0.0       0.0
2977             0.0             0.0             0.0         0.0       0.0
3363             0.0             0.0             0.0         0.0       0.0
…                …               …               …           …         …
250764           0.0             0.0             0.0         0.0       0.0
277427           0.0             0.0             0.0         0.0       0.0
277478           0.0             0.0             0.0         0.0       0.0
277639           0.0             0.0             0.0         0.0       0.0
278418           0.0             0.0             0.0         0.0       0.0

isbn     cn113107
user_id
254           0.0
2276          0.0
2766          0.0
2977          0.0
3363          0.0
…             …
```

```
250764        0.0
277427        0.0
277478        0.0
277639        0.0
278418        0.0

[820 rows x 197767 columns]
```

[19]:
```
# Recommendation
ratings_pivot[ratings_pivot.index == 254]
```

[19]:
```
isbn      904492401X  *0515128325    0  0 00 612183 7  0 00 614494 2  \
user_id
254              0.0          0.0  0.0            0.0            0.0

isbn     0 7336 1053 6  0 907 062 008  0.330241664  000104687X  000104799X  \
user_id
254                0.0            0.0          0.0         0.0         0.0

isbn     …  THEFLYINGACE  UNGRANDHOMMED  X000000000  YOUTELLEM,AND  \
user_id  …
254      …           0.0            0.0         0.0            0.0

isbn     ZR903CX0003  \0432534220\""  \2842053052\""  b00005wz75  cn108465  \
user_id
254              0.0             0.0             0.0         0.0       0.0

isbn     cn113107
user_id
254           0.0

[1 rows x 197767 columns]
```

[20]:
```
##User - User BAsed collaborative filtering
```

[21]:
```
from sklearn.metrics.pairwise import cosine_similarity
import operator
def similar_users(user_id, matrix, k=5):

    # create a df of just the current user
    user = matrix[matrix.index == user_id]

    # and a df of all other users
    other_users = matrix[matrix.index != user_id]

    # calc cosine similarity between user and each other user
    similarities = cosine_similarity(user,other_users)[0].tolist()
```

```
    # create list of indices of these users
    indices = other_users.index.tolist()

    # create key/values pairs of user index and their similarity
    index_similarity = dict(zip(indices, similarities))
#     print(index_similarity)

    # sort by similarity
    index_similarity_sorted = sorted(index_similarity.items(), key=operator.
 ↪itemgetter(1))
    index_similarity_sorted.reverse()
#     print(index_similarity_sorted)

    # grab k users off the top
    top_users_similarities = index_similarity_sorted[:k]
    users = [u[0] for u in top_users_similarities]

    return users
```

[22]:
```
similar_user_indices = similar_users(277478, ratings_pivot,10)
print(similar_user_indices)
```

```
[141819, 12538, 42914, 102647, 80538, 239594, 76352, 81492, 44595, 203799]
```

[23]:
```
def recommend_item(user_index, similar_user_indices, matrix, items=3):

    # load vectors for similar users
    similar_users = matrix[matrix.index.isin(similar_user_indices)]
    # calc avg ratings across the 3 similar users
    similar_users = similar_users.mean(axis=0)
    # convert to dataframe so its easy to sort and filter
    similar_users_df = pd.DataFrame(similar_users, columns=['mean'])


    # load vector for the current user
    user_df = matrix[matrix.index == user_index]
    # transpose it so its easier to filter
    user_df_transposed = user_df.transpose()
    # rename the column as 'rating'
    user_df_transposed.rename(columns = {user_index: 'rating'}, inplace = True)
    # remove any rows without a 0 value. Books not read yet
    user_df_transposed = user_df_transposed[user_df_transposed['rating']==0]
    # generate a list of Books the user has not read
    books_unseen = user_df_transposed.index.tolist()
```

```
    # filter avg ratings of similar users for only Books the current user has␣
↪not read
    similar_users_df_filtered = similar_users_df[similar_users_df.index.
↪isin(books_unseen)]
    # order the dataframe
    similar_users_df_ordered = similar_users_df.sort_values(by=['mean'],␣
↪ascending=False)
    # grab the top n books
    top_n_books = similar_users_df_ordered.head(items)
    top_n_books_indices = top_n_books.index.tolist()
    # lookup these books in the other dataframe to find names
    book_information = books_rating_merged[books_rating_merged['isbn'].
↪isin(top_n_books_indices)]

    return book_information #items
# try it out
recommend_item(277478, similar_user_indices, ratings_pivot)
```

[23]:

	isbn	rating	book_title	book_author	year_of_publication	publisher
488	055321313X	117	Anne of Green Gables (Anne of Green Gables Nov…	L.M. MONTGOMERY	1982	Bantam Classics
736	1558745718	90	Chicken Soup for the Pet Lover's Soul (Chicken…	Jack Canfield	1998	Health Communications
2765	312113420	37	James Herriot's Cat Stories	James Herriot	1994	St. Martin's Press

[ ]: