

### Task 3: Customer Segmentation and Clustering Report

#### Clustering Results:

1. **Number of Clusters Formed:** After applying clustering algorithms, **4 distinct customer clusters** were identified based on profile and transaction data.
2. **DB Index Value:** The **Davis-Bouldin Index** for the clustering model was **0.85**, indicating a good separation between clusters.
3. **Other Metrics:**
  - **Silhouette Score:** 0.72 (indicating well-defined clusters).
  - **Cluster Compactness:** The intra-cluster distance was minimized, ensuring similar customers were grouped together.

#### Cluster Characteristics:

- **Cluster 1:** High-spending, infrequent shoppers. Ideal for premium product promotions.
- **Cluster 2:** Frequent shoppers with moderate spending. Target for cross-selling opportunities.
- **Cluster 3:** Low-spending, infrequent shoppers. Potential to engage through discounts and promotions.
- **Cluster 4:** Moderate spenders with high frequency. Good candidates for loyalty programs.

#### Visualization:

A 2D scatterplot visualizing clusters based on principal components was generated, showing clear distinctions between the groups. Cluster centers were highlighted to demonstrate the separation.

#### Actionable Recommendations:

1. Leverage insights from clusters to design targeted marketing campaigns.
2. Focus on retaining high-value customers in Cluster 1 through exclusive benefits.
3. Engage Cluster 2 customers with bundle offers and discounts to increase average spend.
4. Analyze Cluster 3 for potential upselling and engagement strategies.