# Customer Segmentation Report

The decision to use the Gaussian Mixture Model (GMM) over other clustering methods (e.g., DBSCAN) was based on the following performance metrics:

| Metric | DBSCAN | GMM | K-means |
|---|---|---|---|
| Davies-Bouldin Index | 1.3279 | 0.7491 | **1.1926** |
| Silhouette Score | 0.3730 | 0.5088 | 0.2670 |

- Davies-Bouldin Index: GMM achieved a significantly lower value (0.7491), indicating better-defined and well-separated clusters compared to the others
- Silhouette Score: GMM had a higher score (0.5088), showing better cohesion within clusters and clearer separation between them compared to others

## 1. Number of Clusters Formed

- Number of Clusters: 4 (determined using the Gaussian Mixture Model).

## 2. Clustering Metrics

- Davies-Bouldin Index: 0.7491 (lower is better; indicates well-separated clusters).

- Silhouette Score: 0.5088 (ranges from -1 to 1; higher values indicate better-defined clusters).

## 3. Cluster Characteristics

The following table provides insights into the key characteristics of each cluster:

| Cluster | Key Features |
|---------|--------------|
| Cluster 0 | Low `TotalValue`, Low `Quantity` |
| Cluster 1 | High `TotalValue`, Moderate `Quantity` |
| Cluster 2 | Moderate `TotalValue`, High `Quantity` |
| Cluster 3 | High `TotalValue`, High `Quantity` |

## 4. Cluster Profiling Table

| Cluster | Avg_Quantity | Total_Quantity | Avg_Total Value | Total_Total Value | Avg_Price | Total_Price | Customer_Count |
|---------|--------------|----------------|-----------------|-------------------|-----------|-------------|----------------|
| 0 | 3.538462 | 736 | 432.351827 | 89929.18 | 120.668702 | 25099.09 | 208 |
| 1 | 1.489726 | 435 | 560.261438 | 163596.34 | 373.756507 | 109136.9 | 292 |
| 2 | 1.533679 | 296 | 187.302746 | 36149.43 | 121.642487 | 23477.0 | 193 |
| 3 | 3.485342 | 1070 | 1303.975928 | 400320.61 | 374.075179 | 114841.08 | 307 |

# 5. Cluster Profiling Insights

1. Cluster 0: Low Quantity, Moderate Value Buyers

   - Customers make fewer purchases but spend a moderate amount per transaction.

   - Strategy: Encourage more frequent purchases through targeted promotions.

2. Cluster 1: High Value, High Quantity Buyers

   - These are premium customers with the highest spending and purchase frequency.

   - Strategy: Focus on loyalty programs and personalized services to retain them.

3. Cluster 2: High Quantity, Moderate Value Buyers

   - Customers purchase frequently but spend moderately per transaction.

   - Strategy: Upsell and cross-sell products to increase transaction values.

4. Cluster 3: Low Value, Low Price Buyers

   - These customers spend the least per transaction and purchase less frequently.

   - Strategy: Offer bundle deals or discounts to increase their spending.

# 6. Business Implications

1. Targeted Marketing:

   - Cluster 3 (Premium Customers): Focus on loyalty programs, premium offers, and personalized services to retain these valuable customers.

   - Cluster 1 (High-Value Customers): Offer exclusive discounts or high-end product recommendations to increase purchase frequency.

   - Cluster 2 (Frequent Buyers): Promote bundles or subscription plans to maximize revenue from their frequent transactions.

   - Cluster 0 (Low Engagement): Use targeted campaigns to re-engage these customers with attractive offers or incentives.

2. Resource Allocation:

   - Allocate more resources to premium and high-value customers for retention.

   - Design cost-effective strategies for engaging low-value customers.

3. Product Recommendations:

   - Use insights from frequent buyers (Cluster 2) to recommend products that align with their purchasing patterns.