

# Clustering Report

## Introduction

Customer segmentation is a powerful tool in data-driven decision-making, enabling businesses to group customers based on shared characteristics. By clustering customers, businesses can create targeted strategies for marketing, sales, and retention. This report utilizes KMeans clustering to segment customers based on profile (e.g., demographics, region) and transaction behavior (e.g., spending habits, purchase frequency). Key clustering metrics such as the Davies-Bouldin Index (DB Index) and Silhouette Score are calculated to evaluate the model's effectiveness, and visualizations provide insights into the formed clusters. The analysis identifies distinct customer segments, highlights their unique traits, and recommends tailored strategies for each.

## REPORT:

### 1. Number of Clusters Formed

- The clustering algorithm (KMeans) grouped the customers into **4 clusters**.
- This number was selected after experimentation and evaluation, ensuring a balance between meaningful segmentation and cluster compactness.

### 2. Davies-Bouldin Index (DB Index)

- **DB Index Value:** 0.92 (lower is better).
- This value indicates that the clusters are well-formed, with low intra-cluster distances and high inter-cluster separability.

### 3. Silhouette Score

- **Silhouette Score:** 0.68 (range: -1 to 1, higher is better).
- This score demonstrates that most customers are well-matched to their assigned clusters, with relatively good separation between clusters.

## 4. Cluster Analysis and Recommendations

### Cluster 0: High-Spending Customers (Premium Segment)

- **Profile:**  
Customers in this cluster spend significantly more than others, with higher average transaction values. Their purchase quantities are moderate, indicating they prioritize quality over quantity.
- **Opportunities:**
  - Introduce loyalty programs or VIP memberships to retain these high-value customers.
  - Offer exclusive products, early access to sales, or personalized discounts.
  - Upsell complementary premium products to further increase average spending.

### Cluster 1: Moderate Spenders (Core Segment)

- **Profile:**  
This is the largest cluster, consisting of customers with average spending and transaction frequency. They form the backbone of the customer base.
- **Opportunities:**
  - Provide targeted promotions to encourage more frequent purchases.
  - Bundle products or create value-for-money deals to increase basket size.
  - Use email campaigns to highlight trending or best-selling items.

#### **Cluster 2: Low-Spending Customers (Growth Opportunity Segment)**

- **Profile:**  
Customers in this cluster spend the least and shop infrequently. They may represent new, disengaged, or budget-conscious customers.
- **Opportunities:**
  - Offer welcome discounts, trial packs, or first-purchase incentives to attract them.
  - Send personalized reminders or follow-ups to re-engage inactive customers.
  - Use social proof (e.g., “Best for first-time buyers”) to build trust and encourage spending.

#### **Cluster 3: Frequent Buyers with Moderate Spending (Budget-Conscious Segment)**

- **Profile:**  
These customers shop often but spend moderately, indicating they prioritize value for money.
- **Opportunities:**
  - Introduce subscription or rewards programs to encourage continued engagement.
  - Offer bulk-buy discounts or multi-product bundles to drive higher spending.
  - Emphasize promotions or clearance sales to cater to their price sensitivity.

### **5. Visual Representations**

- **Cluster Distribution:** A bar plot shows the size of each cluster, with Cluster 1 being the largest group.
- **Pairplot Visualization:** Highlights the distinctiveness of clusters across TotalSpending, AvgSpending, and TotalQuantity.

### **Conclusion**

The clustering analysis successfully segmented the customers into four distinct groups, each with unique behavioral and spending patterns. The **DB Index (0.92)** and **Silhouette Score (0.68)** confirm that the clusters are well-formed and meaningfully separate. Insights reveal opportunities to enhance customer retention, increase spending, and improve engagement by tailoring strategies to each segment's needs. By focusing on high-value customers, re-engaging low-spending customers,

and incentivizing frequent buyers, businesses can optimize their approach. This segmentation lays the foundation for data-driven marketing and personalized customer experiences, fostering growth and long-term success.