

Customer Behavior Analysis Using Clustering

An Unsupervised Learning Project by Amani Althobaiti

Project Introduction

Objective: Segment customers into similar groups based on financial behavior using clustering algorithms.

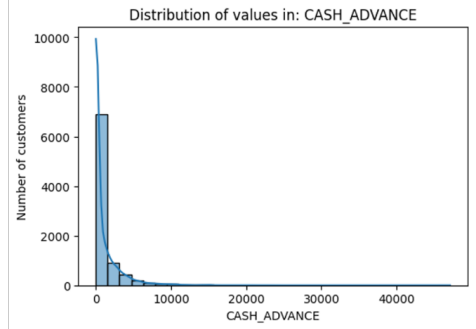
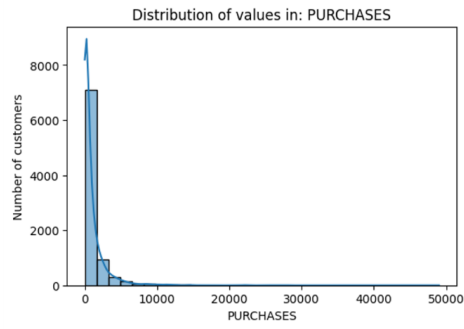
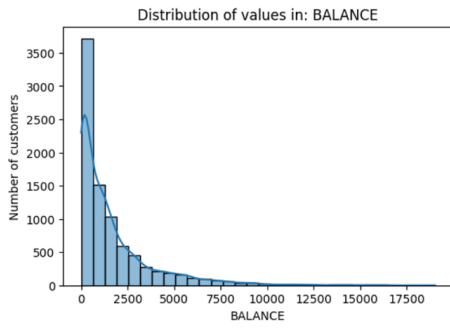
Dataset: Credit card data from Kaggle.

Steps Overview

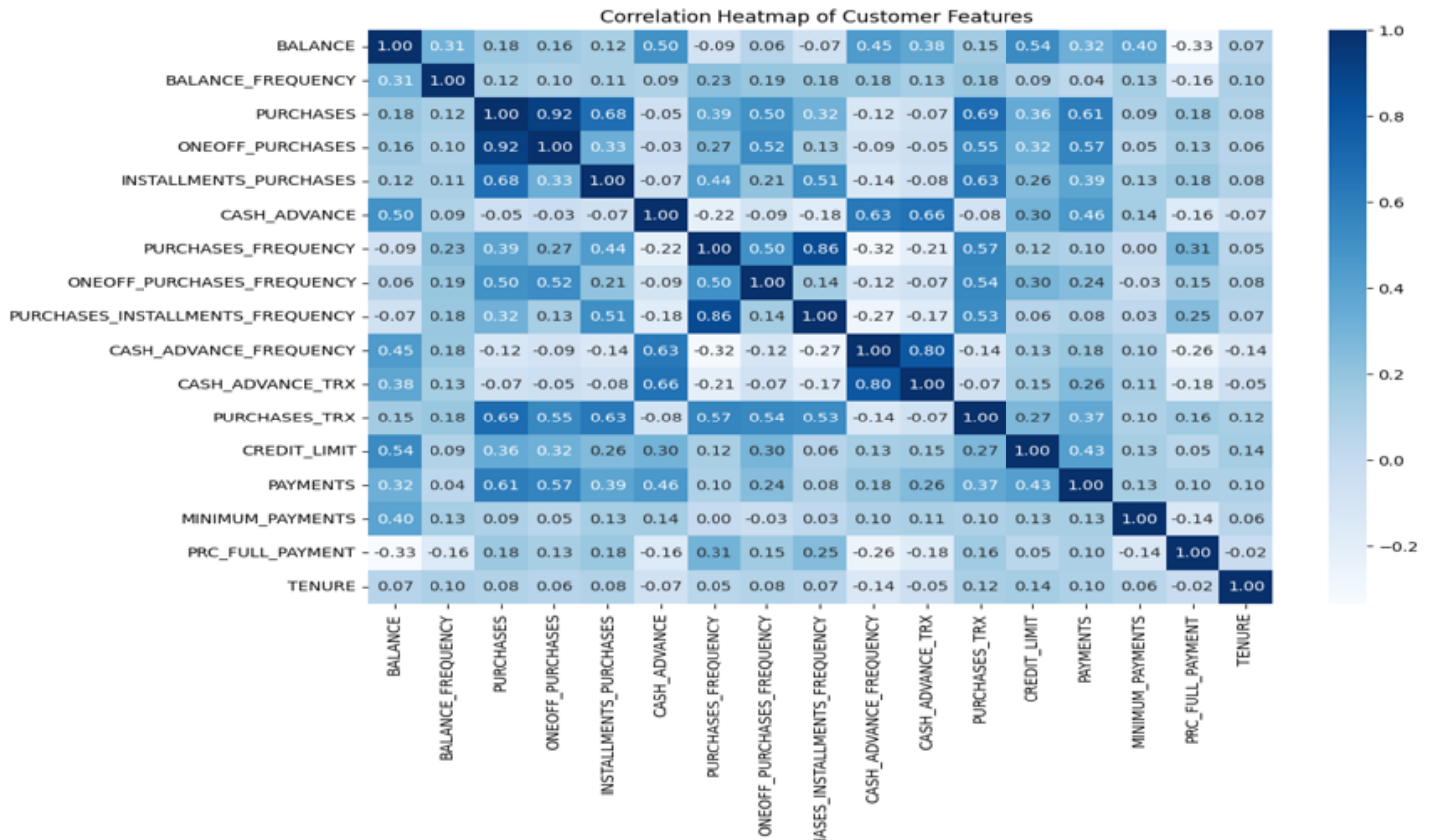
- Clean and explore the data
- Standardize features using StandardScaler
- Reduce dimensions using PCA
- Apply KMeans and Hierarchical Clustering
- Evaluate results and interpret clusters

Key Visuals and Results

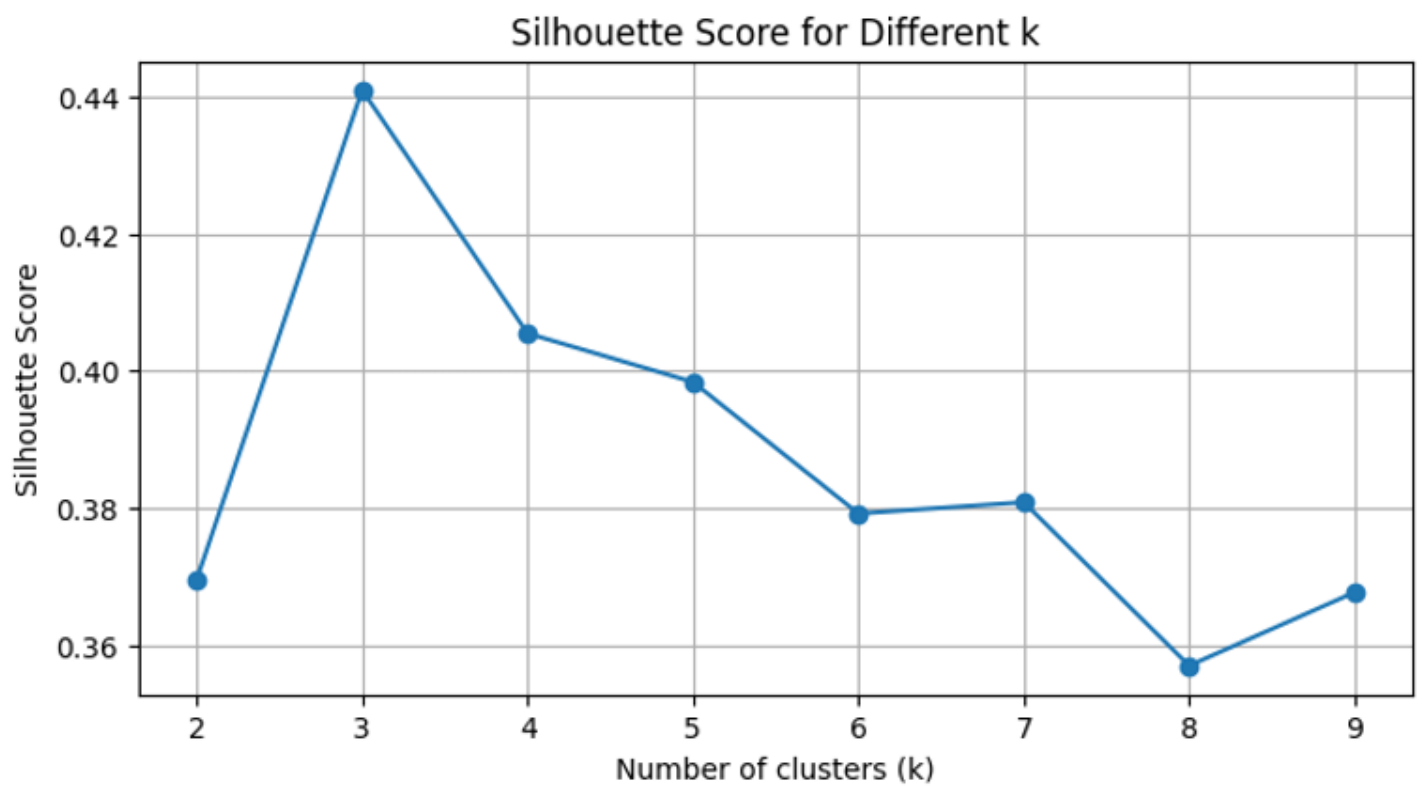
The following visuals illustrate feature distributions, correlation, optimal clustering, PCA scatter, and dendrogram analysis.



Histogram: Distribution of values in BALANCE, PURCHASES, and CASH_ADVANCE. Shows most customers have low values, with a few outliers.

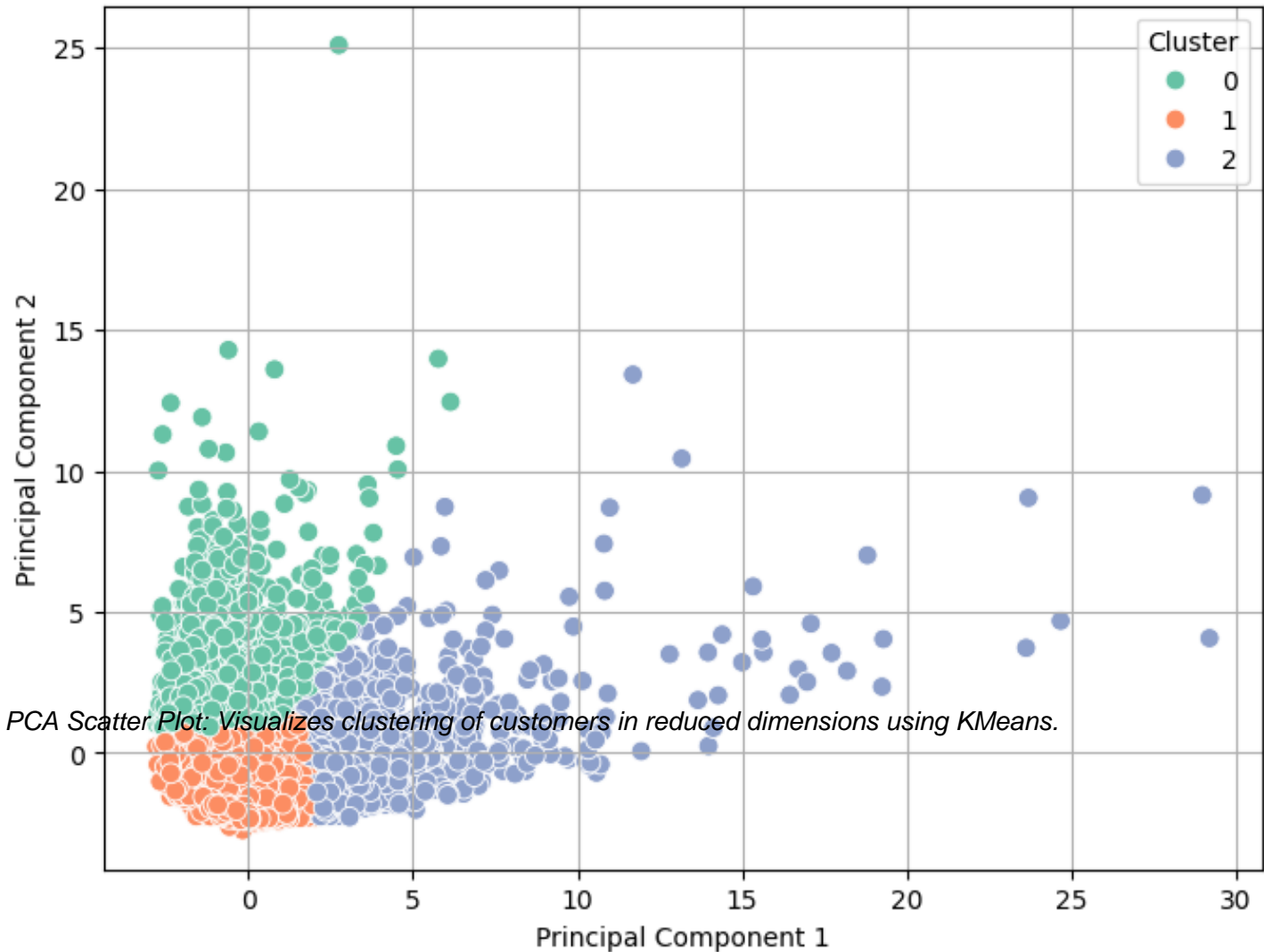


Correlation Heatmap: Highlights relationships between features. Notable correlation between purchases and payments.

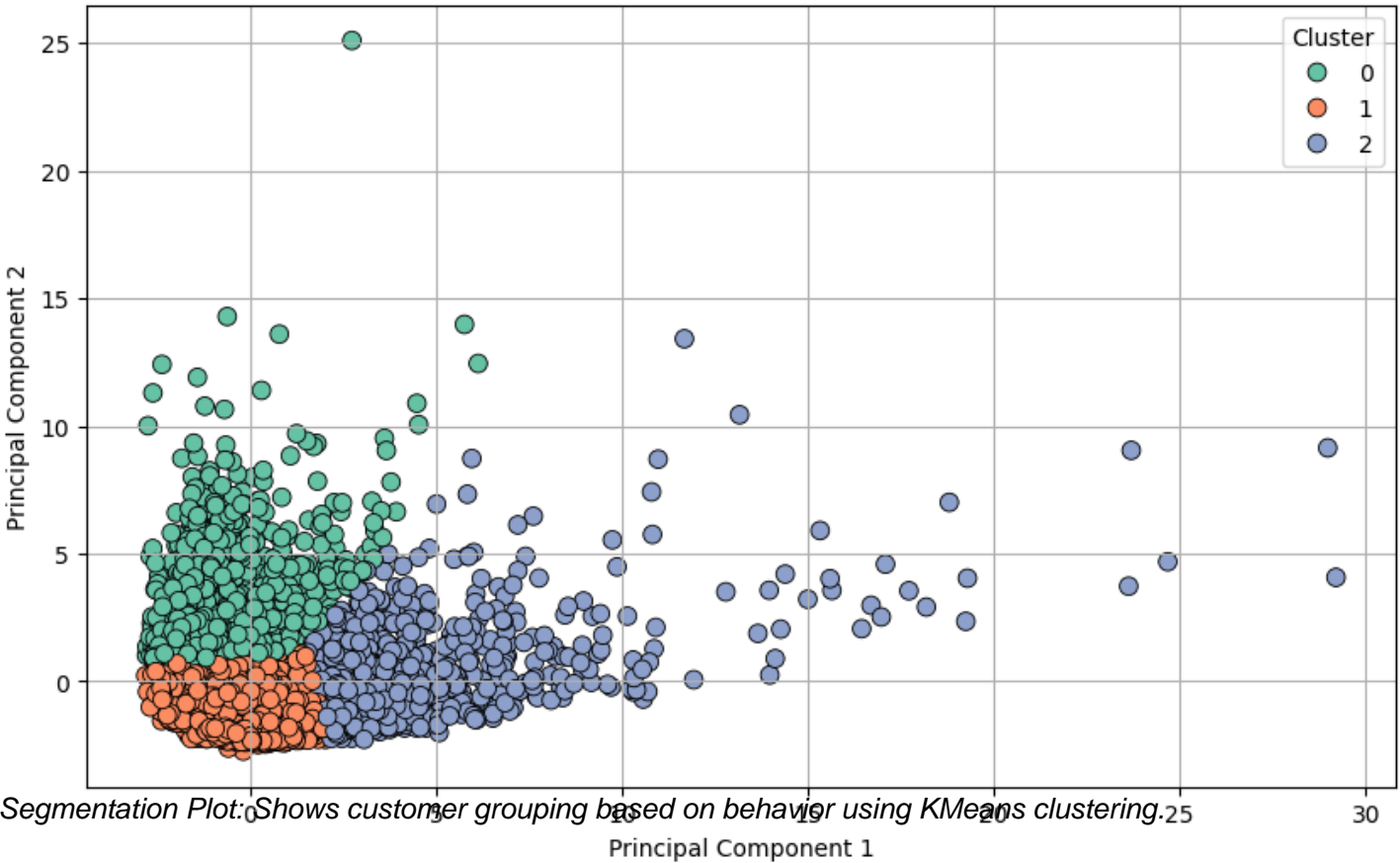


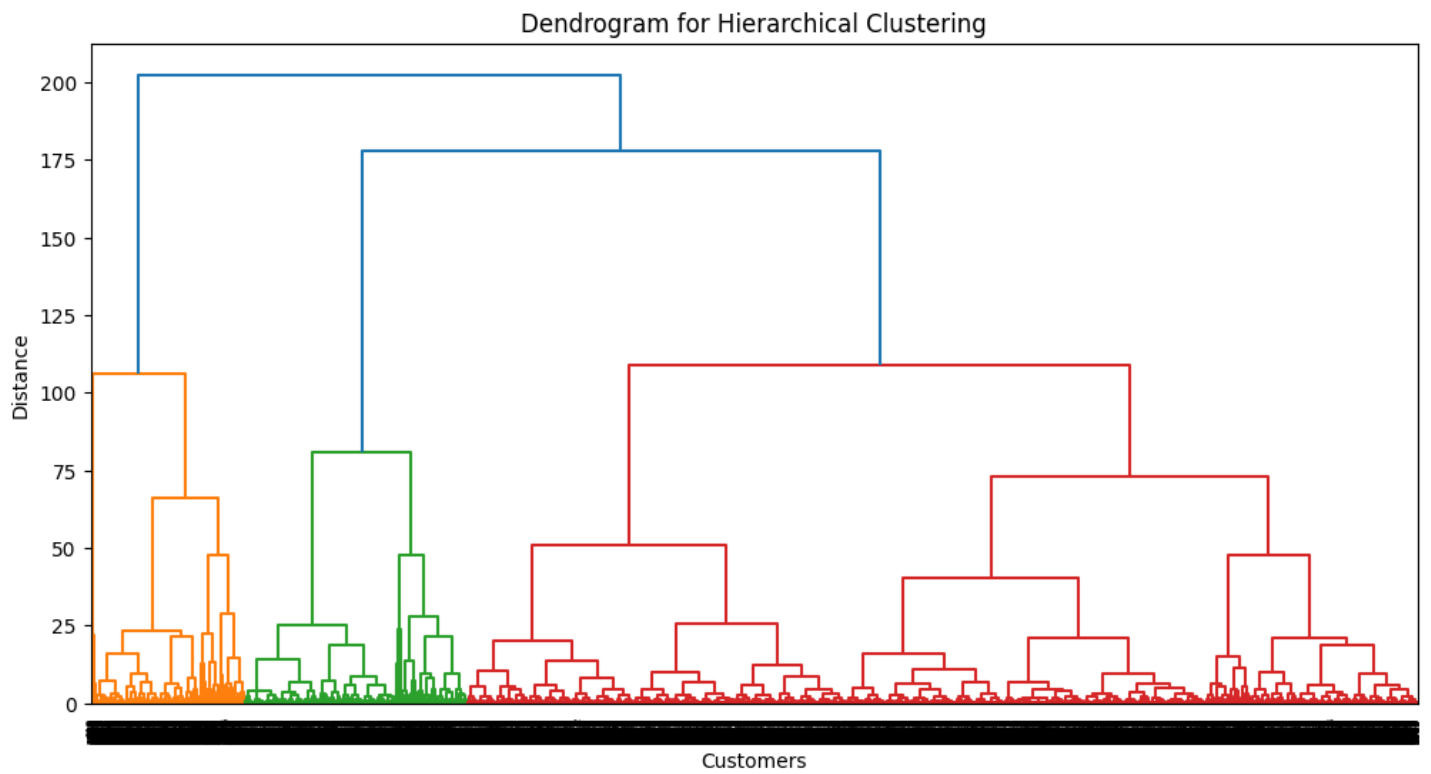
Silhouette Score: Indicates the optimal number of clusters is 3.

KMeans Clustering Results (PCA Reduced Space)



Customer Segmentation based on KMeans Clustering





Dendrogram: Hierarchical clustering visualizes progressive merging and confirms 3 primary clusters.

Final Results Summary

The clustering analysis revealed three distinct customer behavior groups:

1. Cluster 2 - High Purchasers:

- Customers with the highest purchasing activity.
- Suitable for loyalty and premium marketing strategies.

2. Cluster 0 - High Cash Withdrawals:

- Customers who rely more on cash advances than purchases.
- May benefit from financial guidance or adjusted credit offerings.

3. Cluster 1 - Low Activity:

- Customers with minimal spending or withdrawals.
- Could be targeted with engagement or reactivation campaigns.

Key Insights:

- Clustering using PCA and KMeans effectively segmented the customers.
- Silhouette score confirmed 3 optimal clusters.
- The findings support personalized marketing and customer management strategies.

Recommendation:

Conduct regular segmentation updates to adapt to changes in customer behavior.