

# Customer Segmentation Clustering Report

## 1. Overview

This report presents the results of customer segmentation using K-Means clustering. The dataset consists of customer profiles and transaction history, which have been analyzed to identify distinct customer groups based on their purchasing behavior.

## 2. Clustering Process

### 2.1 Data Preparation

- The dataset was preprocessed by encoding categorical variables (Region) and normalizing numerical features (Total Revenue, Avg. Transaction Value, Transaction Count, and Unique Products).
- StandardScaler was applied to ensure uniform scaling of features.

### 2.2 Clustering Model

- **Algorithm Used:** K-Means Clustering
- **Number of Clusters:** 5 (Tuned between 2-10)
- **Random State:** 42 (Ensures reproducibility)
- **Evaluation Metric:** Davies-Bouldin Index

### 2.3 Clustering Evaluation

- **Davies-Bouldin Index: 1.211**
  - A lower DB Index indicates better clustering quality. The obtained value suggests a moderately well-formed clustering structure.

## 3. Visualization

- Principal Component Analysis (PCA) was used to reduce feature dimensions to two components for visualization.
- The scatter plot (provided) illustrates the five customer clusters in a 2D space.
- Each color represents a distinct cluster, highlighting different customer behaviors.

## 4. Key Observations

- Cluster 0 (Blue): Customers with high transaction variability.
- Cluster 1 (Orange): Customers with moderate spending and average transaction count.
- Cluster 2 (Green): Low-revenue customers with limited product diversity.
- Cluster 3 (Red): Customers with high transaction frequency but moderate revenue.
- Cluster 4 (Purple): High-value customers with diverse product purchases.

## 5. Conclusion

- The clustering model successfully segmented customers into distinct groups.

- The DB Index suggests room for optimization by adjusting the number of clusters or exploring hierarchical clustering.
- These clusters can be leveraged for targeted marketing strategies, personalized recommendations, and customer retention efforts.