осковский государственный технический университет им. Н.Э. Баумана
Кафедра «Системы обработки информации и управления»

Лабораторная работа №4

по дисциплине «Методы машинного обучения»

на тему«Создание рекомендательной модели»

Выполнил: Ван Пэй

Группа：ИУ5-22М

Москва — 2021 г.

Цель лабораторной работы:

Изучение разработки рекомендательных моделей.

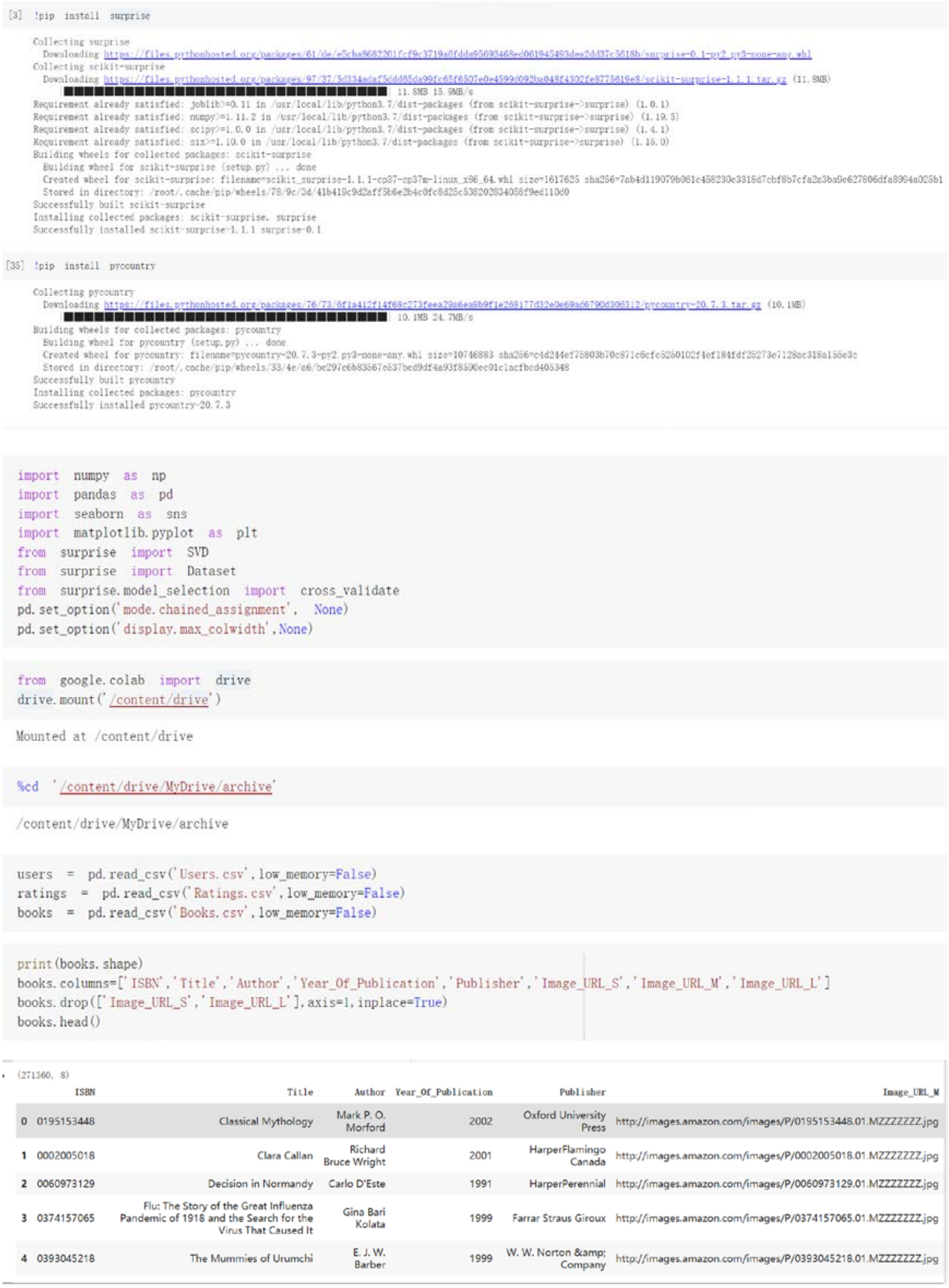
Задание:

- Выбрать произвольный набор данных (датасет), предназначенный для построения рекомендательных моделей.
- Опираясь на материалы лекции, сформировать рекомендации для одного пользователя (объекта) двумя произвольными способами.
- Сравнить полученные рекомендации (если это возможно, то с применением метрик).

Описание набора данных

Используется набор данных Book-Crossing по kaggle. Набор данных Book-Crossing состоит из 3 файлов: Users，Books，Ratings.

Используется Popularity Based Recommendation и Collabrative Filtering Based Recommendation.



```
[3]  !pip  install  surprise

    Collecting surprise
      Downloading https://files.pythonhosted.org/packages/61/de/e5cba8682201fcf9c3719a6fdda95693468ed061945493dea2dd37c5618b/surprise-0.1-py2.py3-none-any.whl
    Collecting scikit-surprise
      Downloading https://files.pythonhosted.org/packages/97/37/5d334adaf5ddd65da99fc65f6507e0e4599d092ba048f4302fe8775619e8/scikit-surprise-1.1.1.tar.gz (11.8MB)
         |████████████████████████████████| 11.8MB 15.9MB/s
    Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.7/dist-packages (from scikit-surprise->surprise) (1.0.1)
    Requirement already satisfied: numpy>=1.11.2 in /usr/local/lib/python3.7/dist-packages (from scikit-surprise->surprise) (1.19.5)
    Requirement already satisfied: scipy>=1.0.0 in /usr/local/lib/python3.7/dist-packages (from scikit-surprise->surprise) (1.4.1)
    Requirement already satisfied: six>=1.10.0 in /usr/local/lib/python3.7/dist-packages (from scikit-surprise->surprise) (1.15.0)
    Building wheels for collected packages: scikit-surprise
      Building wheel for scikit-surprise (setup.py) ... done
      Created wheel for scikit-surprise: filename=scikit_surprise-1.1.1-cp37-cp37m-linux_x86_64.whl size=1617625 sha256=7ab4d119079b061c458230e3318d7cbf8b7cfa2a3ba9e627806dfa8904a025b1
      Stored in directory: /root/.cache/pip/wheels/78/9c/3d/41b419c9d2aff5b6e2b4c0fc8d25c538202834058f9ed110d0
    Successfully built scikit-surprise
    Installing collected packages: scikit-surprise, surprise
    Successfully installed scikit-surprise-1.1.1 surprise-0.1
```

```
[35]  !pip  install  pycountry

    Collecting pycountry
      Downloading https://files.pythonhosted.org/packages/76/73/6f1a412f14f68c273feea29a6ea9b9f1e268177d32e0e69a6790d306312/pycountry-20.7.3.tar.gz (10.1MB)
         |████████████████████████████████| 10.1MB 24.7MB/s
    Building wheels for collected packages: pycountry
      Building wheel for pycountry (setup.py) ... done
      Created wheel for pycountry: filename=pycountry-20.7.3-py2.py3-none-any.whl size=10746883 sha256=c4d244ef75803b70c871c6cfc5250102f4ef184fdf25273e7128ac318a155e3c
      Stored in directory: /root/.cache/pip/wheels/33/4e/a6/be297e6b83567e537bed9df4a93f8590ec01c1acfbcd405348
    Successfully built pycountry
    Installing collected packages: pycountry
    Successfully installed pycountry-20.7.3
```

```
import  numpy  as  np
import  pandas  as  pd
import  seaborn  as  sns
import  matplotlib.pyplot  as  plt
from  surprise  import  SVD
from  surprise  import  Dataset
from  surprise.model_selection  import  cross_validate
pd.set_option('mode.chained_assignment',  None)
pd.set_option('display.max_colwidth',None)
```

```
from  google.colab  import  drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
%cd  '/content/drive/MyDrive/archive'
```

```
/content/drive/MyDrive/archive
```

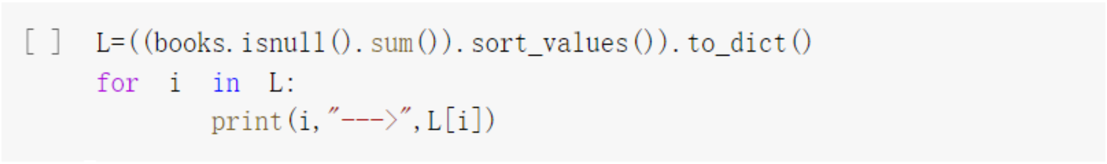
```
users  =  pd.read_csv('Users.csv',low_memory=False)
ratings  =  pd.read_csv('Ratings.csv',low_memory=False)
books  =  pd.read_csv('Books.csv',low_memory=False)
```

```
print(books.shape)
books.columns=['ISBN','Title','Author','Year_Of_Publication','Publisher','Image_URL_S','Image_URL_M','Image_URL_L']
books.drop(['Image_URL_S','Image_URL_L'],axis=1,inplace=True)
books.head()
```

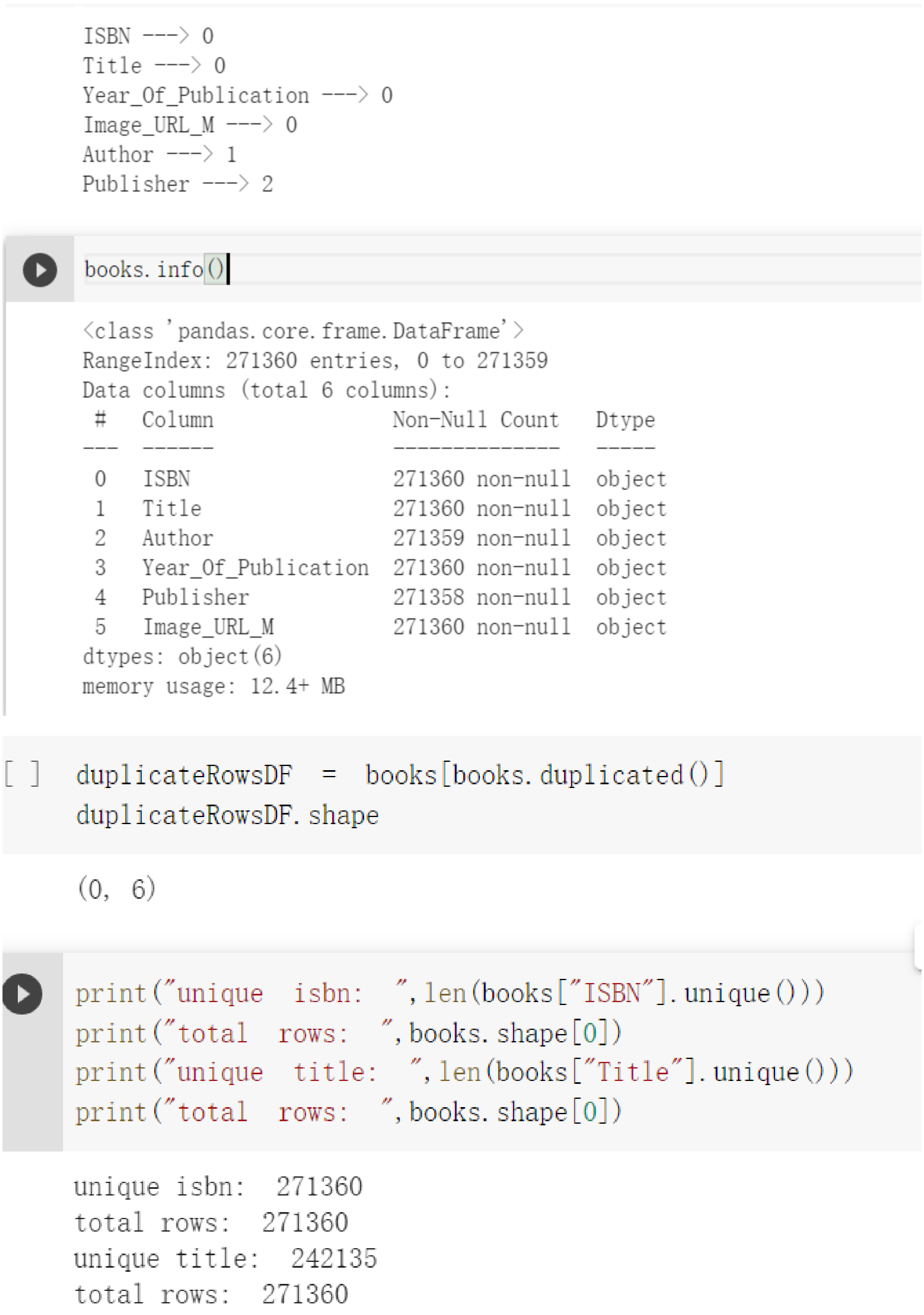
```
(271360, 8)
```

	ISBN	Title	Author	Year_Of_Publication	Publisher	Image_URL_M
0	0195153448	Classical Mythology	Mark P. O. Morford	2002	Oxford University Press	http://images.amazon.com/images/P/0195153448.01.MZZZZZZZ.jpg
1	0002005018	Clara Callan	Richard Bruce Wright	2001	HarperFlamingo Canada	http://images.amazon.com/images/P/0002005018.01.MZZZZZZZ.jpg
2	0060973129	Decision in Normandy	Carlo D'Este	1991	HarperPerennial	http://images.amazon.com/images/P/0060973129.01.MZZZZZZZ.jpg
3	0374157065	Flu: The Story of the Great Influenza Pandemic of 1918 and the Search for the Virus That Caused It	Gina Bari Kolata	1999	Farrar Straus Giroux	http://images.amazon.com/images/P/0374157065.01.MZZZZZZZ.jpg
4	0393045218	The Mummies of Urumchi	E. J. W. Barber	1999	W. W. Norton &amp; Company	http://images.amazon.com/images/P/0393045218.01.MZZZZZZZ.jpg

Check NULL values



```
[ ]  L=((books.isnull().sum()).sort_values()).to_dict()
     for  i  in  L:
         print(i,"--->",L[i])
```



```
ISBN ---> 0
Title ---> 0
Year_Of_Publication ---> 0
Image_URL_M ---> 0
Author ---> 1
Publisher ---> 2
```

```
books.info()
```

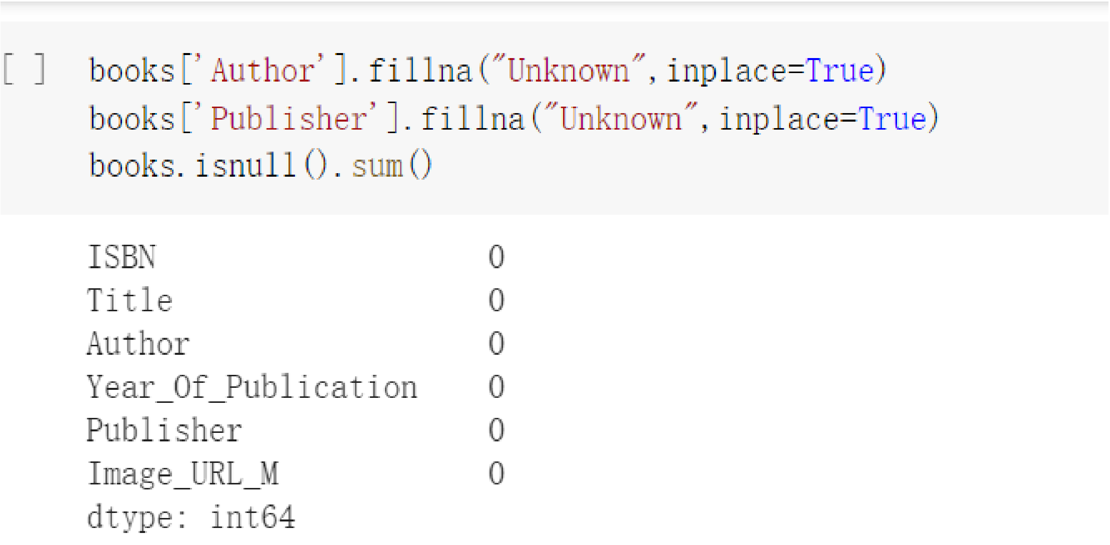
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 271360 entries, 0 to 271359
Data columns (total 6 columns):
 #   Column               Non-Null Count   Dtype
---  ------               --------------   -----
 0   ISBN                 271360 non-null  object
 1   Title                271360 non-null  object
 2   Author               271359 non-null  object
 3   Year_Of_Publication  271360 non-null  object
 4   Publisher            271358 non-null  object
 5   Image_URL_M          271360 non-null  object
dtypes: object(6)
memory usage: 12.4+ MB
```

```
[ ]  duplicateRowsDF = books[books.duplicated()]
     duplicateRowsDF.shape
```

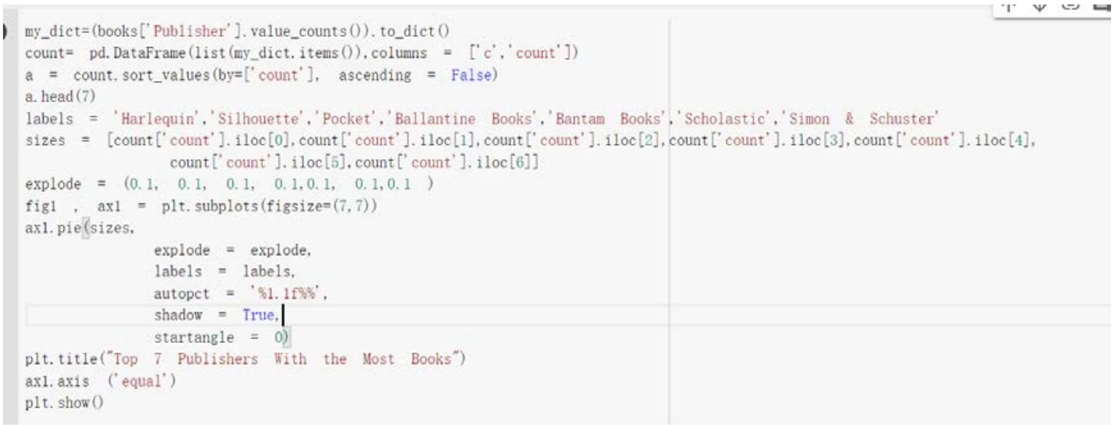
```
(0, 6)
```

```
print("unique isbn: ",len(books["ISBN"].unique()))
print("total rows: ",books.shape[0])
print("unique title: ",len(books["Title"].unique()))
print("total rows: ",books.shape[0])
```

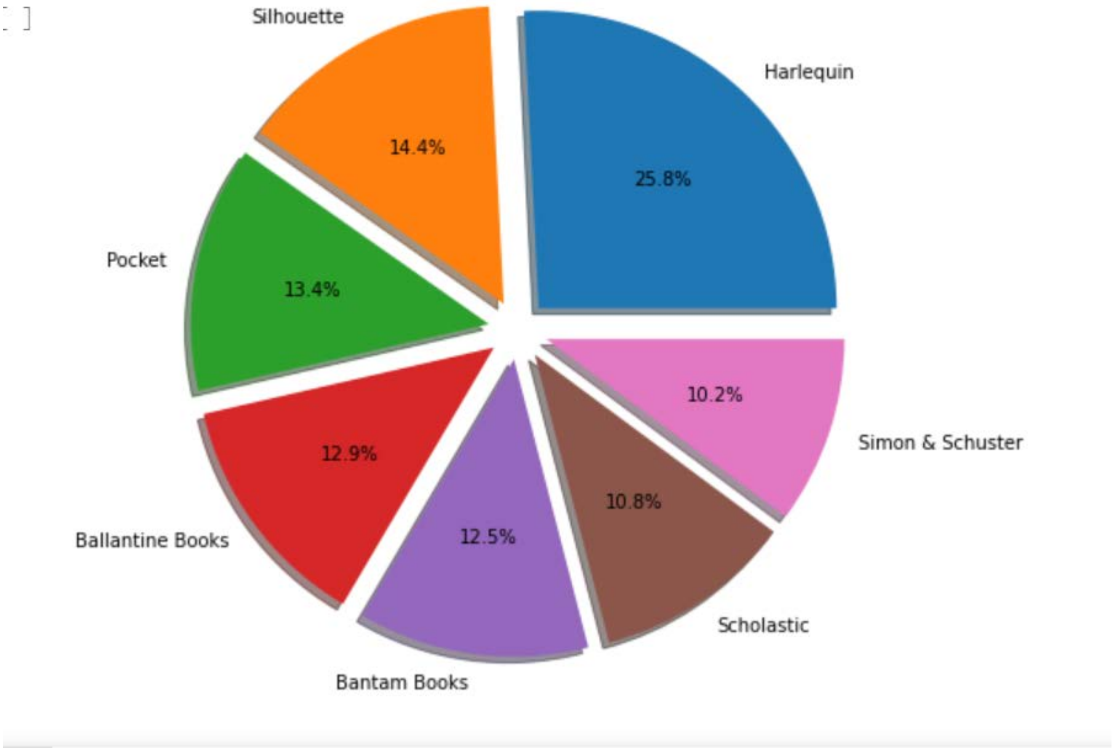
```
unique isbn:  271360
total rows:  271360
unique title:  242135
total rows:  271360
```

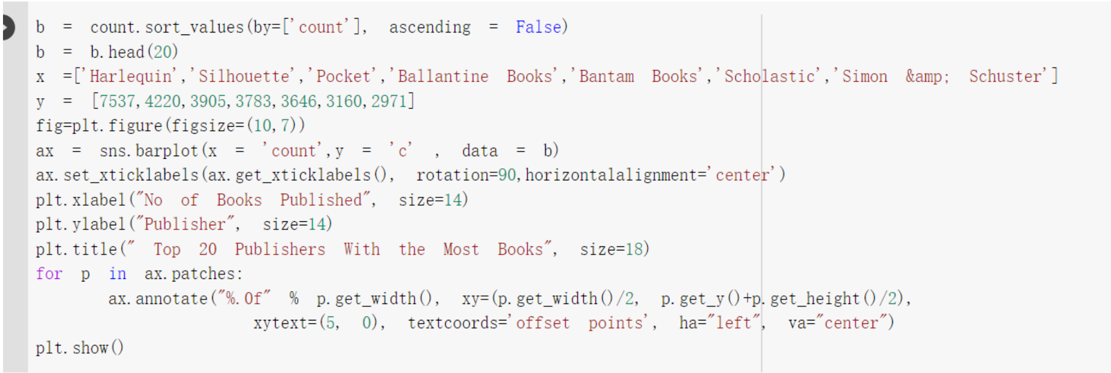


```
[ ]  books['Author'].fillna("Unknown",inplace=True)
     books['Publisher'].fillna("Unknown",inplace=True)
     books.isnull().sum()

     ISBN                   0
     Title                  0
     Author                 0
     Year_Of_Publication    0
     Publisher              0
     Image_URL_M            0
     dtype: int64
```

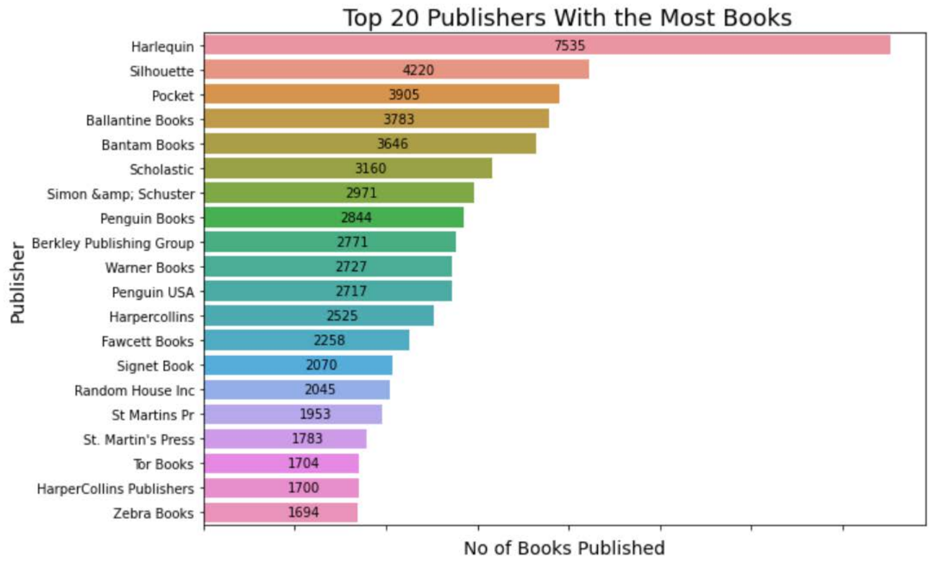


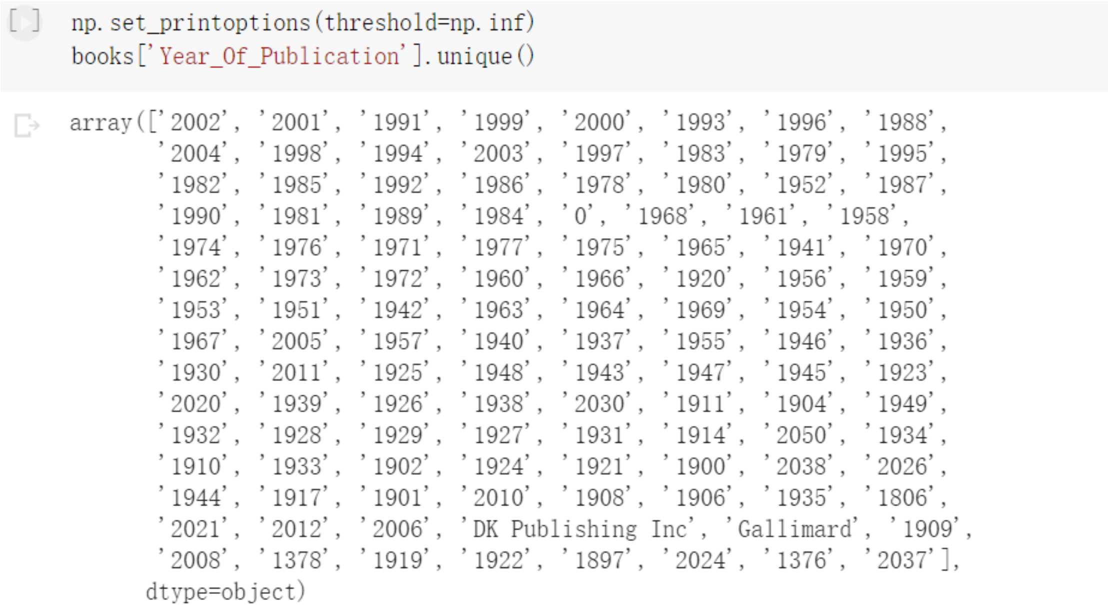
```
my_dict=(books['Publisher'].value_counts()).to_dict()
count= pd.DataFrame(list(my_dict.items()),columns = ['c','count'])
a = count.sort_values(by=['count'], ascending = False)
a.head(7)
labels = 'Harlequin','Silhouette','Pocket','Ballantine Books','Bantam Books','Scholastic','Simon & Schuster'
sizes = [count['count'].iloc[0],count['count'].iloc[1],count['count'].iloc[2],count['count'].iloc[3],count['count'].iloc[4],
                  count['count'].iloc[5],count['count'].iloc[6]]
explode = (0.1, 0.1, 0.1, 0.1,0.1, 0.1,0.1 )
fig1 , ax1 = plt.subplots(figsize=(7,7))
ax1.pie(sizes,
                explode = explode,
                labels = labels,
                autopct = '%1.1f%%',
                shadow = True,
                startangle = 0)
plt.title("Top 7 Publishers With the Most Books")
ax1.axis ('equal')
plt.show()
```





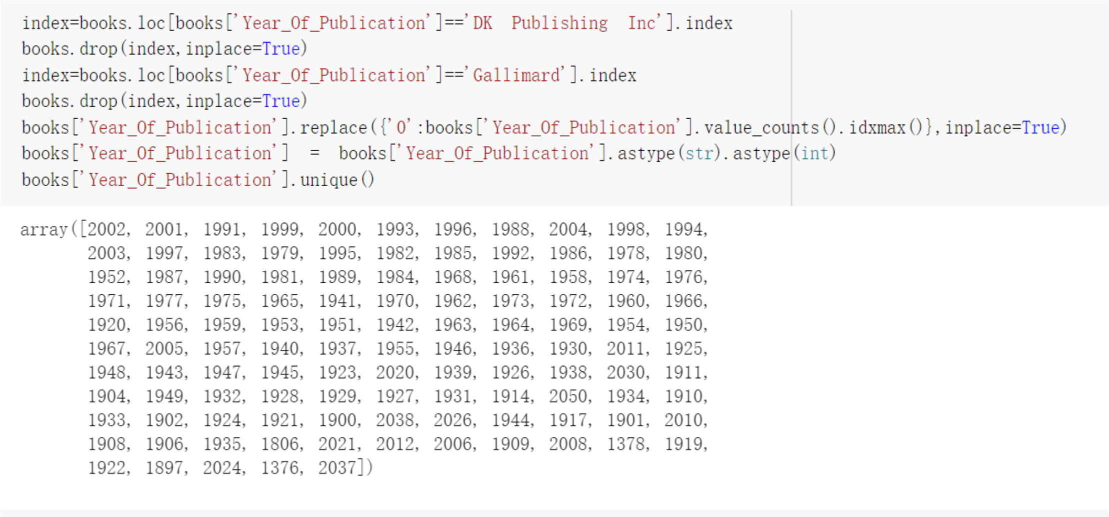
```
b = count.sort_values(by=['count'], ascending = False)
b = b.head(20)
x =['Harlequin','Silhouette','Pocket','Ballantine Books','Bantam Books','Scholastic','Simon &amp; Schuster']
y = [7537,4220,3905,3783,3646,3160,2971]
fig=plt.figure(figsize=(10,7))
ax = sns.barplot(x = 'count',y = 'c' , data = b)
ax.set_xticklabels(ax.get_xticklabels(), rotation=90,horizontalalignment='center')
plt.xlabel("No of Books Published", size=14)
plt.ylabel("Publisher", size=14)
plt.title(" Top 20 Publishers With the Most Books", size=18)
for p in ax.patches:
        ax.annotate("%.0f" % p.get_width(), xy=(p.get_width()/2, p.get_y()+p.get_height()/2),
                    xytext=(5, 0), textcoords='offset points', ha="left", va="center")
plt.show()
```





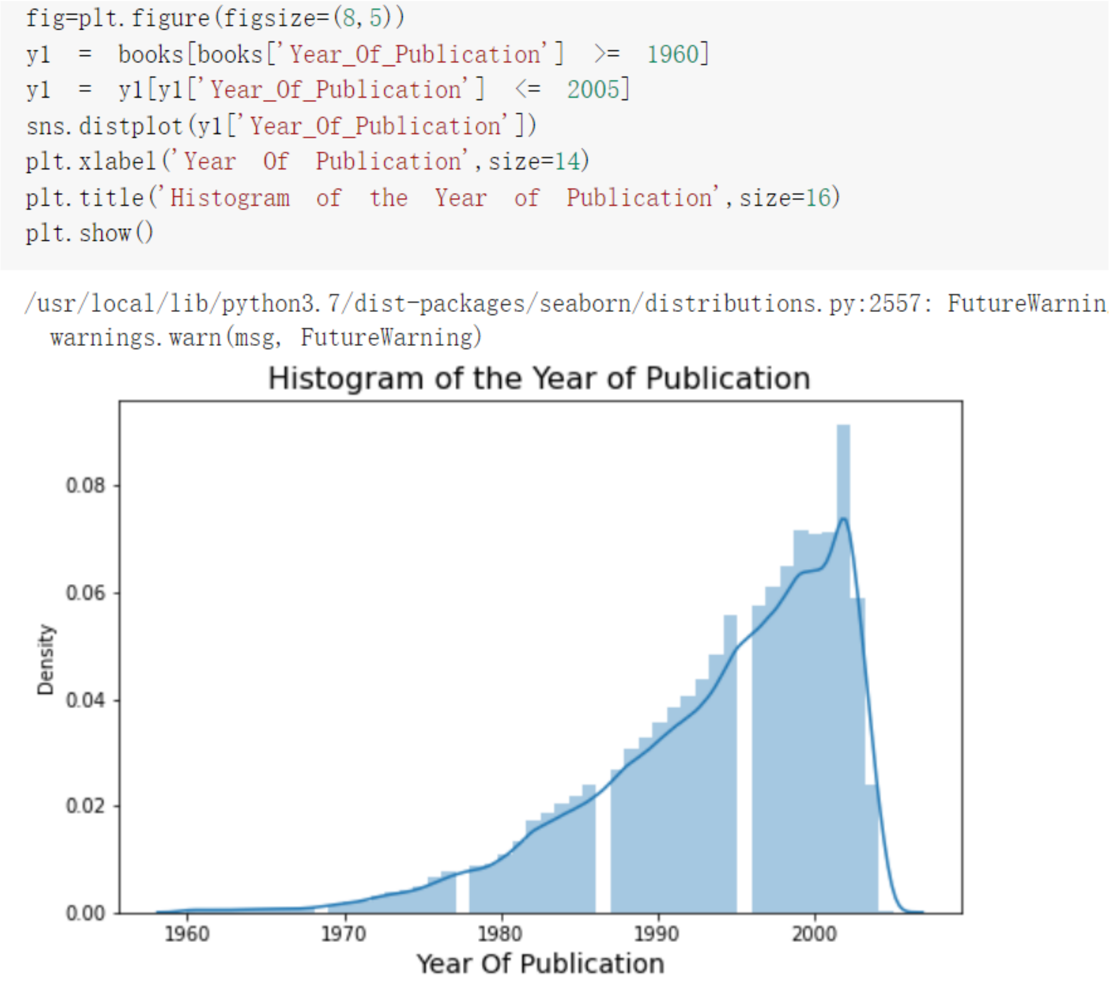
```
np.set_printoptions(threshold=np.inf)
books['Year_Of_Publication'].unique()
```

```
array(['2002', '2001', '1991', '1999', '2000', '1993', '1996', '1988',
       '2004', '1998', '1994', '2003', '1997', '1983', '1979', '1995',
       '1982', '1985', '1992', '1986', '1978', '1980', '1952', '1987',
       '1990', '1981', '1989', '1984', '0', '1968', '1961', '1958',
       '1974', '1976', '1971', '1977', '1975', '1965', '1941', '1970',
       '1962', '1973', '1972', '1960', '1966', '1920', '1956', '1959',
       '1953', '1951', '1942', '1963', '1964', '1969', '1954', '1950',
       '1967', '2005', '1957', '1940', '1937', '1955', '1946', '1936',
       '1930', '2011', '1925', '1948', '1943', '1947', '1945', '1923',
       '2020', '1939', '1926', '1938', '2030', '1911', '1904', '1949',
       '1932', '1928', '1929', '1927', '1931', '1914', '2050', '1934',
       '1910', '1933', '1902', '1924', '1921', '1900', '2038', '2026',
       '1944', '1917', '1901', '2010', '1908', '1906', '1935', '1806',
       '2021', '2012', '2006', 'DK Publishing Inc', 'Gallimard', '1909',
       '2008', '1378', '1919', '1922', '1897', '2024', '1376', '2037'],
      dtype=object)
```



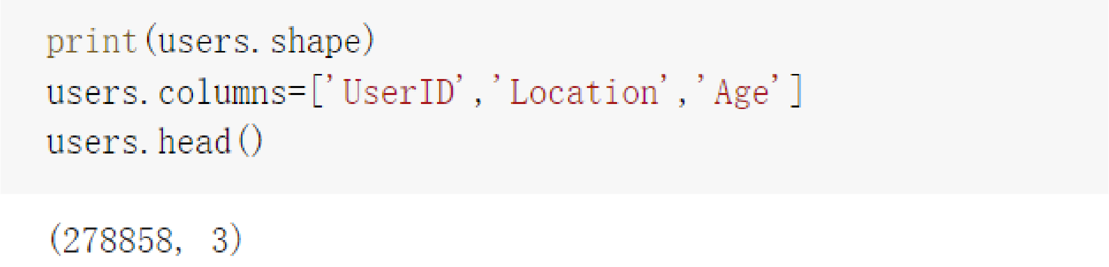
```
index=books.loc[books['Year_Of_Publication']=='DK  Publishing  Inc'].index
books.drop(index,inplace=True)
index=books.loc[books['Year_Of_Publication']=='Gallimard'].index
books.drop(index,inplace=True)
books['Year_Of_Publication'].replace({'0':books['Year_Of_Publication'].value_counts().idxmax()},inplace=True)
books['Year_Of_Publication']  =  books['Year_Of_Publication'].astype(str).astype(int)
books['Year_Of_Publication'].unique()
```

```
array([2002, 2001, 1991, 1999, 2000, 1993, 1996, 1988, 2004, 1998, 1994,
       2003, 1997, 1983, 1979, 1995, 1982, 1985, 1992, 1986, 1978, 1980,
       1952, 1987, 1990, 1981, 1989, 1984, 1968, 1961, 1958, 1974, 1976,
       1971, 1977, 1975, 1965, 1941, 1970, 1962, 1973, 1972, 1960, 1966,
       1920, 1956, 1959, 1953, 1951, 1942, 1963, 1964, 1969, 1954, 1950,
       1967, 2005, 1957, 1940, 1937, 1955, 1946, 1936, 1930, 2011, 1925,
       1948, 1943, 1947, 1945, 1923, 2020, 1939, 1926, 1938, 2030, 1911,
       1904, 1949, 1932, 1928, 1929, 1927, 1931, 1914, 2050, 1934, 1910,
       1933, 1902, 1924, 1921, 1900, 2038, 2026, 1944, 1917, 1901, 2010,
       1908, 1906, 1935, 1806, 2021, 2012, 2006, 1909, 2008, 1378, 1919,
       1922, 1897, 2024, 1376, 2037])
```



```
fig=plt.figure(figsize=(8,5))
y1  =  books[books['Year_Of_Publication']  >=  1960]
y1  =  y1[y1['Year_Of_Publication']  <=  2005]
sns.distplot(y1['Year_Of_Publication'])
plt.xlabel('Year  Of  Publication',size=14)
plt.title('Histogram  of  the  Year  of  Publication',size=16)
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2557: FutureWarnin
  warnings.warn(msg, FutureWarning)
```



```
print(users.shape)
users.columns=['UserID','Location','Age']
users.head()
```

```
(278858, 3)
```

	UserID	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

```
users.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 278858 entries, 0 to 278857
Data columns (total 3 columns):
 #   Column    Non-Null Count   Dtype  
---  ------    --------------   -----  
 0   UserID    278858 non-null  int64  
 1   Location  278858 non-null  object 
 2   Age       168096 non-null  float64
dtypes: float64(1), int64(1), object(1)
memory usage: 6.4+ MB
```

```
L=((users.isnull().sum()).sort_values()).to_dict()
for  i  in  L:
        print(i,"--->",L[i])
```

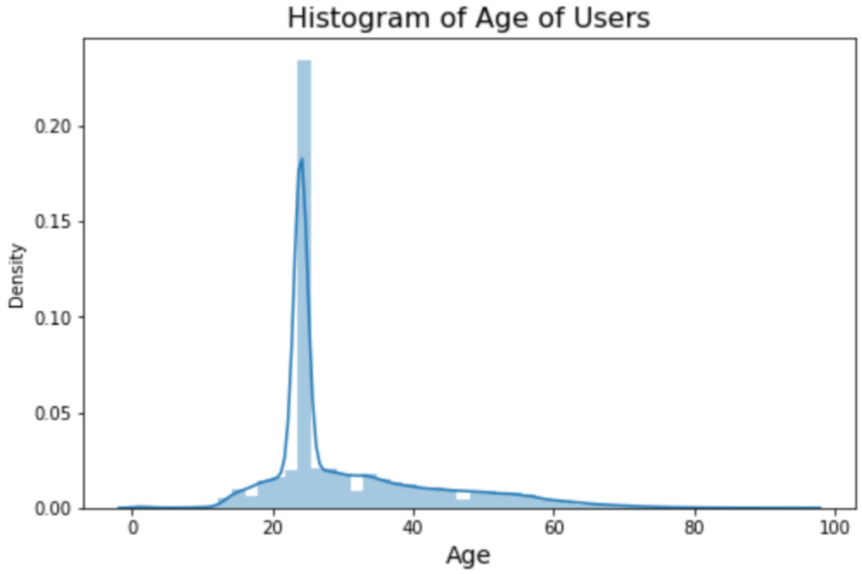
```
UserID ---> 0
Location ---> 0
Age ---> 110762
```

```
users['Age'].fillna(users['Age'].value_counts().idxmax(),inplace=True)
for  i  in  users['Age'][users['Age']>95]:
            users['Age'].replace({i:users['Age'].value_counts().idxmax()},inplace=True)
for  i  in  users['Age'][users['Age']==0]:
            users['Age'].replace({i:users['Age'].value_counts().idxmax()},inplace=True)
users['Age']  =  users['Age'].astype(int)
users['Age'].unique()
```

```
array([24, 18, 17, 61, 26, 14, 25, 19, 46, 55, 32, 20, 34, 23, 51, 31, 21,
       44, 30, 57, 43, 37, 41, 54, 42, 50, 39, 53, 47, 36, 28, 35, 13, 58,
       49, 38, 45, 62, 63, 27, 33, 29, 66, 40, 15, 60, 79, 22, 16, 65, 59,
       48, 72, 56, 67,  1, 80, 52, 69, 71, 73, 78,  9, 64, 12, 74, 75,  3,
       76, 83, 68, 11, 77,  2, 70, 93,  8,  7,  4, 81, 10,  5,  6, 84, 82,
       90, 91, 94, 85, 86, 92, 87, 95, 89, 88])
```

```
fig=plt.figure(figsize=(8,5))
sns.distplot(users['Age'])
plt.xlabel('Age',size=14)
plt.title('Histogram  of  Age  of  Users',size=16)
plt.show()
```

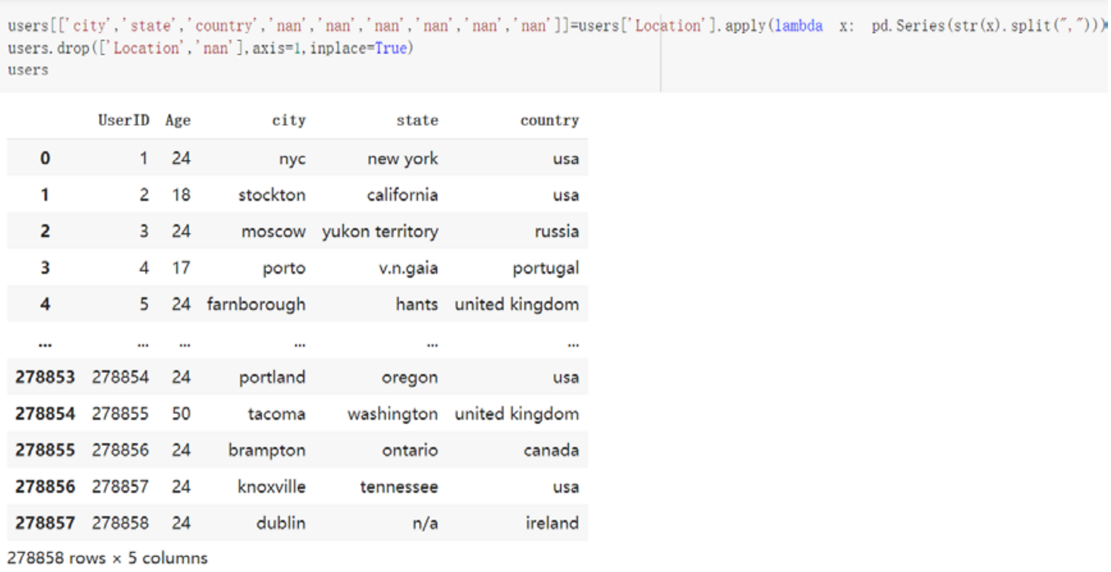
```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2557: FutureWarning: `distp
  warnings.warn(msg, FutureWarning)
```



```
users['Location']
```

```
0                        nyc, new york, usa
1                 stockton, california, usa
2             moscow, yukon territory, russia
3                 porto, v.n.gaia, portugal
4        farnborough, hants, united kingdom
                           ...
```

```
278853                   portland, oregon, usa
278854     tacoma, washington, united kingdom
278855               brampton, ontario, canada
278856               knoxville, tennessee, usa
278857                    dublin, n/a, ireland
Name: Location, Length: 278858, dtype: object
```



```
users[['city','state','country','nan','nan','nan','nan','nan','nan']]=users['Location'].apply(lambda  x:  pd.Series(str(x).split(",")))
users.drop(['Location','nan'],axis=1,inplace=True)
users
```

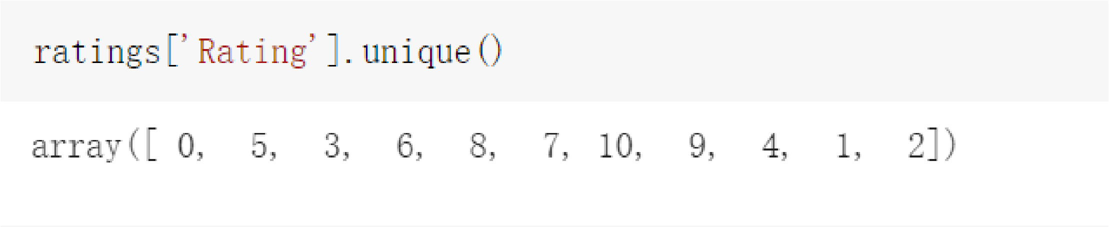
	UserID	Age	city	state	country
0	1	24	nyc	new york	usa
1	2	18	stockton	california	usa
2	3	24	moscow	yukon territory	russia
3	4	17	porto	v.n.gaia	portugal
4	5	24	farnborough	hants	united kingdom
...	...	...	...	...	...
278853	278854	24	portland	oregon	usa
278854	278855	50	tacoma	washington	united kingdom
278855	278856	24	brampton	ontario	canada
278856	278857	24	knoxville	tennessee	usa
278857	278858	24	dublin	n/a	ireland

278858 rows × 5 columns

```
print(ratings.shape)
ratings.columns=['UserID','ISBN','Rating']
ratings.head()
```

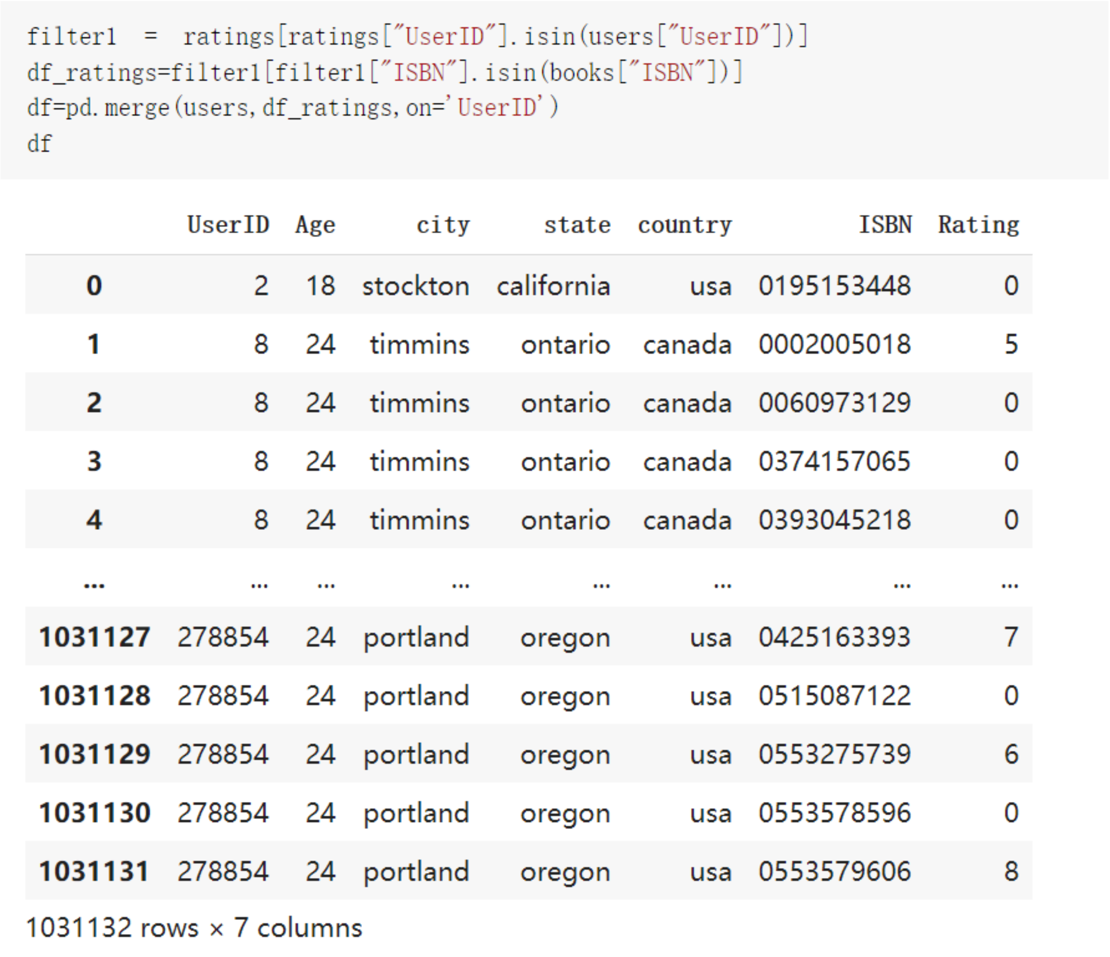
(1149780, 3)

	UserID	ISBN	Rating
0	276725	034545104X	0
1	276726	0155061224	5
2	276727	0446520802	0
3	276729	052165615X	3
4	276729	0521795028	6



```
ratings['Rating'].unique()
```

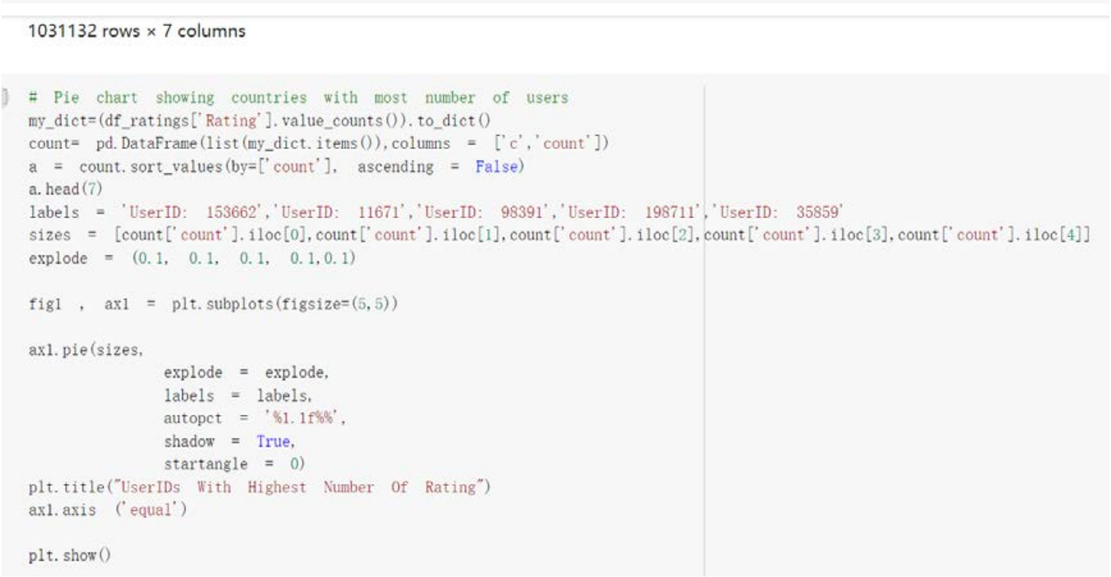
```
array([ 0,  5,  3,  6,  8,  7, 10,  9,  4,  1,  2])
```



```
filter1 = ratings[ratings["UserID"].isin(users["UserID"])]
df_ratings=filter1[filter1["ISBN"].isin(books["ISBN"])]
df=pd.merge(users,df_ratings,on='UserID')
df
```

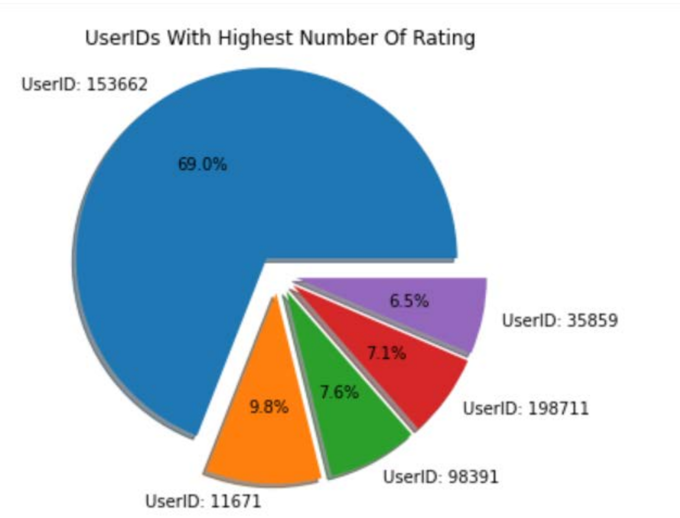
	UserID	Age	city	state	country	ISBN	Rating
0	2	18	stockton	california	usa	0195153448	0
1	8	24	timmins	ontario	canada	0002005018	5
2	8	24	timmins	ontario	canada	0060973129	0
3	8	24	timmins	ontario	canada	0374157065	0
4	8	24	timmins	ontario	canada	0393045218	0
...	...	...	...	...	...	...	...
1031127	278854	24	portland	oregon	usa	0425163393	7
1031128	278854	24	portland	oregon	usa	0515087122	0
1031129	278854	24	portland	oregon	usa	0553275739	6
1031130	278854	24	portland	oregon	usa	0553578596	0
1031131	278854	24	portland	oregon	usa	0553579606	8

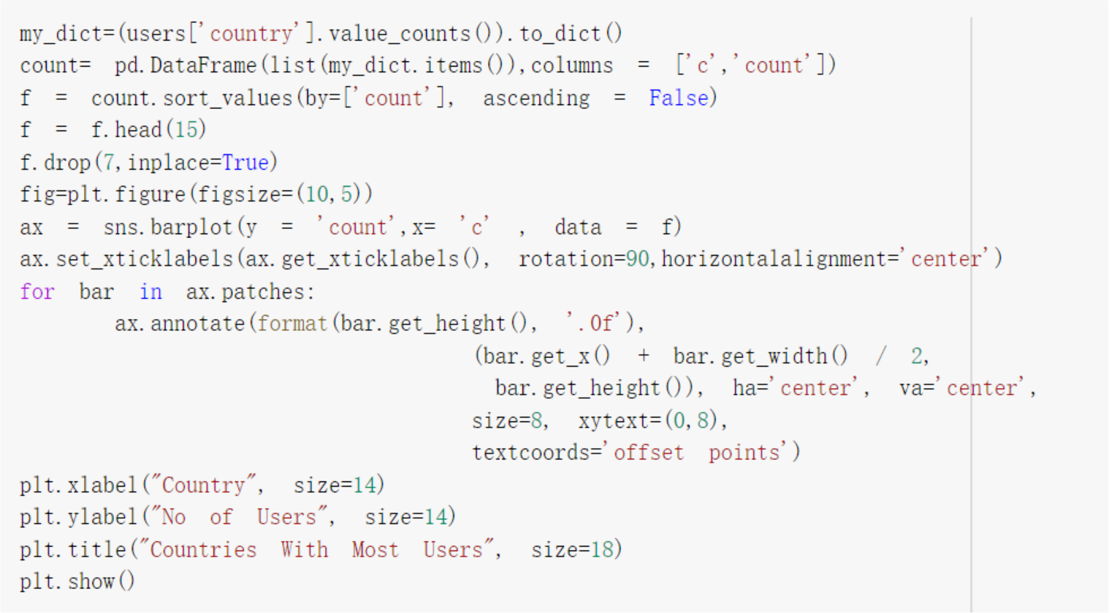
1031132 rows × 7 columns



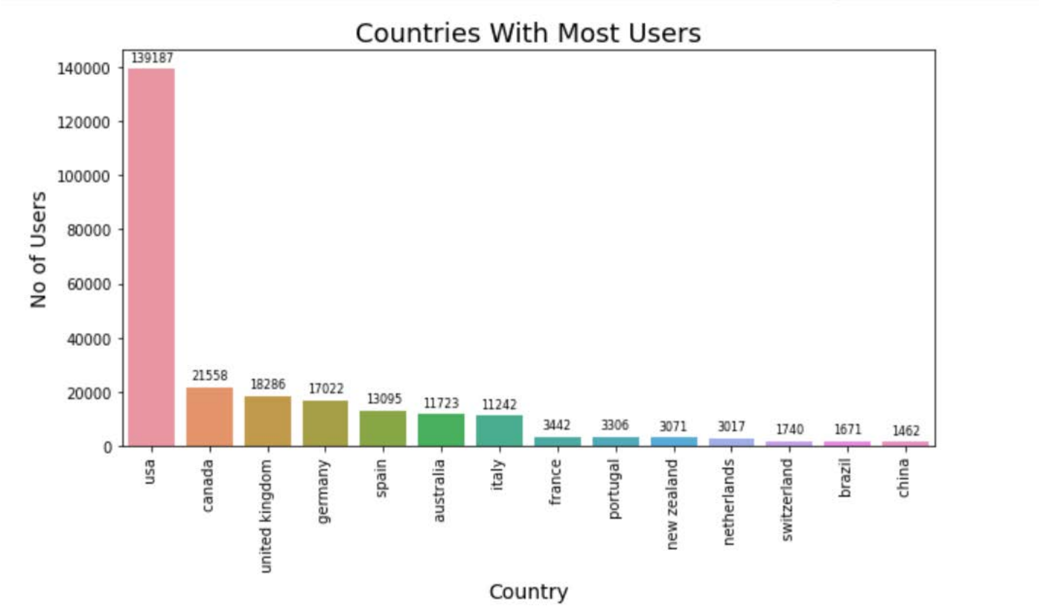
1031132 rows × 7 columns

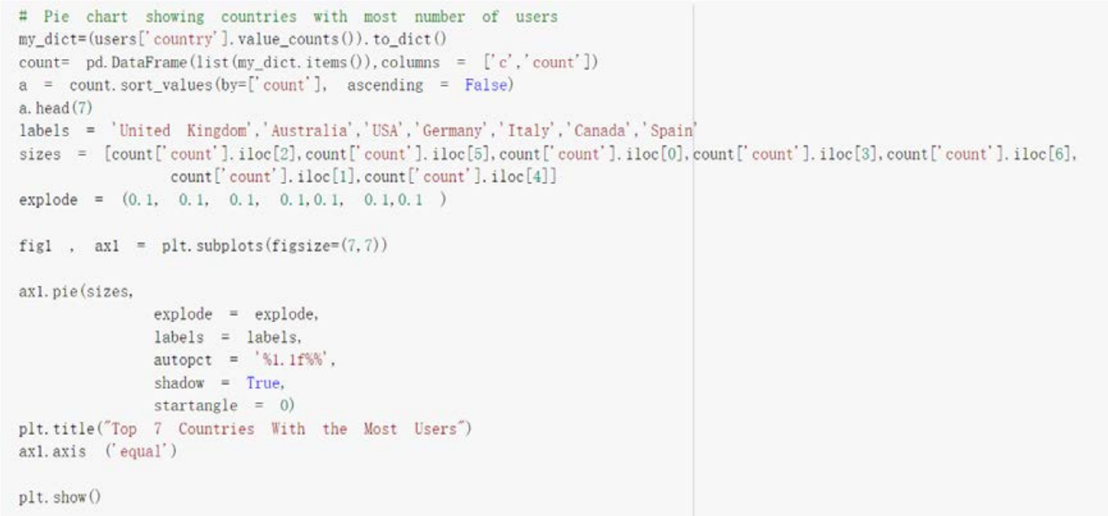
```
# Pie chart showing countries with most number of users
my_dict=(df_ratings['Rating'].value_counts()).to_dict()
count= pd.DataFrame(list(my_dict.items()),columns = ['c','count'])
a = count.sort_values(by=['count'], ascending = False)
a.head(7)
labels = 'UserID: 153662','UserID: 11671','UserID: 98391','UserID: 198711','UserID: 35859'
sizes = [count['count'].iloc[0],count['count'].iloc[1],count['count'].iloc[2],count['count'].iloc[3],count['count'].iloc[4]]
explode = (0.1, 0.1, 0.1, 0.1,0.1)

fig1 , ax1 = plt.subplots(figsize=(5,5))

ax1.pie(sizes,
            explode = explode,
            labels = labels,
            autopct = '%1.1f%%',
            shadow = True,
            startangle = 0)
plt.title("UserIDs With Highest Number Of Rating")
ax1.axis ('equal')

plt.show()
```



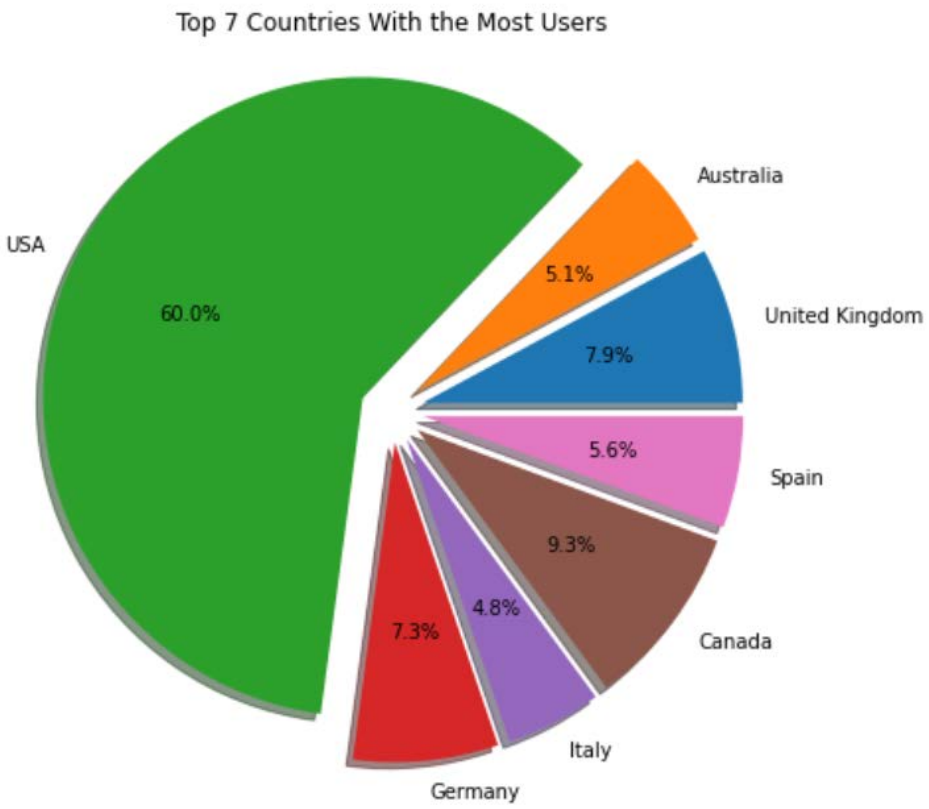


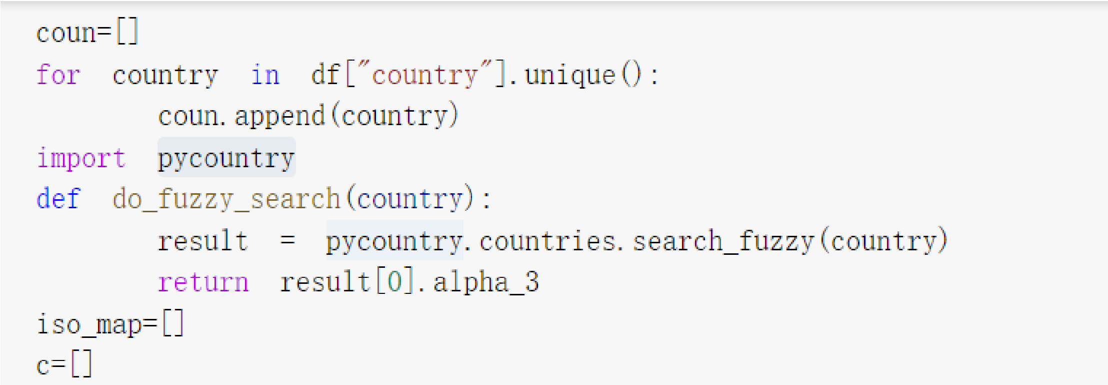
```
my_dict=(users['country'].value_counts()).to_dict()
count= pd.DataFrame(list(my_dict.items()),columns = ['c','count'])
f = count.sort_values(by=['count'], ascending = False)
f = f.head(15)
f.drop(7,inplace=True)
fig=plt.figure(figsize=(10,5))
ax = sns.barplot(y = 'count',x= 'c' , data = f)
ax.set_xticklabels(ax.get_xticklabels(), rotation=90,horizontalalignment='center')
for bar in ax.patches:
        ax.annotate(format(bar.get_height(), '.0f'),
                                              (bar.get_x() + bar.get_width() / 2,
                                                bar.get_height()), ha='center', va='center',
                                              size=8, xytext=(0,8),
                                              textcoords='offset points')
plt.xlabel("Country", size=14)
plt.ylabel("No of Users", size=14)
plt.title("Countries With Most Users", size=18)
plt.show()
```





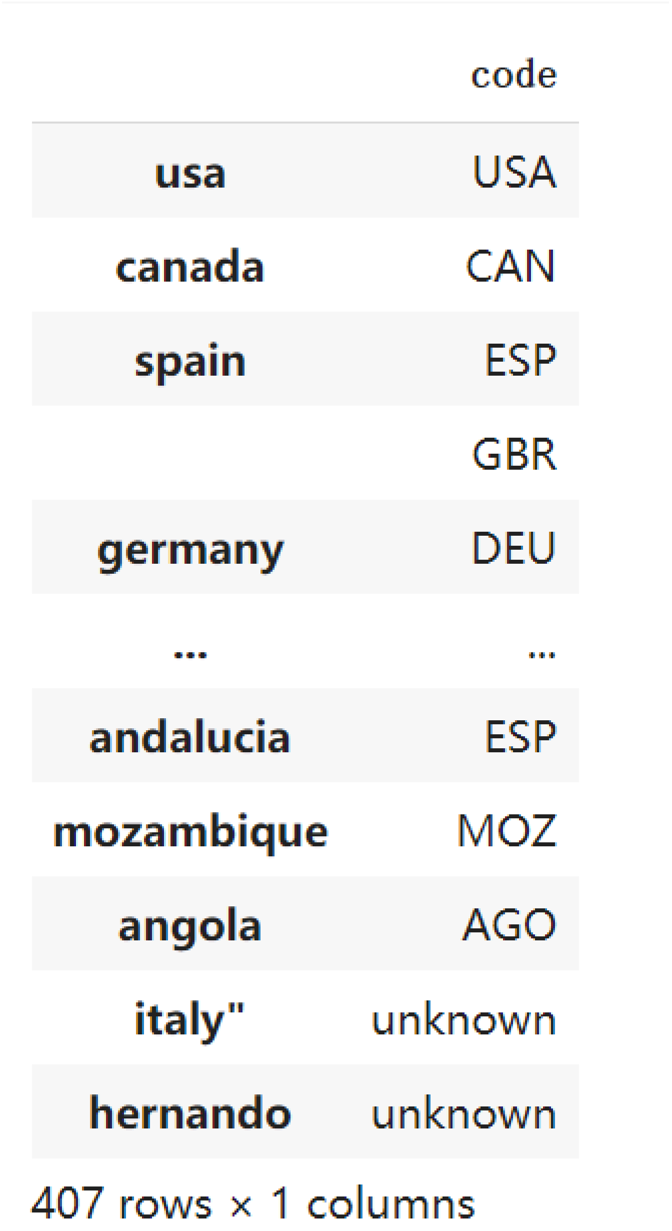
```
# Pie chart showing countries with most number of users
my_dict=(users['country'].value_counts()).to_dict()
count= pd.DataFrame(list(my_dict.items()),columns = ['c','count'])
a = count.sort_values(by=['count'], ascending = False)
a.head(7)
labels = 'United Kingdom','Australia','USA','Germany','Italy','Canada','Spain'
sizes = [count['count'].iloc[2],count['count'].iloc[5],count['count'].iloc[0],count['count'].iloc[3],count['count'].iloc[6],
                  count['count'].iloc[1],count['count'].iloc[4]]
explode = (0.1, 0.1, 0.1, 0.1,0.1, 0.1,0.1 )

fig1 , ax1 = plt.subplots(figsize=(7,7))

ax1.pie(sizes,
                explode = explode,
                labels = labels,
                autopct = '%1.1f%%',
                shadow = True,
                startangle = 0)
plt.title("Top 7 Countries With the Most Users")
ax1.axis ('equal')

plt.show()
```





```
coun=[]
for country in df["country"].unique():
        coun.append(country)
import pycountry
def do_fuzzy_search(country):
        result = pycountry.countries.search_fuzzy(country)
        return result[0].alpha_3
iso_map=[]
c=[]
```

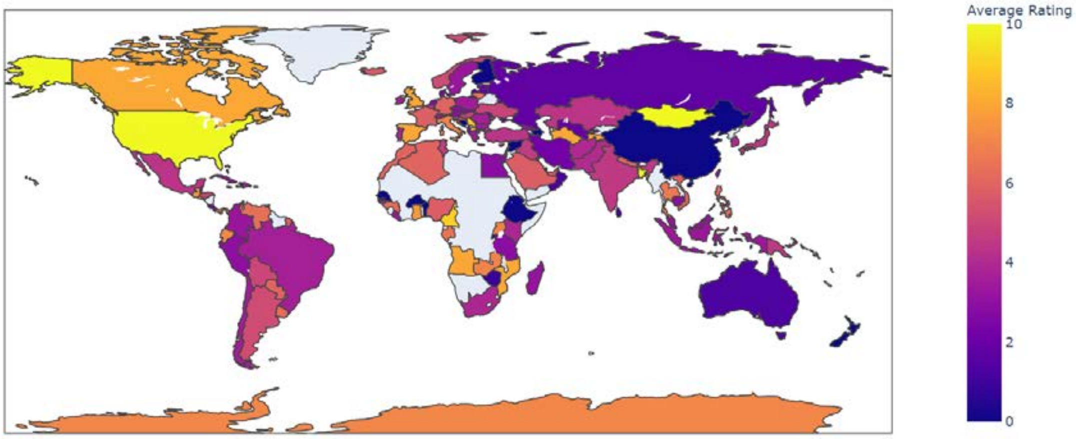
```
for  i  in  coun:
        try:
                iso_map.append(do_fuzzy_search(i))
                c.append(i)
        except:
                iso_map.append(’unknown’)
                c.append(i)
                continue
df1=pd.DataFrame(iso_map,c,columns=[’code’])
df1
```



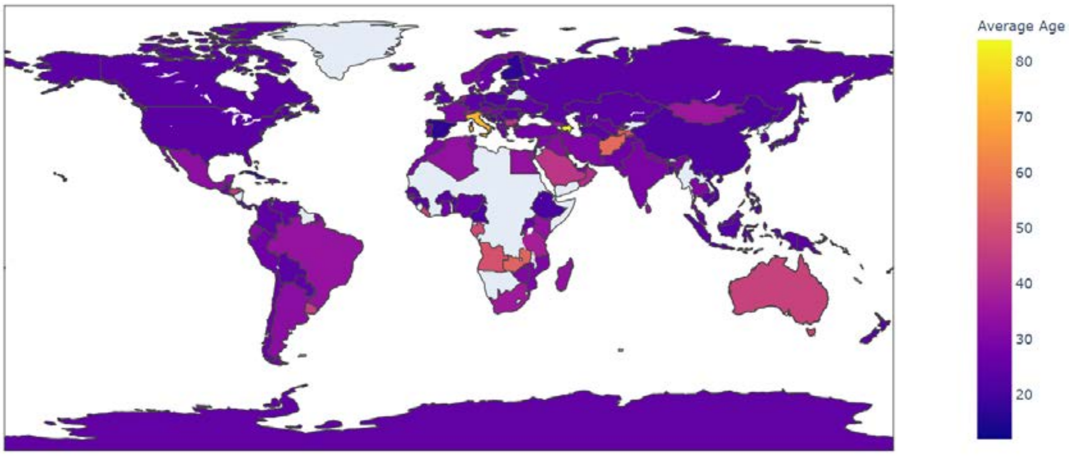
```
                 code
usa               USA
canada            CAN
spain             ESP
                  GBR
germany           DEU
...               ...
andalucia         ESP
mozambique        MOZ
angola            AGO
italy"        unknown
hernando      unknown

407 rows × 1 columns
```

```
l=list(df1.index)
country_code=[]
for  i  in  df[’country’]:
        if  i  in  l:
                country_code.append(df1[’code’].loc[df1.index==i][0])
df[’Country_Code’]  =  np.array(country_code)
```

```
import  pycountry
grouped  =  df.groupby([’Country_Code’,’country’])
avg=pd.DataFrame(grouped[’Rating’].agg(np.mean))
avg.reset_index(inplace=True)
avg.columns=[’Country  Code’,’Country’,’Average  Rating’]
import  plotly.express  as  px
fig  =  px.choropleth(avg,  locations=avg[’Country  Code’],color=avg[’Average  Rating’],hover_name=avg[’Country’],
                    color_continuous_scale=px.colors.sequential.Plasma)
fig.show()
```



```
import  pycountry
grouped  =  df.groupby([’Country_Code’,’country’])
avg=pd.DataFrame(grouped[’Age’].agg(np.mean))
avg.reset_index(inplace=True)
avg.columns=[’Country  Code’,’Country’,’Average  Age’]
import  plotly.express  as  px
fig  =  px.choropleth(avg,  locations=avg[’Country  Code’],color=avg[’Average  Age’],hover_name=avg[’Country’],
                    color_continuous_scale=px.colors.sequential.Plasma)
fig.show()
```



Popularity Based Recommendation

```
[ ]  a=df[df['Rating']>0]
     grouped = a.groupby('ISBN')
     popular_books = pd.DataFrame(grouped['Rating'].agg([np.size, np.mean]))
     most_popular = popular_books.sort_values(['mean'], ascending=False)
     pop=most_popular[most_popular['size']>200]
     pop_title=list(pop[:10].index)
     titles=[]
     for i in pop_title:
             titles.append(books['Title'].loc[books['ISBN']==i].values[0])
     index=1
     for i in titles:
             print(index,'.  ',i)
             index+=1
```

```
1 .  Harry Potter and the Order of the Phoenix (Book 5)
2 .  To Kill a Mockingbird
3 .  Harry Potter and the Sorcerer's Stone (Harry Potter (Paperback))
4 .  The Secret Life of Bees
5 .  The Da Vinci Code
6 .  The Lovely Bones: A Novel
7 .  The Red Tent (Bestselling Backlist)
8 .  The Poisonwood Bible: A Novel
9 .  Where the Heart Is (Oprah's Book Club (Paperback))
10 .  Angels &amp; Demons
```

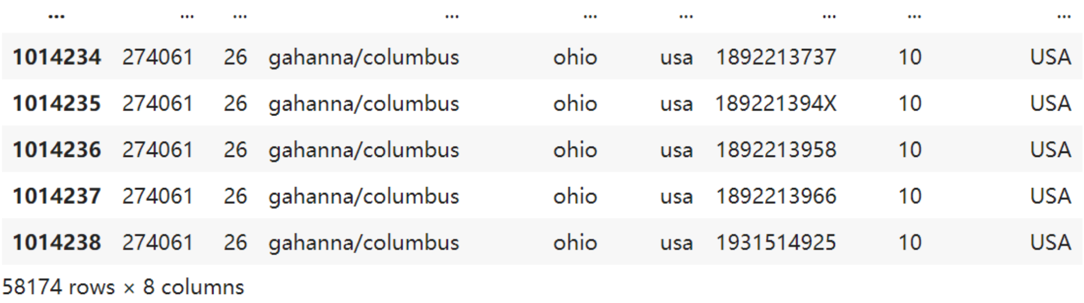
Collabrative Filtering Based Recommendation

```
[ ]
```

```
[ ]  df=df[df['Rating']>0]
```

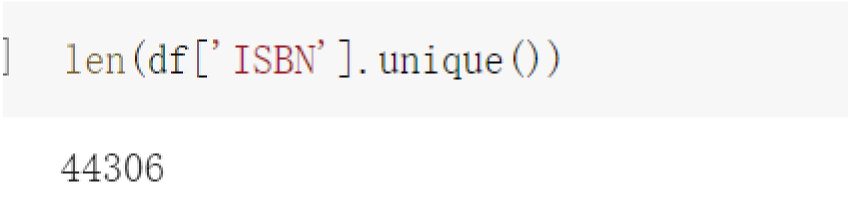
```
[ ]  counts1 = df['UserID'].value_counts()
     df= df[df['UserID'].isin(counts1[counts1 > 200].index)]
     df
```

	UserID	Age	city	state	country	ISBN	Rating	Country_Code
10196	4385	33	albq	new mexico	usa	0061083402	10	USA
10198	4385	33	albq	new mexico	usa	0061093343	9	USA
10199	4385	33	albq	new mexico	usa	0061096156	10	USA
10201	4385	33	albq	new mexico	usa	0312956762	10	USA
10202	4385	33	albq	new mexico	usa	0312980353	10	USA



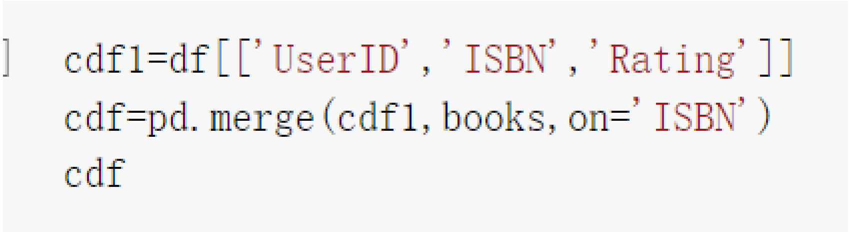
...	...	...	...	...	...	...	...	...
1014234	274061	26	gahanna/columbus	ohio	usa	1892213737	10	USA
1014235	274061	26	gahanna/columbus	ohio	usa	189221394X	10	USA
1014236	274061	26	gahanna/columbus	ohio	usa	1892213958	10	USA
1014237	274061	26	gahanna/columbus	ohio	usa	1892213966	10	USA
1014238	274061	26	gahanna/columbus	ohio	usa	1931514925	10	USA

58174 rows × 8 columns

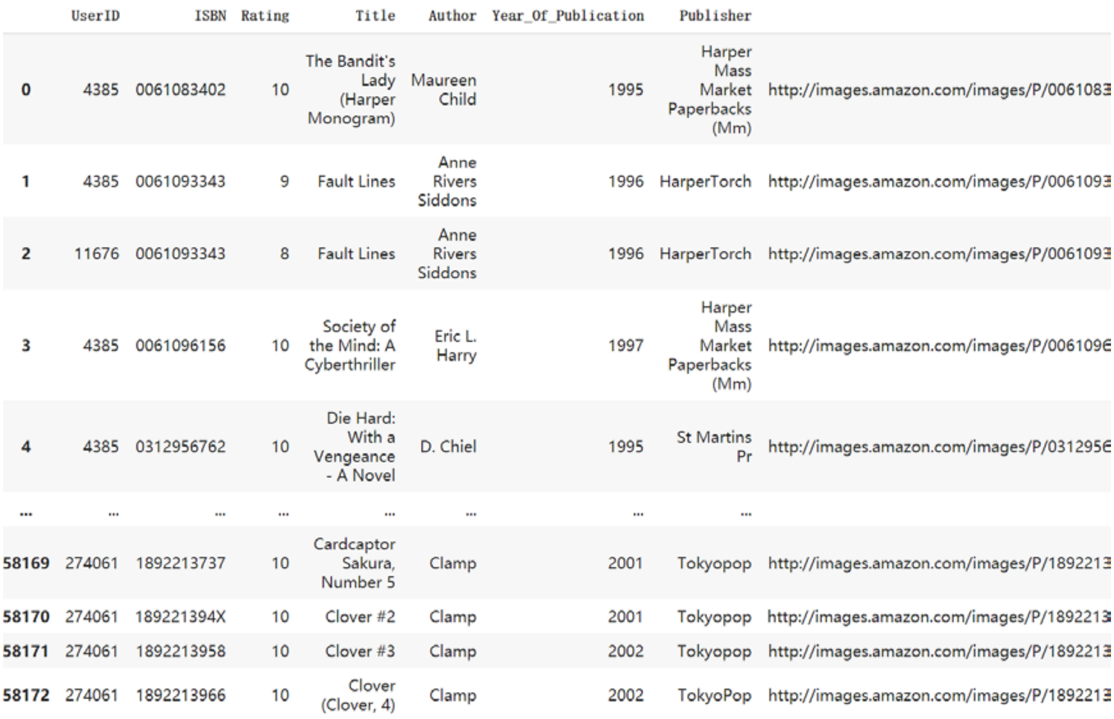


```
] len(df[’ISBN’].unique())
```

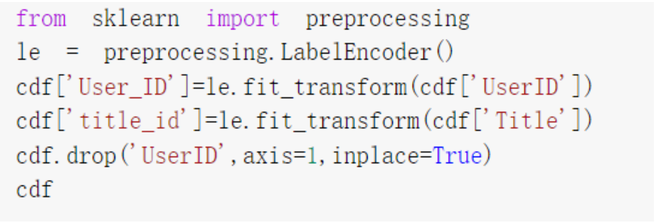
```
44306
```



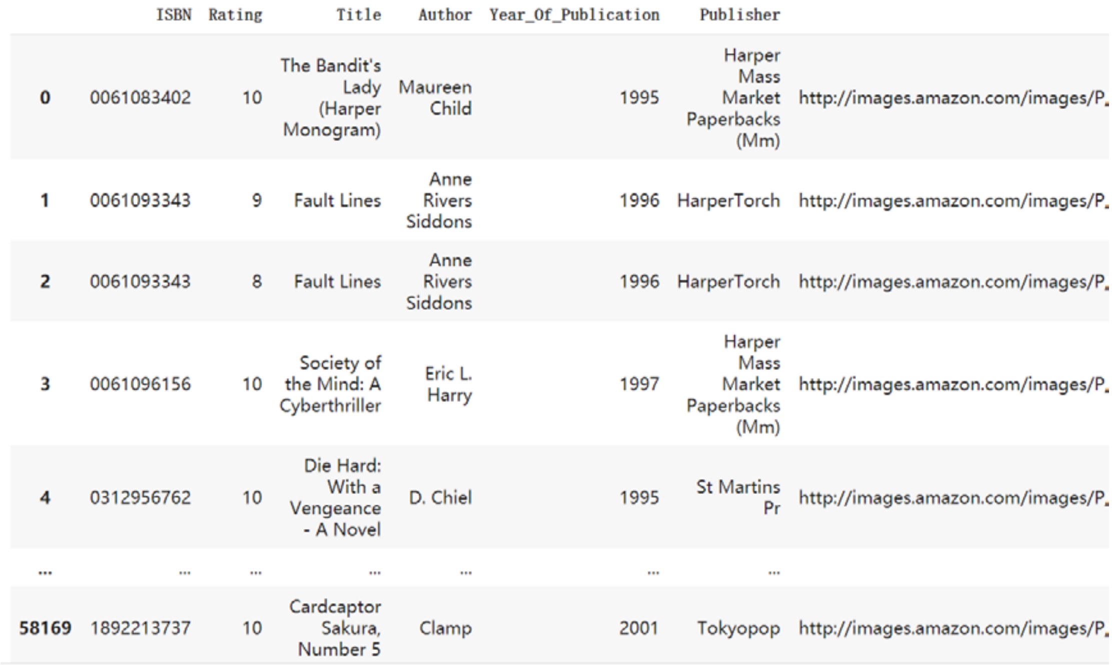
```
] cdf1=df[[’UserID’,’ISBN’,’Rating’]]
  cdf=pd.merge(cdf1,books,on=’ISBN’)
  cdf
```



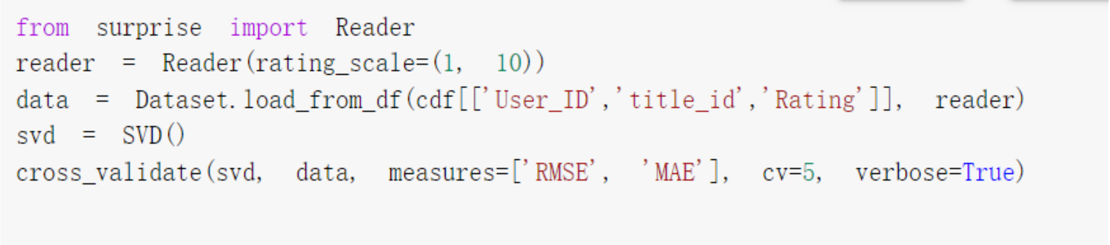
	UserID	ISBN	Rating	Title	Author	Year_Of_Publication	Publisher	
0	4385	0061083402	10	The Bandit's Lady (Harper Monogram)	Maureen Child	1995	Harper Mass Market Paperbacks (Mm)	http://images.amazon.com/images/P/0061083
1	4385	0061093343	9	Fault Lines	Anne Rivers Siddons	1996	HarperTorch	http://images.amazon.com/images/P/0061093
2	11676	0061093343	8	Fault Lines	Anne Rivers Siddons	1996	HarperTorch	http://images.amazon.com/images/P/0061093
3	4385	0061096156	10	Society of the Mind: A Cyberthriller	Eric L. Harry	1997	Harper Mass Market Paperbacks (Mm)	http://images.amazon.com/images/P/0061096
4	4385	0312956762	10	Die Hard: With a Vengeance - A Novel	D. Chiel	1995	St Martins Pr	http://images.amazon.com/images/P/0312956
...	...	...	...	...	...	...	...	
58169	274061	1892213737	10	Cardcaptor Sakura, Number 5	Clamp	2001	Tokyopop	http://images.amazon.com/images/P/1892213
58170	274061	189221394X	10	Clover #2	Clamp	2001	Tokyopop	http://images.amazon.com/images/P/1892213
58171	274061	1892213958	10	Clover #3	Clamp	2002	Tokyopop	http://images.amazon.com/images/P/1892213
58172	274061	1892213966	10	Clover (Clover, 4)	Clamp	2002	TokyoPop	http://images.amazon.com/images/P/1892213



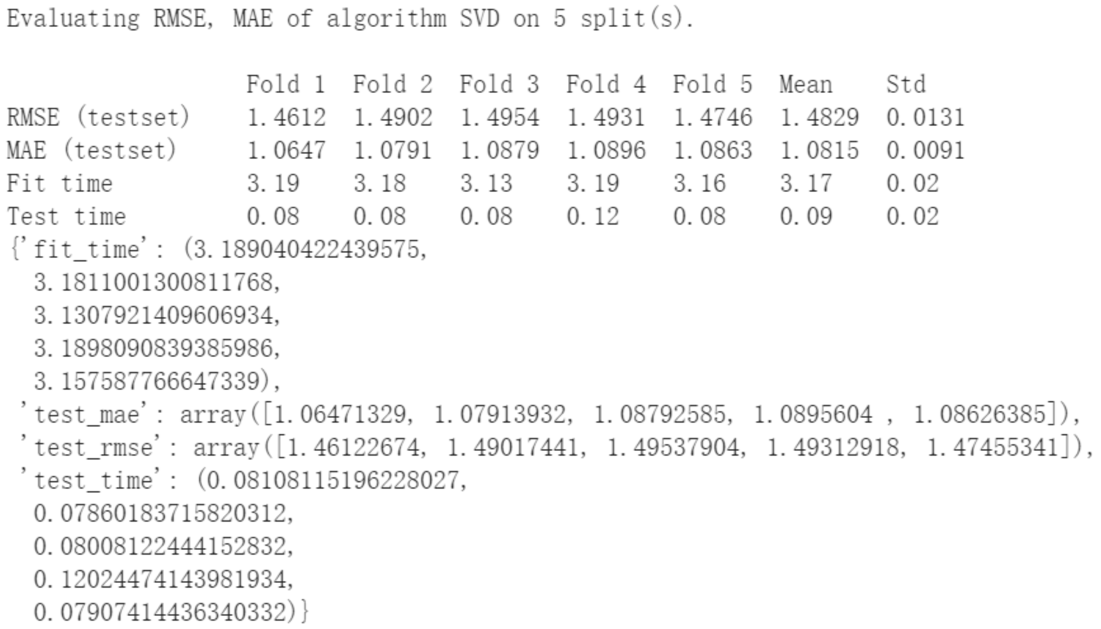
```
from sklearn import preprocessing
le = preprocessing.LabelEncoder()
cdf[’User_ID’]=le.fit_transform(cdf[’UserID’])
cdf[’title_id’]=le.fit_transform(cdf[’Title’])
cdf.drop(’UserID’,axis=1,inplace=True)
cdf
```



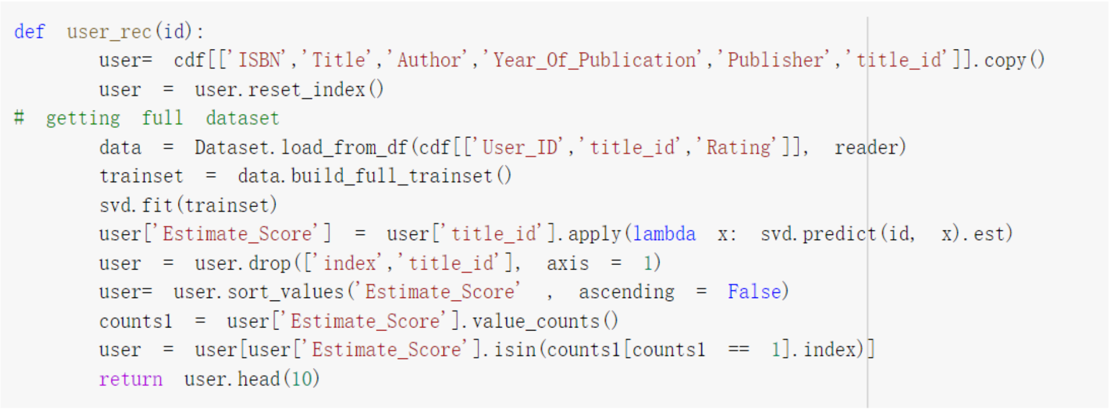
	ISBN	Rating	Title	Author	Year_Of_Publication	Publisher	
0	0061083402	10	The Bandit's Lady (Harper Monogram)	Maureen Child	1995	Harper Mass Market Paperbacks (Mm)	http://images.amazon.com/images/P
1	0061093343	9	Fault Lines	Anne Rivers Siddons	1996	HarperTorch	http://images.amazon.com/images/P
2	0061093343	8	Fault Lines	Anne Rivers Siddons	1996	HarperTorch	http://images.amazon.com/images/P
3	0061096156	10	Society of the Mind: A Cyberthriller	Eric L. Harry	1997	Harper Mass Market Paperbacks (Mm)	http://images.amazon.com/images/P
4	0312956762	10	Die Hard: With a Vengeance - A Novel	D. Chiel	1995	St Martins Pr	http://images.amazon.com/images/P
...	...	...	...	...	...	...	
58169	1892213737	10	Cardcaptor Sakura, Number 5	Clamp	2001	Tokyopop	http://images.amazon.com/images/P



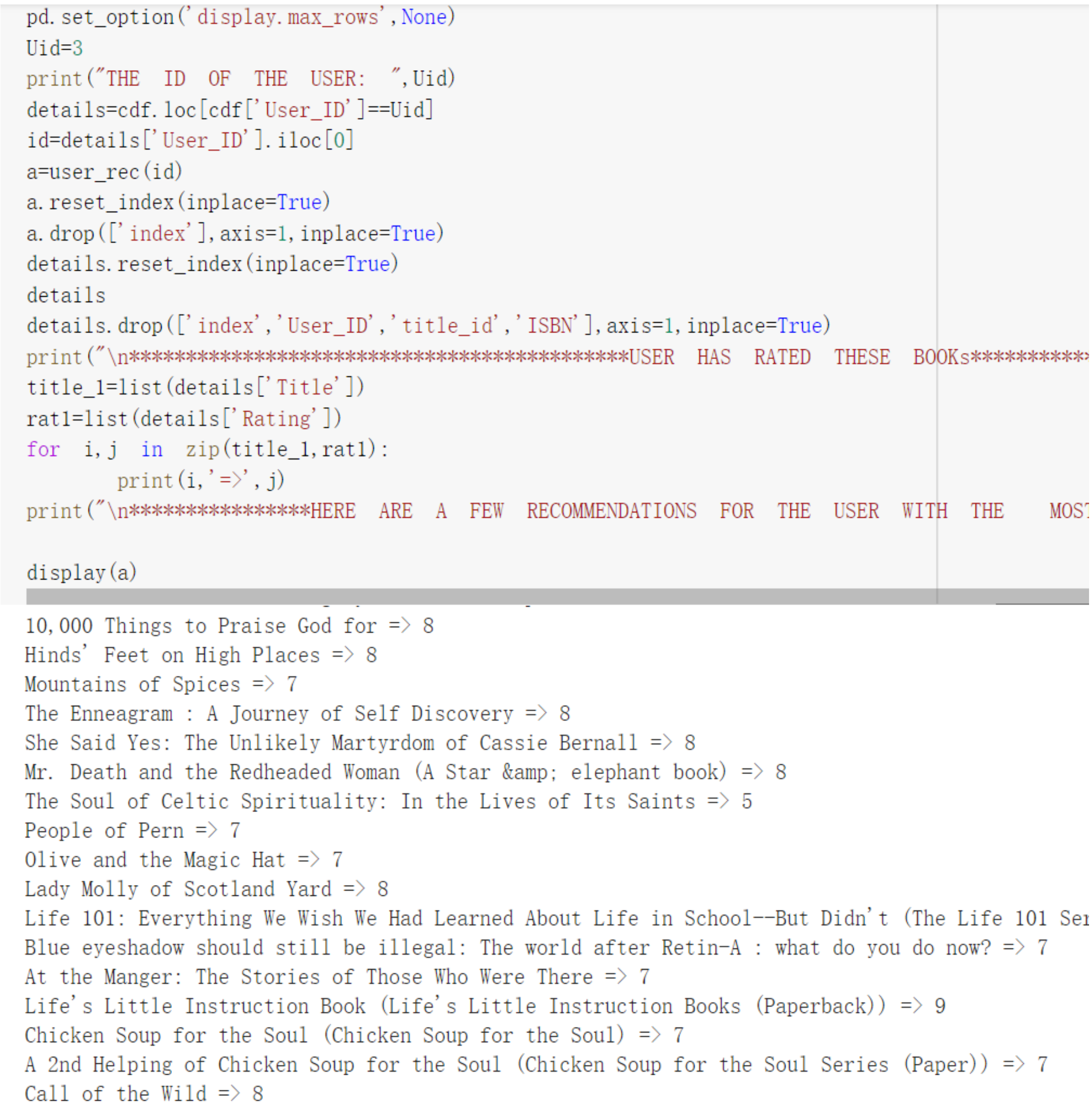
```
from surprise import Reader
reader = Reader(rating_scale=(1, 10))
data = Dataset.load_from_df(cdf[['User_ID','title_id','Rating']], reader)
svd = SVD()
cross_validate(svd, data, measures=['RMSE', 'MAE'], cv=5, verbose=True)
```



```
Evaluating RMSE, MAE of algorithm SVD on 5 split(s).

                  Fold 1  Fold 2  Fold 3  Fold 4  Fold 5  Mean    Std
RMSE (testset)    1.4612  1.4902  1.4954  1.4931  1.4746  1.4829  0.0131
MAE (testset)     1.0647  1.0791  1.0879  1.0896  1.0863  1.0815  0.0091
Fit time          3.19    3.18    3.13    3.19    3.16    3.17    0.02
Test time         0.08    0.08    0.08    0.12    0.08    0.09    0.02
{'fit_time': (3.189040422439575,
  3.1811001300811768,
  3.1307921409606934,
  3.1898090839385986,
  3.157587766647339),
 'test_mae': array([1.06471329, 1.07913932, 1.08792585, 1.0895604 , 1.08626385]),
 'test_rmse': array([1.46122674, 1.49017441, 1.49537904, 1.49312918, 1.47455341]),
 'test_time': (0.08108115196228027,
  0.07860183715820312,
  0.08008122444152832,
  0.12024474143981934,
  0.07907414436340332)}
```

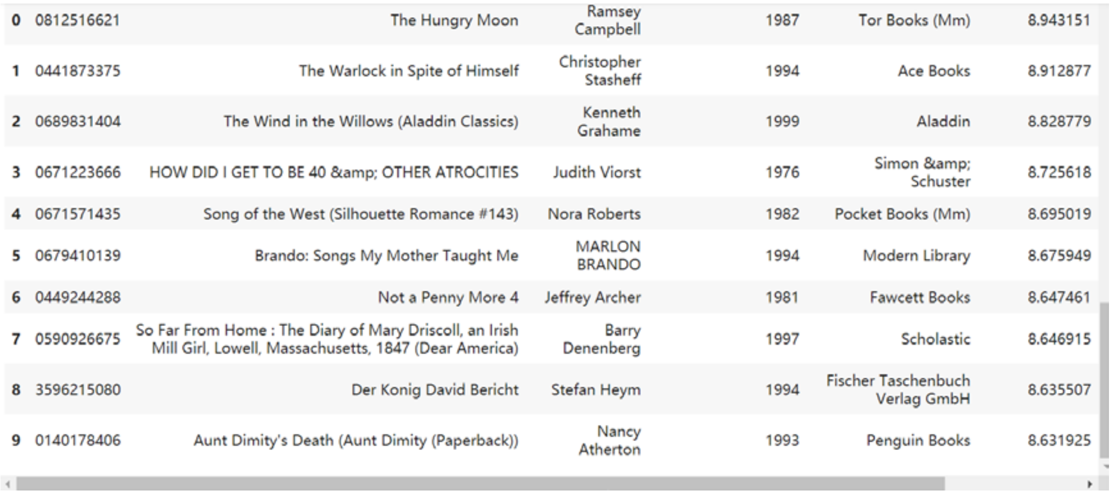


```
def  user_rec(id):
        user= cdf[['ISBN','Title','Author','Year_Of_Publication','Publisher','title_id']].copy()
        user  =  user.reset_index()
#  getting  full  dataset
        data  =  Dataset.load_from_df(cdf[['User_ID','title_id','Rating']],  reader)
        trainset  =  data.build_full_trainset()
        svd.fit(trainset)
        user['Estimate_Score']  =  user['title_id'].apply(lambda  x:  svd.predict(id,  x).est)
        user  =  user.drop(['index','title_id'],  axis  =  1)
        user= user.sort_values('Estimate_Score'  ,  ascending  =  False)
        counts1  =  user['Estimate_Score'].value_counts()
        user  =  user[user['Estimate_Score'].isin(counts1[counts1  ==  1].index)]
        return  user.head(10)
```



```
pd.set_option('display.max_rows',None)
Uid=3
print("THE  ID  OF  THE  USER:  ",Uid)
details=cdf.loc[cdf['User_ID']==Uid]
id=details['User_ID'].iloc[0]
a=user_rec(id)
a.reset_index(inplace=True)
a.drop(['index'],axis=1,inplace=True)
details.reset_index(inplace=True)
details
details.drop(['index','User_ID','title_id','ISBN'],axis=1,inplace=True)
print("\n********************************************USER  HAS  RATED  THESE  BOOKs**********
title_1=list(details['Title'])
rat1=list(details['Rating'])
for  i,j  in  zip(title_1,rat1):
        print(i,'=>',j)
print("\n****************HERE  ARE  A  FEW  RECOMMENDATIONS  FOR  THE  USER  WITH  THE   MOS

display(a)
```

```
10,000 Things to Praise God for => 8
Hinds' Feet on High Places => 8
Mountains of Spices => 7
The Enneagram : A Journey of Self Discovery => 8
She Said Yes: The Unlikely Martyrdom of Cassie Bernall => 8
Mr. Death and the Redheaded Woman (A Star &amp; elephant book) => 8
The Soul of Celtic Spirituality: In the Lives of Its Saints => 5
People of Pern => 7
Olive and the Magic Hat => 7
Lady Molly of Scotland Yard => 8
Life 101: Everything We Wish We Had Learned About Life in School--But Didn't (The Life 101 Se
Blue eyeshadow should still be illegal: The world after Retin-A : what do you do now? => 7
At the Manger: The Stories of Those Who Were There => 7
Life's Little Instruction Book (Life's Little Instruction Books (Paperback)) => 9
Chicken Soup for the Soul (Chicken Soup for the Soul) => 7
A 2nd Helping of Chicken Soup for the Soul (Chicken Soup for the Soul Series (Paper)) => 7
Call of the Wild => 8
```



0	0812516621	The Hungry Moon	Ramsey Campbell	1987	Tor Books (Mm)	8.943151
1	0441873375	The Warlock in Spite of Himself	Christopher Stasheff	1994	Ace Books	8.912877
2	0689831404	The Wind in the Willows (Aladdin Classics)	Kenneth Grahame	1999	Aladdin	8.828779
3	0671223666	HOW DID I GET TO BE 40 &amp; OTHER ATROCITIES	Judith Viorst	1976	Simon &amp; Schuster	8.725618
4	0671571435	Song of the West (Silhouette Romance #143)	Nora Roberts	1982	Pocket Books (Mm)	8.695019
5	0679410139	Brando: Songs My Mother Taught Me	MARLON BRANDO	1994	Modern Library	8.675949
6	0449244288	Not a Penny More 4	Jeffrey Archer	1981	Fawcett Books	8.647461
7	0590926675	So Far From Home : The Diary of Mary Driscoll, an Irish Mill Girl, Lowell, Massachusetts, 1847 (Dear America)	Barry Denenberg	1997	Scholastic	8.646915
8	3596215080	Der Konig David Bericht	Stefan Heym	1994	Fischer Taschenbuch Verlag GmbH	8.635507
9	0140178406	Aunt Dimity's Death (Aunt Dimity (Paperback))	Nancy Atherton	1993	Penguin Books	8.631925

Список литературы

[1] Гапанюк Ю. Е. Лабораторная работа «Обработка признаков (часть2)» [Электронный ресурс] https://github.com/ugapanyuk/ml_course_2021/wiki/LAB_MMO__FEATURES