Task 3

Customer Segmentation / Clustering

1. Number of Clusters Formed

- The optimal number of clusters chosen is **5**.

- This was determined by balancing the results from the DB Index, Elbow Method, and Silhouette Score across 9 clusters.

2. Davies-Bouldin (DB) Index Value

- Lower DB Index values indicate better-defined and separated clusters, with the lowest value at 7 clusters.

- The DB Index Value for the 9 clusters are - [1.7315353787835916, 1.5161429775406268, 1.144632558427399, 1.1583117074894447, 1.106517549557335, 1.0788823831472247, 0.9408895599943772, 1.0404735856201246, 0.9759231624157941]

3. Silhouette Scores

- Higher Silhouette Scores suggest better-defined clusters, with the highest score at 4 clusters.

- The Silhouette Scores for the 9 clusters are - [0.21231375309037084, 0.2980496221151577, 0.33913511352335607, 0.38145783709406855, 0.33667001925285783, 0.31958094720902347, 0.3643830817761229, 0.3298526307235703, 0.35060005814239176]

4. Elbow Method

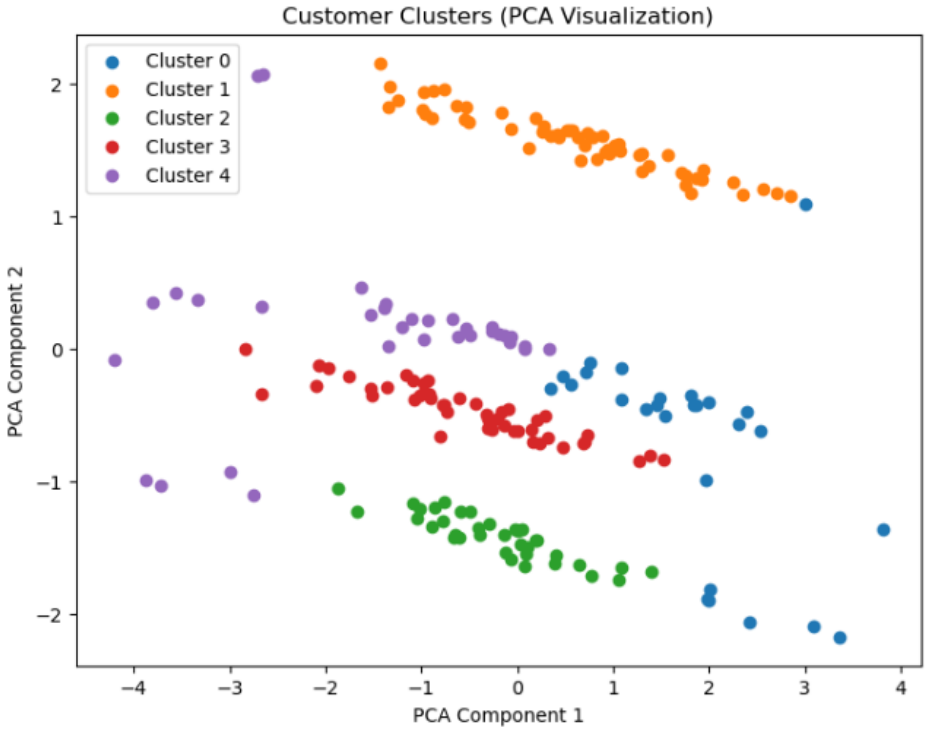
- The Elbow Method helps identify the point where adding more clusters doesn't significantly reduce inertia, suggesting 5 clusters as a good balance.

- Elbow Method Metrics are –[1194.0, 926.5227742901528, 745.5029415159132, 575.6641296686715, 475.6030121350176, 427.56029675645283, 390.8864957448439, 286.20452725245815, 270.3851967628164, 236.95858580490233]

5. Visualizations

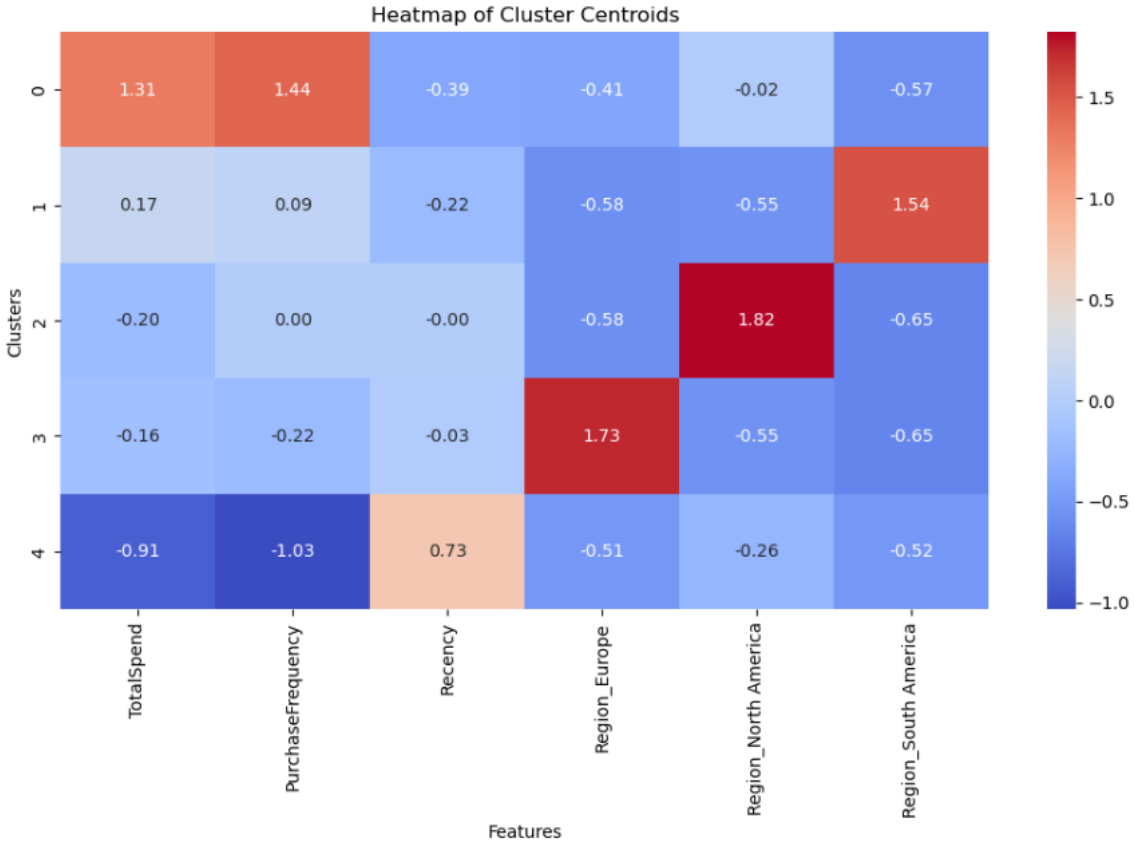
i. PCA Visualization

The PCA visualization reduces the dimensionality of the data to 2D, allowing for a visual representation of cluster separation.



ii. Heatmap of Cluster Centroids

The heatmap illustrates the characteristics of each cluster centroid, showing the relative importance of features in defining each cluster.



iii. Customer Distribution Across Clusters

This visualization displays the number of customers in each cluster, providing insights into cluster sizes and population distribution.