Clustering Results

Number of Clusters Formed

After experimenting with different cluster counts between 2 and 10, the chosen number of clusters is 3. Although the elbow rule suggested 5 clusters, 3 yielded the best Davies-Bouldin (DB) Index, indicating more compact and well-separated clusters.

DB Index Value

The optimal DB Index achieved is approximately 0.88. A lower DB Index implies better-defined clusters and suggests that these 3 clusters have relatively high intra-cluster similarity and good separation from each other.

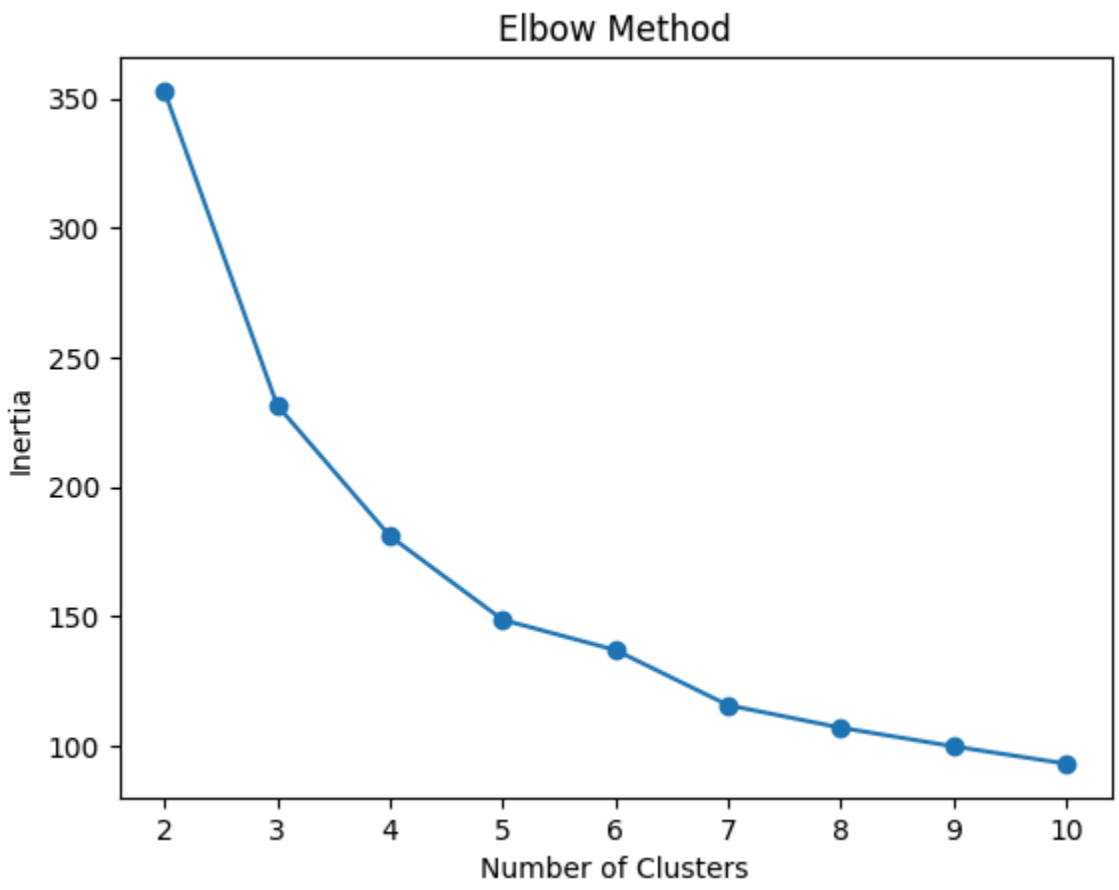
Other Relevant Clustering Metrics

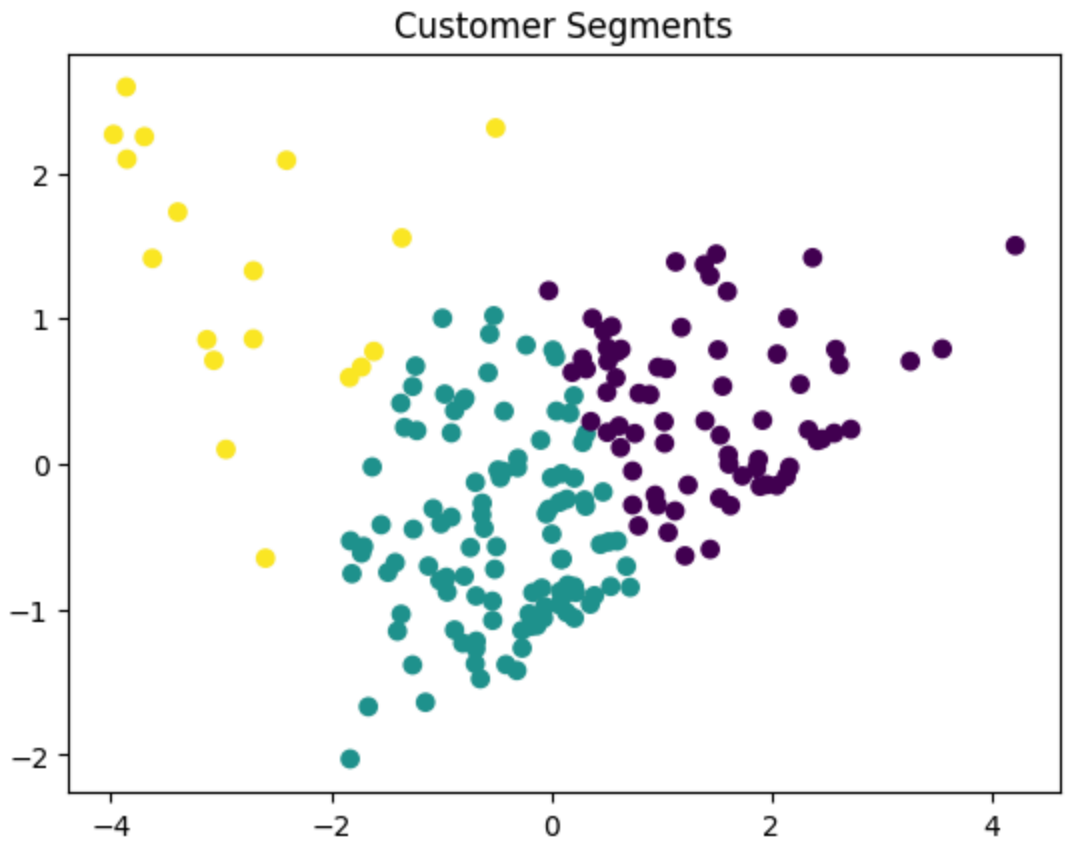
- **Silhouette Score**: By testing multiple cluster counts, the 3-cluster solution produced a reasonably high silhouette score, reinforcing that the clusters are cohesive and distinct.
- **Inertia/Within-Cluster Sum of Squares (WCSS):** While 5 clusters showed a slightly lower WCSS, the trade-off for better overall separation was not as strong as with 3 clusters.

Clustering Logic and Metrics

1. **Data Preparation**
    - Features such as total spending, frequency of transactions, and recency were aggregated per customer.
    - Numerical features were scaled for uniform weighting in the clustering algorithm.
2. **Algorithmic Approach**
    - K-Means was employed to partition customers into segments.
    - Tried GMM and DBSCan but yielded no better results.
    - The elbow rule indicated a potential optimum with 5 clusters, but further evaluation using the DB Index and silhouette score found 3 clusters to be more optimal.
3. **Interpretation**
    - The first cluster typically represents high-frequency, higher-spend customers who engage consistently.
    - The second cluster may include moderate spenders with moderate frequency.
    - The third cluster can encapsulate less active or new customers with lower transaction counts.

Visualizing Clusters





Overall, opting for 3 clusters results in a balance between cluster cohesion and separation, reflected in the DB Index of 0.88, and provides interpretable segments for targeted marketing and strategic decision-making.