Report on Customer Segmentation

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Overview

This report presents the findings and methodologies used in performing cluster analysis on the provided dataset. The analysis involved customer segmentation using K-Means clustering, supported by Principal Component Analysis (PCA) for visualization and quality evaluation metrics for validation.

Key Metrics

- **Number of Clusters:** 9
- **Davies-Bouldin Index:** 0.4498 (indicating excellent cluster separation)
- **Silhouette Score:** 0.5499 (indicating moderately well-defined clusters)

Methodology

1. Preprocessing and EDA

- **Objective:** To clean and explore the data for patterns, trends, and inconsistencies.
- **Steps Taken:**
  - Identified and handled missing values.
  - Standardized features to ensure uniform scaling.
  - Analyzed patterns and distributions for actionable insights.

2. Optimal Clusters Identification

- Applied the **K-Means clustering algorithm** to the dataset.
- Utilized the **Elbow Method** to determine the optimal number of clusters. Nine clusters were identified as the most suitable choice for segmentation.

3. Dimensionality Reduction with PCA

- **Objective:** To reduce dimensionality and improve interpretability.
- **Steps Taken:**
  - Performed **Principal Component Analysis (PCA)** to project high-dimensional data into 2D space.
  - Retained maximum variance to highlight cluster separations effectively.

4. Cluster Evaluation

- Evaluated the quality and separation of clusters using the following metrics:
  - **Davies-Bouldin Index:** 0.4498 — indicating excellent separation between clusters.
  - **Silhouette Score:** 0.5499 — indicating moderately strong cluster definitions.

5. Cluster Visualization

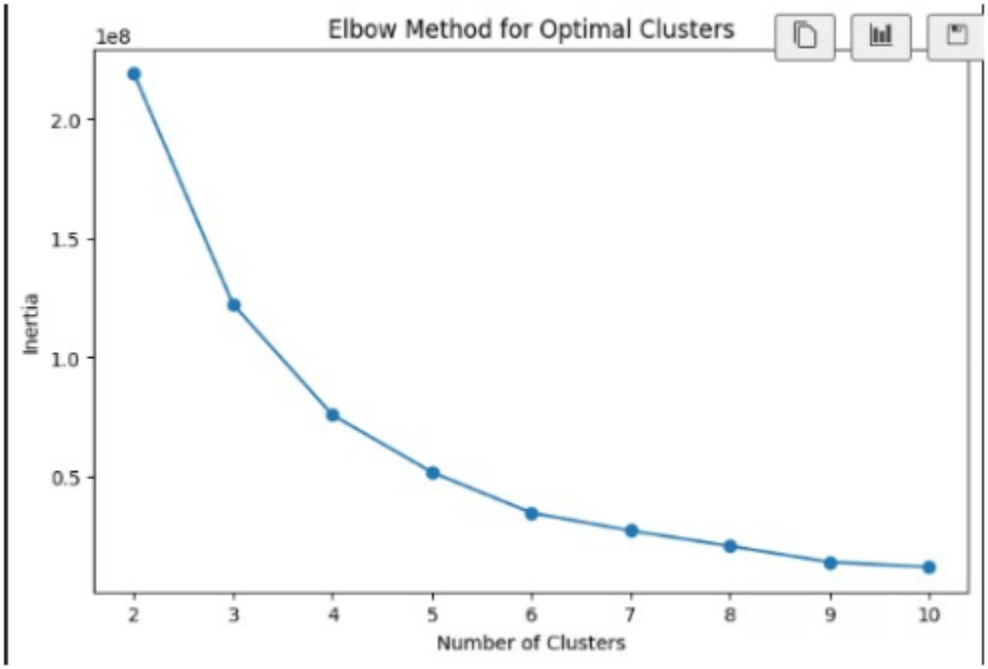
- Visualized clusters in 2D space using PCA projection.

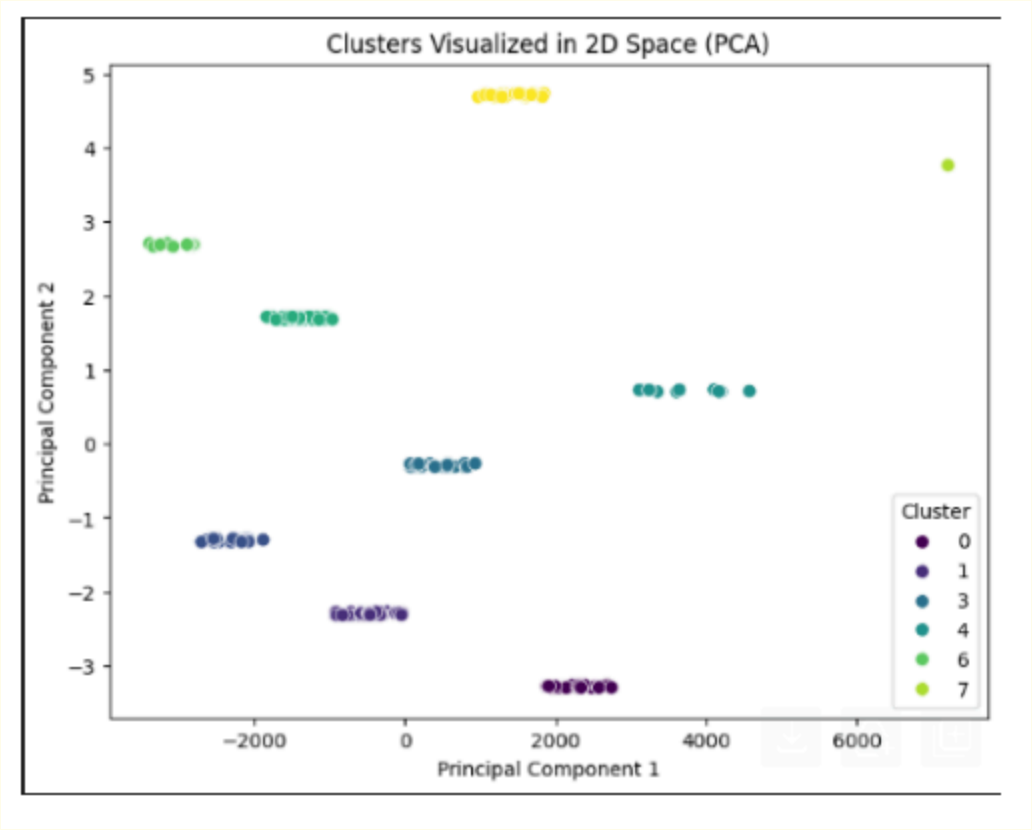
- Highlighted the spatial distribution and separations between clusters, providing a clear understanding of customer segmentation.

Findings and Insights

- Customers were segmented into **9 meaningful groups** based on transaction values and regional patterns.
- These clusters provide actionable insights to design targeted business strategies:
    - **High-value segments** can be approached with premium offerings.
    - **Regional patterns** can inform localized marketing campaigns.

Images:





Conclusion

The clustering analysis successfully segmented customers into well-defined groups. The combination of K-Means clustering and PCA visualization ensured robust insights into customer behavior, enabling data-driven strategies. The metrics confirm the quality of clustering, with clear separations and moderate cluster definitions.

For further details or refinements, please feel free to reach out.