Capstone Project

Online Retail Customer Segmentation

Team Members

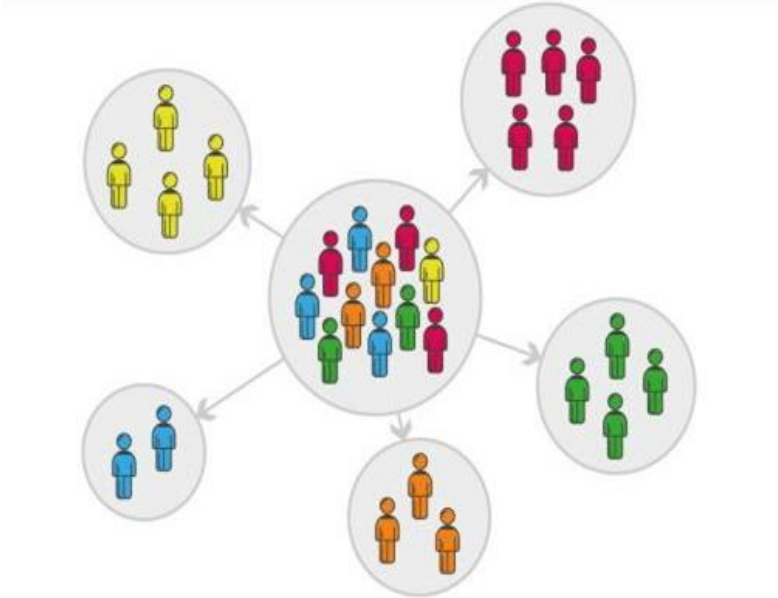
Manoj

Aman

Babu

Customer Segmentation Analysis follows:

- ❑ Problem Statements
- ❑ Data Information
- ❑ Data Analysis
- ❑ Data cleaning
- ❑ Data Preparation
- ❑ Model Training
- ❑ Summary
- ❑ Challenges
- ❑ Conclusion



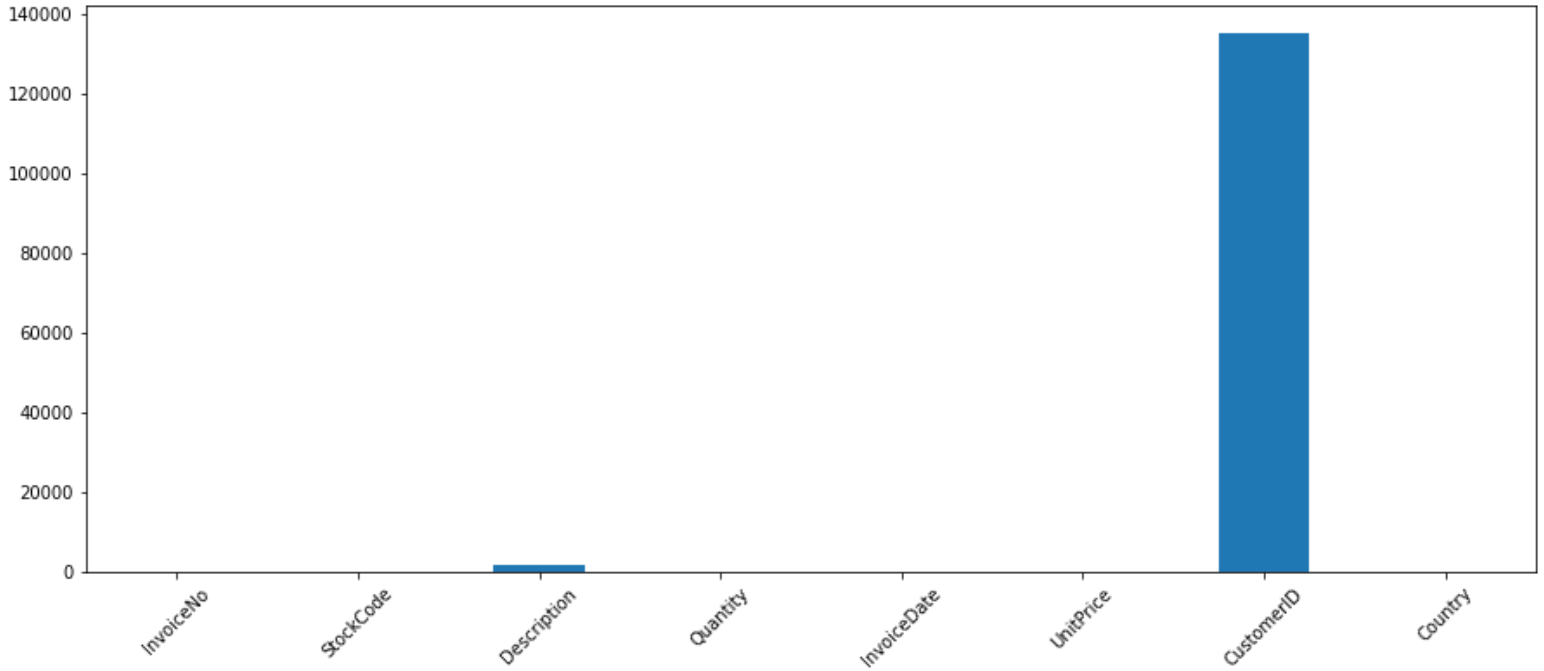
Problem Statements:

- ❑How Null values in the data handled?
- ❑Does data contains negative values?
- ❑Does data contains outliers?
- ❑Any country dominated in terms of data?
- ❑Number of clusters based on silhouette score?
- ❑Better visualization of clusters for different algorithms?

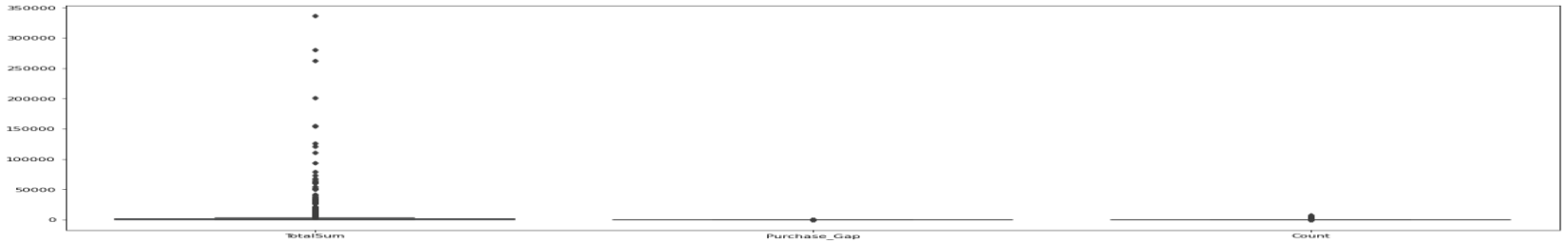
Data Summary

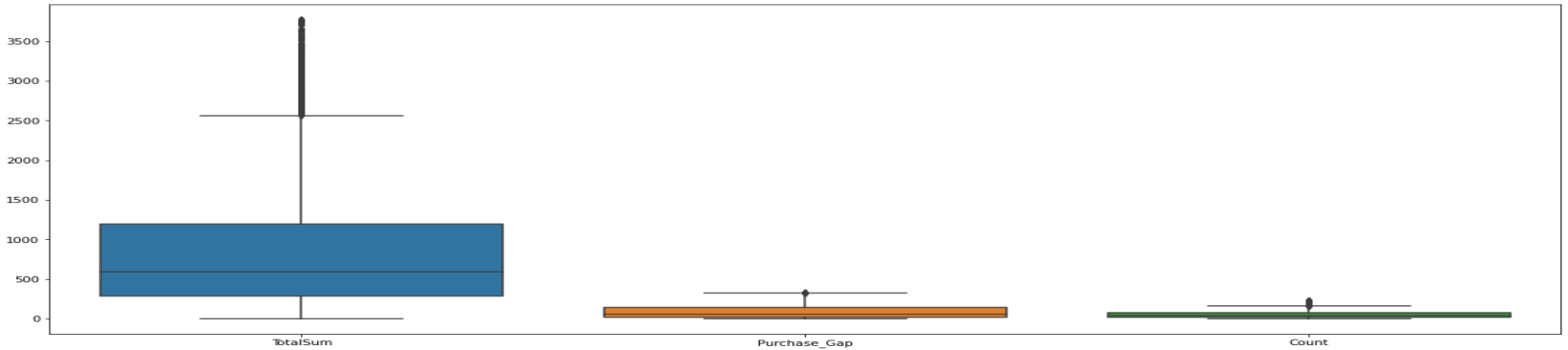
- **File type**: Excel
- **File size**: 23MB
- **Dataset shape**:
  - Rows:541909
  - Columns:8
- **Important Columns:**
  - CustomerID
  - Quantity
  - UnitPrice
  - InvoiceDate

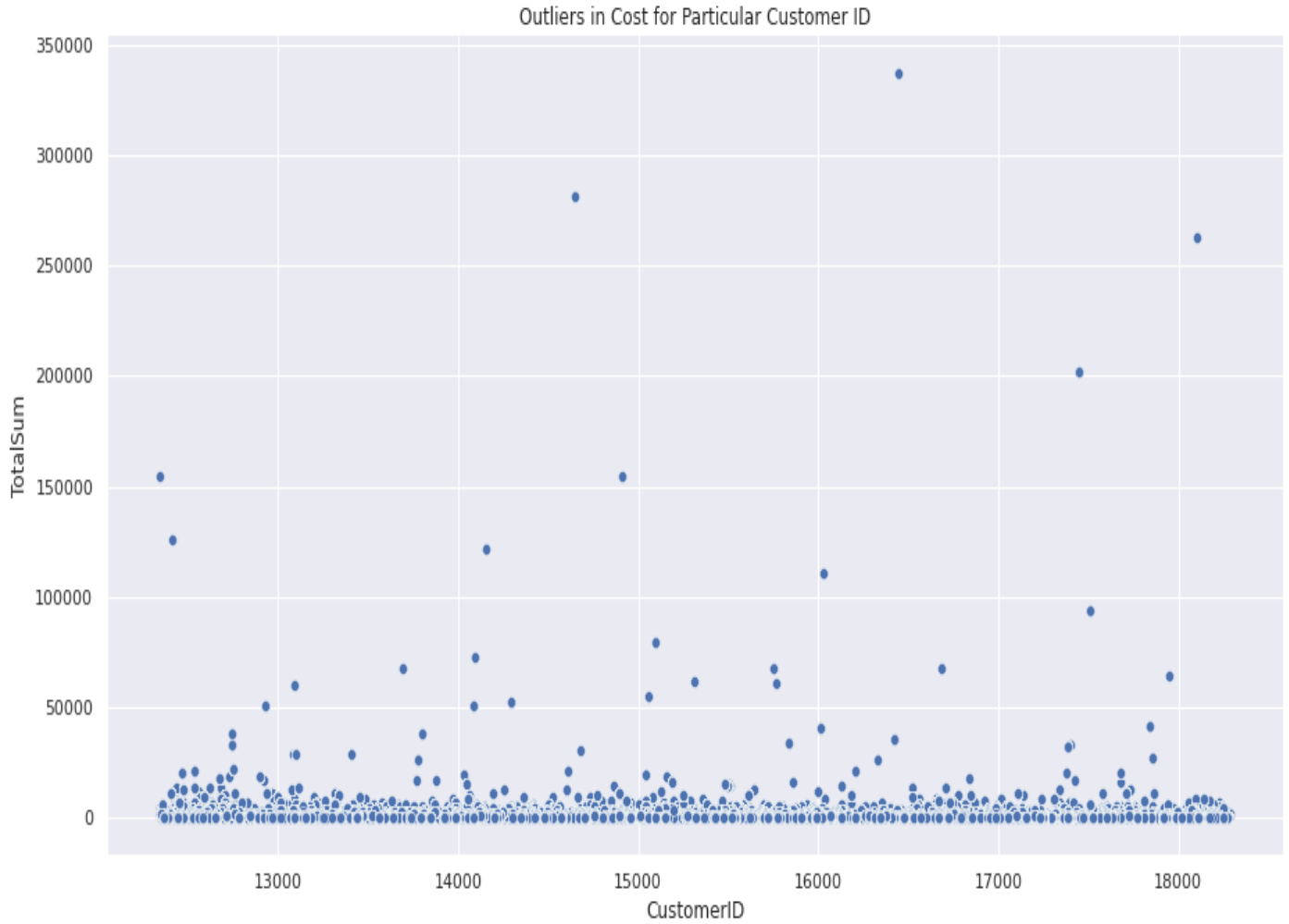
Does data contains Null values?

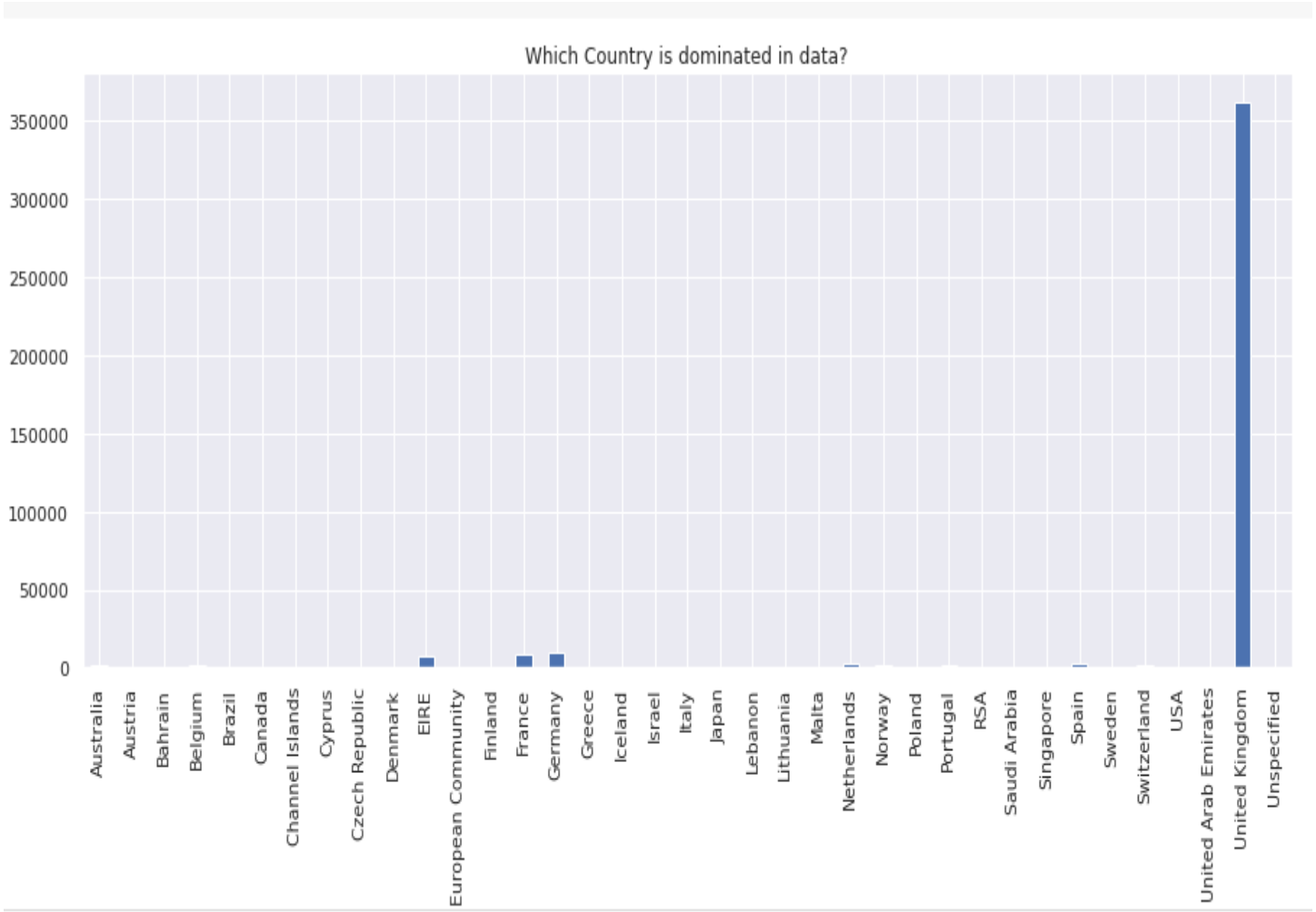


Does data contains outliers?

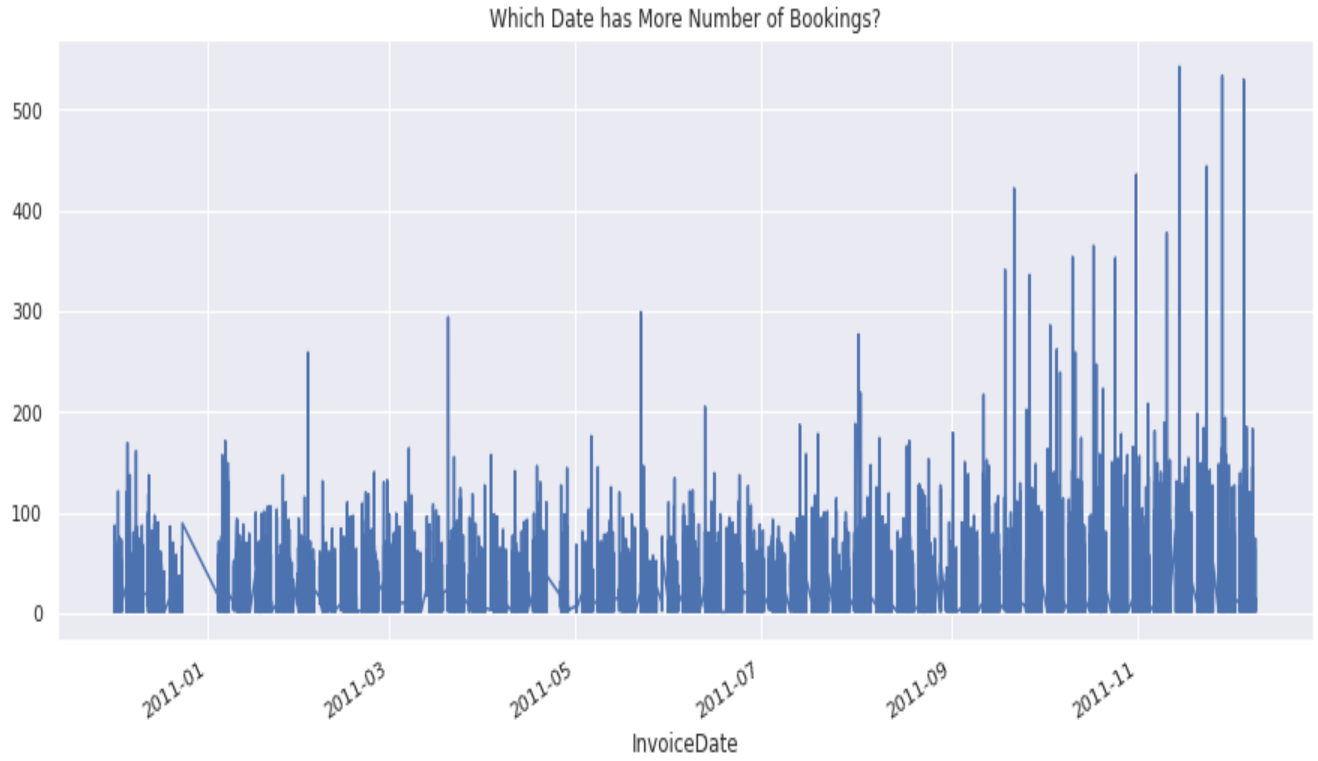




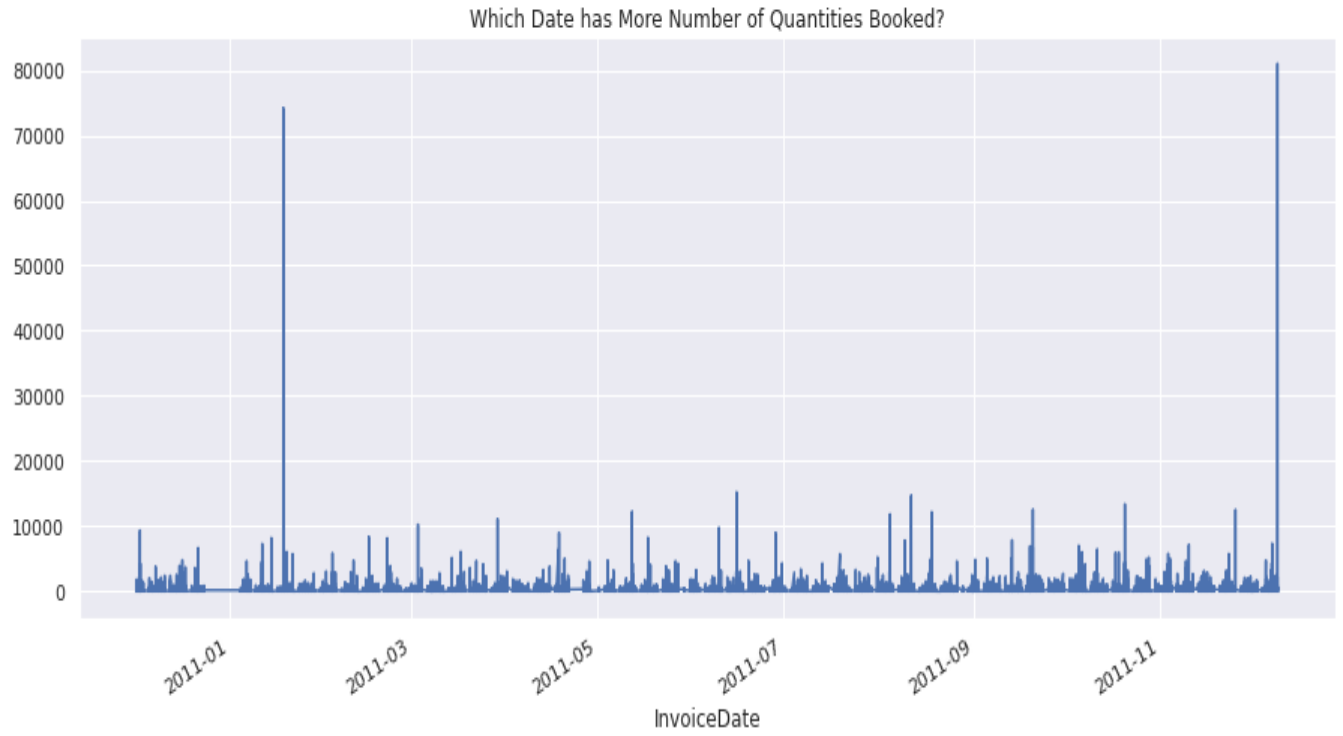

Outliers in Cost for Particular Customer ID
TotalSum
350000
300000
250000
200000
150000
100000
50000
0
13000
14000
15000
16000
17000
18000
CustomerID


Which Country is dominated in data?
350000
300000
250000
200000
150000
100000
50000
0
Australia
Austria
Bahrain
Belgium
Brazil
Canada
Channel Islands
Cyprus
Czech Republic
Denmark
EIRE
European Community
Finland
France
Germany
Greece
Iceland
Israel
Italy
Japan
Lebanon
Lithuania
Malta
Netherlands
Norway
Poland
Portugal
RSA
Saudi Arabia
Singapore
Spain
Sweden
Switzerland
USA
United Arab Emirates
United Kingdom
Unspecified

```
eda_df.groupby('InvoiceDate').count()['InvoiceNo'].plot.line(figsize=(15,6))
plt.title('Which Date has More Number of Bookings?')
plt.show()
```



```
eda_df.groupby('InvoiceDate')['Quantity'].sum().plot.line(figsize=(15,6))
plt.title('Which Date has More Number of Quantities Booked?')
plt.show()
```



<Figure size 1440x360 with 0 Axes>

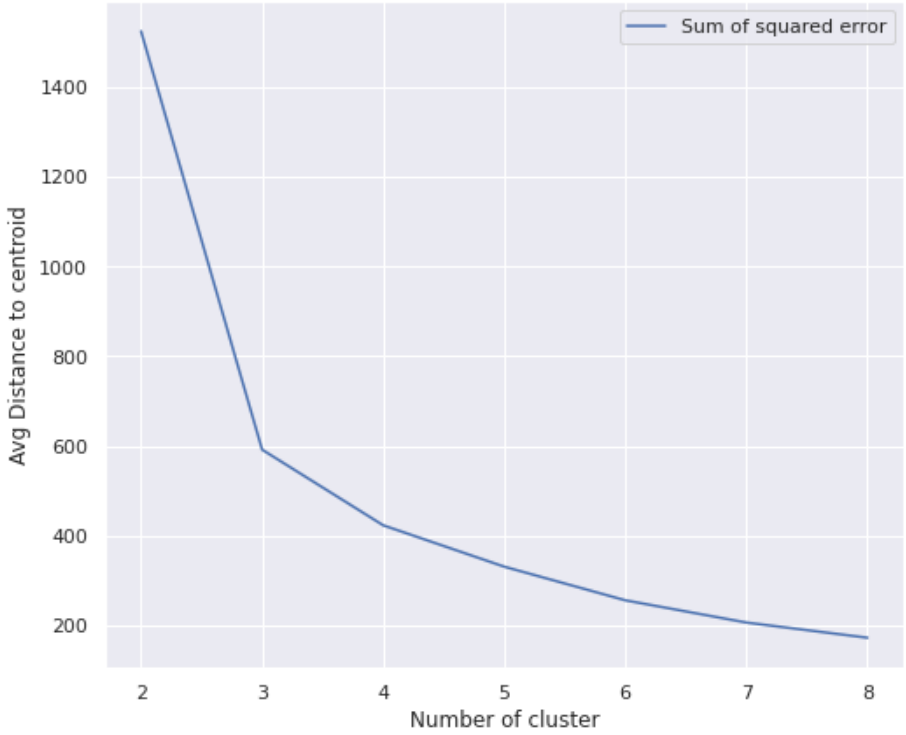
How to find optimal cluster size?

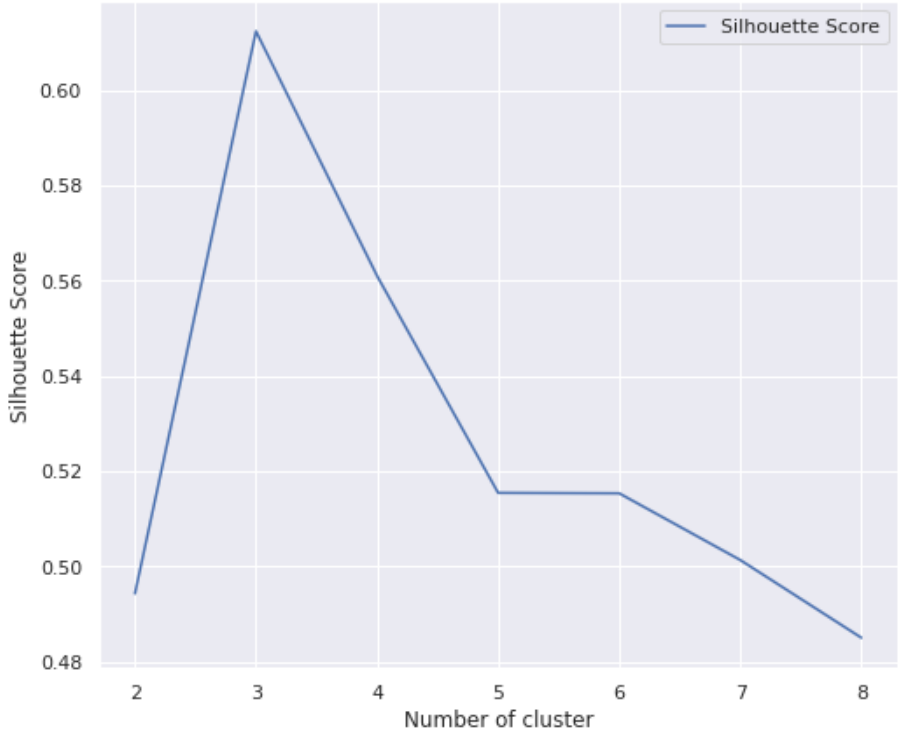
Elbow method: it runs on k-means clustering, it measures the sum of square distances from each point to its assigned center vs each cluster.

Silhouette score: The silhouette ranges from −1 to +1, where a high value indicates that the object is well matched to its own cluster and poorly matched to neighboring clusters.

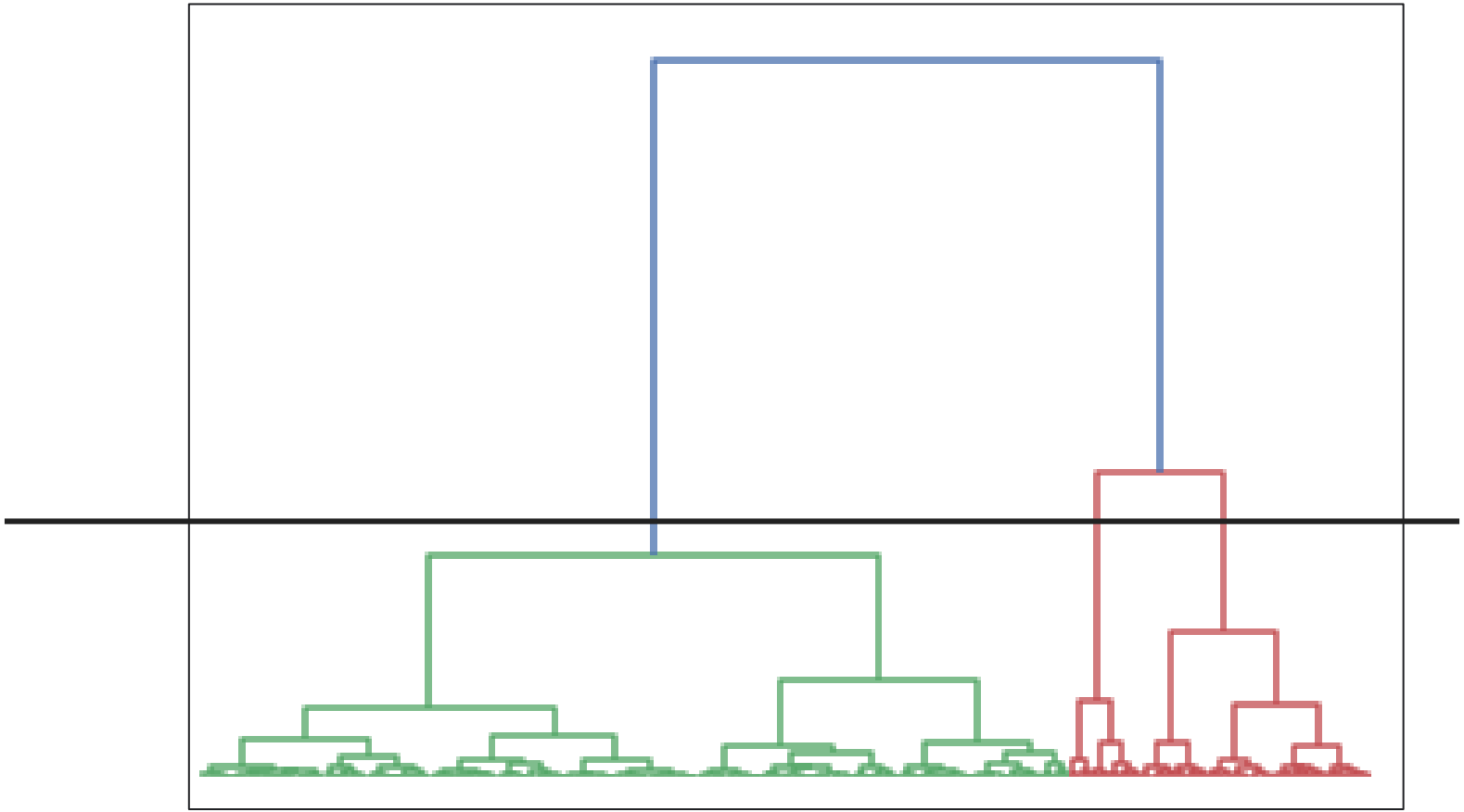
```
for n_clusters=2, The Silhoutte Coefficient is=0.494287286282782 96
for n_clusters=3, The Silhoutte Coefficient is=0.6123894802353901
for n_clusters=4, The Silhoutte Coefficient is=0.561019099786192
for n_clusters=5, The Silhoutte Coefficient is=0.5154420877925352
for n_clusters=6, The Silhoutte Coefficient is=0.5153482718550463
for n_clusters=7, The Silhoutte Coefficient is=0.5013357480604806
for n_clusters=8, The Silhoutte Coefficient is=0.48501437515080126
```

How does Elbow and silhouette graph look?





Visualization of Dendrogram Linkage

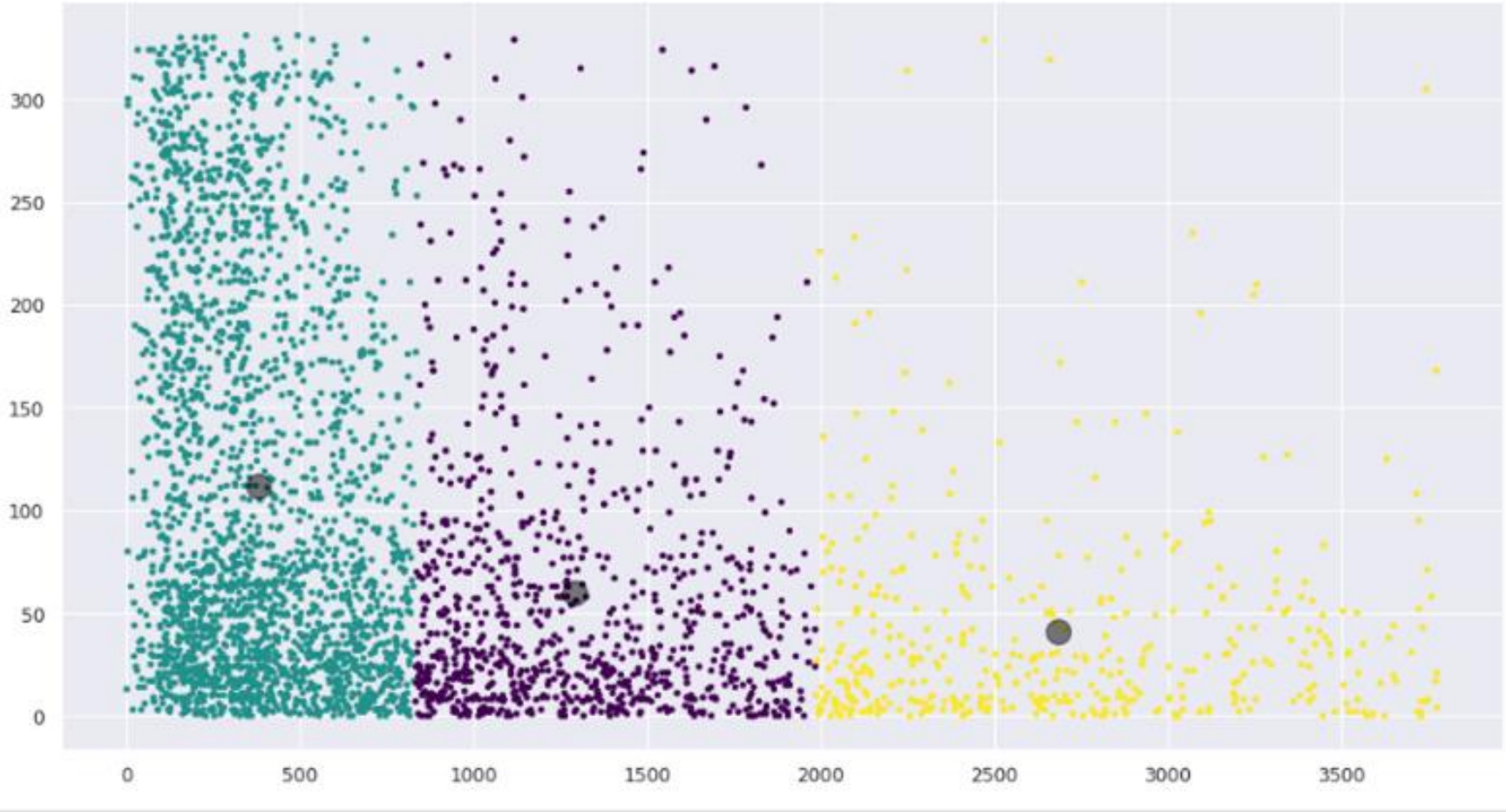


What are the Clustering algorithms used?

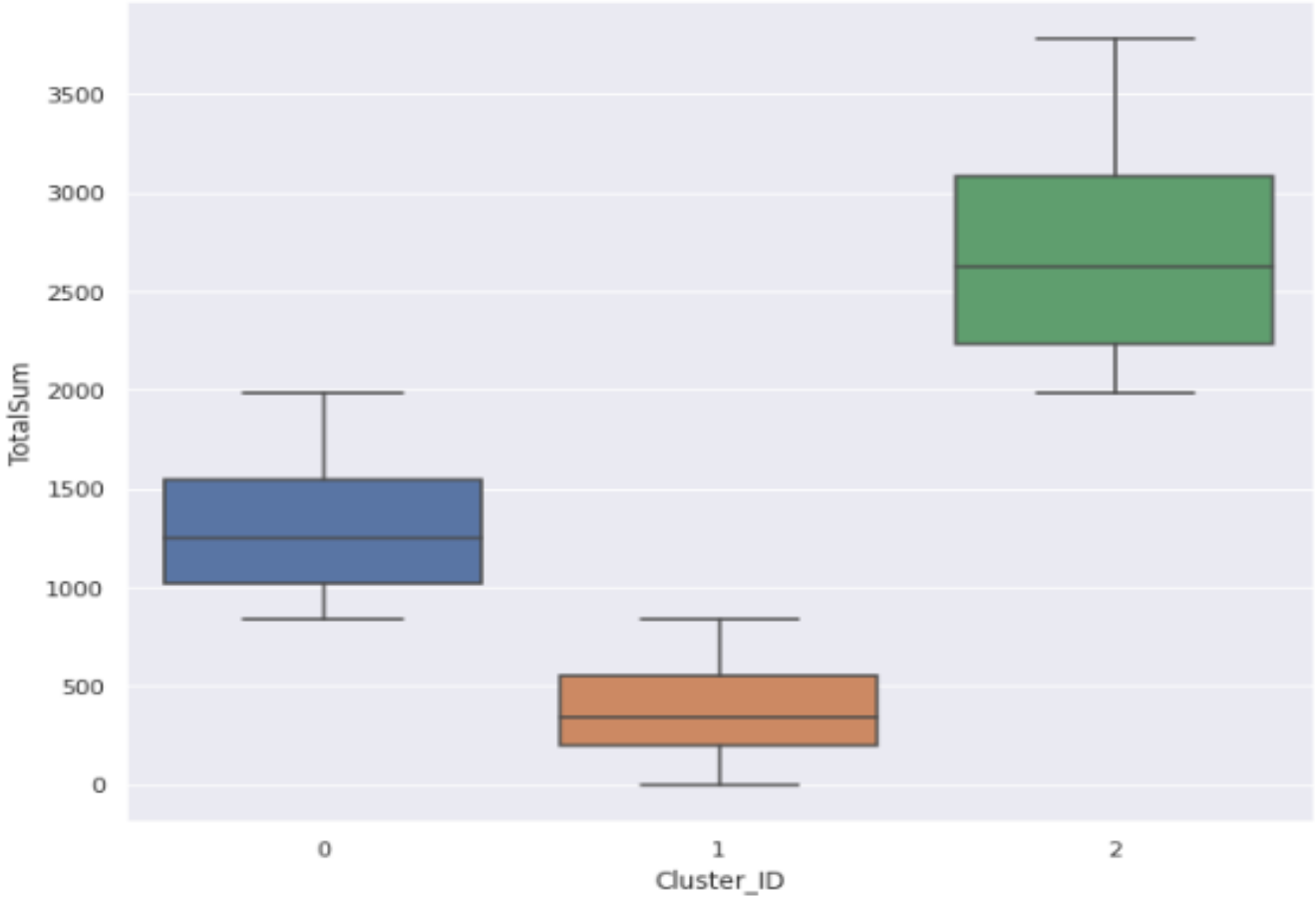
```
#CLuster=3, Parameter Tuning
kmeans=KMeans(n_clusters=3,max_iter=50)
ckmeans=kmeans.fit(X)
y_kmeans=kmeans.predict(X)
centers = kmeans.cluster_centers_
new_df['Cluster_ID']=kmeans.labels_
```

```
from sklearn.cluster import AgglomerativeClustering
ac=AgglomerativeClustering(n_clusters=3 ,affinity='euclidean',linkage='ward')
y_ac=ac.fit_predict(assign)
```

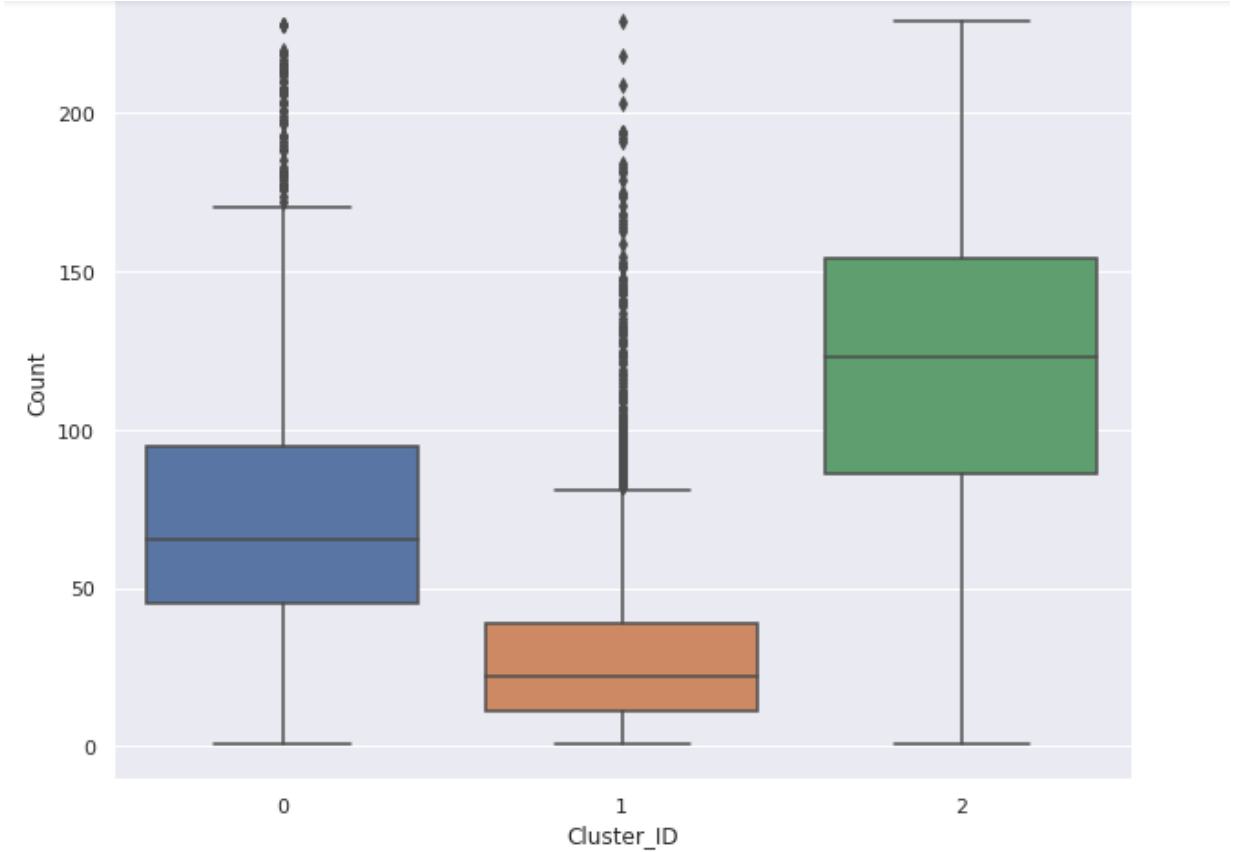
For Cluster size=3, Centers representation



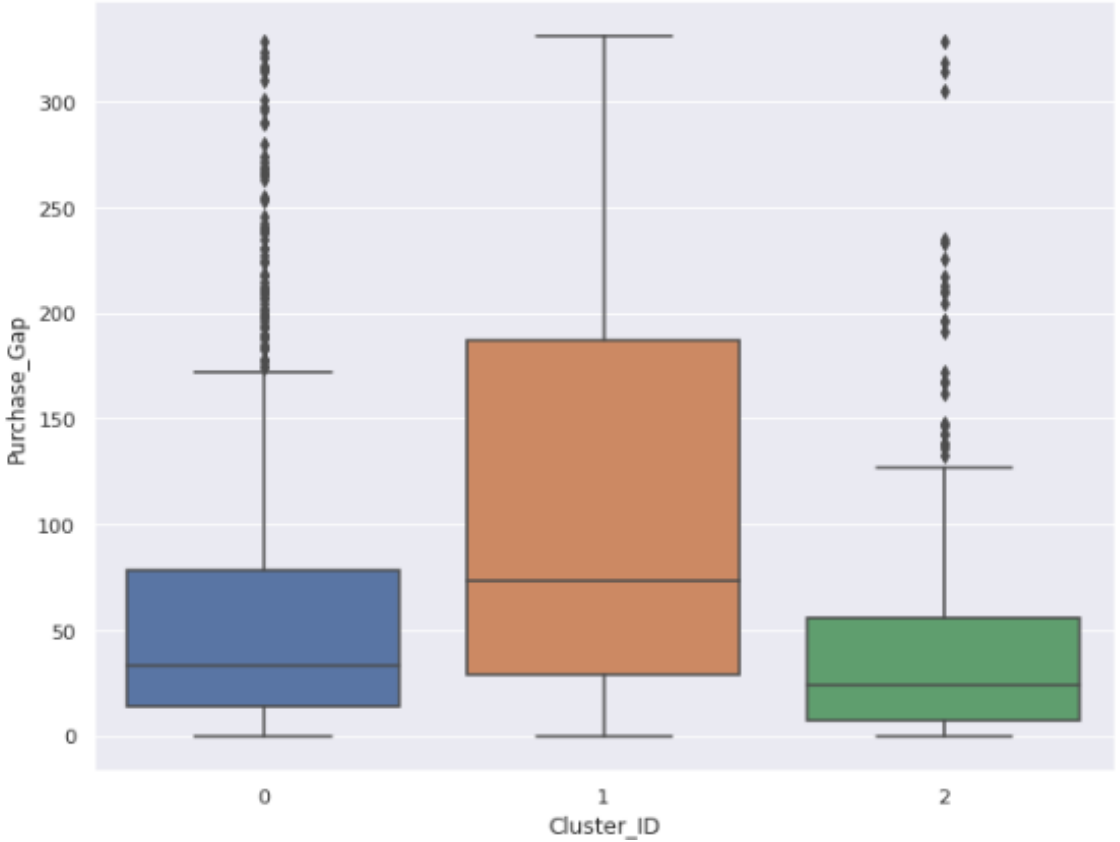
Which Cluster is having high spendings?



Which Cluster ID has made Highest Order Count?



Which Cluster takes more time gap to Purchase?



Summary

- First imported the libraries and dataset which was in excel file and This dataset contains 541909 rows and 8 columns, then checked for duplication of data and null values.
- There were more than 120000 null values present in CustomerID Column it main column as other column was filled with zero and drop all values.
- We Converted data into High Spending, Late Purchases ID, Number of Order till date.
- Various plots are visualized to see Outliers and Applied Interquartile Range method.
- Data was used different units so its scaled using Standard Scaler and normalise data.
- Applied Principle Component Analysis and reduced to 2-dim
- To find Number Clusters we applied Elow Method and silhouette score the Selected Cluster Size=3 with Visualize Graph.
- K-Means Clustering was applied with cluster size=3.
- Dendrogram Linkage and Hierarchical Agglomerative Clustering Models are applied
- Detailed visualization of each Cluster Center and their Spendings, Delay, Frequency of Number of Orders.

Conclusion

- Given Data for Customer Segmentation most of them are irrelevant like StockCode, Description.etc and there is no relation.
- After Applying Elbow and Silhouette score are more at cluster size =3, score was than 0.6,
- Same results applied with Dendrogram results of Kmeans Clusters Centers in plots appears better than Hierarchical Agglomerative Clustering

- Cluster_0 CustomerID's take more time gap between Each Oder they Placed(Rarely).
- Cluster_1 CustomerID's Makes always a Bulk Purchases which leads high Spendings(Retailers).
- Cluster_2 CustomerID's Has Highest Orders Placed(Small Shopes with less inventory).

Challenges and Future Analysis

- Whole data Consists of duplicated data initially there was more than 5-lakh data after grouped Based Customer ID it was left with 3.5 thousand Customers left.
- Grouping them based on certain assumptions and there was many negative values.

- Expand our Analysis to multiple cities and compare patterns and trends amongst these Customer_ID.
- Expectation-Maximization algorithm using Gaussian mixture model where not only mean as well as variance of data is considered.


AI
Q&A
https://slides.app.goo.gl/ojJmj

THANK YOU