```
import pandas as pd
import numpy as np
from sklearn.cluster import KMeans
from sklearn.metrics import davies_bouldin_score, silhouette_score
from sklearn.preprocessing import StandardScaler
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.decomposition import PCA

customers = pd.read_csv("/content/Customers.csv")
transactions = pd.read_csv("/content/Transactions.csv")

data = pd.merge(transactions, customers, on="CustomerID", how="inner")

customer_data = data.groupby('CustomerID').agg({
    'TotalValue': ['sum', 'mean'],
    'TransactionID': 'count',
    'CustomerName': 'first',
    'Region': 'first'
}).reset_index()

customer_data = pd.get_dummies(customer_data,
columns=['Region','CustomerName'], drop_first=True)
```

```
<ipython-input-8-51be4c44edd0>:1: PerformanceWarning: dropping on a
non-lexsorted multi-index without a level parameter may impact
performance.
  customer_data = pd.get_dummies(customer_data,
columns=['Region','CustomerName'], drop_first=True)
```

```
customer_data.columns = ['CustomerID', 'TotalSpent',
'AvgTransactionValue', 'NumTransactions'] +
list(customer_data.columns[4:])

X = customer_data.drop(columns=['CustomerID'])

db_scores = []
silhouette_scores = []
for n_clusters in range(2, 11):  # Trying between 2 and 10 clusters
    kmeans = KMeans(n_clusters=n_clusters, random_state=42, n_init=10)
    cluster_labels = kmeans.fit_predict(X)

    # Calculate Davies-Bouldin Index
    db_index = davies_bouldin_score(X, cluster_labels)
    db_scores.append(db_index)

    # Calculate Silhouette Score
    sil_score = silhouette_score(X, cluster_labels)
    silhouette_scores.append(sil_score)
```

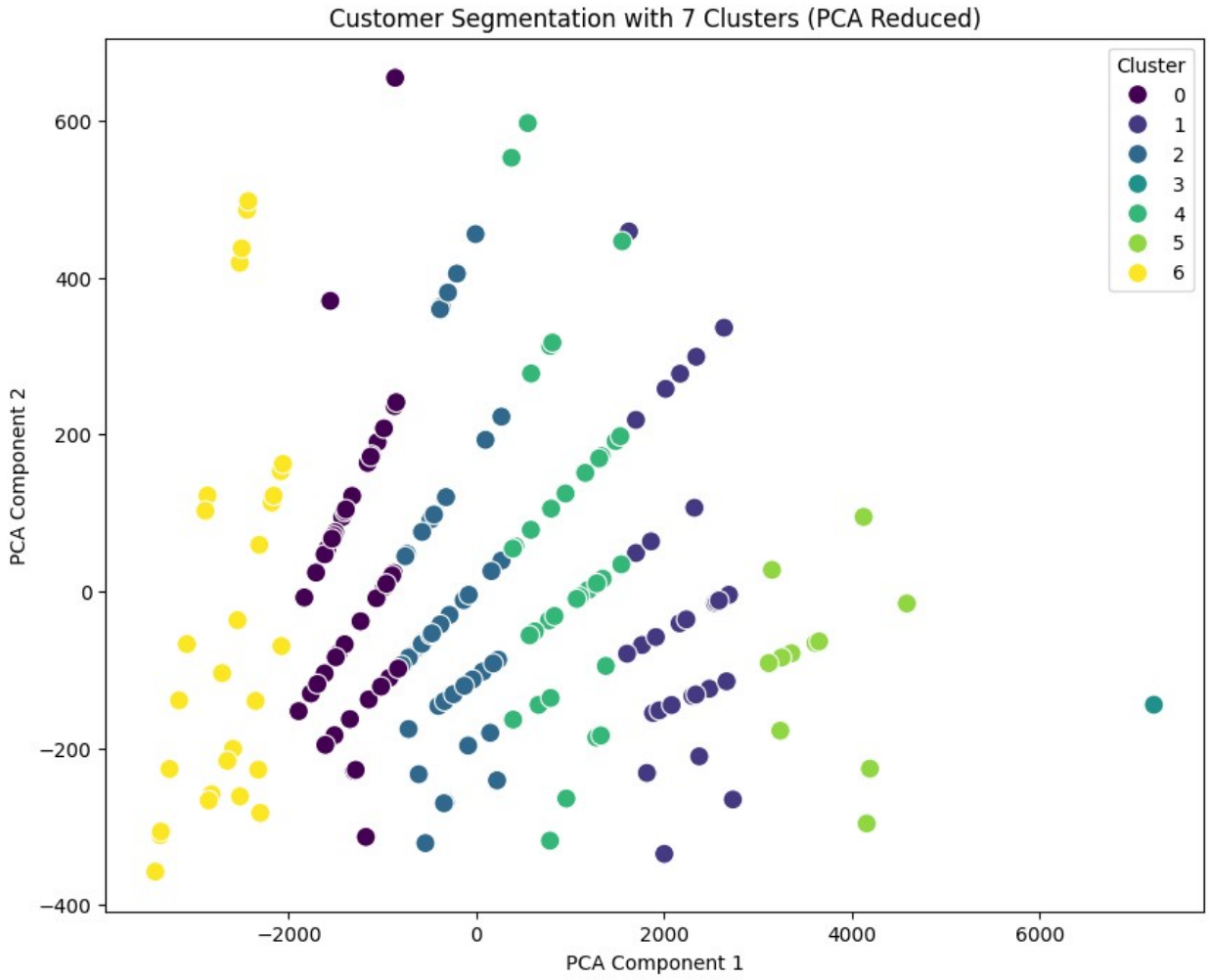
```
optimal_clusters = np.argmin(db_scores) + 2
print(f"Optimal number of clusters: {optimal_clusters}")
print(f"DB Index for optimal clusters: {db_scores[optimal_clusters -
2]}")
```

```
Optimal number of clusters: 7
DB Index for optimal clusters: 0.5352009718349171
```

```
kmeans = KMeans(n_clusters=optimal_clusters, random_state=42,
n_init=10)
customer_data['Cluster'] = kmeans.fit_predict(X)

pca = PCA(n_components=2)
X_pca = pca.fit_transform(X)

plt.figure(figsize=(10, 8))
sns.scatterplot(x=X_pca[:, 0], y=X_pca[:, 1],
hue=customer_data['Cluster'], palette="viridis", s=100)
plt.title(f"Customer Segmentation with {optimal_clusters} Clusters
(PCA Reduced)")
plt.xlabel("PCA Component 1")
plt.ylabel("PCA Component 2")
plt.legend(title="Cluster")
plt.show()
```


Customer Segmentation with 7 Clusters (PCA Reduced)
Cluster
0
1
2
3
4
5
6
PCA Component 2
600
400
200
0
−200
−400
−2000
0
2000
4000
6000
PCA Component 1