

## Clustering Report

### Overview

This report provides an analysis of customer segmentation using clustering techniques. The goal was to group customers based on their transaction behavior, enabling targeted marketing strategies and personalized customer experiences.

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### Methodology

1. **Dataset:** The clustering analysis utilized the merged customer and transaction datasets.
  2. **Features:**
    - **TotalValue:** Total revenue generated by a customer.
    - **Quantity:** Total quantity of products purchased.
  3. **Clustering Algorithm:** KMeans clustering with 5 clusters was used.
  4. **Evaluation Metric:** The Davies-Bouldin Index was calculated to assess cluster quality.
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### Results

#### Clusters Formed

- **Number of Clusters:** 5
- Each cluster represents distinct customer groups based on their purchasing behavior.

#### Cluster Characteristics

- **Cluster 1:** Low-value customers purchasing low quantities.
- **Cluster 2:** High-value customers purchasing fewer products.
- **Cluster 3:** Medium-value customers with moderate purchases.
- **Cluster 4:** Bulk buyers with low total value.
- **Cluster 5:** High-value, frequent buyers.

#### Evaluation

- **Davies-Bouldin Index:** 0.516
    - A lower value indicates better-defined clusters, suggesting good separation between groups.
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### Visualizations

#### Cluster Scatter Plot

A scatter plot of TotalValue vs. Quantity was generated, with each point color-coded by cluster. This visualization highlights the distinct nature of customer segments.

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#### Recommendations

1. **High-Value Customers:** Focus on personalized loyalty programs for high-value customers (Clusters 2 and 5).
  2. **Bulk Buyers:** Offer volume discounts to bulk buyers in Cluster 4.
  3. **Low-Value Customers:** Create incentives to increase spending among customers in Cluster 1.
  4. **Marketing Strategies:** Design cluster-specific campaigns based on customer profiles.
  5. **Ongoing Monitoring:** Reassess clusters periodically as customer behavior evolves.
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