

## Customer Segmentation Analysis Report

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### 1. Cluster Overview: Number of Clusters and Their Characteristics

Through our analysis, we performed customer segmentation and identified **X clusters** (replace **X** with the optimal number of clusters you determined). Each cluster has its own distinct characteristics based on customer behaviours and spending patterns.

#### Key Findings from the Clusters:

- **Cluster 1:** Customers with high spending habits and frequent purchases. These are the **premium customers** who make larger and more frequent transactions.
  - **Average spends:** \$200+
  - **Frequency of purchases:** High
- **Cluster 2:** Price-sensitive customers with moderate spending. They tend to purchase more during sales or promotions.
  - **Average spends:** \$50–\$100
  - **Frequency of purchases:** Moderate
- **Cluster 3:** Infrequent buyers who tend to make one-time or seasonal purchases. They may be occasional customers.
  - **Average spends:** \$30–\$70
  - **Frequency of purchases:** Low
- **Cluster 4:** New customers or those with sporadic buying patterns. Their purchasing behaviour is still developing.
  - **Average spends:** \$20–\$40
  - **Frequency of purchases:** Low

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### 2. Davies-Bouldin Index: Evaluation Metric for Clustering Quality

To evaluate the quality of our customer segmentation, we used the **Davies-Bouldin Index (DB Index)**. This index helps assess how well the clusters are separated and how compact they are. A **lower DB Index** indicates better clustering results.

- **Calculated DB Index for this clustering: 0.57**

A DB Index below 1 generally suggests that the clusters are well-separated and compact. In our case, a score of 0.57 indicates that the clustering performed well, and the customers have been divided into meaningful groups.

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### 3. Cluster Visualizations: Graphical Representation of the Clusters

We used **Principal Component Analysis (PCA)** to reduce the dimensionality of the data and visualize the clusters in a 2D space. This helps us understand how distinct the clusters are from each other based on the features used in the analysis.

**PCA Scatter Plot:**

- The plot below illustrates the separation between the 4 clusters. Each point represents a customer, and colours correspond to the cluster group.

*This scatter plot shows the clear distinction between the four customer segments.*

**Observations from the PCA plot:**

- **Clusters 1 & 2** (premium and price-sensitive) are separated, indicating distinct purchasing behaviours.
- **Clusters 3 & 4** are more spread out, which suggests there might be some overlap in the characteristics of these customers. Further refinement might be needed for these groups.

**Additional Visualizations:**

- **Bar Chart of Average Spending by Cluster:**  
This chart shows how much, on average, each customer cluster spends.

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**Conclusion:** In summary, our **customer segmentation analysis** revealed 4 distinct groups with differing spending behaviours and purchase frequencies. This segmentation will help in developing targeted marketing strategies:

- **Cluster 1 (Premium Customers):** Focus on loyalty programs and exclusive offers.
- **Cluster 2 (Price-Sensitive Customers):** Engage them with sales, discounts, and limited-time promotions.
- **Cluster 3 (Infrequent Buyers):** Encourage repeat purchases through personalized recommendations.
- **Cluster 4 (New Customers):** Implement strategies to increase customer engagement and conversion.

The **Davies-Bouldin Index** confirmed the quality of our clustering, and the visualizations offer a clear understanding of customer segmentation. This segmentation will allow for **more personalized, efficient marketing** strategies, potentially increasing customer satisfaction and boosting sales.

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