Clustering Results Report

Objective

The goal of the clustering analysis was to segment customers into distinct groups based on their profiles and transaction histories. This segmentation enables better targeting of marketing strategies, personalized customer service, and product recommendations.

1. Number of Clusters Formed

After applying the clustering algorithm and evaluating the optimal number of clusters using the **elbow method** and **silhouette score**, we determined that the dataset can be effectively segmented into **X clusters**.

Cluster Details

- Cluster 1: Contains Y% of customers, characterized by [key traits such as high/low spending, specific regions, or product preferences].
- Cluster 2: Contains Z% of customers, characterized by [key traits].
- (Repeat for each cluster as needed.)

2. Evaluation Metrics

DB Index (Davies-Bouldin Index)

- The Davies-Bouldin Index measures the compactness and separation of clusters. A lower value indicates better-defined clusters.
- **DB Index Value**: **X.XX**

Silhouette Score

- The silhouette score measures how similar a point is to its own cluster compared to other clusters. A score closer to 1 indicates better-defined clusters.
- **Silhouette Score**: **X.XX**

Inertia (for K-Means)

- Inertia measures the within-cluster sum of squared distances (WSS). Lower inertia suggests compact clusters.
- **Inertia Value**: **X,XXX**

3. Cluster Visualization

Visual Representation

Clusters were visualized using a **scatter plot** with **PCA (Principal Component Analysis)** for dimensionality reduction:

- **Figure 1**: 2D scatter plot showing customer clusters. Each cluster is represented by a unique color.

- **Figure 2**: Bar chart showing the number of customers in each cluster.

Insights from Visualizations

1. **Cluster Overlap**: There is little/no overlap between clusters, indicating clear separations.
2. **Cluster Sizes**: Cluster 1 is the largest, comprising X% of the total customers, while Cluster 3 is the smallest, with Y%.

4. Key Findings

1. **Cluster Profiles**:
   - **Cluster 1**: Customers with high spending and frequent transactions, primarily from Region A. Suitable for premium product marketing.
   - **Cluster 2**: Low-spending customers with irregular purchases. Ideal for discount-based offers.
   - **Cluster 3**: Medium-spending customers with consistent transactions. Potential for loyalty programs.
2. **Business Recommendations**:
   - Focus on **Cluster 1** for high-value campaigns and exclusive product launches.
   - Develop retention strategies for **Cluster 2** to increase transaction frequency.
   - Offer personalized rewards for **Cluster 3** to improve loyalty and spending.

5. Conclusion

The clustering analysis provided actionable segmentation of customers, enabling better-targeted marketing efforts. With a Davies-Bouldin Index of **X.XX**, the clustering model achieved well-defined groupings. Future work can focus on adding more features (e.g., behavioral data) to improve segmentation accuracy.