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import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler

# Step 1: Load Data
# Sample dataset: You can replace this with your real CRM data
df = pd.read_csv('customer_data.csv') # Assuming it includes 'SpendingScore' and 'Frequency'

# Step 2: Data Exploration
print(df.head())
print(df.describe())
print(df.info())

# Step 3: Handle Missing Values
df.dropna(inplace=True)

# Step 4: Feature Selection
features = df[['SpendingScore', 'Frequency']]

# Step 5: Scaling (important for clustering)
scaler = StandardScaler()
scaled_features = scaler.fit_transform(features)

# Step 6: Optimal K (Elbow Method)
wcss = []
for i in range(1, 11):
    km = KMeans(n_clusters=i, random_state=42)
    km.fit(scaled_features)
    wcss.append(km.inertia_)

# Plotting the Elbow Curve
plt.figure(figsize=(8, 4))
plt.plot(range(1, 11), wcss, marker='o')
plt.title('Elbow Method for Optimal k')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
plt.grid(True)
plt.show()

# Step 7: KMeans Clustering
kmeans = KMeans(n_clusters=4, random_state=42)

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df['Segment'] = kmeans.fit_predict(scaled_features)

# Step 8: Visualize the Segments
plt.figure(figsize=(8, 6))
sns.scatterplot(
    x=features['SpendingScore'],
    y=features['Frequency'],
    hue=df['Segment'],
    palette='Set2',
    s=100
)
plt.title('Customer Segments by Spending Score and Frequency')
plt.xlabel('Spending Score')
plt.ylabel('Frequency')
plt.legend(title='Segment')
plt.grid(True)
plt.show()

# Step 9: Analyze Segments
segment_summary = df.groupby('Segment')[['SpendingScore', 'Frequency']].mean()
print(segment_summary)

# Optional: Save the segmented data
df.to_csv('segmented_customers.csv', index=False)

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