```
import torch
import numpy as np
from sklearn.cluster import KMeans
from sklearn.metrics import silhouette_score
from sklearn.preprocessing import StandardScaler

tensor_features =
torch.load('/kaggle/input/task2-dataset1/stacked_tensor.pt')

flattened_data = tensor_features.view(tensor_features.size(0), -
1).numpy()

scaler = StandardScaler()
normalized_data = scaler.fit_transform(flattened_data)

wcss = []
silhouette_scores = []

num_clusters_range = range(2, 25)

for num_clusters in num_clusters_range:
    kmeans = KMeans(n_clusters=num_clusters, random_state=42)
    clusters = kmeans.fit_predict(normalized_data)
    wcss.append(kmeans.inertia_)
    silhouette_avg = silhouette_score(normalized_data, clusters)
    silhouette_scores.append(silhouette_avg)
    print(f"For n_clusters = {num_clusters}, the average
silhouette_score is : {silhouette_avg}")
```

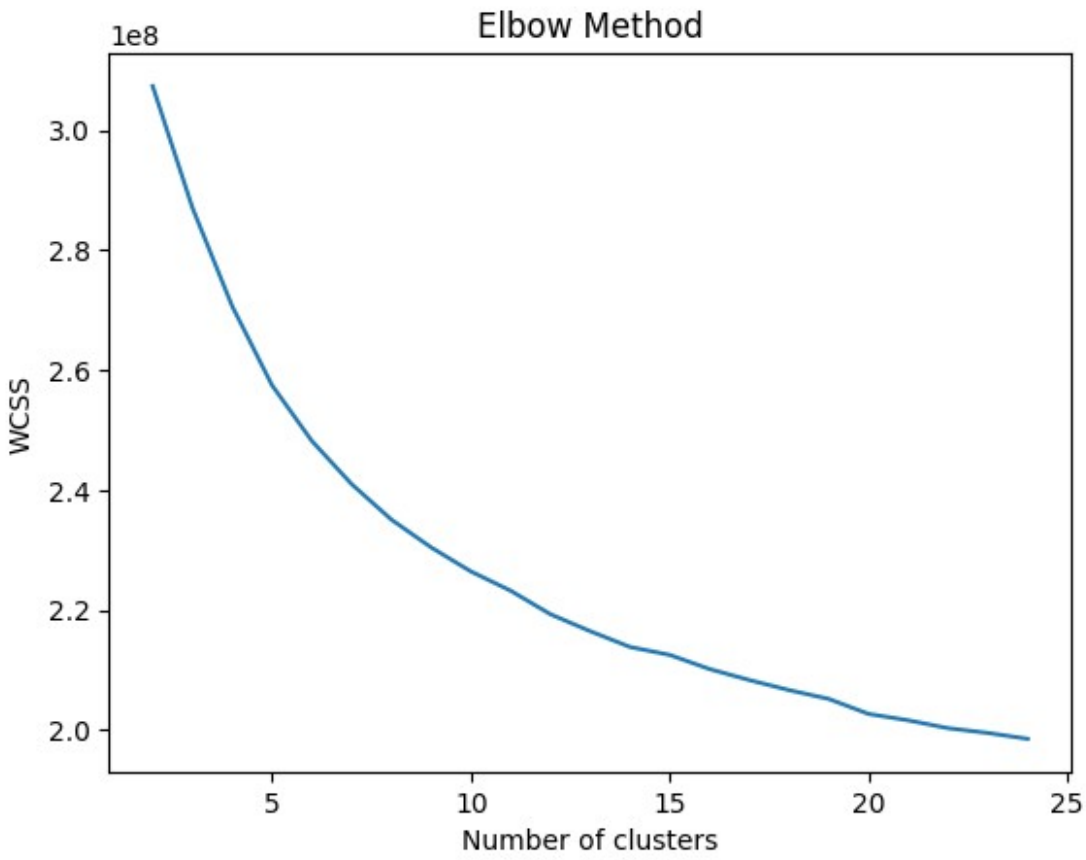
```
/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 2, the average silhouette_score is :
0.18999557197093964

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 3, the average silhouette_score is :
0.10898039489984512

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(
```

```
For n_clusters = 4, the average silhouette_score is :
0.11243752390146255

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 5, the average silhouette_score is :
0.11622769385576248

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 6, the average silhouette_score is :
0.10476924479007721

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 7, the average silhouette_score is :
0.0885905772447586

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 8, the average silhouette_score is :
0.09009360522031784

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 9, the average silhouette_score is :
0.0935397520661354

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
```

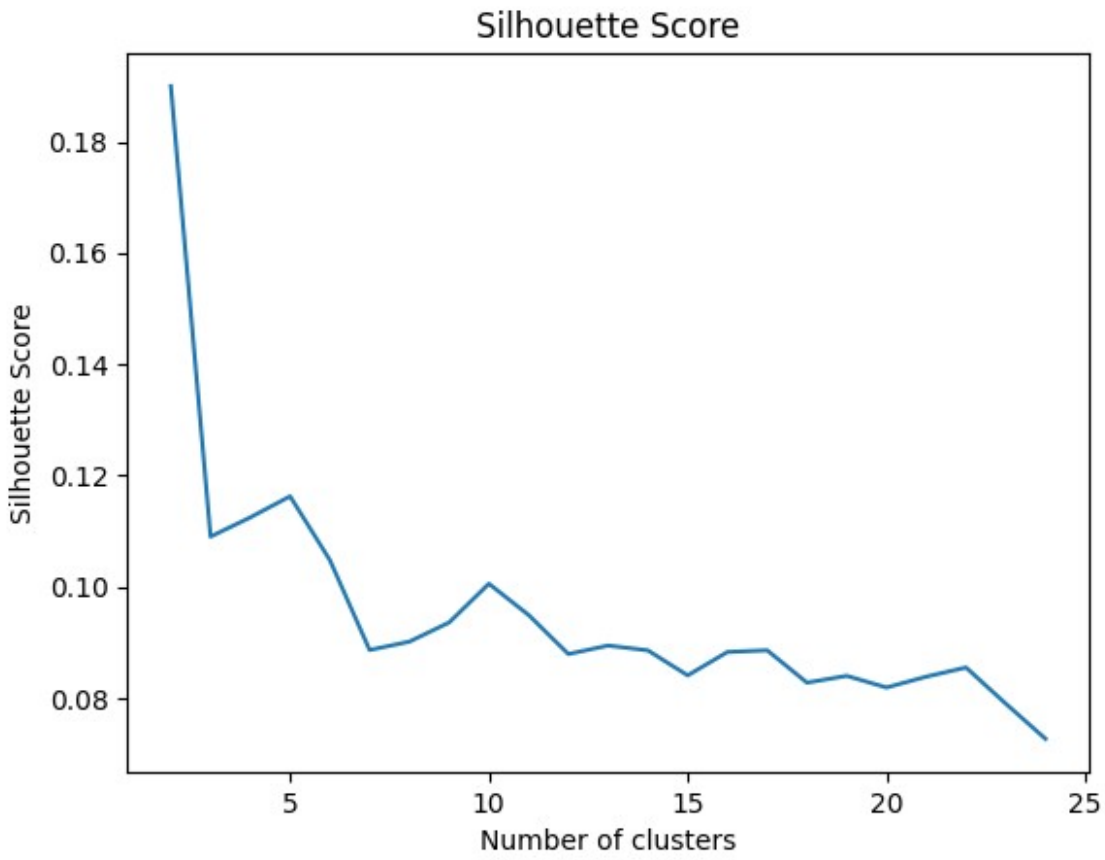
```
to suppress the warning
  warnings.warn(

For n_clusters = 10, the average silhouette_score is :
0.10050849616527557

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 11, the average silhouette_score is :
0.0948830246925354

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 12, the average silhouette_score is :
0.08786584436893463

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 13, the average silhouette_score is :
0.0893929973244667

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 14, the average silhouette_score is :
0.08852233737707138

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 15, the average silhouette_score is :
0.08402486145496368
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 16, the average silhouette_score is :
0.0882333293557167

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 17, the average silhouette_score is :
0.08854110538959503

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 18, the average silhouette_score is :
0.08272284269332886

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 19, the average silhouette_score is :
0.08394520729780197

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 20, the average silhouette_score is :
0.08184782415628433

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(
```

```
For n_clusters = 21, the average silhouette_score is :
0.08379487693309784

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 22, the average silhouette_score is :
0.08544876426458359

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 23, the average silhouette_score is :
0.07895168662071228

/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(

For n_clusters = 24, the average silhouette_score is :
0.07262012362480164

import matplotlib.pyplot as plt
plt.plot(num_clusters_range, wcss)
plt.title('Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
plt.show()
```




```
# Plot Silhouette Score
plt.plot(num_clusters_range, silhouette_scores)
plt.title('Silhouette Score')
plt.xlabel('Number of clusters')
plt.ylabel('Silhouette Score')
plt.show()
```




```
num_clusters = 5

kmeans = KMeans(n_clusters=num_clusters, random_state=42)

clusters = kmeans.fit_predict(normalized_data)
```

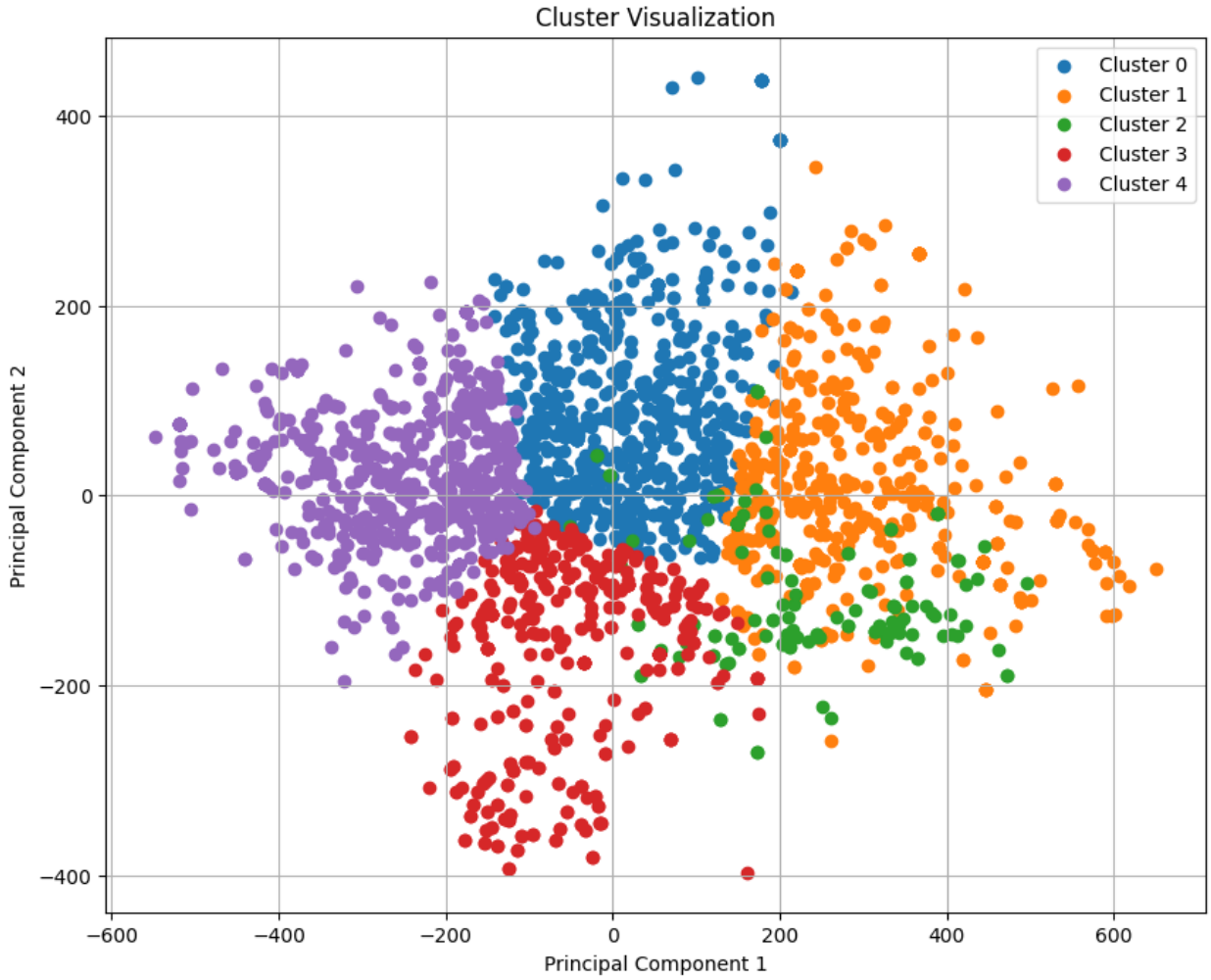
```
/opt/conda/lib/python3.10/site-packages/sklearn/cluster/
_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
  warnings.warn(
```

```
silhouette_avg = silhouette_score(normalized_data, clusters)
print(f"Silhouette Score: {silhouette_avg}")
```

```
Silhouette Score: 0.11622769385576248
```

```
from sklearn.decomposition import PCA
import matplotlib.pyplot as plt

pca = PCA(n_components=2)
reduced_data = pca.fit_transform(normalized_data)
```

```
plt.figure(figsize=(10, 8))
for cluster_label in range(num_clusters):
    cluster_points = reduced_data[clusters == cluster_label]
    plt.scatter(cluster_points[:, 0], cluster_points[:, 1],
label=f'Cluster {cluster_label}')
plt.title('Cluster Visualization')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.legend()
plt.grid(True)
plt.show()
```




```
from sklearn.manifold import TSNE
from sklearn.metrics import silhouette_samples
import seaborn as sns
```

```
tsne = TSNE(n_components=2, random_state=42)
tsne_data = tsne.fit_transform(normalized_data)

plt.figure(figsize=(10, 8))
sns.scatterplot(x=tsne_data[:, 0], y=tsne_data[:, 1], hue=clusters,
palette='Set1', legend='full')
plt.title('t-SNE Visualization of Clusters')
plt.xlabel('t-SNE Component 1')
plt.ylabel('t-SNE Component 2')
plt.show()
```