AI and ML task 8

objective

1.Load and visualize dataset (optional PCA for 2D view). 2.Fit K-Means and assign cluster labels. 3.Use the Elbow Method to find optimal K. 4.Visualize clusters with color-coding. 5.Evaluate clustering using Silhouette Score.

Importing libraries

In [151]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
sns.set()
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
```

In [73]:
```
data=pd.read_csv('Mall_Customers.csv')
```

In [75]:
```
data
```

Out[75]:

	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
...	...	...	...	...	...
195	196	Female	35	120	79
196	197	Female	45	126	28
197	198	Male	32	126	74
198	199	Male	32	137	18
199	200	Male	30	137	83

200 rows × 5 columns

In [111]:
```
data.shape
```

Out[111]:
```
(200, 5)
```

In [113]:
```
data.describe(include='all')
```

Out[113]:

	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
count	200.000000	200	200.000000	200.000000	200.000000
unique	NaN	2	NaN	NaN	NaN
top	NaN	Female	NaN	NaN	NaN
freq	NaN	112	NaN	NaN	NaN
mean	100.500000	NaN	38.850000	60.560000	50.200000
std	57.879185	NaN	13.969007	26.264721	25.823522
min	1.000000	NaN	18.000000	15.000000	1.000000
25%	50.750000	NaN	28.750000	41.500000	34.750000
50%	100.500000	NaN	36.000000	61.500000	50.000000
75%	150.250000	NaN	49.000000	78.000000	73.000000
max	200.000000	NaN	70.000000	137.000000	99.000000

In [155]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype 
---  ------                  --------------  ----- 
 0   CustomerID              200 non-null    int64 
 1   Gender                  200 non-null    object
 2   Age                     200 non-null    int64 
 3   Annual Income (k$)      200 non-null    int64 
 4   Spending Score (1-100)  200 non-null    int64 
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

In [157]:
```
data.isnull()
```

Out[157]:

	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	False	False	False	False	False
1	False	False	False	False	False
2	False	False	False	False	False
3	False	False	False	False	False
4	False	False	False	False	False
...	...	...	...	...	...
195	False	False	False	False	False
196	False	False	False	False	False
197	False	False	False	False	False
198	False	False	False	False	False
199	False	False	False	False	False

200 rows × 5 columns

In [159]:
```
data.isnull().sum()
```

Out[159]:
```
CustomerID                0
Gender                    0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

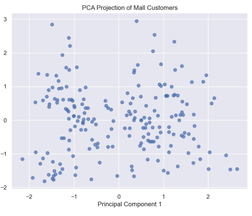
Load and visualize dataset (optional PCA for 2D view).

In [241]:
```
features = ['Age', 'Annual Income (k$)', 'Spending Score (1-100)']
X = data[features]
```

In [161]:
```
# Standardize the data
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
```

In [189]:
```
# Apply PCA to reduce to 2 dimensions for visualization
pca = PCA(n_components=2)
X_pca = pca.fit_transform(X_scaled)
```

In [190]:
```
plt.figure(figsize=(8, 6))
plt.scatter(X_pca[:, 0], X_pca[:, 1], alpha=0.7)
plt.title('PCA Projection of Mall Customers')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.grid(True)
plt.show()
```



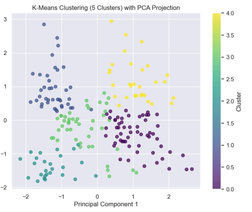
Fit K-Means and assign cluster labels.

In [240]:
```
from sklearn.cluster import KMeans
import warnings
warnings.filterwarnings('ignore')
```

In [240]:
```
# Fit K-Means and predict clusters
kmeans = KMeans(n_clusters=5, random_state=42)
clusters = kmeans.fit_predict(X_scaled)
```

In [192]:
```
data['Cluster'] = clusters
```

In [193]:
```
plt.figure(figsize=(8, 6))
scatter = plt.scatter(X_pca[:, 0], X_pca[:, 1], c=clusters, cmap='viridis', alpha=0.7)
plt.title('K-Means Clustering (5 Clusters) with PCA Projection')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.grid(True)
plt.colorbar(scatter, label='Cluster')
plt.show()
```



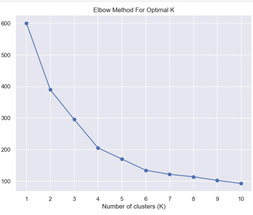
In [241]:
```
print(data.head())
```

```
   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   

   Cluster  
0        2  
1        3  
2        2  
3        3  
4        2  
```

Use the Elbow Method to find optimal K.

In [240]:
```
inertia = []
K_range = range(1, 11)

for k in K_range:
    kmeans = KMeans(n_clusters=k, random_state=42)
    kmeans.fit(X_scaled)
    inertia.append(kmeans.inertia_)
```

In [202]:
```
# Plot the Elbow curve
plt.figure(figsize=(8, 6))
plt.plot(K_range, inertia, marker='o')
plt.title('Elbow Method For Optimal K')
plt.xlabel('Number of clusters (K)')
plt.ylabel('Inertia')
plt.grid(True)
plt.xticks(K_range)
plt.show()
```



Visualize clusters with color-coding.

In [240]:
```
plt.figure(figsize=(8, 6))
for cluster in range(5):
    plt.scatter(
        X_pca[clusters == cluster, 0],
        X_pca[clusters == cluster, 1],
        label=f'Cluster {cluster}',
        alpha=0.7
    )

plt.title('Mall Customers Cluster Visualization (K=5)')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.legend()
plt.grid(True)
plt.show()
```

Evaluate clustering using Silhouette Score.

In [171]:
```
from sklearn.metrics import silhouette_score
```

In [173]:
```
sil_score = silhouette_score(X_scaled, clusters)

sil_score
```

Out[173]: 0.4046687377734565

In [ ]: