, 31. Scenario: You work as a data scientist for an e-commerce company that sells a wide range of

products online. The company collects vast amounts of data about its customers, including their

purchase history, browsing behavior, demographics, and more. The marketing team wants to

understand their customer base better and improve their targeted marketing strategies. They have

asked you to perform customer segmentation using clustering techniques to identify distinct groups

of customers with similar characteristics.

Question: Your task is to use Python and clustering algorithms to segment the customers into

different groups based on their behavior and characteristics. The marketing team will use these

segments to tailor their marketing campaigns and promotions effectively.

Code:

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

from sklearn.preprocessing import StandardScaler

from sklearn.cluster import KMeans

from sklearn.decomposition import PCA

file\_path =r"C:\Users\vara prasad\Downloads\customer\_segmentation\_data.csv"

df = pd.read\_csv(file\_path)

features = ['Age', 'Annual\_Income', 'Spending\_Score', 'Online\_Sessions\_per\_Month', 'Average\_Order\_Value', 'Total\_Purchases', 'Customer\_Lifetime\_Value']

X = df[features]

scaler = StandardScaler()

X\_scaled = scaler.fit\_transform(X)

inertia = []

cluster\_range = range(2, 11)

for k in cluster\_range:

kmeans = KMeans(n\_clusters=k, random\_state=42)

kmeans.fit(X\_scaled)

inertia.append(kmeans.inertia\_)

plt.figure(figsize=(8,4))

plt.plot(cluster\_range, inertia, marker='o', linestyle='-', color='teal')

plt.title('Elbow Method for Optimal k')

plt.xlabel('Number of Clusters (k)')

plt.ylabel('Inertia')

plt.xticks(cluster\_range)

plt.show()

optimal\_k = 5

kmeans = KMeans(n\_clusters=optimal\_k, random\_state=42)

kmeans.fit(X\_scaled)

df['Cluster'] = kmeans.labels\_

pca = PCA(n\_components=2)

X\_pca = pca.fit\_transform(X\_scaled)

plt.figure(figsize=(8,4))

sns.scatterplot(x=X\_pca[:, 0], y=X\_pca[:, 1], hue=df['Cluster'], palette='viridis', s=60, alpha=0.8)

plt.title('Customer Segmentation Clusters (PCA)')

plt.xlabel('PCA Component 1')

plt.ylabel('PCA Component 2')

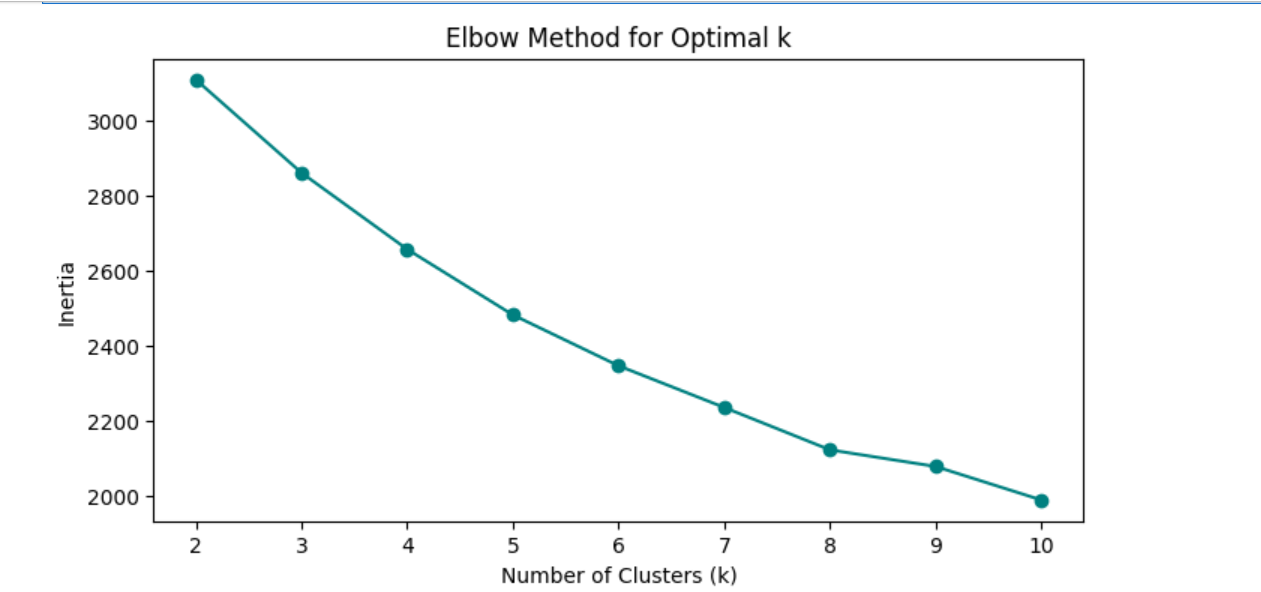
plt.legend(title='Cluster')

plt.show()

df.to\_csv('segmented\_customers.csv', index=False)

print('Customer segmentation complete. Results saved to segmented\_customers.csv.')

output:



A diagram of a number of dots

AI-generated content may be incorrect.

Dataset:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CustomerID | Age | Annual\_Income | Spending\_Score | Online\_Sessions\_per\_Month | Average\_Order\_Value | Total\_Purchases | Customer\_Lifetime\_Value | Preferred\_Device | Region | Churn\_Risk |
| 1 | 56 | 23343 | 81 | 56 | 962.09 | 323 | 19576.11 | Tablet | West | Low |
| 2 | 69 | 33500 | 5 | 46 | 476.16 | 180 | 32346.58 | Mobile | East | Low |
| 3 | 46 | 73222 | 29 | 43 | 881.49 | 190 | 39129.79 | Mobile | West | Low |
| 4 | 32 | 49375 | 4 | 16 | 25.04 | 407 | 11251.85 | Mobile | North | High |
| 5 | 60 | 29662 | 10 | 4 | 823.55 | 154 | 7322.23 | Mobile | Central | Low |
| 6 | 25 | 36964 | 56 | 52 | 244.05 | 196 | 33320.58 | Tablet | Central | Medium |
| 7 | 38 | 133429 | 17 | 37 | 910.53 | 466 | 593.05 | Mobile | South | Medium |
| 8 | 56 | 141692 | 74 | 54 | 21.1 | 311 | 9329.44 | Mobile | South | Low |
| 9 | 36 | 79638 | 17 | 21 | 565.06 | 262 | 1939.03 | Mobile | Central | Medium |
| 10 | 40 | 93666 | 84 | 14 | 761.5 | 419 | 8760.81 | Mobile | North | Low |
| 11 | 28 | 105067 | 88 | 31 | 273.51 | 406 | 9475.3 | Mobile | East | Low |
| 12 | 28 | 138937 | 69 | 55 | 209.27 | 427 | 19689.84 | Mobile | East | Low |
| 13 | 41 | 87215 | 34 | 48 | 102.42 | 143 | 20415.19 | Desktop | North | Low |
| 14 | 53 | 89042 | 6 | 18 | 339.9 | 342 | 43775.99 | Mobile | East | Low |
| 15 | 57 | 33284 | 53 | 7 | 568.65 | 316 | 25750.43 | Mobile | West | Low |
| 16 | 41 | 92789 | 66 | 10 | 133.53 | 101 | 36308.54 | Mobile | Central | Low |
| 17 | 20 | 104664 | 77 | 7 | 389.16 | 244 | 5654.8 | Mobile | Central | Low |
| 18 | 39 | 113468 | 43 | 33 | 28.89 | 490 | 11659.22 | Tablet | North | Medium |
| 19 | 19 | 81389 | 75 | 23 | 822.31 | 12 | 35295.7 | Mobile | East | Medium |
| 20 | 41 | 29435 | 23 | 21 | 145.88 | 239 | 3113.8 | Mobile | South | Low |
| 21 | 61 | 74340 | 55 | 19 | 297.68 | 49 | 24586.58 | Desktop | South | Low |
| 22 | 47 | 64078 | 80 | 48 | 38.06 | 42 | 30168.76 | Mobile | East | Medium |
| 23 | 55 | 98832 | 95 | 19 | 443.6 | 166 | 30306.21 | Mobile | South | Low |
| 24 | 19 | 71293 | 75 | 36 | 843.32 | 82 | 1635.17 | Tablet | North | Medium |
| 25 | 38 | 115981 | 16 | 29 | 404.31 | 429 | 16444.35 | Desktop | North | Low |
| 26 | 50 | 98781 | 8 | 18 | 195.91 | 291 | 32006.29 | Tablet | East | Low |
| 27 | 29 | 80403 | 4 | 2 | 758.62 | 158 | 7875.49 | Mobile | South | Low |
| 28 | 39 | 49124 | 4 | 1 | 793.03 | 216 | 34923.07 | Mobile | North | Low |
| 29 | 61 | 115435 | 56 | 47 | 190.28 | 490 | 37423.3 | Mobile | North | Medium |
| 30 | 42 | 63919 | 25 | 5 | 775.44 | 158 | 49107.47 | Mobile | West | Low |
| 31 | 66 | 128761 | 67 | 20 | 948.35 | 462 | 10887.18 | Desktop | West | Medium |
| 32 | 44 | 141305 | 96 | 11 | 183.05 | 134 | 41343.97 | Mobile | North | Medium |
| 33 | 59 | 55247 | 67 | 42 | 775.56 | 67 | 26254.68 | Desktop | East | Low |
| 34 | 45 | 141172 | 27 | 2 | 714.4 | 336 | 18986.4 | Desktop | Central | Medium |
| 35 | 33 | 114758 | 93 | 3 | 484.1 | 7 | 6557.65 | Mobile | Central | Low |
| 36 | 32 | 111747 | 32 | 23 | 76.76 | 436 | 36907.53 | Mobile | North | Low |
| 37 | 64 | 82752 | 50 | 55 | 93.2 | 14 | 12174.95 | Desktop | North | Medium |
| 38 | 68 | 76573 | 61 | 12 | 855.37 | 73 | 18885.39 | Mobile | North | Low |
| 39 | 61 | 79101 | 51 | 20 | 990.35 | 399 | 3595.84 | Desktop | East | Low |
| 40 | 69 | 122756 | 19 | 5 | 682.53 | 405 | 40167.66 | Mobile | West | Low |
| 41 | 20 | 46646 | 21 | 37 | 457.04 | 163 | 38446.13 | Mobile | North | Low |
| 42 | 54 | 124185 | 5 | 38 | 654.62 | 66 | 36813.98 | Mobile | North | Medium |
| 43 | 68 | 43049 | 82 | 30 | 602.51 | 347 | 15322.45 | Tablet | South | Medium |
| 44 | 24 | 99605 | 92 | 9 | 395.94 | 130 | 9087.26 | Mobile | East | Medium |
| 45 | 38 | 118116 | 42 | 34 | 84.31 | 419 | 32058.89 | Desktop | North | Medium |
| 46 | 26 | 117379 | 61 | 53 | 825.08 | 466 | 25060.24 | Mobile | South | Low |
| 47 | 56 | 88385 | 22 | 44 | 384.4 | 206 | 9323.5 | Desktop | Central | Low |
| 48 | 35 | 146131 | 21 | 35 | 822.41 | 276 | 34452.61 | Desktop | North | Low |
| 49 | 21 | 60158 | 70 | 52 | 267.46 | 466 | 49560.76 | Mobile | North | Low |
| 50 | 42 | 85417 | 1 | 58 | 21.01 | 256 | 37487.37 | Mobile | South | Low |
| 51 | 31 | 43289 | 5 | 22 | 175.76 | 266 | 37129.33 | Desktop | East | High |
| 52 | 67 | 130226 | 12 | 44 | 479.17 | 25 | 47540.48 | Mobile | North | Low |
| 53 | 26 | 120793 | 90 | 24 | 945.42 | 450 | 10545.35 | Desktop | Central | Low |
| 54 | 43 | 29823 | 46 | 17 | 120.15 | 281 | 28494.72 | Mobile | North | Low |
| 55 | 19 | 80160 | 34 | 10 | 857.13 | 253 | 48992.51 | Desktop | Central | Medium |
| 56 | 37 | 61975 | 49 | 30 | 536.48 | 310 | 8682.06 | Desktop | West | Medium |
| 57 | 45 | 29540 | 78 | 56 | 829.4 | 289 | 35162.47 | Tablet | West | Low |
| 58 | 64 | 36364 | 90 | 59 | 312.41 | 164 | 29497.6 | Mobile | Central | Low |
| 59 | 24 | 24611 | 45 | 46 | 843.15 | 95 | 29530.72 | Mobile | East | Medium |
| 60 | 61 | 47663 | 27 | 23 | 777.37 | 270 | 35034.7 | Mobile | North | Low |
| 61 | 25 | 71991 | 73 | 32 | 245.45 | 321 | 46516.04 | Mobile | North | Low |
| 62 | 64 | 77679 | 26 | 17 | 148.71 | 110 | 39237.81 | Mobile | West | Medium |
| 63 | 52 | 124182 | 47 | 50 | 870.69 | 336 | 3278.74 | Mobile | Central | Medium |
| 64 | 31 | 50977 | 86 | 51 | 963.97 | 310 | 42710.04 | Desktop | North | Low |
| 65 | 34 | 114704 | 56 | 17 | 50.68 | 238 | 11664.3 | Mobile | North | Medium |
| 66 | 53 | 69115 | 94 | 14 | 736.64 | 381 | 19157.25 | Mobile | East | Medium |
| 67 | 67 | 111007 | 63 | 9 | 911.33 | 436 | 23355.77 | Desktop | South | Low |
| 68 | 57 | 108223 | 48 | 40 | 860.21 | 387 | 24304.85 | Mobile | West | High |
| 69 | 21 | 80890 | 61 | 2 | 965.23 | 483 | 22041.43 | Mobile | West | Medium |
| 70 | 19 | 86387 | 81 | 45 | 764.89 | 425 | 46898.99 | Tablet | South | Medium |
| 71 | 23 | 38071 | 26 | 25 | 453.45 | 390 | 35447.94 | Tablet | North | Medium |
| 72 | 59 | 79275 | 36 | 39 | 325.71 | 25 | 31742.95 | Mobile | East | Low |
| 73 | 21 | 92369 | 1 | 9 | 334.33 | 141 | 2967.18 | Mobile | East | Low |
| 74 | 46 | 31938 | 8 | 54 | 729.93 | 117 | 45243.71 | Desktop | West | Low |
| 75 | 35 | 55195 | 99 | 22 | 750.92 | 482 | 45514.81 | Mobile | East | Low |
| 76 | 43 | 111680 | 52 | 43 | 216.35 | 392 | 39120.55 | Mobile | South | Low |
| 77 | 61 | 24000 | 79 | 46 | 870.76 | 405 | 847.95 | Mobile | North | Medium |
| 78 | 51 | 90588 | 47 | 4 | 720.63 | 482 | 3335.37 | Mobile | South | Medium |
| 79 | 27 | 121042 | 56 | 26 | 571.5 | 452 | 11648.57 | Mobile | Central | Medium |
| 80 | 53 | 113610 | 86 | 58 | 482.1 | 25 | 7001.8 | Mobile | West | Medium |
| 81 | 31 | 140420 | 14 | 29 | 552.37 | 79 | 20242.38 | Desktop | East | Medium |
| 82 | 48 | 123691 | 90 | 45 | 176.06 | 68 | 46169.84 | Tablet | Central | Low |
| 83 | 65 | 126306 | 28 | 34 | 219.63 | 173 | 23866.99 | Mobile | East | Low |
| 84 | 32 | 117856 | 87 | 23 | 109.34 | 444 | 1163.43 | Desktop | North | Low |
| 85 | 25 | 58304 | 78 | 37 | 170.58 | 12 | 14495.91 | Desktop | North | Medium |
| 86 | 31 | 131783 | 88 | 11 | 464.62 | 288 | 2707.45 | Mobile | North | Low |
| 87 | 40 | 89449 | 2 | 6 | 539.75 | 128 | 2296.24 | Mobile | East | Medium |
| 88 | 57 | 102986 | 26 | 18 | 37.5 | 96 | 14148.13 | Desktop | Central | Low |
| 89 | 38 | 109643 | 14 | 21 | 800.86 | 92 | 14142.81 | Mobile | North | Medium |
| 90 | 33 | 40764 | 59 | 42 | 308.28 | 141 | 39462.77 | Desktop | Central | Medium |
| 91 | 62 | 128940 | 56 | 36 | 913.6 | 31 | 48754.32 | Mobile | East | Medium |
| 92 | 35 | 106027 | 7 | 41 | 968.16 | 334 | 18874.75 | Tablet | Central | High |
| 93 | 64 | 58494 | 3 | 38 | 201.75 | 20 | 21729.9 | Mobile | East | Medium |
| 94 | 41 | 23373 | 23 | 34 | 472.86 | 146 | 42317.08 | Mobile | East | High |
| 95 | 43 | 32161 | 18 | 17 | 21.21 | 477 | 13772.88 | Desktop | West | High |
| 96 | 42 | 117532 | 38 | 37 | 606.36 | 316 | 8240.9 | Mobile | East | Medium |
| 97 | 62 | 112658 | 99 | 25 | 615.16 | 447 | 42727.94 | Mobile | East | Medium |
| 98 | 58 | 143633 | 15 | 38 | 262.59 | 390 | 2801.78 | Mobile | South | Low |
| 99 | 46 | 120386 | 64 | 58 | 567.24 | 160 | 31175.12 | Mobile | North | Low |
| 100 | 32 | 47350 | 89 | 12 | 241.03 | 349 | 28318.65 | Mobile | West | Low |
| 101 | 62 | 113008 | 28 | 23 | 177.61 | 43 | 17623.06 | Tablet | West | Low |
| 102 | 18 | 114297 | 74 | 53 | 658.49 | 254 | 16101.88 | Mobile | West | Low |
| 103 | 42 | 45351 | 39 | 42 | 339.41 | 130 | 38706.96 | Desktop | South | High |
| 104 | 24 | 108668 | 57 | 22 | 598.46 | 60 | 4778.02 | Desktop | East | Medium |
| 105 | 26 | 134585 | 17 | 21 | 444.58 | 151 | 12220.82 | Tablet | North | Medium |
| 106 | 41 | 35305 | 86 | 27 | 984.66 | 467 | 36756.21 | Mobile | Central | Low |
| 107 | 18 | 95353 | 90 | 57 | 166.59 | 287 | 27641.87 | Desktop | East | Low |
| 108 | 61 | 96797 | 44 | 31 | 475.31 | 499 | 6835.42 | Mobile | South | Low |
| 109 | 25 | 85953 | 25 | 6 | 686.85 | 5 | 44165.71 | Desktop | East | Low |
| 110 | 41 | 77458 | 17 | 27 | 407.63 | 467 | 19975.67 | Desktop | East | Low |
| 111 | 28 | 127112 | 13 | 40 | 975.21 | 418 | 41479.48 | Desktop | South | Low |
| 112 | 68 | 40358 | 84 | 34 | 727.45 | 266 | 39491.79 | Mobile | West | High |
| 113 | 34 | 23267 | 25 | 12 | 663.84 | 345 | 31409.06 | Desktop | West | Medium |
| 114 | 25 | 102745 | 68 | 45 | 761.92 | 130 | 24976.82 | Mobile | North | Low |
| 115 | 52 | 109588 | 10 | 57 | 953.6 | 382 | 48987.77 | Desktop | North | Low |
| 116 | 52 | 58513 | 67 | 53 | 909.66 | 267 | 7675.77 | Tablet | West | Low |
| 117 | 50 | 46092 | 18 | 7 | 729.8 | 178 | 36395.21 | Mobile | Central | Low |
| 118 | 22 | 31338 | 86 | 10 | 754.18 | 253 | 9963.94 | Tablet | East | High |