Data Science Methodology

LECTURE 03: DATA SCIENCE CUSTOMER SEGMENTATION USING RFM MODEL

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INTRODUCTION

- **Different customers have different needs.**
- **With the increase in customer numbers and their variations, it becomes not easy to understand the requirement of each customer.**
- **Identifying potential customers' needs can improve the marketing campaign, which ultimately increases the sales.**
- **Segmentation can play a better role in grouping those customers into various segments.**

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TOPICS OF TODAY

- **What is Customer Segmentation?**
- **Need of Customer Segmentation**
- **Types of Segmentation**
- **Customer Segmentation using RFM Analysis**
- **Identify Potential Customer Segments using RFM in Python**
- **Conclusion**

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WHAT IS CUSTOMER SEGMENTATION?

- ***Customer segmentation is a method of dividing customers into groups or clusters on the basis of common characteristics.***
- **We can segment customers into the B2C model using various customer's demographic characteristics such as occupation, gender, age, location, and marital status.**
- **Psychographic characteristics such as social class, lifestyle and personality characteristics and behavioral characteristics such as spending, consumption habits, product/service usage, and previously purchased products.**

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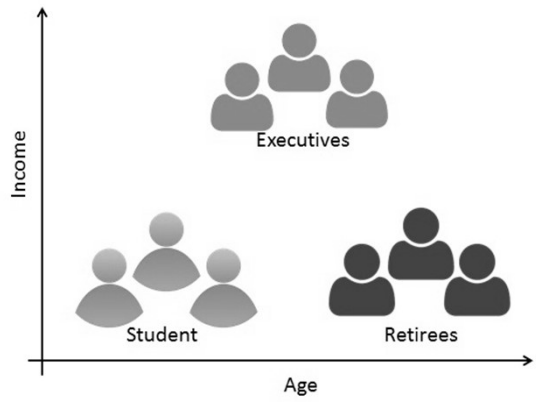
EXAMPLE: AGE/INCOME SEGMENTATION



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NEED OF CUSTOMER SEGMENTATION

- **It helps in identifying the most potential customers.**
- **It helps managers to easily communicate with a targeted groups of the audience.**
- **It improves the quality of service, and customer loyalty, via a better understanding of segments.**
- **It helps managers to design special offers for targeted customers, to encourage them to buy more products.**
- **It also helps in identifying new products that customers could be interested in.**

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TYPES OF SEGMENTATION

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CUSTOMER SEGMENTATION USING RFM ANALYSIS

- **RFM (Recency, Frequency, Monetary) analysis is a behavior-based approach grouping customers into segments.**
- **It groups the customers on the basis of their previous purchase transactions.**
- **How recently, how often, and how much did a customer buy.**
- **RFM filters customers into various groups for the purpose of better service.**
- **There may be a segment of customers who are the big spenders but what if they purchased only once! How recently they purchased? Do they often purchase our product?**

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RFM MODEL

- **Recency (R): Who have purchased recently? Number of days since last purchase (least recency)**
- **Frequency (F): Who has purchased frequently? It means the total number of purchases. (high frequency)**
- **Monetary Value(M): Who has high purchase amount? It means the total money customer spent (high monetary value)**

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RFM MODEL

- **Here, Each of the three variables(Recency, Frequency, and Monetary) can be divided into four equal quartiles (Q1-Q4), which creates 64 (4x4x4) different customer segments.**

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STEPS OF RFM(RECENCY, FREQUENCY, MONETARY):

- **Calculate the Recency, Frequency, Monetary values for each customer.**
- **Add segment bin values to RFM table using quartile.**
- **Sort the customer RFM score in ascending order.**

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EXAMPLE

1.Calculate the Recency, Frequency, Monetary values for each customer.

CustomerID	monetary	frequency	recency
12346.0	325	77183.60	1
12747.0	2	4196.01	103
12748.0	0	33719.73	4596
12749.0	3	4090.88	199
12820.0	3	942.34	59

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EXAMPLE

2. Add segment bin values to RFM table using quartile.

CustomerID	monetary	frequency	recency	r_quartile	f_quartile	m_quartile
12346.0	325	77183.60	1	1	1	1
12747.0	2	4196.01	103	4	1	4
12748.0	0	33719.73	4596	4	1	4
12749.0	3	4090.88	199	4	1	4
12820.0	3	942.34	59	3	2	4

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EXAMPLE

- **3. Concatenate all scores in single column (RFM_Score).**

CustomerID	monetary	frequency	recency	r_quartile	f_quartile	m_quartile	RFM_Score
12346.0	325	77183.60	1	1	1	1	111
12747.0	2	4196.01	103	4	1	4	414
12748.0	0	33719.73	4596	4	1	4	414
12749.0	3	4090.88	199	4	1	4	414
12820.0	3	942.34	59	3	2	4	324

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- `#import modules`
  ```
  import pandas as pd # for dataframes
  import matplotlib.pyplot as plt # for plotting graphs
  import seaborn as sns # for plotting graphs
  import datetime as dt
  ```
- **Loading Dataset**
- Let's first load the required HR dataset using the pandas read CSV function.

```
data = pd.read_excel("Online_Retail.xlsx")

df=pd.DataFrame(data)
print(df.head()) #first 5 rows
print(df.tail()) #last 5 rows
```

https://www.kaggle.com/code/sarahm/customer-segmentation-using-rfm-analysis

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

```
data = pd.read_excel("Online_Retail.xlsx")
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 541909 entries, 0 to 541908
Data columns (total 9 columns):
 #   Column       Non-Null Count   Dtype
---  ------       --------------   -----
 0   InvoiceNo    541909 non-null  object
 1   StockCode    541909 non-null  object
 2   lower        1816 non-null    object
 3   Description  540455 non-null  object
 4   Quantity     541909 non-null  int64
 5   InvoiceDate  541909 non-null  datetime64[ns]
 6   UnitPrice    541909 non-null  float64
 7   CustomerID   406829 non-null  float64
 8   Country      541909 non-null  object
dtypes: datetime64[ns](1), float64(2), int64(1), object(5)
memory usage: 37.2+ MB
```

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- data = pd.read_excel("Online_Retail.xlsx")
- data.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 541909 entries, 0 to 541908
Data columns (total 9 columns):
 #   Column       Non-Null Count   Dtype
---  ------       --------------   -----
 0   InvoiceNo    541909 non-null  object
 1   StockCode    541909 non-null  object
 2   lower        1816 non-null    object
 3   Description  540455 non-null  object
 4   Quantity     541909 non-null  int64
 5   InvoiceDate  541909 non-null  datetime64[ns]
 6   UnitPrice    541909 non-null  float64
 7   CustomerID   406829 non-null  float64
 8   Country      541909 non-null  object
dtypes: datetime64[ns](1), float64(2), int64(1), object(5)
memory usage: 37.2+ MB
```

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- Removing Duplicates
- Sometimes you get a messy dataset.
- You may want to remove duplicates, which will skew your analysis.
- In python, pandas offer function drop_duplicates(), which drops the repeated or duplicate records.

```
filtered_data=data[['Country','CustomerID']].drop_duplicates()
```

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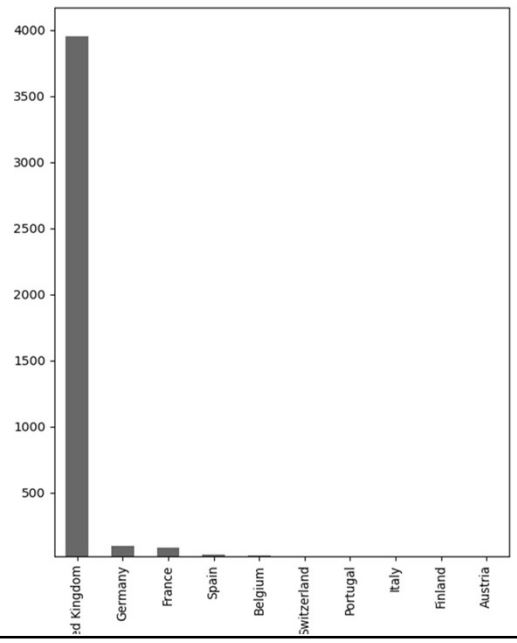
IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **Data Insights**
- `#Top ten country's customer`
  `filtered_data.Country.value_counts( )[:10].plot(kind='bar')`



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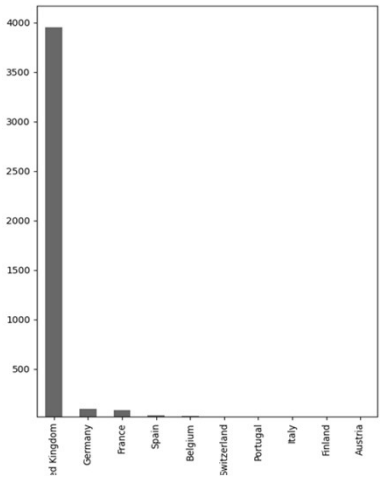
IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **Data Insights**
- **In the shown graph, you can observe most of the customers are from the "United Kingdom". So, we can filter data for United Kingdom customers.**

```
uk_data=data[data.Country=='United Kingdom’]
```



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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

Data Insights

```
uk_data=data[data.Country=='United Kingdom']
uk_data.info()

<class 'pandas.core.frame.DataFrame'>
Int64Index: 361878 entries, 0 to 541893
Data columns (total 9 columns):
 #   Column       Non-Null Count   Dtype
---  ------       --------------   -----
 0   InvoiceNo    361878 non-null  object
 1   StockCode    361878 non-null  object
 2   lower        1297 non-null    object
 3   Description  361878 non-null  object
 4   Quantity     361878 non-null  int64
```

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

```
Data columns (total 9 columns):
 #   Column       Non-Null Count   Dtype
---  ------       --------------   -----
 0   InvoiceNo    361878 non-null  object
 1   StockCode    361878 non-null  object
 2   lower        1297 non-null    object
 3   Description  361878 non-null  object
 4   Quantity     361878 non-null  int64
 5   InvoiceDate  361878 non-null  datetime64[ns]
 6   UnitPrice    361878 non-null  float64
 7   CustomerID   361878 non-null  float64
 8   Country      361878 non-null  object
dtypes: datetime64[ns](1), float64(2), int64(1), object(5)
memory usage: 27.6+ MB
```

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **Data Insights**
- **The `nunique()` function in pandas is convenient in getting summary statistics about the uniqueness of the columns. This function returns the count, of unique values in each column of the data.**

```
print(data.nunique())
```

```
InvoiceNo      25900
StockCode       4070
lower            953
Description     4223
Quantity         722
InvoiceDate    23260
UnitPrice       1630
CustomerID      4372
Country           38
dtype: int64
```

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **Data Insights**
- **The `describe()` function in pandas is convenient in getting various summary statistics. This function returns the count, mean, standard deviation, minimum and maximum values and the quantiles of the data.**

```
print(uk_data.describe())
```

```
       Quantity      UnitPrice     CustomerID
count  361878.000000  361878.000000  361878.000000
mean       11.077029       3.256007   15547.871368
std       263.129266      70.654731    1594.402590
min    -80995.000000       0.000000   12346.000000
25%         2.000000       1.250000   14194.000000
50%         4.000000       1.950000   15514.000000
75%        12.000000       3.750000   16931.000000
max     80995.000000   38970.000000   18287.000000
```

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **Data Insights**
- **We observed some of the customers have ordered in a negative quantity, which is not possible. So, we need to filter Quantity greater than zero.**

```
uk_data = uk_data[(uk_data['Quantity']>0)]
uk_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 354345 entries, 0 to 541893 Data columns (total 9 columns):
 #   Column       Non-Null Count   Dtype
---  ------       --------------   -----
 0   InvoiceNo    354345 non-null  object
 1   StockCode    354345 non-null  object
 2   lower        1285 non-null    object
 3   Description  354345 non-null  object
 4   Quantity     354345 non-null  int64
 5   InvoiceDate  354345 non-null  datetime64[ns]
```

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **Filter required Columns**

We can filter the necessary columns for RFM analysis. We only need here five columns `CustomerID`, `InvoiceDate`, `InvoiceNo`, `Quantity`, and `UnitPrice`.

`CustomerId` will uniquely define your customers,

`InvoiceDate` help us calculate recency of purchase,

`InvoiceNo` helps us to count the number of time transaction performed(frequency).

`Quantity` purchased in each transaction, and

`UnitPrice` of each unit purchased by the customer will help us calculate the total purchased amount.

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **Filter required Columns**

```
uk_data=uk_data[['CustomerID','InvoiceDate','InvoiceNo','Quantity',
  'UnitPrice']]
uk_data['TotalPrice'] = uk_data['Quantity'] * uk_data['UnitPrice']
uk_data['InvoiceDate'].min(),uk_data['InvoiceDate'].max()
(Timestamp('2010-12-01 08:26:00'), Timestamp('2011-12-09
  12:49:00'))
PRESENT = dt.datetime(2011,12,10)
uk_data['InvoiceDate'] = pd.to_datetime(uk_data['InvoiceDate'])
print(uk_data.head())
```

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **Filter required Columns**

```
uk_data=uk_data[['CustomerID','InvoiceDate','InvoiceNo','Quantity','UnitPrice']]
uk_data['TotalPrice'] = uk_data['Quantity'] * uk_data['UnitPrice']
uk_data['InvoiceDate'].min(),uk_data['InvoiceDate'].max()
(Timestamp('2010-12-01 08:26:00'), Timestamp('2011-12-09 12:49:00'))
PRESENT = dt.datetime(2011,12,10)
uk_data['InvoiceDate'] = pd.to_datetime(uk_data['InvoiceDate'])
print(uk_data.head())

dtypes: datetime64[ns](1), float64(2), int64(1), object(5)
memory usage: 27.0+ MB
   CustomerID         InvoiceDate InvoiceNo  Quantity  UnitPrice  TotalPrice
0     17850.0 2010-12-01 08:26:00    536365         6       2.55       15.30
1     17850.0 2010-12-01 08:26:00    536365         6       3.39       20.34
2     17850.0 2010-12-01 08:26:00    536365         8       2.75       22.00
3     17850.0 2010-12-01 08:26:00    536365         6       3.39       20.34
4     17850.0 2010-12-01 08:26:00    536365         6       3.39       20.34
```

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **RFM Analysis**
- Here, we are going to perform following operations:
  - *For Recency*, Calculate the number of days between present date and date of last purchase each customer.
  - *For Frequency*, Calculate the number of orders for each customer.
  - *For Monetary*, Calculate sum of purchase price for each customer.

```
rfm= uk_data.groupby('CustomerID').agg({'InvoiceDate': lambda date:
(PRESENT - date.max()).days, 'InvoiceNo': lambda num: len(num),
'TotalPrice': lambda price: price.sum()})
```

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **RFM Analysis**

```
print(rfm.head())
```

CustomerID	InvoiceDate	InvoiceNo	TotalPrice
12346.0	325	1	77183.60
12747.0	2	103	4196.01
12748.0	0	4596	33719.73
12749.0	3	199	4090.88
12820.0	3	59	942.34

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **RFM Analysis**

```
# Change the name of columns
rfm.columns =['recency','frequency', 'monetary']
rfm['recency'] = rfm['recency'].astype(int)

print(rfm.head())
```

```
             recency  frequency monetary
CustomerID
12346.0          325          1    77183
12747.0            2        103     4196
12748.0            0       4596    33719
12749.0            3        199     4090
12820.0            3         59      942
```

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **Computing Quartile of RFM values**

- **Customers with the lowest recency, highest frequency and monetary amounts considered as top customers.**
- `qcut()` **is Quartile-based discretization function. qcut bins the data based on sample quartiles.**
- **For example, 1000 values for 4 quartiles would produce a categorical object indicating quartile membership for each customer.**

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **Computing Quartiles of RFM values**

```
• rfm['r_quartile'] = pd.qcut(rfm['recency'], 4, ['1','2','3','4'])
• rfm['f_quartile'] = pd.qcut(rfm['frequency'], 4, ['4','3','2','1'])
• rfm['m_quartile'] = pd.qcut(rfm['monetary'], 4, ['4','3','2','1’])
• print(rfm.head())
```

CustomerID	recency	frequency	monetary	r_quartile	f_quartile	m_quartile
12346.0	325	1	77183	4	4	1
12747.0	2	103	4196	1	1	1
12748.0	0	4596	33719	1	1	1
12749.0	3	199	4090	1	1	1
12820.0	3	59	942	1	2	2

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **RFM result interpretations**
- concatenate all three quartiles(r_quartile,f_quartile,m_quartile) in a single column, this rank will help you to segment the customers well group.

```
• rfm['RFM_Score'] = rfm.r_quartile.astype(str)+
  rfm.f_quartile.astype(str) + rfm.m_quartile.astype(str)
  print(rfm.head())
```

CustomerID	recency	frequency	monetary	r_quartile	f_quartile	m_quartile	RFM_Score
12346.0	325	1	77183	4	4	1	441
12747.0	2	103	4196	1	1	1	111
12748.0	0	4596	33719	1	1	1	111
12749.0	3	199	4090	1	1	1	111
12820.0	3	59	942	1	2	2	122

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IDENTIFY POTENTIAL CUSTOMER SEGMENTS USING RFM IN PYTHON

- **RFM result interpretations**
- We need to see the highest priority customers (RFM_Score=111). To do that,
- `# Filter out Top/Best customers`

```
print(rfm[rfm['RFM_Score']=='111'].sort_values('monetary',ascending
=False).head())
print(rfm.columns)
```

```
CustomerID recency  frequency   monetary r_quartile f_quartile m_quartile   RFM_Score
18102            0        431  259657.30          1          1          1         111
17450            8        337  194550.79          1          1          1         111
17511            2        963   91062.38          1          1          1         111
16684            4        277   66653.56          1          1          1         111
14096            4       5111   65164.79          1          1          1         111
Index(['recency', 'frequency', 'monetary', 'r_quartile', 'f_quartile', 'm_quartile',
'RFM_Score'],dtype='object')
```

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RFM MODEL CONCLUSION

- We have learned customer segmentation, Need of Customer Segmentation, and Types of Segmentation.
- We have focused on Customer segmenation via RFM model.
- We have learned RFM implementation via Python. Also, we have seen some basic concepts of pandas module such as handling duplicates, groupby, and qcut() for bins based on sample quartiles.

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ASSIGNMENT 1

- **Find another data set, with at least 50,000 records**
- **What else does the Lambda function for aggregation in the Pandas module provide?**
- **Give examples of its use on the downloaded data set you found**
- **Perform RFM model on it**

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