# Customer Segmentation Report

## Introduction

Customer segmentation is a powerful tool that helps businesses understand their customers better by grouping them into distinct categories based on shared characteristics. The objective of this analysis is to use clustering techniques to segment customers and derive actionable insights for targeted marketing and personalized recommendations.

## Data Preparation

Datasets Used:

1. Customers.csv: Contains customer information such as CustomerID, Name, Region, and SignupDate.
2. Products.csv: Includes product details like ProductID, Category, and Price.
3. Transactions.csv: Provides transaction data such as TransactionID, CustomerID, ProductID, Quantity, and TotalValue.

Feature Engineering:

- Aggregated transaction data by customer to calculate:
  - Total spending (total_spent).
  - Total quantity purchased (total_quantity).
  - Number of unique product categories (unique_categories).
  - Number of unique products purchased (unique_products).
- Added customer region as a categorical feature and encoded it.
- Normalized numerical features for consistency.

## Methodology

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Clustering Algorithm:

- Used K-Means clustering, a partition-based clustering method.

Evaluation Metric:

- Evaluated clustering performance using the Davies-Bouldin Index (DB Index). A lower DB Index indicates better-defined clusters.

Process:

1. Tested cluster counts ranging from 2 to 10.
2. Calculated the DB Index for each cluster count.
3. Selected the number of clusters with the lowest DB Index as the optimal value.

## Results

Optimal Number of Clusters:

- The optimal number of clusters was determined to be 3 based on the lowest DB Index.

Cluster Characteristics:

- Cluster 1: High-spending customers with a diverse range of purchases.
- Cluster 2: Moderate-spending customers focused on specific categories.
- Cluster 3: Low-spending customers with limited variety in purchases.

Visualization:

- DB Index plot showing optimal clusters.
- Pair plots visualizing cluster separation across key features.

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## Insights

1. High-Value Customers (Cluster 1): These customers are ideal for premium product promotions and loyalty programs.
2. Focused Shoppers (Cluster 2): Targeted marketing campaigns based on their preferred product categories can increase engagement.
3. Occasional Buyers (Cluster 3): Strategies like discounts or bundle offers could encourage repeat purchases.

## Conclusion

The clustering analysis provides a clear understanding of customer behavior, enabling data-driven decisions for marketing and product strategies. Businesses can leverage these insights to:

- Personalize customer experiences.
- Improve customer retention.
- Optimize resource allocation for marketing campaigns.

## Next Steps

1. Deploy segmentation results into CRM systems for actionable insights.
2. Monitor customer behavior over time to refine clustering models.
3. Explore additional features like customer reviews or browsing history for deeper segmentation.