Online Retail Customer Segmentation

Unsupervised Machine Learning

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Content

Problem Statement

Given a dataset related to a online retailer based out of the UK, we need to analyse and identify major customer segments using K Means algorithm and also using different verification method to confirm the result.

What is Customer Segmentation?

- **Practice of dividing a customer base into groups of individuals** that are similar in specific ways relevant to marketing, such as age, gender, interests and spending habits.

- Allows us to better understand our customers **helping us target these customers in a more efficient manner and improve the customer experience**.

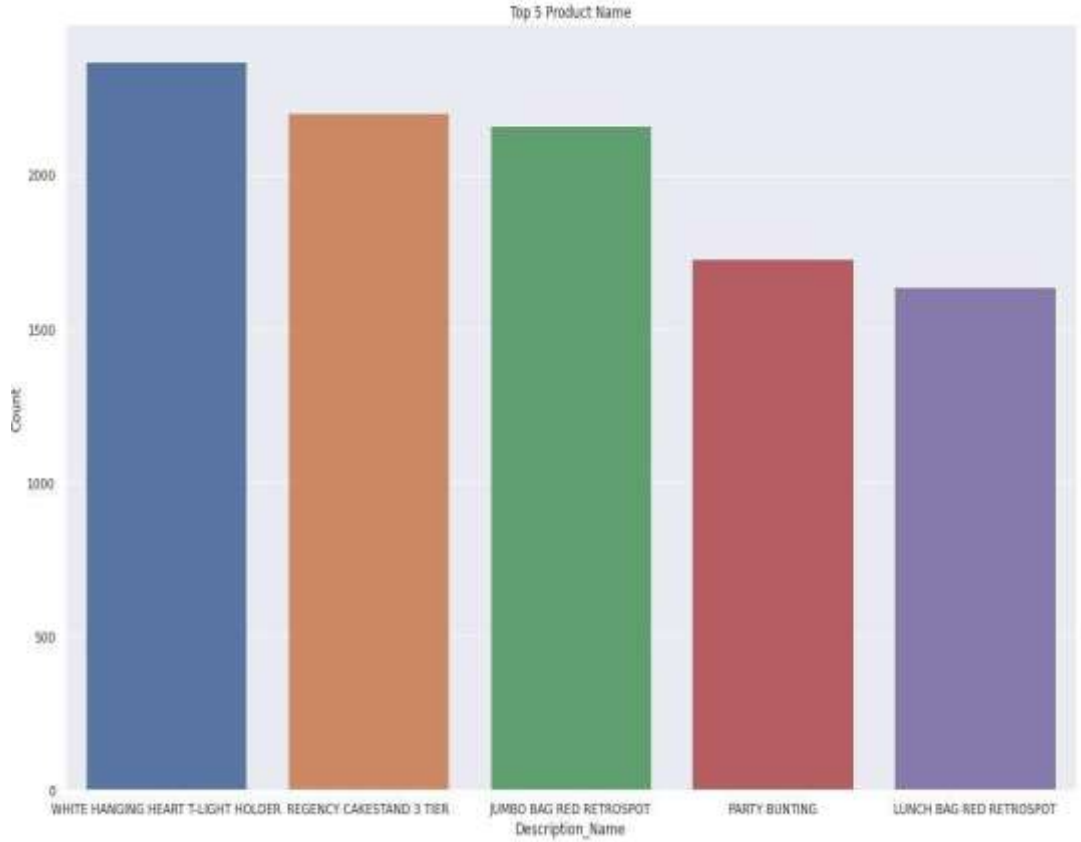
Data Summary

- A transnational data set with transactions occurring **between 1st December 2010 and 9th December 2011** for a UK-based online retailer.
- Shape (rows- 541909, columns-8)
- The company **mainly sells unique all-occasion gifts**.
- Many customers of the company are **wholesalers.**

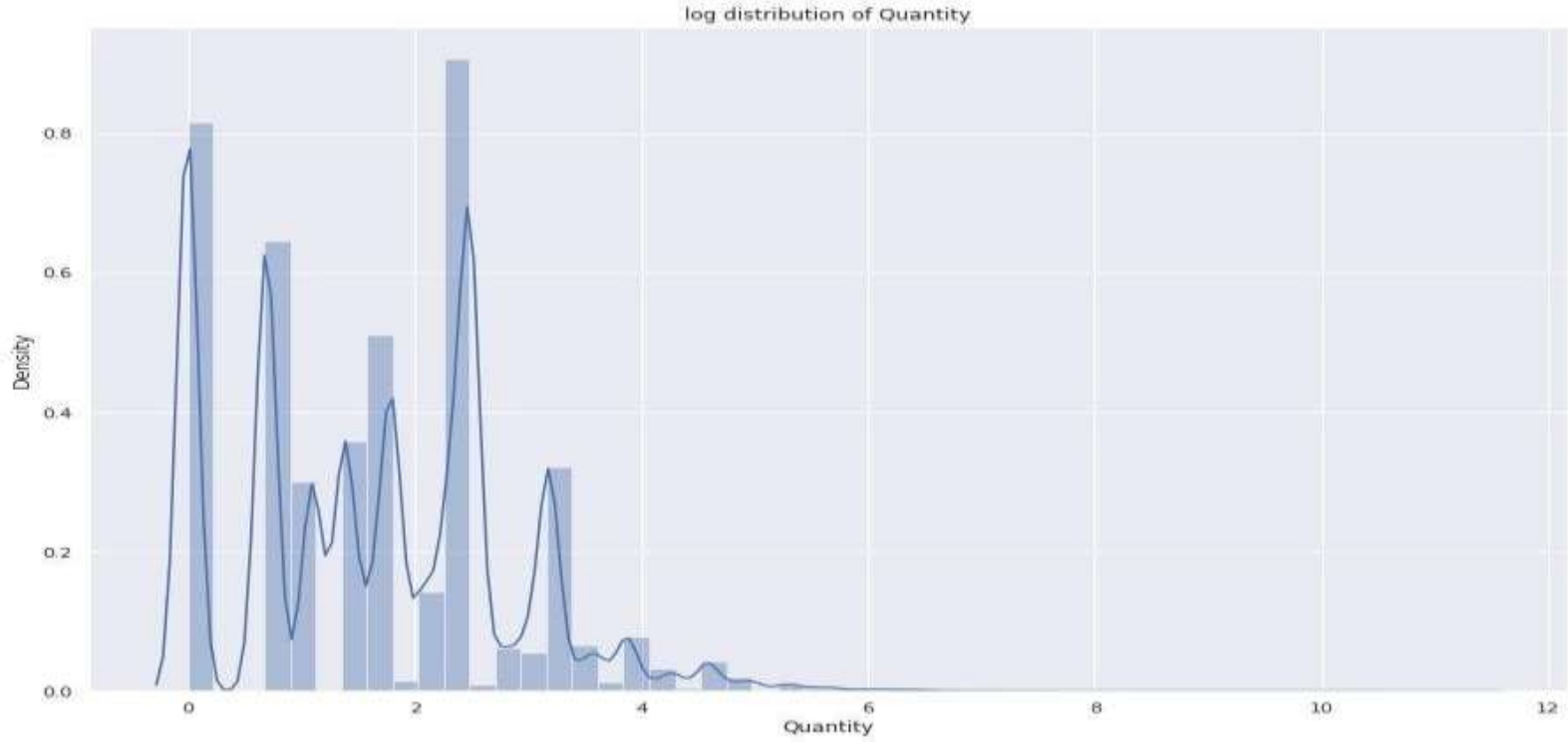
InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	2010-12-01 08:26:00	2.55	17850.0	United Kingdom
536365	71053	WHITE METAL LANTERN	6	2010-12-01 08:26:00	3.39	17850.0	United Kingdom
536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	2010-12-01 08:26:00	2.75	17850.0	United Kingdom
536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	2010-12-01 08:26:00	3.39	17850.0	United Kingdom
536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	2010-12-01 08:26:00	3.39	17850.0	United Kingdom

Cleaning Data Finding the most Purchased Products

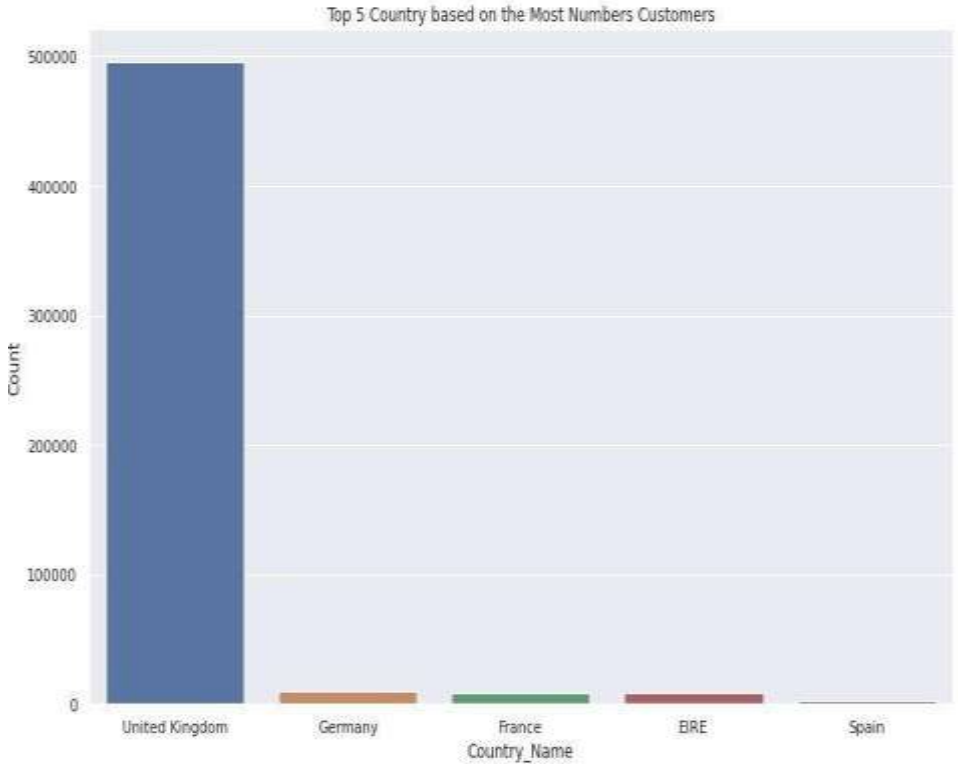
Description_Name	Count
WHITE HANGING HEART T-LIGHT HOLDER	2369
REGENCY CAKESTAND 3 TIER	2200
JUMBO BAG RED RETROSPOT	2159
PARTY BUNTING	1727
LUNCH BAG RED RETROSPOT	1638

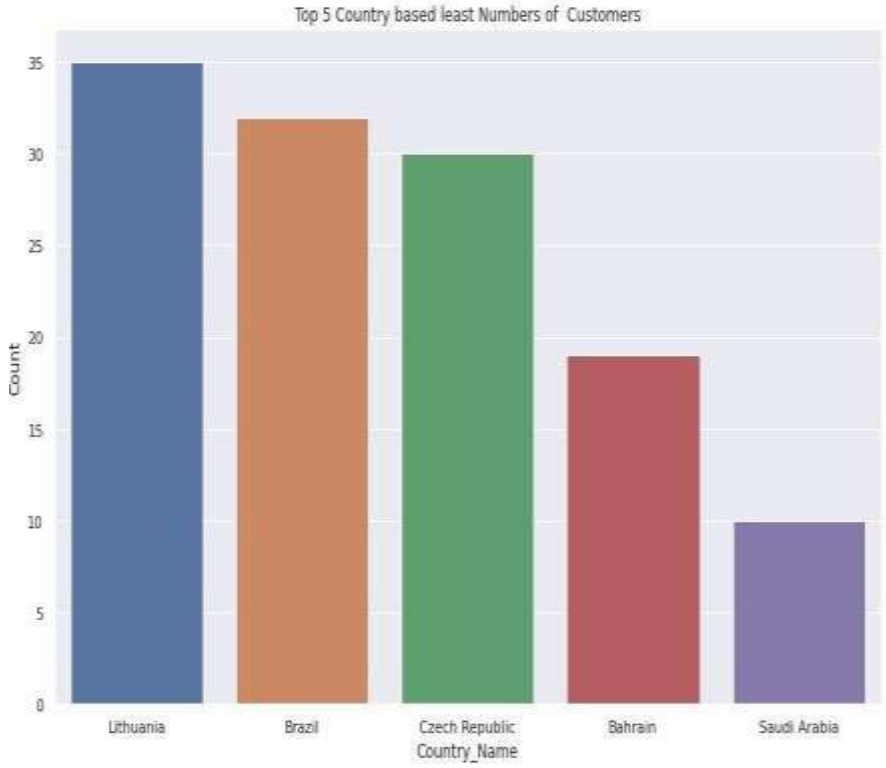


Log Distribution of Quantity

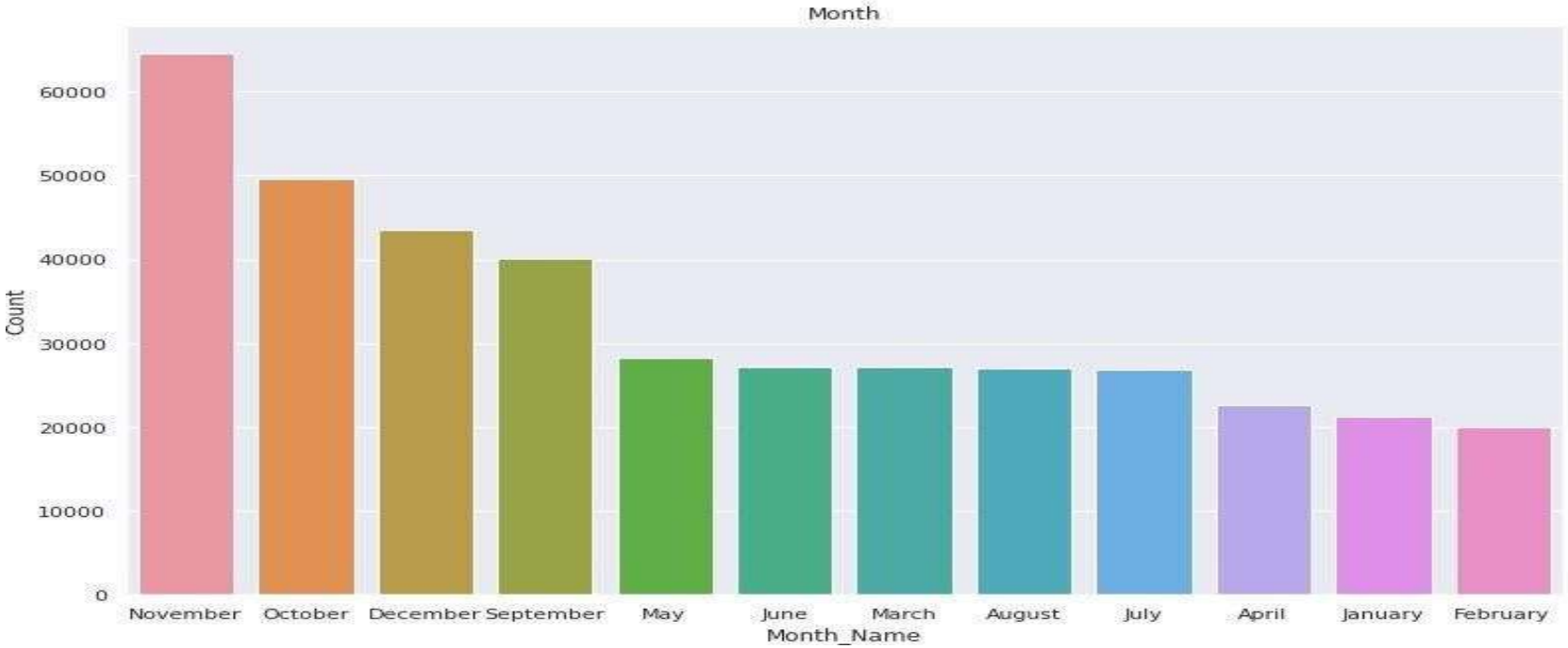


Top 5 vs Bottom 5 countries



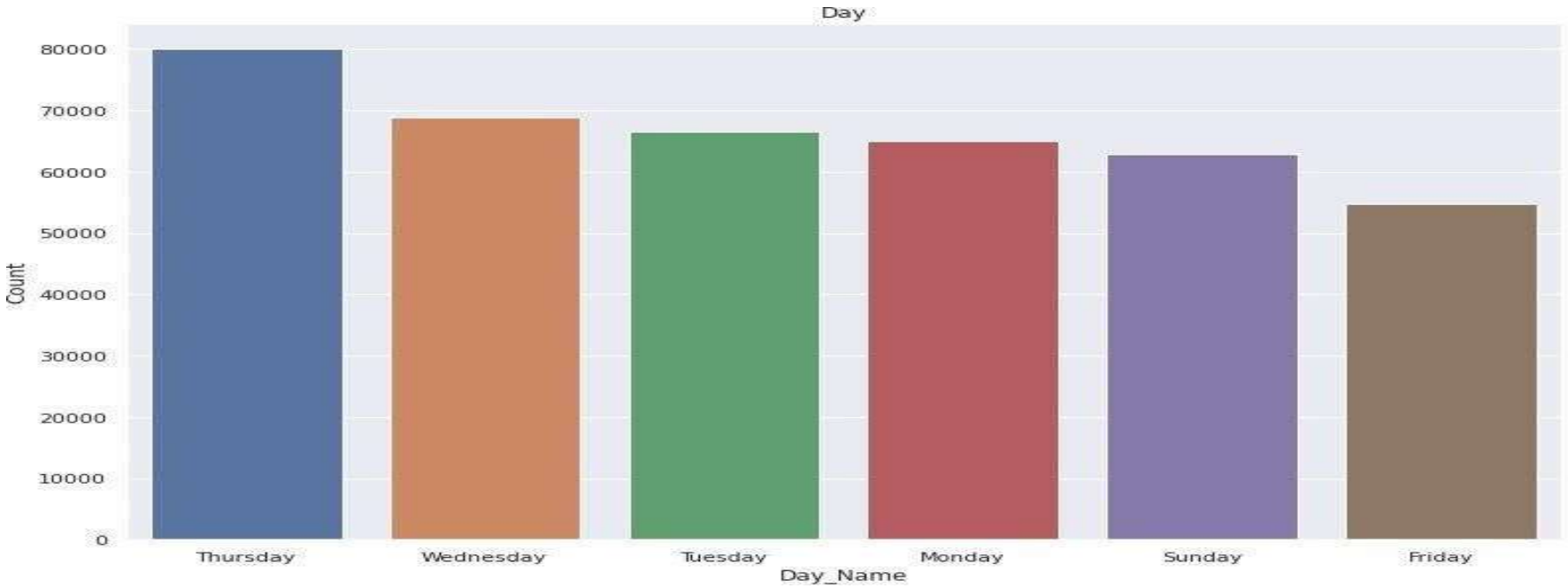


Month-wise analysis

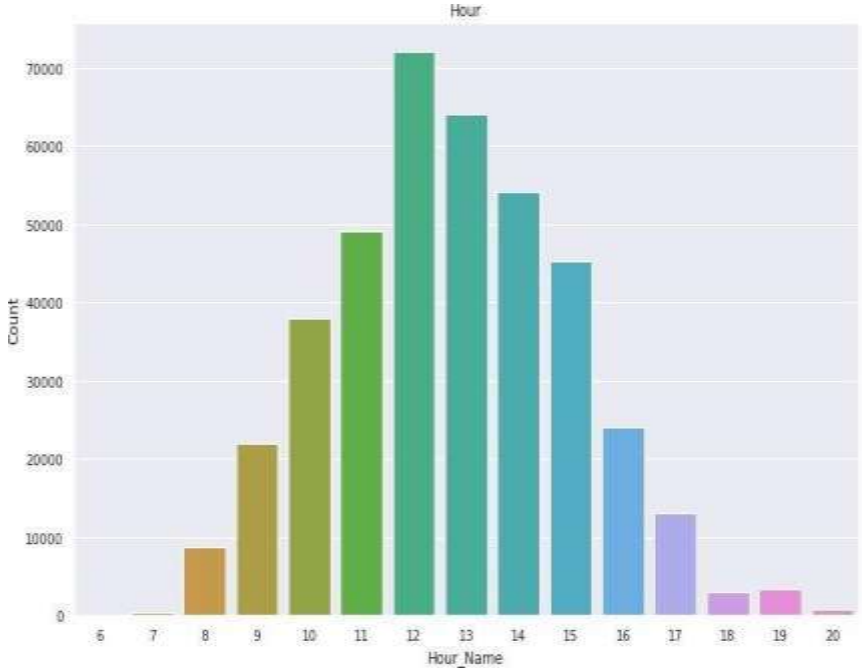


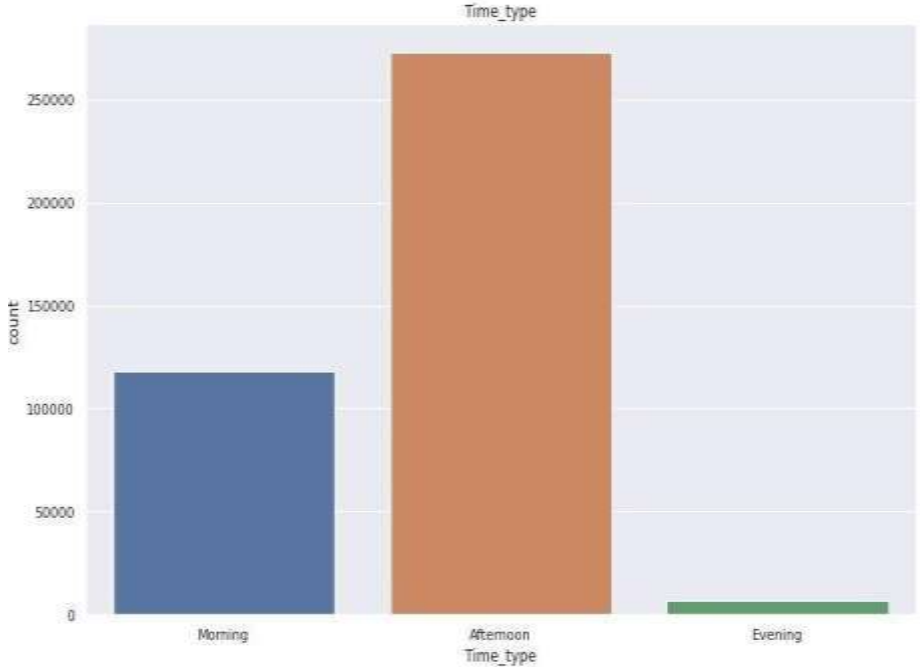
November and December could be the months with highest sales in anticipation of Christmas

Daywise analysis



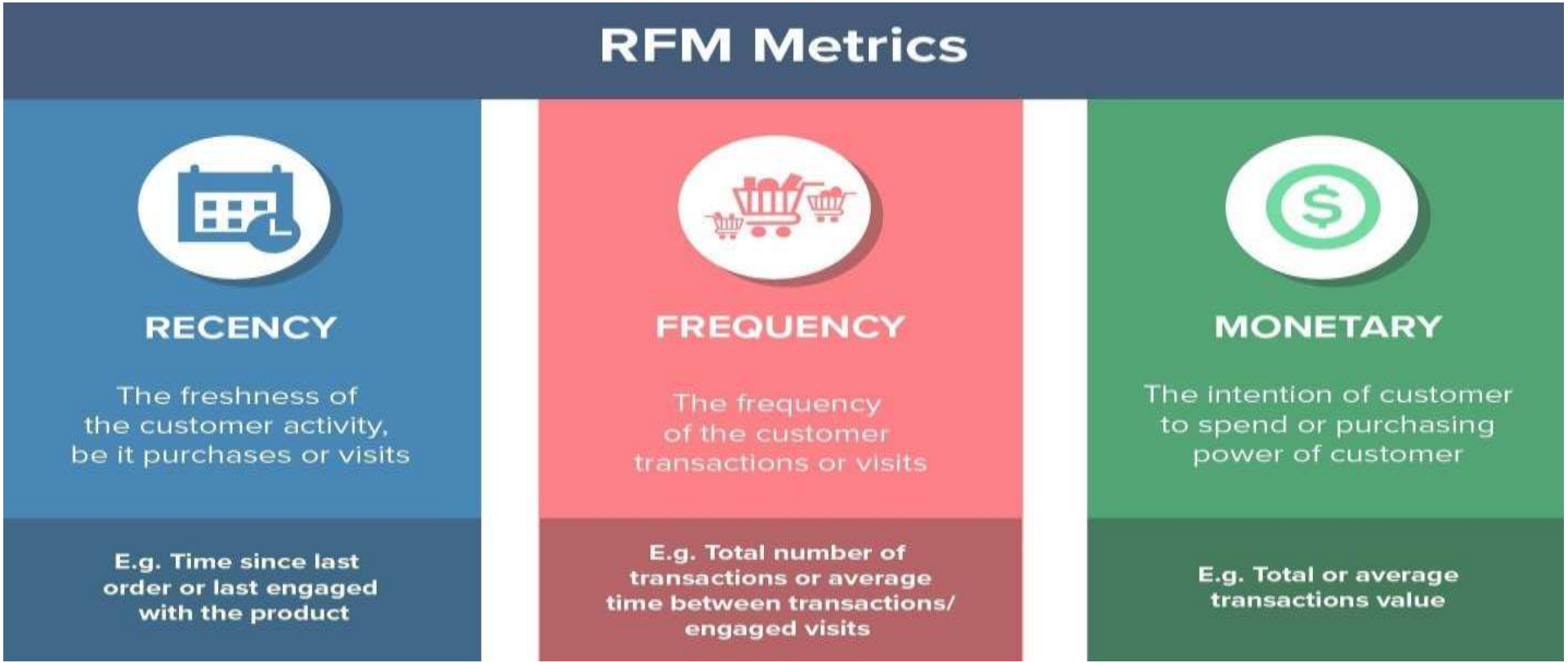
Hourwise analysis



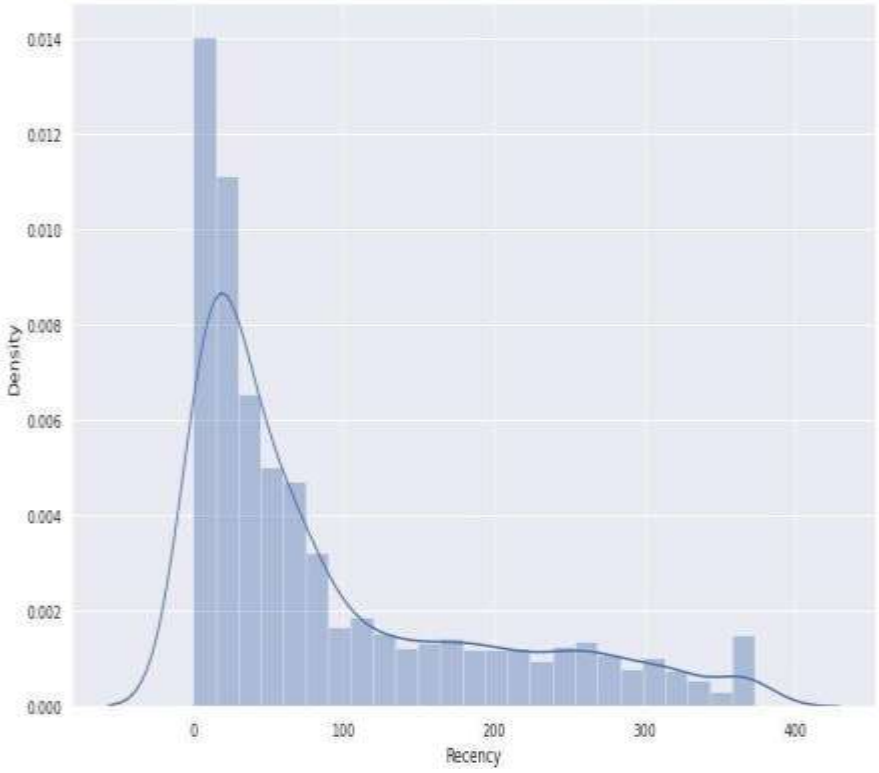


Working hours witnessing the highest sales could be attributed to the fact that a large part of the dataset is Wholesalers'data

Recency,Frequency,Monetary values



Recency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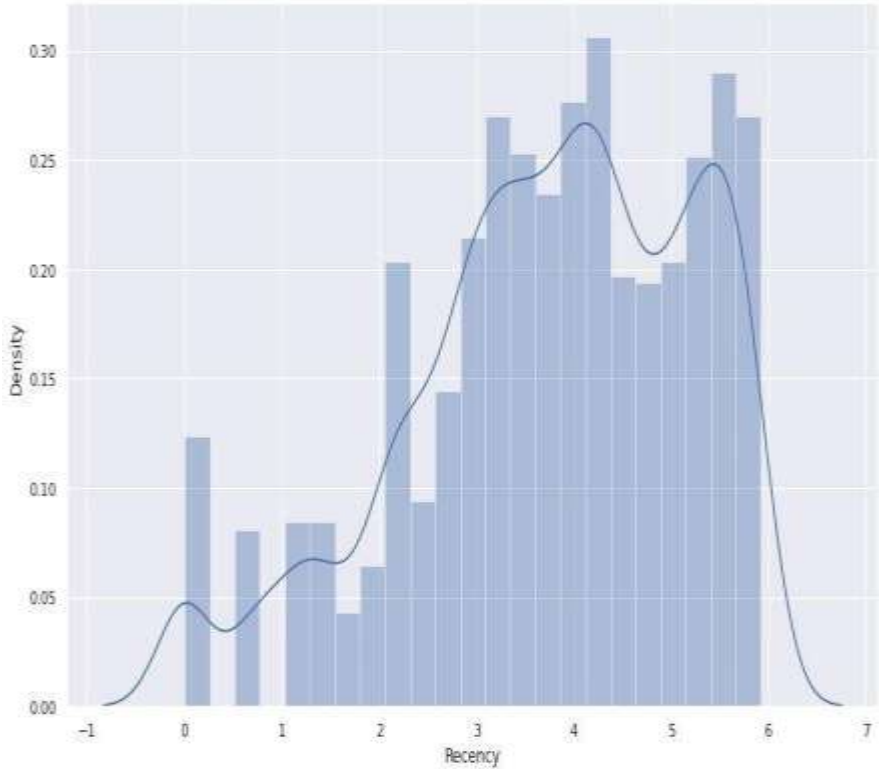
0.012
0.010
0.008
0.006
0.004
0.002
0.000
Density
0
100
200
300
400
Recency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0.25
0.20
0.15
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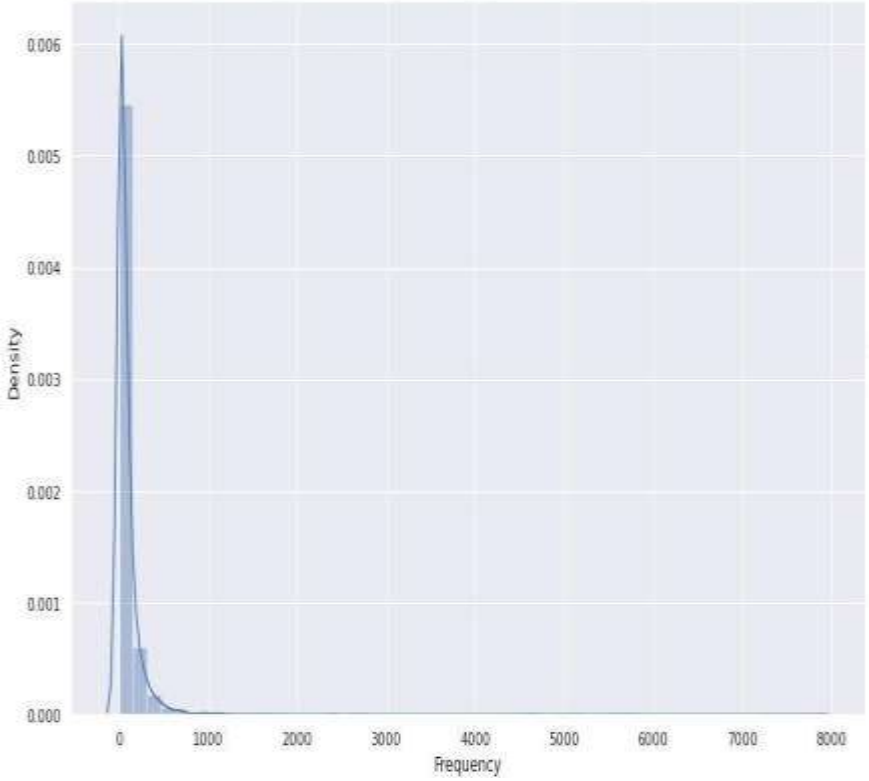
Density
−1
0
1
2
3
4
5
6
7
Recency

Frequency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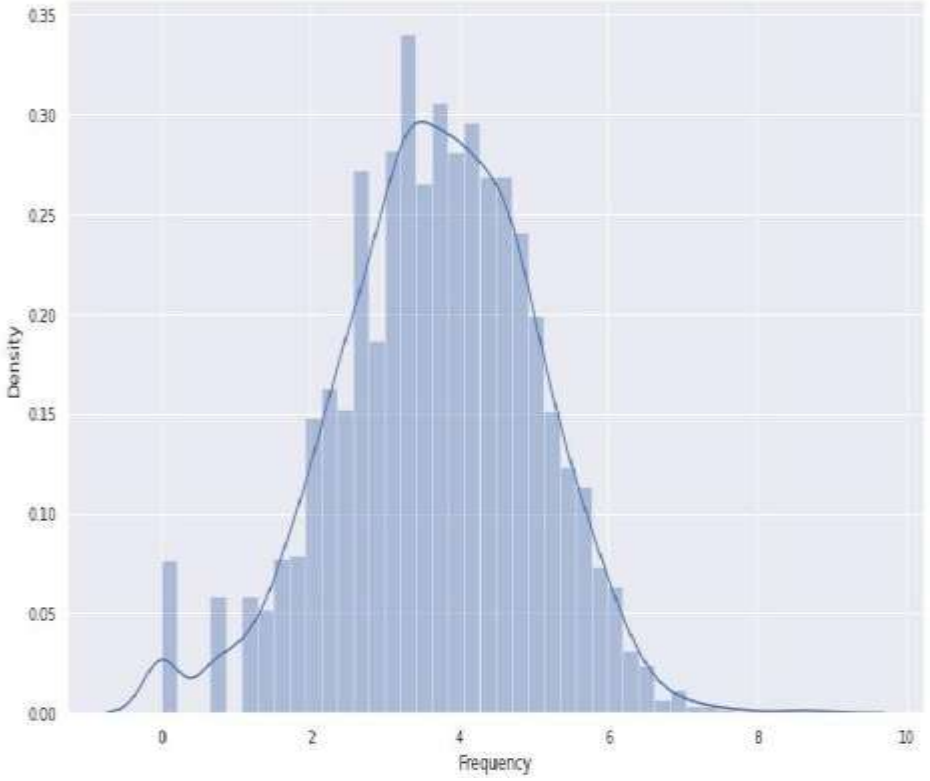
0.000
Density
0
1000
2000
3000
4000
5000
6000
7000
8000
Frequency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0.15
0.10
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Density
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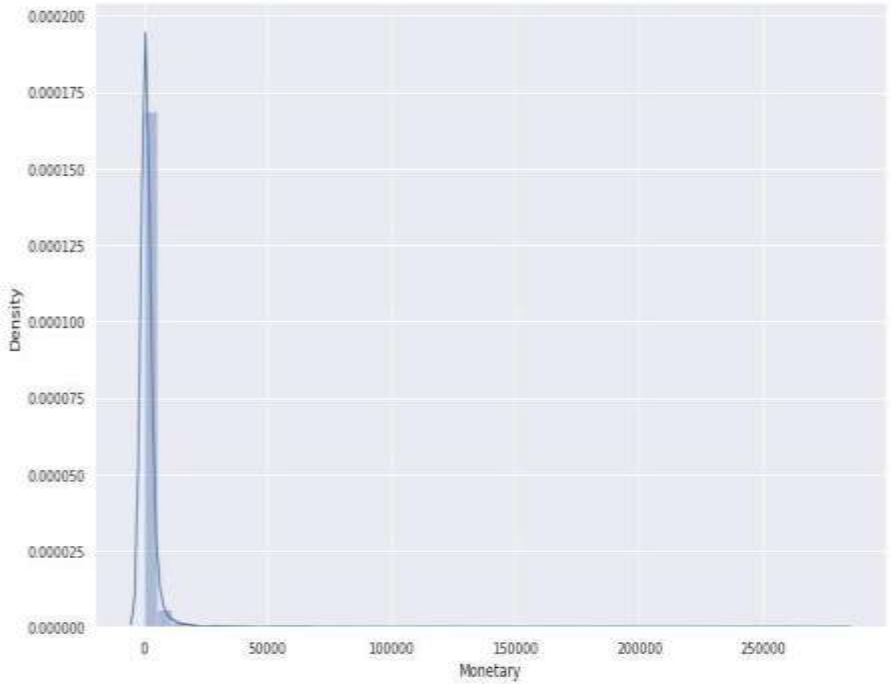
6
8
10
Frequency

Monetary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0.000125
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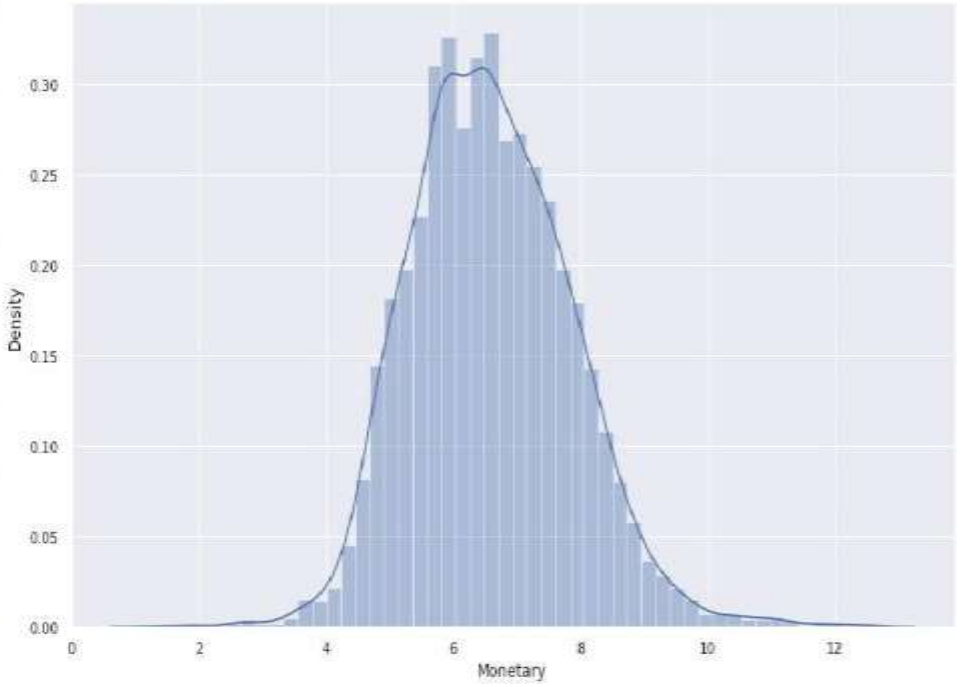
100000
150000
200000
250000
Monetary


0.30
0.25
0.20
0.15
0.10
0.05
0.00
Density
0
2
4
6
8
10
12
Monetary

Let,s get some insight about

DBSCAN (Density Based Spatial Clustering of Application with Noise) :
It is basically a clustering algorithm based on density

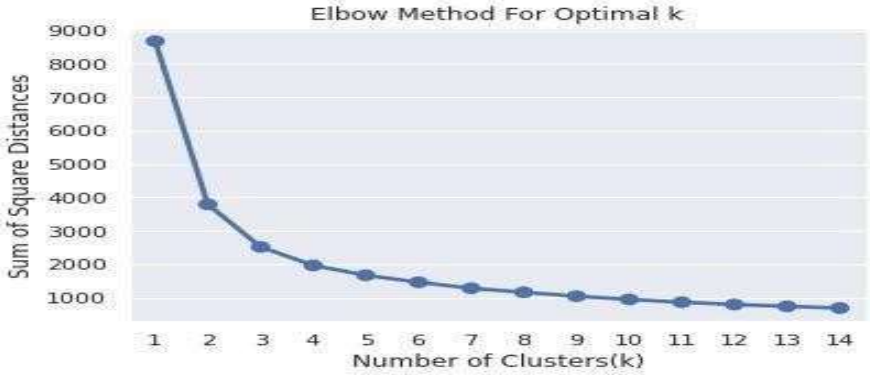
Silhouette score : Silhouette score is used to evaluate the quality of clusters; ranges from -1 to1 , where a high value indicates that the object is well matched to its own cluster and poorly matched to neighboring clusters

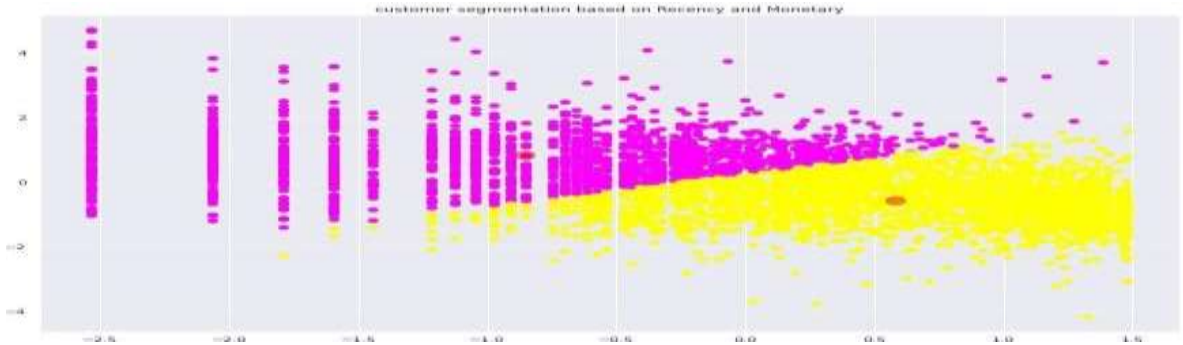
elbow method : a point from where the value of clusters starts decreasing suddenly

Dendogram : representation of hierarchial clustering

Silhouette score and Elbow method on R&M

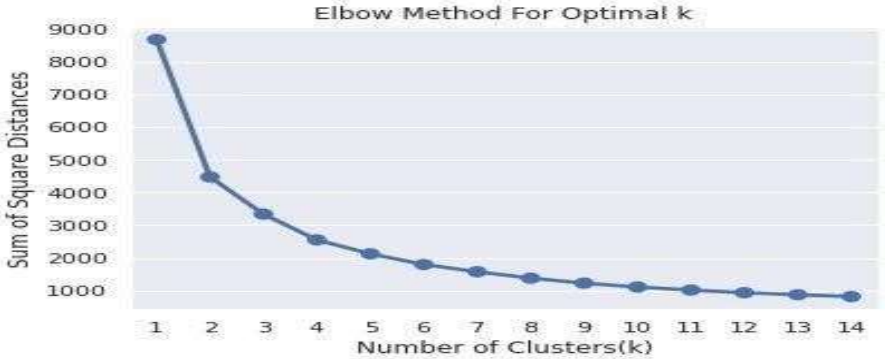
```
For n_clusters = 2, silhouette score is 0.4216081125935063
For n_clusters = 3, silhouette score is 0.3432957775914936
For n_clusters = 4, silhouette score is 0.36494104664274657
For n_clusters = 5, silhouette score is 0.33668503688485785
For n_clusters = 6, silhouette score is 0.3439780941919187
For n_clusters = 7, silhouette score is 0.3458567202377316
For n_clusters = 8, silhouette score is 0.33919727934627264
For n_clusters = 9, silhouette score is 0.3458423886312394
For n_clusters = 10, silhouette score is 0.34850666375861195
For n_clusters = 11, silhouette score is 0.3385166366909024
For n_clusters = 12, silhouette score is 0.3427649471441594
For n_clusters = 13, silhouette score is 0.34083950250492523
For n_clusters = 14, silhouette score is 0.3406096956008792
For n_clusters = 15, silhouette score is 0.34223526314989594
```

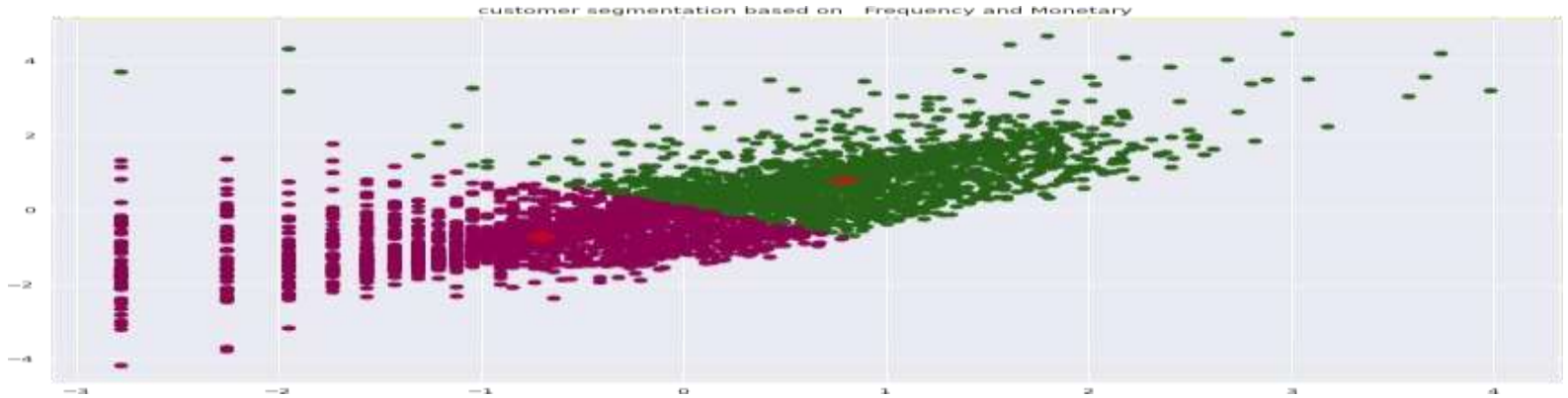




Silhouette score and Elbow method on F&M

```
For n_clusters = 2, silhouette score is 0.478535709506603
For n_clusters = 3, silhouette score is 0.40764120562174455
For n_clusters = 4, silhouette score is 0.3713782596510203
For n_clusters = 5, silhouette score is 0.34479733808079405
For n_clusters = 6, silhouette score is 0.35974563779013946
For n_clusters = 7, silhouette score is 0.33835032540639154
For n_clusters = 8, silhouette score is 0.3519892091800133
For n_clusters = 9, silhouette score is 0.3460160650521864
For n_clusters = 10, silhouette score is 0.3619887930235607
For n_clusters = 11, silhouette score is 0.36822618560766546
For n_clusters = 12, silhouette score is 0.35460489785135785
For n_clusters = 13, silhouette score is 0.3624674157300161
For n_clusters = 14, silhouette score is 0.365206169877763 16
For n_clusters = 15, silhouette score is 0.36101570873847355
```

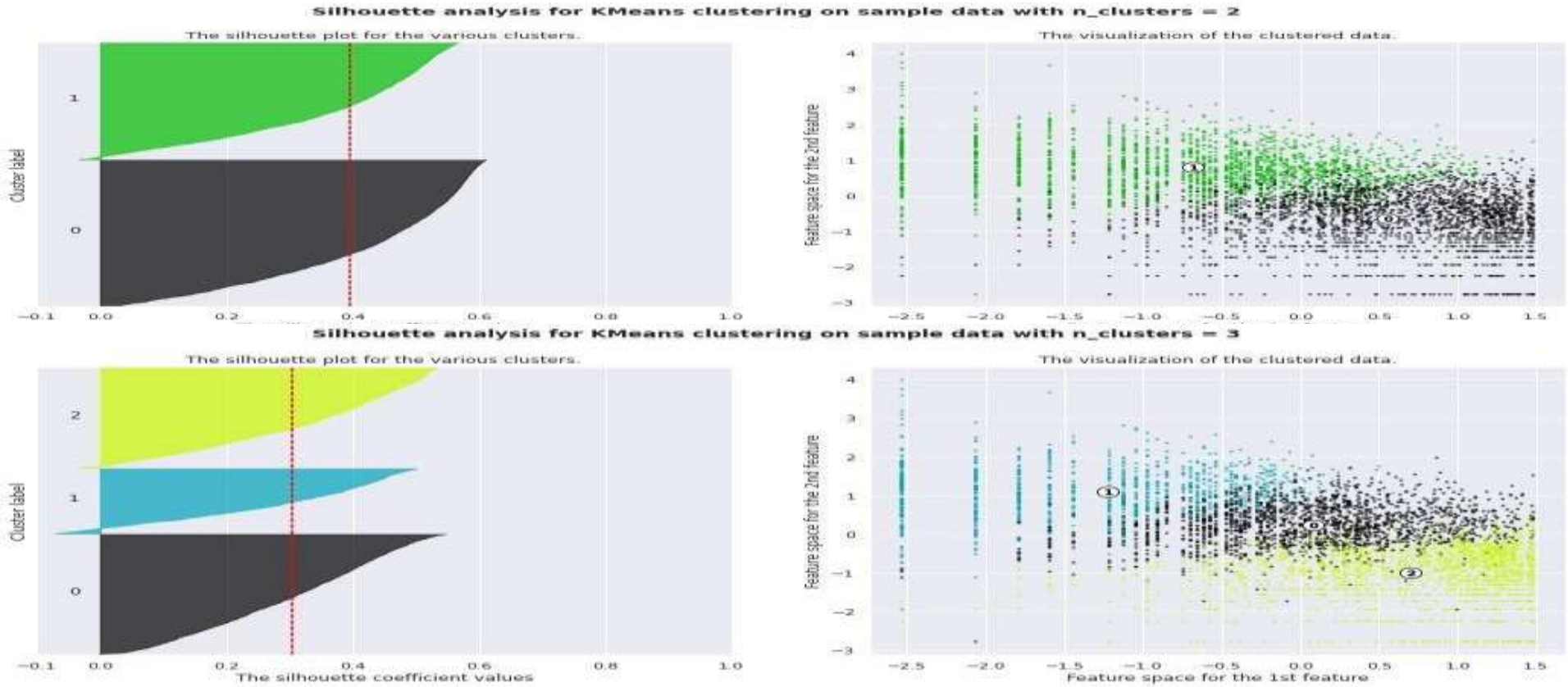




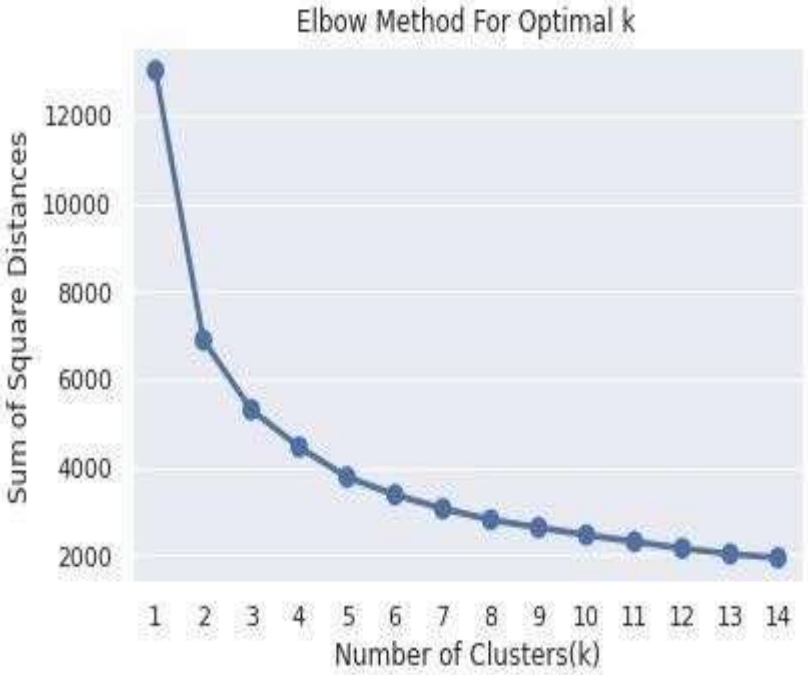
Silhouette analysis on R, F and M

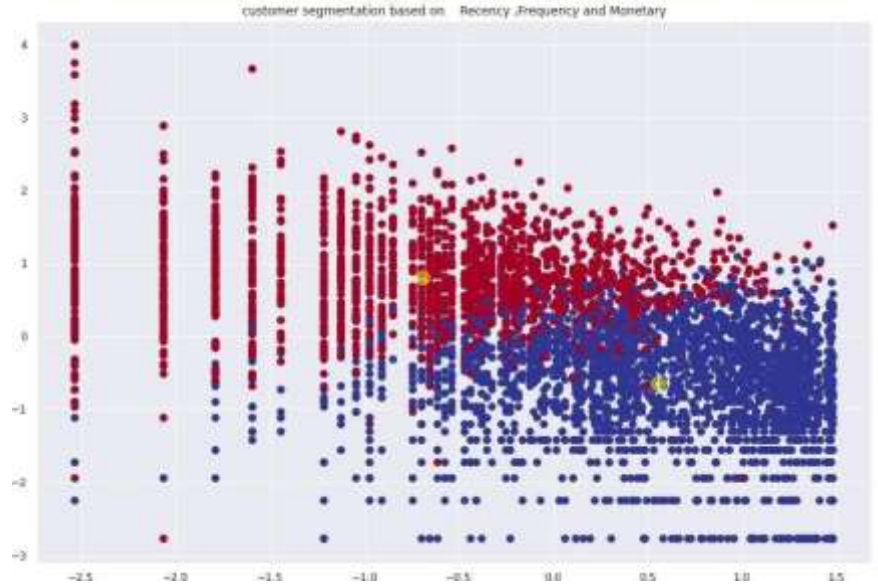
```
For n_clusters = 2 The average silhouette_score is : 0.395423791756615
For n_clusters = 3 The average silhouette_score is : 0.30310658681490 85
For n_clusters = 4 The average silhouette_score is : 0.302725517496819 86
For n_clusters = 5 The average silhouette_score is : 0.27880346166089 47
For n_clusters = 6 The average silhouette_score is : 0.27854318607070516
For n_clusters = 7 The average silhouette_score is : 0.2623613650755882
For n_clusters = 8 The average silhouette_score is : 0.2638608672365028
For n_clusters = 9 The average silhouette_score is : 0.25878886517568883
For n_clusters = 10 The average silhouette_score is : 0.259477127868534 05
For n_clusters = 11 The average silhouette_score is : 0.25946024250011 22
For n_clusters = 12 The average silhouette_score is : 0.263599810039632 45
For n_clusters = 13 The average silhouette_score is : 0.262169054485507 76
For n_clusters = 14 The average silhouette_score is : 0.26102008903605 79
For n_clusters = 15 The average silhouette_score is : 0.25496577320666 74
```

Silhouette analysis on RFM



Elbow method and Cluster chart on RFM

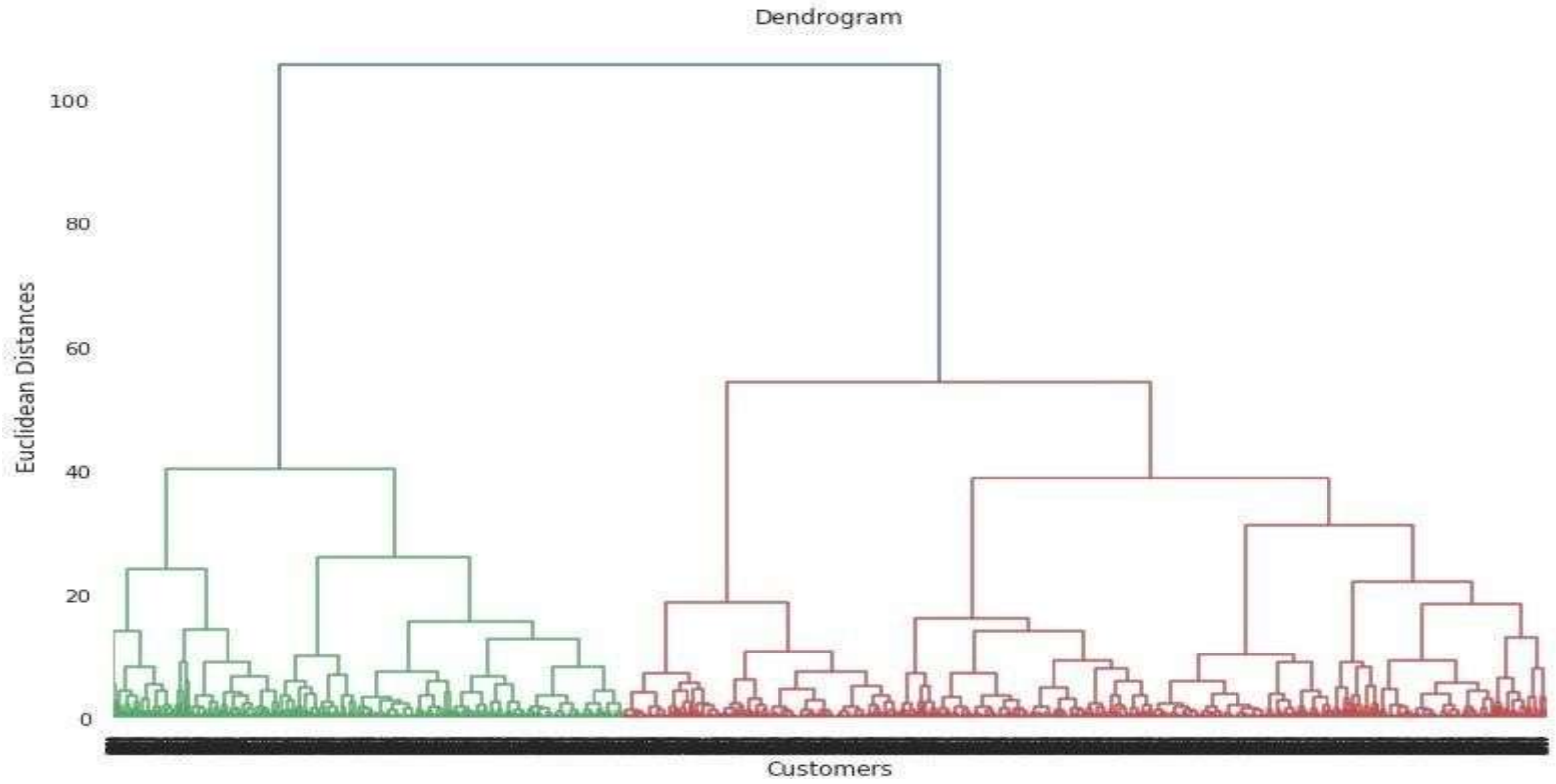




RFM Analysis

CustomerID	Recency	Frequency	Monetary	R	F	M	RFMGroup	RFMScore	Recency_log	Frequency_log	Monetary_log	Cluster
12346.0	325	1	77183.60	4	4	1	441	9	5.783825	0.000000	11.253942	1
12347.0	2	182	4310.00	1	1	1	111	3	0.693147	5.204007	8.368693	0
12348.0	75	31	1797.24	3	3	1	331	7	4.317488	3.433987	7.494007	1
12349.0	18	73	1757.55	2	2	1	221	5	2.890372	4.290459	7.471676	0
12350.0	310	17	334.40	4	4	3	443	11	5.736572	2.833213	5.812338	1
12352.0	36	85	2506.04	2	2	1	221	5	3.583519	4.442651	7.826459	0
12353.0	204	4	89.00	4	4	4	444	12	5.318120	1.386294	4.488636	1
12354.0	232	58	1079.40	4	2	2	422	8	5.446737	4.060443	6.984161	1
12355.0	214	13	459.40	4	4	3	443	11	5.365976	2.564949	6.129921	1
12356.0	22	59	2811.43	2	2	1	221	5	3.091042	4.077537	7.941449	0

Dendrogram



Challenges

- Huge dataset
- Null values
- Treatment of cancelled orders
- Right number of ‘k’ for clusters

Conclusion

Model Name	Data	Optimal Number of Clusters
K-Means with Silhouette Score	RM	2
K-Means with Elbow method	RM	2
DBSCAN	RM	2
K-Means with Silhouette Score	FM	2
K-Means with Elbow method	FM	2
DBSCAN	FM	2
K-Means with Silhouette Score	RFM	2
K-Means with Elbow method	RFM	2
Hierarchical Clustering	RFM	2
DBSCAN	RFM	3

THANK YOU