

# Customer Segmentation Using Clustering

## Introduction

Customer segmentation is essential in marketing to identify different customer groups based on spending behavior, age, and income. This project employs **K-Means** and **Hierarchical Clustering** to categorize customers, enabling businesses to create targeted marketing strategies.

## Dataset

The **Mall Customer Segmentation Dataset** includes:

- **CustomerID**: Unique identifier.
- **Gender**: Male/Female.
- **Age**: Customer's age.
- **Annual Income (k\$)**: Yearly income in thousands.
- **Spending Score (1-100)**: A measure of customer spending behavior.

## Exploratory Data Analysis (EDA)

EDA was performed to analyze the dataset:

- **Missing Values Check**: Ensured data completeness.
- **Statistical Summary**: Examined distributions of age, income, and spending score.
- **Visualizations**: Histograms, boxplots, and pairplots to understand feature relationships.

## Clustering Techniques

### 1. K-Means Clustering

- **Optimal K Selection**: Used the **Elbow Method** to determine the best number of clusters.
- **Implementation**: Applied KMeans from sklearn.
- **Results**: Customers grouped based on income and spending behavior.

## 2. Hierarchical Clustering

- **Dendrogram Analysis:** Determined the number of clusters.
- **Implementation:** Used `AgglomerativeClustering` to group customers.
- **Comparison:** Hierarchical clustering results were compared with K-Means.

## Results & Insights

- **Segmented Customers** into **low, moderate, and high spenders** based on income and spending scores.
- **High-Income, High-Spending Group:** Luxury shoppers.
- **Low-Income, High-Spending Group:** Impulsive buyers benefiting from promotions.
- **Moderate Groups:** Balanced shopping behavior.

## Conclusion

Customer segmentation aids businesses in crafting effective marketing strategies. Understanding customer behavior enables personalized promotions, increasing engagement. Future improvements could explore **advanced clustering techniques (DBSCAN, Gaussian Mixture Models)** and predictive modeling for customer retention strategies.