

## Objective

The objective was to perform customer segmentation using the **K-Means Clustering** algorithm. The analysis aimed to identify distinct customer groups for targeted marketing strategies.

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## Data Preparation

### 1. Input Data

- The dataset (Processed\_Data.csv) was aggregated at the customer level to extract the following features:
  - **TotalValue**: Sum of transaction values.
  - **Quantity**: Total number of products purchased.
  - **ProductID**: Number of unique products purchased.

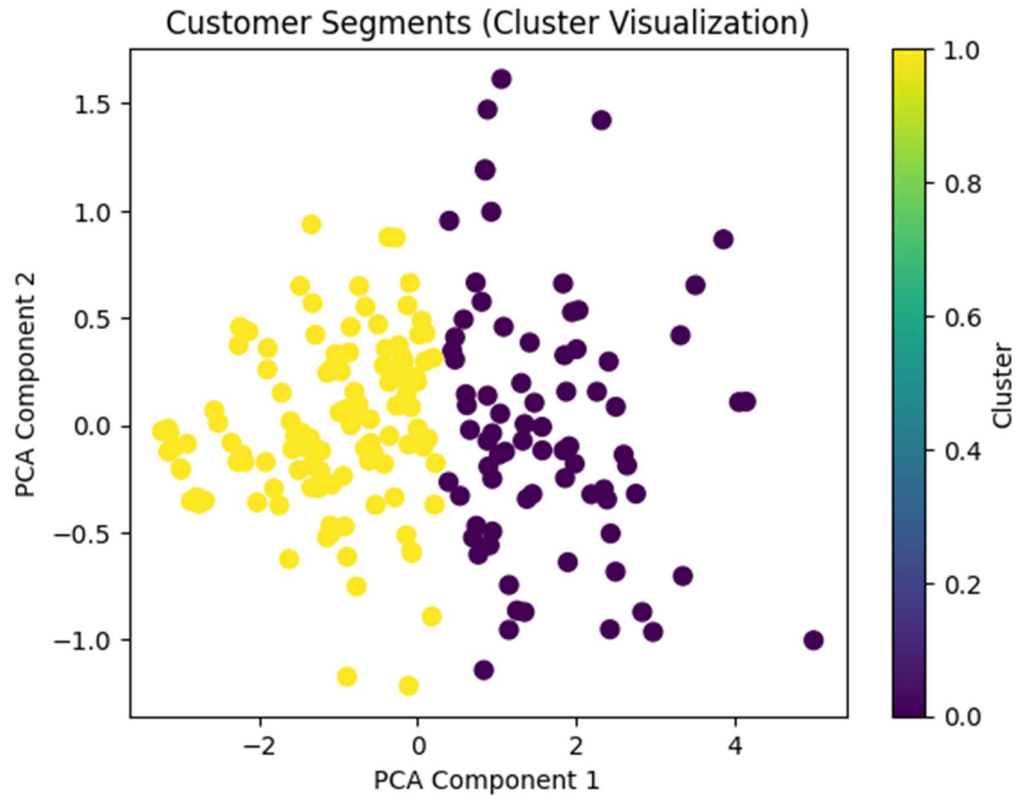
### 2. Feature Scaling

- Features were standardized using the **StandardScaler** for improved clustering performance.
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## Cluster Analysis

### 1. Optimal Number of Clusters

- The optimal number of clusters was determined using the **Davies-Bouldin Index (DB Index)**.
- A lower DB Index indicates better cluster separation and compactness.
- Results showed that the optimal number of clusters was **2**, with a DB Index of **0.7318**.



## 2. Clustering Process

- **K-Means Algorithm:** Performed clustering with the optimal number of clusters (**2**).
- Each customer was assigned to one of the two clusters based on their purchasing behavior.

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## Results

### 1. Cluster Characteristics

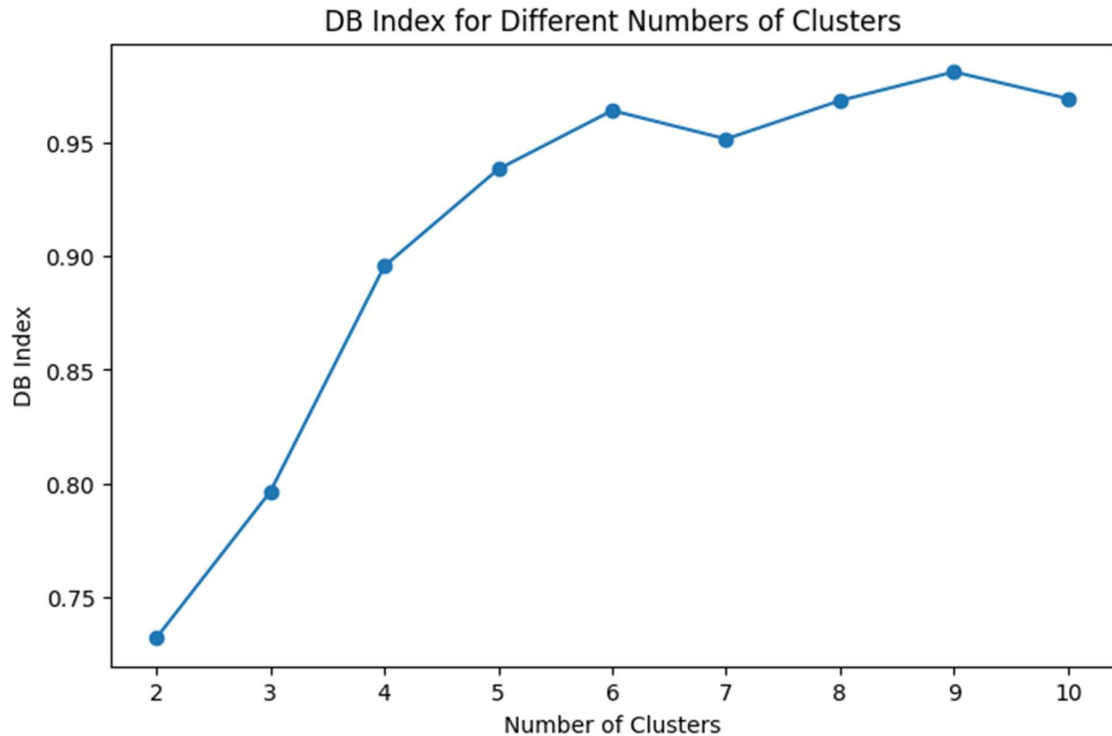
- **Cluster 0:** High-value customers with frequent purchases and a preference for a wide variety of products.
- **Cluster 1:** Low-to-mid-value customers with fewer transactions and a narrower product range.

### 2. Cluster Assignments

- The clustering results, including cluster labels, were saved in Clustering\_Results.csv.
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## Visualization

### 1. DB Index Plot



- The DB Index for cluster counts ranging from 2 to 10 was plotted to determine the optimal number of clusters.
- The plot clearly indicated **2 clusters** as the optimal choice.

### 2. Cluster Visualization

- **PCA (Principal Component Analysis)** was used to reduce the feature dimensions to 2 for visualization.
- The scatter plot showed well-separated customer clusters.

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## Actionable Insights

### 1. Cluster 0:

- Focus on loyalty programs, exclusive offers, and personalized recommendations.
- Target customers with premium products.

### 2. Cluster 1:

- Encourage engagement with discounts and product bundling.
  - Implement strategies to increase their average transaction value.
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## Conclusion

- **Optimal Clusters:** 2
- **Davies-Bouldin Index:** 0.7318
- The clustering effectively grouped customers into actionable segments, providing insights for tailored marketing strategies.