BLENDED LEARNING

Implementation of Customer Segmentation Using K-Means Clustering

AIM:

To implement customer segmentation using K-Means clustering on the Mall Customers dataset to group customers based on purchasing habits.

Equipments Required:

1. Hardware – PCs
2. Anaconda – Python 3.7 Installation / Jupyter notebook

Algorithm

1.Load the Data Import the dataset to start the clustering analysis process.

2.Explore the Data Analyze the dataset to understand distributions, patterns, and key characteristics.

3.Select Relevant Features Identify the most informative features to improve clustering accuracy and relevance.

4.Preprocess the Data Clean and scale the data to prepare it for clustering.

5.Determine Optimal Number of Clusters Use techniques like the elbow method to find the ideal number of clusters.

6.Train the Model with K-Means Clustering Apply the K-Means algorithm to group data points into clusters based on similarity.

7.Analyze and Visualize Clusters Examine and visualize the resulting clusters to interpret patterns and relationships.

Program:

```
/*
Program to implement customer segmentation using K-Means clustering on the Mall Custom
Developed by: GANESH PRABHU J
```

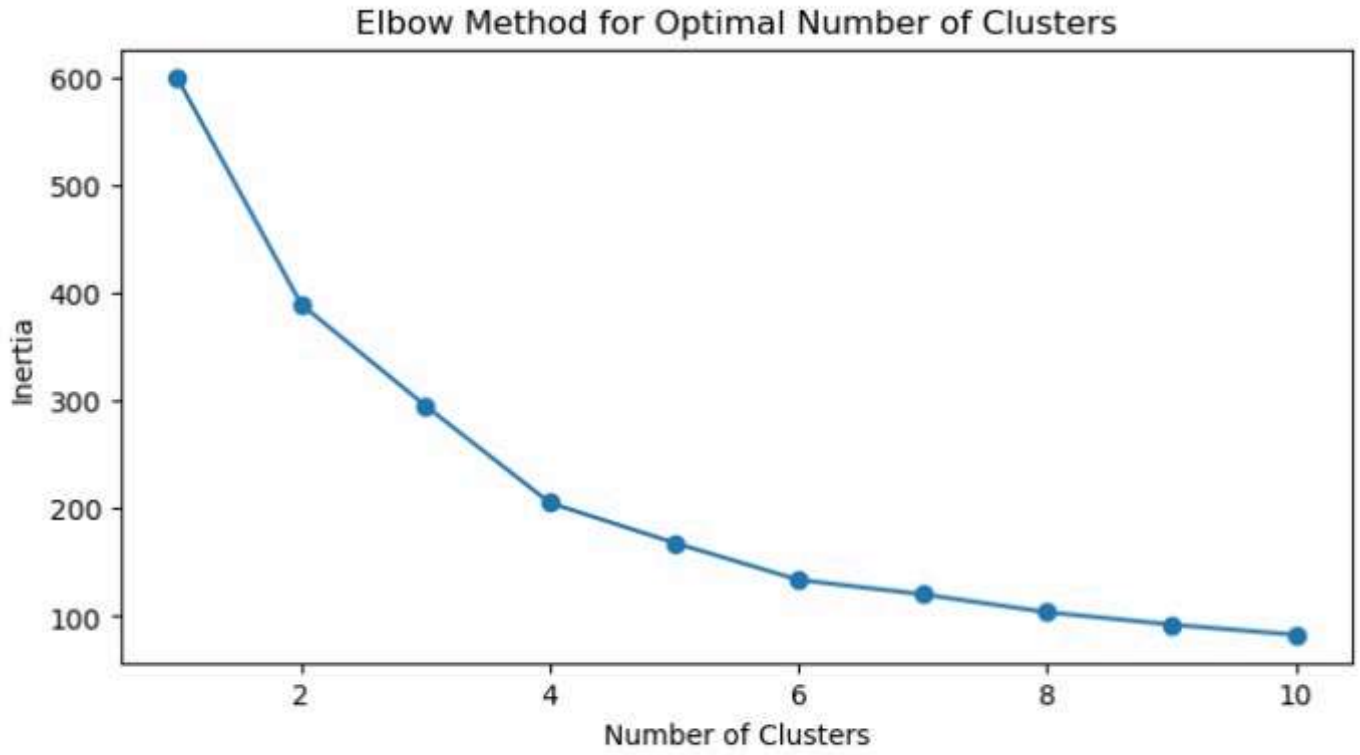
```
RegisterNumber: 212223220023
*/
```

```
import os
os.environ["OMP_NUM_THREADS"] = "1"  # Prevent MKL memory leak warning on Windows

import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import silhouette_score
import warnings

# Optional: suppress only the specific warning message if you want cleaner output
warnings.filterwarnings("ignore", message="KMeans is known to have a memory leak on Wi

# Step 1: Load the dataset
url = "https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-ML0187EN
data = pd.read_csv(url)

# Step 2: Explore the data
print(data.head())
print(data.columns)

# Step 3: Select relevant features
features = ['Age', 'Annual Income (k$)', 'Spending Score (1-100)']
X = data[features]

# Step 4: Standardize features
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

# Step 5: Elbow method to find optimal clusters
inertia_values = []
for i in range(1, 11):
    kmeans = KMeans(n_clusters=i, random_state=42, n_init=10)  # Explicit n_init to su
    kmeans.fit(X_scaled)
    inertia_values.append(kmeans.inertia_)

plt.figure(figsize=(8, 4))
plt.plot(range(1, 11), inertia_values, marker='o', linestyle='-')
plt.xlabel('Number of Clusters')
plt.ylabel('Inertia')
plt.title('Elbow Method for Optimal Number of Clusters')
plt.show()

# Step 6: Train KMeans with chosen clusters
optimal_clusters = 4
kmeans = KMeans(n_clusters=optimal_clusters, random_state=42, n_init=10)  # Explicit n
```

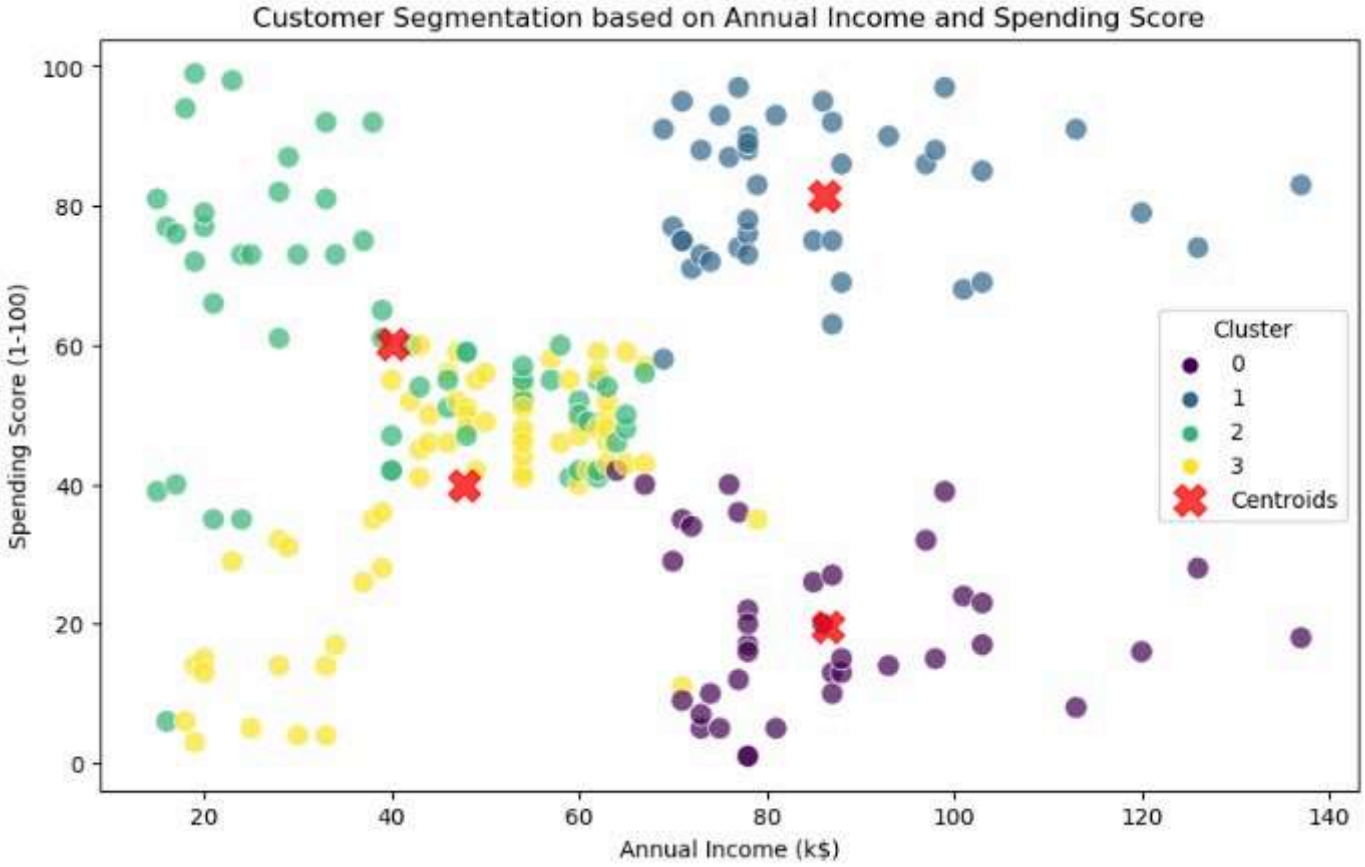
```
kmeans.fit(X_scaled)

# Step 7: Add cluster labels to data
data['Cluster'] = kmeans.labels_

# Silhouette score
sil_score = silhouette_score(X_scaled, kmeans.labels_)
print(f'Silhouette Score: {sil_score}')

# Step 8: Visualize clusters
plt.figure(figsize=(10, 6))
sns.scatterplot(
    data=data,
    x='Annual Income (k$)',
    y='Spending Score (1-100)',
    hue='Cluster',
    palette='viridis',
    s=100,
    alpha=0.7
)

# Plot cluster centroids (inverse scale)
centers = scaler.inverse_transform(kmeans.cluster_centers_)
plt.scatter(centers[:, 1], centers[:, 2], c='red', s=200, alpha=0.75, marker='X', labe

plt.title('Customer Segmentation based on Annual Income and Spending Score')
plt.xlabel('Annual Income (k$)')
plt.ylabel('Spending Score (1-100)')
plt.legend(title='Cluster')
plt.show()
```

Output:

```
   CustomerID  Gender  Age  Annual Income (k$)  Spending Score (1-100)
0           1    Male   19                  15                      39
1           2    Male   21                  15                      81
2           3  Female   20                  16                       6
3           4  Female   23                  16                      77
4           5  Female   31                  17                      40
Index(['CustomerID', 'Gender', 'Age', 'Annual Income (k$)',
       'Spending Score (1-100)'],
      dtype='object')
```




```
Silhouette Score: 0.4039582785148566
```



Result:

Thus, customer segmentation was successfully implemented using K-Means clustering, grouping customers into distinct segments based on their annual income and spending score.