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Documentation for Task 3: Customer Segmentation / Clustering

1. Objective:

This task focuses on performing customer segmentation using clustering techniques on the eCommerce Transactions dataset. The goal is to group customers into distinct segments based on their transactional behavior and profile information, enabling better-targeted marketing strategies.

2. Dataset Overview:

The analysis was conducted on the following datasets:
1. Customers.csv: Contains details such as CustomerID, CustomerName, Region, and SignupDate.
2. Transactions.csv: Consists of TransactionID, CustomerID, ProductID, TransactionDate, Quantity, and TotalValue.

3. Methodology:

The following steps were performed:

1. Data Preprocessing:
  - Transactional features such as total spend, average transaction value, and quantity were aggregated.
  - Features were scaled using StandardScaler for consistent analysis.

2. Clustering:
  - Spectral Clustering was applied with the optimal number of clusters set to 10.
  - Davies-Bouldin Index was used to evaluate clustering quality.

3. Visualization:
  - Clusters were visualized using a scatter plot, showing customer group distribution based on normalized features.

4. Key Metrics and Clustering Results:

1. Number of Clusters: 10
2. Davies-Bouldin Index: 1.0438 (Lower values indicate better clustering quality)
3. Cluster Metrics:
  - Average Transaction Count, Total Spend, and Average Transaction Value for each cluster are summarized below:

Cluster 0: Avg. Transaction Count: 5.29, Total Spend: $5,132.04, Avg. Transaction Value: $978.97

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Cluster 1: Avg. Transaction Count: 4.88, Total Spend: $2,688.89, Avg. Transaction Value: $553.30
Cluster 7 (Top Cluster): Highest Avg. Transaction Count: 8.45, Total Spend: $6,852.12, Avg. Transaction Value: $823.67.

5. ***Key Insights:***

A. ***Cluster Highlights***:

Cluster 7: Exhibits the highest transaction count (8.45 on average) and total spend ($6,852.12). This group represents the most valuable customers for the business, likely contributing a significant portion of revenue.

Cluster 6: Has the lowest total spend ($643.13) and transaction count (2.00), indicating minimal customer engagement. These may be new or inactive customers.

B. ***Spending Patterns:***

Cluster 5: Features the highest average transaction value ($1,109.35), suggesting this group prefers higher-value or luxury purchases.

Clusters such as 0 and 4 exhibit balanced transaction counts and total spend, representing moderately active customers.

C. ***Cluster Quality:***

The Davies-Bouldin Index (1.0438) suggests that the clustering is well-defined, with distinct and moderately compact clusters.

#***Strategic Recommendations***:

Target High-Value Customers (Cluster 7): Provide exclusive offers, early access to premium products, or loyalty benefits to strengthen relationships with this segment.

Re-Engage Inactive Customers (Cluster 6): Use targeted campaigns like discounts or personalized communications to increase their activity.

Luxury Focus for Cluster 5: Market high-end products and premium services to this group, as they show a preference for higher transaction values.

The segmentation analysis underscores the need for tailored marketing and operational strategies to maximize customer engagement and revenue.