Strategic Customer Segmentation Analysis

- Uncovering Consumer Patterns using Unsupervised Machine Learning
- Key Objective: Transform mall customer data into actionable marketing segments using K-Means and Hierarchical Clustering.

Aman Verma (1753 FY AI&ML)

Data Insights & Pre-processing

- Dataset: Mall_Customers.csv
- Features Analyzed: Gender, Age, Annual Income ($k), Spending Score (1-100)
- Data Cleaning: Checked inconsistencies and missing values
- Feature Engineering: Focused on Annual Income and Spending Score
- Standardization: Applied scaling to prevent bias between features

Methodology – Finding the Optimal Segments

- Problem: Number of clusters is unknown in unsupervised learning
- Tool Used: Elbow Method
- Calculated Within-Cluster Sum of Squares (WCSS)
- Optimal clusters identified at K = 5
- Stakeholder Insight: 5 clusters provide stable and meaningful segmentation

K-Means Clustering Results

- 200 customers grouped into 5 distinct clusters
- High Income, High Spend – Most profitable target group
- High Income, Low Spend – Opportunity for engagement improvement
- Average Income, Average Spend – Largest and stable segment
- Low Income, High Spend – Likely younger or highly loyal customers
- Low Income, Low Spend – Lower priority segment

Validation – Hierarchical Clustering

- Second model used to validate K-Means findings
- Dendrogram visualized customer merging patterns
- Ward's Method applied for hierarchical grouping
- Confirmed existence of 5 reliable customer segments

Strategic Recommendations

- Personalization: Premium loyalty programs for high income/high spend customers
- Incentivization: Discount marketing for high income/low spend group
- Operational Focus: Inventory alignment for average income/average spend customers
- Conclusion: Segment-based marketing improves Return on Ad Spend (ROAS)

Implementation Reference

- The full implementation code demonstrating this data preparation process is available at the following link:

https://colab.research.google.com/drive/1wOip3jRhdNP5O57QelAMahG4oCDGS4G_?usp=sharing

- This link is provided for transparency and auditability.