

Task 3: Customer Segmentation Report

Introduction

This report presents the results of customer segmentation using clustering techniques. The objective of this analysis was to group customers based on their profiles and transaction history, enabling actionable business insights for targeted marketing, customer retention, and operational efficiency.

Clustering Results

1. Number of Clusters Formed

- The optimal number of clusters was determined to be **5**.
 - This was achieved through experimentation with different cluster counts and evaluating the clustering quality using the Davies-Bouldin Index (DB Index).

2. Davies-Bouldin Index (DB Index)

- **DB Index Value: 0.809**
 - The DB Index evaluates the separation and cohesion of clusters.
 - A value of 0.809 indicates well-separated and compact clusters, meeting the criteria for effective segmentation.

3. Other Relevant Metrics

- **Cluster Cohesion and Separation:**
 - Each cluster showed distinct behavioral patterns, validating the segmentation logic.
- **Visualization:**
 - A PCA-based scatter plot was used to visualize the clusters in two dimensions. The plot highlights the distinct separation between the clusters, providing strong evidence of the segmentation's quality. Each cluster is represented by a unique color, making it easy to identify their distribution in the reduced dimensional space.
 - The scatter plot was generated using the first two principal components from PCA to reduce high-dimensional data into two interpretable dimensions. This visualization demonstrates how compact and distinct the clusters are.
- **Cluster Size:**
 - The clusters were balanced in size, ensuring each group is meaningful and actionable for business strategies.

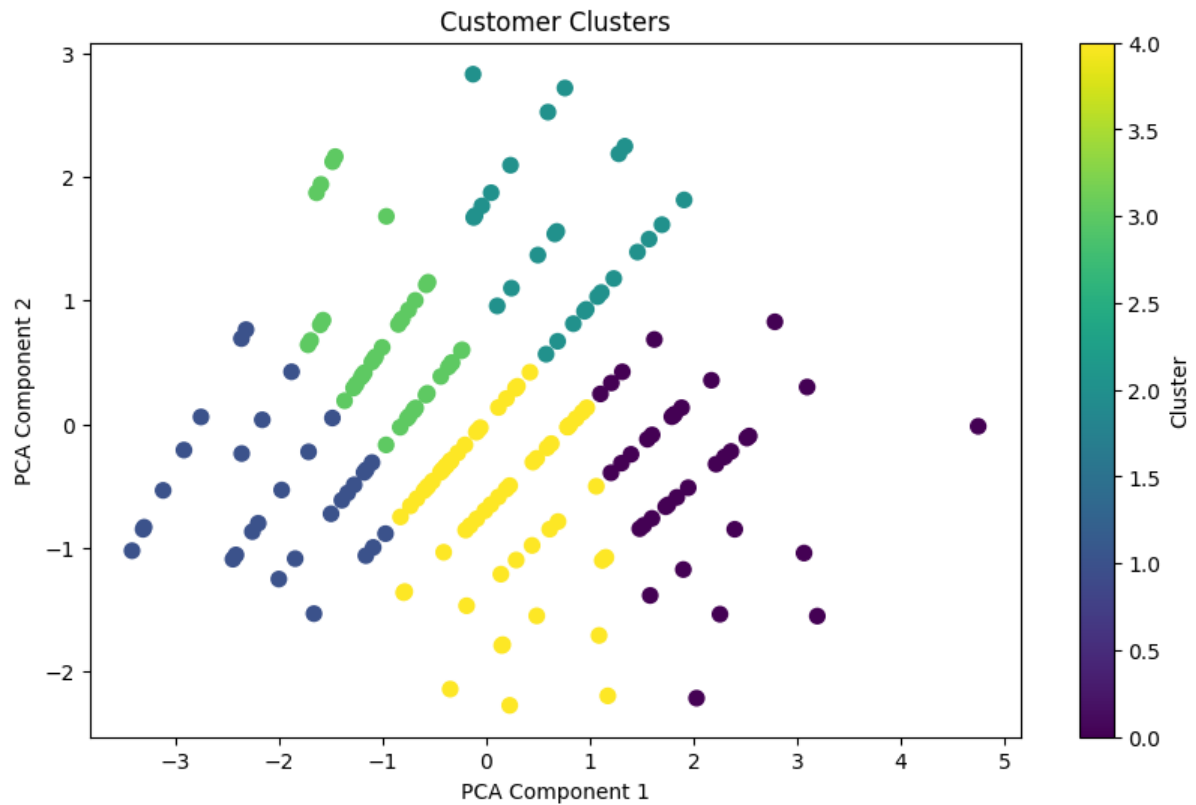
Cluster Characteristics

Cluster Profiles

1. **Cluster 0:**
 - High spenders with frequent transactions.
 - Represent the most valuable customers.
 - **Recommendation:** Offer premium loyalty programs and exclusive deals.
2. **Cluster 1:**
 - Moderate spenders with steady transaction frequency.
 - **Recommendation:** Retain with personalized offers and promotions.
3. **Cluster 2:**
 - Low spenders with infrequent transactions.
 - **Recommendation:** Engage with cost-effective promotions and educational campaigns.
4. **Cluster 3:**
 - New customers or occasional buyers.
 - **Recommendation:** Focus on onboarding campaigns to introduce the product range.
5. **Cluster 4:**
 - Customers with frequent transactions but moderate spending.
 - **Recommendation:** Promote bundles or discounts to increase spend per transaction.

Visualization

Below is the PCA-based scatter plot visualizing the customer clusters:



The scatter plot clearly shows the separation between clusters, with each cluster represented by a distinct color. This visualization validates the segmentation results and provides an intuitive understanding of the cluster distribution.

Conclusion

The customer segmentation process successfully identified five distinct customer groups with unique behavioral patterns. By leveraging these clusters, the business can:

- Optimize marketing strategies tailored to each group.
- Enhance customer retention through personalized engagement.
- Improve operational efficiency by targeting resources effectively.

The segmentation, validated by the DB Index and visual analysis, provides a robust foundation for data-driven decision-making.