Customer Segmentation using K-Means Clustering for Mall Marketing Insights

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This project performs customer segmentation using K-Means clustering on a dataset of mall customers. The dataset includes features such as age, annual income, and spending score. An optimal number of clusters (k=5) was determined using the Elbow Method, which identified the point where the inertia starts to decrease at a slower rate. The resulting clusters provide valuable insights into the different customer segments, enabling targeted marketing strategies and better understanding of customer behavior patterns.

source data: https://www.kaggle.com/datasets/vjchoudhary7/customer-segmentation-tutorial-in-python

In [19]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler

file_path = '/Users/fernando/Desktop/Code/Sources/Mall_Customers.csv'
data = pd.read_csv(file_path)

print('Columns check:\n' ,data.columns)
top_10_spending = data.sort_values(by='Spending Score (1-100)', ascending=False).head(10)
print('\n\n Top 10 Spending Score: \n\n', top_10_spending)
# print(data.head(10))
# print(data.info())

selected_features = ['Age', 'Annual Income (k$)', 'Spending Score (1-100)']
data = data[selected_features].dropna()

scaler = StandardScaler()
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data_scaled = scaler.fit_transform(data)

inertia = []
K = range(1, 11)
for k in K:
    kmeans = KMeans(n_clusters=k, random_state=42)
    kmeans.fit(data_scaled)
    inertia.append(kmeans.inertia_)

plt.plot(K, inertia, 'bx-')
plt.xlabel('Number of clusters (k)')
plt.ylabel('Inertia')
plt.title('Elbow Method for Optimal k')
plt.show()

# 5 clusters chosen as minimal slope from 4 to 5 on elbow method for optimal k
n_clusters = 5
kmeans = KMeans(n_clusters=n_clusters, random_state=42)
kmeans.fit(data_scaled)

data['Cluster'] = kmeans.labels_

# print(data.head())

# Group by cluster and calculate the mean of each feature
cluster_summary = data.groupby('Cluster').mean()
print("\n\nCluster Summary: \n\n", cluster_summary)
```
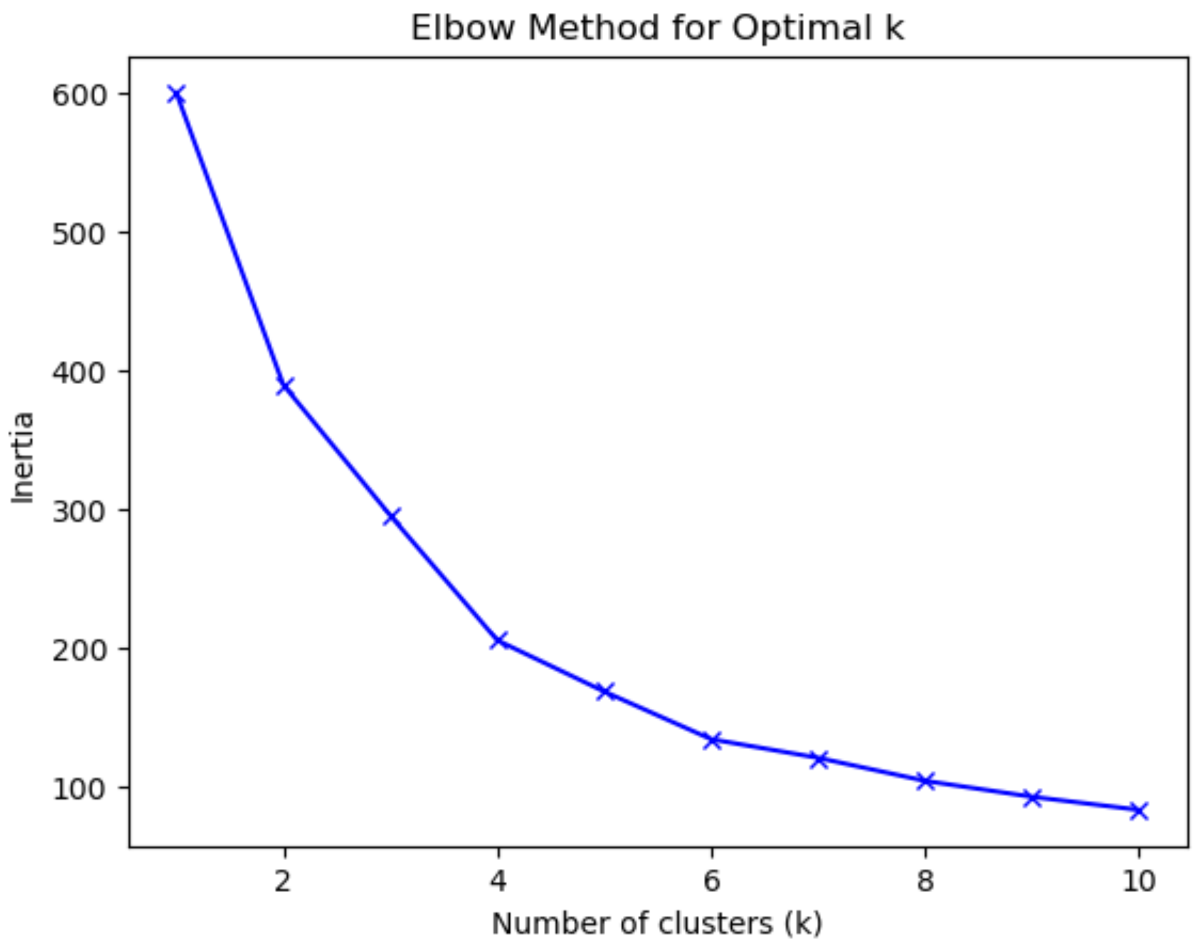

```
Columns check:
 Index(['CustomerID', 'Gender', 'Age', 'Annual Income (k$)',
       'Spending Score (1-100)'],
      dtype='object')


 Top 10 Spending Score:

      CustomerID  Gender  Age  Annual Income (k$)  Spending Score (1-100)
11           12  Female   35                  19                      99
19           20  Female   35                  23                      98
145         146    Male   28                  77                      97
185         186    Male   30                  99                      97
127         128    Male   40                  71                      95
167         168  Female   33                  86                      95
7             8  Female   23                  18                      94
141         142    Male   32                  75                      93
163         164  Female   31                  81                      93
41           42    Male   24                  38                      92
```



```
Cluster Summary:

               Age  Annual Income (k$)  Spending Score (1-100)
Cluster
0        55.638298           54.382979               48.851064
1        32.875000           86.100000               81.525000
2        25.185185           41.092593               62.240741
3        46.250000           26.750000               18.350000
4        39.871795           86.102564               19.358974
```

Cluster 0: Customers in this segment are, on average, 55.6 years old, have an annual income of $54.4k, and a spending score of 48.9. This group represents older customers with moderate income and moderate spending habits.

Cluster 1: Customers in this segment are, on average, 32.9 years old, have an annual income of $86.1k, and a spending score of 81.5. This group represents younger customers with high income and high spending habits.

Cluster 2: Customers in this segment are, on average, 25.2 years old, have an annual income of $41.1k, and a spending score of 62.2. This group represents young customers with lower income but relatively high spending habits.

Cluster 3: Customers in this segment are, on average, 46.3 years old, have an annual income of $26.8k, and a spending score of 18.4. This group represents middle-aged customers with low income and low spending habits.

Cluster 4: Customers in this segment are, on average, 39.9 years old, have an annual income of $86.1k, and a spending score of 19.4. This group represents middle-aged customers with high income but low spending habits.

Comments: Clusters 1 & 2 have the highest spending score at 81.5 and 62.2 this would be the focus for marketing to make the most out of marketing investment.

Side notes: If wanted to incorporate the gender it would have to be turned numerical since K-Means only works with numeric data. The get_dummies() function will convert the 'Gender' column to binary values (0 and 1)

((Encode the 'Gender' column data = pd.get_dummies(data, columns=['Gender'], drop_first=True) Select the features for clustering X = data[['Age', 'Annual Income (k$)', 'Spending Score (1-100)', 'Gender_Male']]))

Notes: Can use just theGender_Male column as it was created through one-hot encoding of the original 'Gender' column. One-hot encoding is a technique that converts a categorical variable into binary (0 or 1) columns, one for each category. In this case, since there are only two categories (Male and Female), only one binary column is needed to represent the information.