

### **Clustering Methodology:**

- The K-Means clustering algorithm was selected for segmentation.
- The optimal number of clusters was determined through evaluation of inertia scores and Davies-Bouldin Index.
- Customers were segmented into five clusters based on their spending behavior, transaction frequency, and regional information.

### **Clustering Results:**

- Number of Clusters Formed: 5
- DB Index: 1.475

### **Cluster Characteristics:**

- Cluster 0: High-value customers with frequent transactions.
- Cluster 1: Moderate spenders with consistent purchasing behavior.
- Cluster 2: Low transaction count, primarily from specific regions.
- Cluster 3: New or inactive customers with minimal engagement.
- Cluster 4: Seasonal buyers with varying purchase patterns.

### **Insights from Clustering:**

- High-Value Customers (Cluster 0) contribute significantly to revenue, making them a key target for retention strategies.
- Clusters 3 and 4 exhibit low engagement, indicating a need for marketing interventions to boost activity.
- Regional distribution shows that certain clusters are more active in specific continents, highlighting the potential for region-specific promotions.
- Transaction frequency is a key differentiator between clusters, with some customers purchasing sporadically and others making regular transactions.
- Outlier detection revealed a few extremely high spenders, who may require personalized marketing strategies.

### **Business Recommendations:**

- Loyalty programs for high-value customers to enhance retention.
- Re-engagement campaigns for low-activity customers (Clusters 3 & 4).
- Region-specific promotions to capitalize on spending patterns in active areas.
- Customized pricing strategies for seasonal buyers.
- Personalized offers for outliers (top spenders) to maximize lifetime value.

Visualization of the clustering:

