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Lab : 10 : Build a recommender system based on amazon reviews

In [1]:

```
#importing the packages
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
import warnings
warnings.filterwarnings('ignore')
```

In [27]:

```
df = pd.read_csv("ratings_Beauty.csv")
df.head()
```

Out[27]:

	UserId	ProductId	Rating	Timestamp
0	A39HTATAQ9V7YF	0205616461	5.0	1369699200
1	A3JM6GV9MNOF9X	0558925278	3.0	1355443200
2	A1Z513UWSAAO0F	0558925278	5.0	1404691200
3	A1WMRR494NWEWV	0733001998	4.0	1382572800
4	A3IAAVS479H7M7	0737104473	1.0	1274227200

In [3]:

```
#shape of the dataset
print("There are",df.shape[0], "rows and", df.shape[1],"columns.")
```

```
There are 2023070 rows and 4 columns.
```

In [4]:

```
#info method
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2023070 entries, 0 to 2023069
Data columns (total 4 columns):
 #   Column     Dtype  
---  ------     -----  
 0   UserId     object 
 1   ProductId  object 
 2   Rating     float64
 3   Timestamp  int64  
dtypes: float64(1), int64(1), object(2)
memory usage: 61.7+ MB
```

In [5]:

```
df.describe(include='all')
```

Out[5]:

	UserId	ProductId	Rating	Timestamp
count	2023070	2023070	2.023070e+06	2.023070e+06
unique	1210271	249274	NaN	NaN
top	A3KEZLJ59C1JVH	B001MA0QY2	NaN	NaN
freq	389	7533	NaN	NaN
mean	NaN	NaN	4.149036e+00	1.360389e+09
std	NaN	NaN	1.311505e+00	4.611860e+07
min	NaN	NaN	1.000000e+00	9.087552e+08
25%	NaN	NaN	4.000000e+00	1.350259e+09
50%	NaN	NaN	5.000000e+00	1.372810e+09
75%	NaN	NaN	5.000000e+00	1.391472e+09
max	NaN	NaN	5.000000e+00	1.406074e+09

In [6]:

```
# Mean rating for each Product
product_rating = df.groupby('ProductId')['Rating'].mean()
product_rating.head()
```

Out[6]:

```
ProductId
0205616461    5.0
0558925278    4.0
0733001998    4.0
0737104473    1.0
0762451459    5.0
Name: Rating, dtype: float64
```

In [7]:

```
# Count of the number of ratings per Product
product_rating_count = df.groupby('ProductId')['Rating'].count()
product_rating_count.head()
```

Out[7]:

```
ProductId
0205616461    1
0558925278    2
0733001998    1
0737104473    1
0762451459    1
Name: Rating, dtype: int64
```

In [8]:

```
# Un-Reliability factor
unreliability = df.groupby('ProductId')['Rating'].std(ddof = -1)
unreliability.head()
```

Out[8]:

```
ProductId
0205616461    0.000000
0558925278    0.816497
0733001998    0.000000
0737104473    0.000000
0762451459    0.000000
Name: Rating, dtype: float64
```

Step 3: Check for missing values and outliers

In [9]:

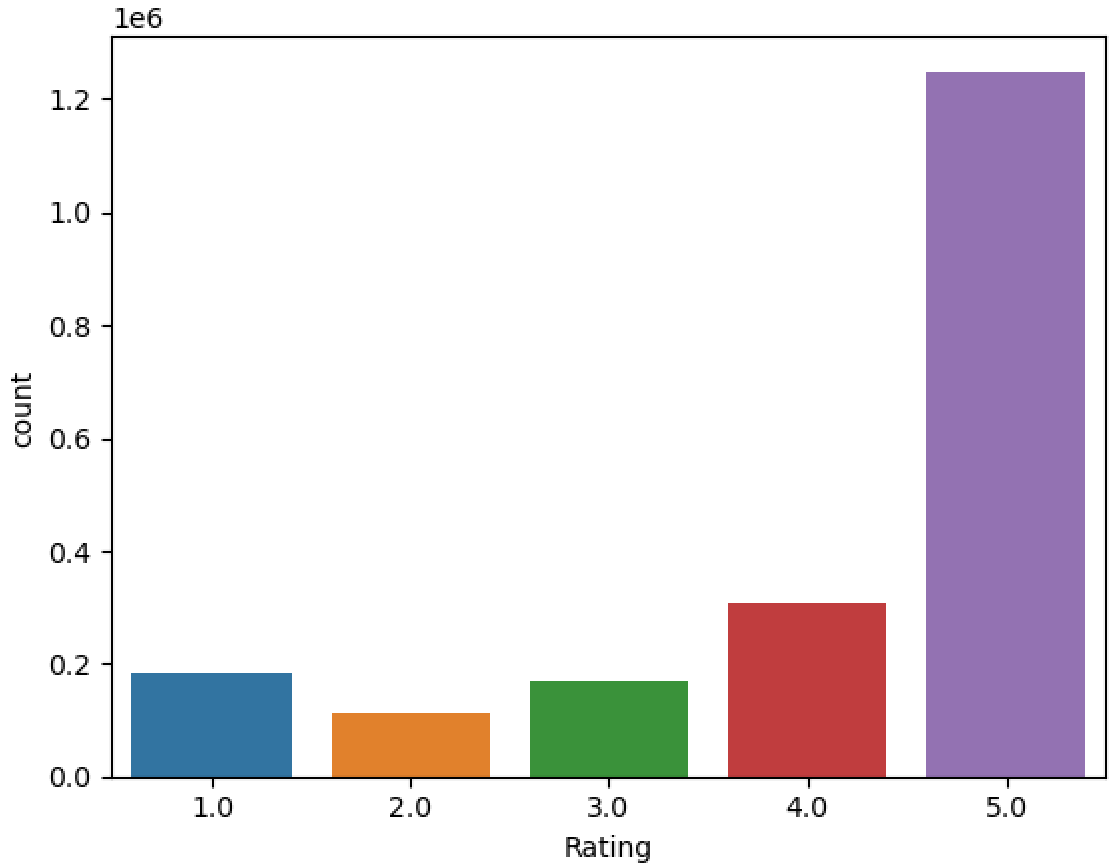
```
df.isnull().sum()
```

Out[9]:

```
UserId       0
ProductId    0
Rating       0
Timestamp    0
dtype: int64
```

In [10]:

```
import seaborn as sns
sns.countplot(x='Rating',data=df)
plt.show()
```



In [11]:

```
def find_outliers_IQR(df):
    q1=df.quantile(0.25)
    q3=df.quantile(0.75)
    IQR=q3-q1
    outliers = df[((df<(q1-1.5*IQR)) | (df>(q3+1.5*IQR)))]
    return outliers
```

In [12]:

```
#outlier for rating feature in the dataset
outliers = find_outliers_IQR(df['Rating'])
print("number of outliers: "+ str(len(outliers)))
print("max outlier value: "+ str(outliers.max()))
print("min outlier value: "+ str(outliers.min()))
```

```
number of outliers: 296818
max outlier value: 2.0
min outlier value: 1.0
```

In [13]:

```
#outlier for timestamp feature in dataset
outliers = find_outliers_IQR(df['Timestamp'])
print("number of outliers: "+ str(len(outliers)))
print("max outlier value: "+ str(outliers.max()))
print("min outlier value: "+ str(outliers.min()))
```

```
number of outliers: 154846
max outlier value: 1288396800
min outlier value: 908755200
```

In [14]:

```
# Data frame with calculated fields and measures
unique_products_list = df.ProductId.unique()
data_model = pd.DataFrame({'Rating': product_rating[unique_products_list],\
 'Count': product_rating_count[unique_products_list], \
 'Unreliability': unreliability[unique_products_list]})
data_model.head()
```

Out[14]:

ProductId	Rating	Count	Unreliability
0205616461	5.0	1	0.000000
0558925278	4.0	2	0.816497
0733001998	4.0	1	0.000000
0737104473	1.0	1	0.000000
0762451459	5.0	1	0.000000

In [15]:

```
# Removing outliers and improbable data points
data_model = data_model[data_model.Count > 50][data_model.Count < 1001].copy()
print(data_model.shape)
```

```
(6763, 3)
```

In [16]:

```
# Normalization function to range 0 - 10
def normalize(values):
    mn = values.min()
    mx = values.max()
    return(10.0/(mx - mn) * (values - mx)+10)
```

In [17]:

```
data_model_norm = normalize(data_model)
data_model_norm.head()
```

Out[17]:

	Rating	Count	Unreliability
ProductId			
9790790961	7.991506	0.201913	6.557281
B00004TMFE	5.713948	0.913921	7.953812
B00004TUBL	8.992153	5.387885	4.449336
B00004TUBV	7.984827	1.275239	6.268773
B00004U9UY	9.244724	1.009564	4.066169

Step 4: Apply Recommendations algorithms to the dataset

In [18]:

```
# Setting up the model
# Recommend 20 similar items
from sklearn.neighbors import KNeighborsClassifier
engine = KNeighborsClassifier(n_neighbors=20)
# Training data points
data_points = data_model_norm[['Count', 'Rating', 'Unreliability']].values
#Training labels
labels = data_model_norm.index.values
print("Data points: ", data_points)
print('\n')
print("Labels: ",labels)
```

```
Data points:  [[0.20191286 7.99150579 6.55728119]
 [0.91392136 5.71394752 7.95381168]
 [5.38788523 8.99215344 4.44933587]
 ...
 [0.21253985 9.6117244  2.18485285]
 [3.04994687 9.33120102 2.47548276]
 [4.64399575 8.69505981 5.78555039]]


Labels:  ['9790790961' 'B00004TMFE' 'B00004TUBL' ... 'B00KWE08Q0' 'B00KWF
DBKE'
 'B00L5JHZJO']
```

In [19]:

```
engine.fit(data_points, labels)
```

Out[19]:

```
KNeighborsClassifier(n_neighbors=20)
```

Step 5: Give recommendations and interpret your result

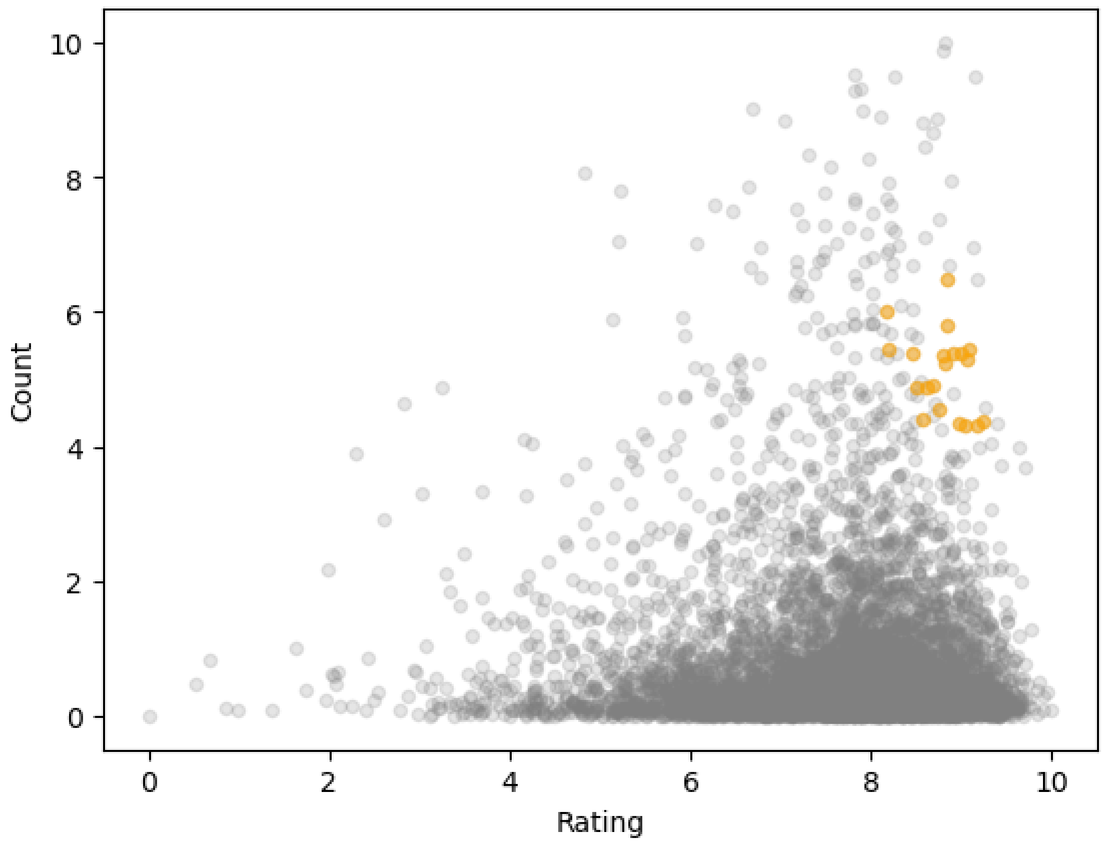
In [21]:

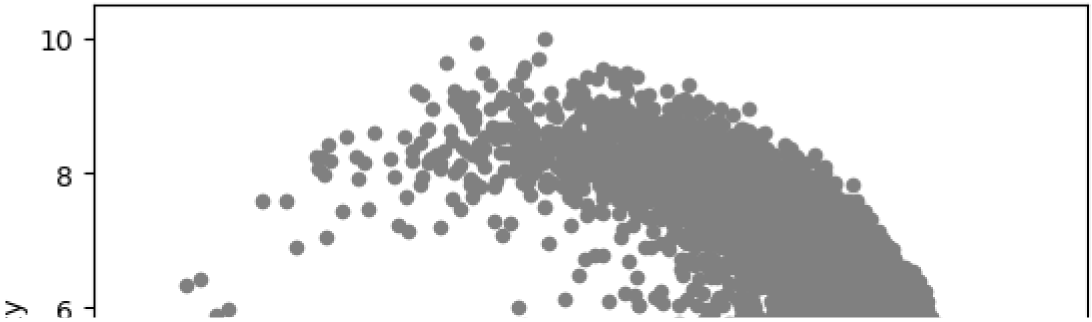
```
# User entered value
product_id = 'B00004TUBL'
product_data = data_model_norm.loc[product_id][['Count', 'Rating', 'Unreliability']].val

# Find recommended products
recommended_products = engine.kneighbors(X=[product_data], n_neighbors=20, return_distar

# List of product IDs from the indexes
products_list = data_model_norm.iloc[recommended_products[0]].index.tolist()

print("Recommended products:")
print(products_list)
```

```
Recommended products:
['B00004TUBL', 'B0000AFUTL', 'B00CNOUZE2', 'B008TBTA6C', 'B009GIOVKC', 'B
000ODNSR0', 'B000NWGCZ2', 'B00D6EDGYE', 'B002TPQPEE', 'B0013TM9UQ', 'B004
XA81ZE', 'B009GEUPDS', 'B00132ZG3U', 'B00H93NJLS', 'B000OQ2DL4', 'B000F35
R00', 'B0018DAUKI', 'B001DKQ3O8', 'B001ET77NY', 'B00178TVXG']
```

In [24]:

```
# Showing recommended products
ax = data_model_norm.plot(kind='scatter', x='Rating', y='Count', color='grey', alpha=0.2
data_model_norm.iloc[recommended_products[0]].plot(kind='scatter', x='Rating', y='Count'
 color='orange', alpha=0.5, ax=ax)
ax2 = data_model_norm.plot(kind='scatter', x='Rating', y='Unreliability', color='grey')
data_model_norm.iloc[recommended_products[0]].plot(kind='scatter', x='Rating', y='Unreli
 color='orange', alpha=0.5, ax=ax2)
plt.show()
```




10
8
6
y