klastrowanie-hierarchiczne

June 16, 2021

[56]:

```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
import seaborn as sns
import pandas_profiling
import copy
from sklearn.decomposition import PCA
import sklearn.metrics
from sklearn import manifold
from sklearn.cluster import AgglomerativeClustering
from sklearn.manifold import TSNE
from sklearn.preprocessing import StandardScaler
```

[57]:

```
df=pd.read_csv("online_shoppers_intention.csv")
df=df.dropna()
```

[58]:

```
X=df.copy()
X=pd.get_dummies(X, columns=["Month","OperatingSystems", "Browser", "Region",␣
 ↪"TrafficType", "VisitorType"] )
nums=["Administrative", "Administrative_Duration",
      "Informational", "Informational_Duration",
      "ProductRelated", "ProductRelated_Duration",
     "BounceRates", "ExitRates", "PageValues", "SpecialDay"]

df_scale=X.copy()
df_scale
```

[58]:

```
       Administrative  Administrative_Duration  Informational  \
0                 0.0                      0.0            0.0
1                 0.0                      0.0            0.0
2                 0.0                     -1.0            0.0
3                 0.0                      0.0            0.0
4                 0.0                      0.0            0.0
…                   …                        …              …
12325             3.0                    145.0            0.0
12326             0.0                      0.0            0.0
12327             0.0                      0.0            0.0
```

```
12328             4.0                     75.0            0.0
12329             0.0                      0.0            0.0

       Informational_Duration  ProductRelated  ProductRelated_Duration  \
0                         0.0             1.0                 0.000000
1                         0.0             2.0                64.000000
2                        -1.0             1.0                -1.000000
3                         0.0             2.0                 2.666667
4                         0.0            10.0               627.500000
…                       …             …                      …
12325                     0.0            53.0              1783.791667
12326                     0.0             5.0               465.750000
12327                     0.0             6.0               184.250000
12328                     0.0            15.0               346.000000
12329                     0.0             3.0                21.250000

       BounceRates  ExitRates  PageValues  SpecialDay  …  TrafficType_14  \
0         0.200000   0.200000    0.000000         0.0  …               0
1         0.000000   0.100000    0.000000         0.0  …               0
2         0.200000   0.200000    0.000000         0.0  …               0
3         0.050000   0.140000    0.000000         0.0  …               0
4         0.020000   0.050000    0.000000         0.0  …               0
…            …        …         …         …  …             …
12325     0.007143   0.029031   12.241717         0.0  …               0
12326     0.000000   0.021333    0.000000         0.0  …               0
12327     0.083333   0.086667    0.000000         0.0  …               0
12328     0.000000   0.021053    0.000000         0.0  …               0
12329     0.000000   0.066667    0.000000         0.0  …               0

       TrafficType_15  TrafficType_16  TrafficType_17  TrafficType_18  \
0                   0               0               0               0
1                   0               0               0               0
2                   0               0               0               0
3                   0               0               0               0
4                   0               0               0               0
…               …             …             …             …
12325               0               0               0               0
12326               0               0               0               0
12327               0               0               0               0
12328               0               0               0               0
12329               0               0               0               0

       TrafficType_19  TrafficType_20  VisitorType_New_Visitor  \
0                   0               0                        0
1                   0               0                        0
2                   0               0                        0
3                   0               0                        0
```

```
4                  0              0                       0
…               …             …                       …
12325              0              0                       0
12326              0              0                       0
12327              0              0                       0
12328              0              0                       0
12329              0              0                       0                       1

       VisitorType_Other  VisitorType_Returning_Visitor
0                      0                              1
1                      0                              1
2                      0                              1
3                      0                              1
4                      0                              1
…                    …                            …
12325                  0                              1
12326                  0                              1
12327                  0                              1
12328                  0                              1
12329                  0                              0

[12316 rows x 75 columns]
```

[59]:

```
scaler = StandardScaler()
df_scale[nums]=(df_scale[nums]-df_scale[nums].mean())/df_scale[nums].std()
df_scale
```

[59]:

```
       Administrative  Administrative_Duration  Informational  \
0           -0.697553                -0.457458      -0.396615
1           -0.697553                -0.457458      -0.396615
2           -0.697553                -0.463112      -0.396615
3           -0.697553                -0.457458      -0.396615
4           -0.697553                -0.457458      -0.396615
…                 …                        …            …
12325        0.205312                 0.362398      -0.396615
12326       -0.697553                -0.457458      -0.396615
12327       -0.697553                -0.457458      -0.396615
12328        0.506267                -0.033395      -0.396615
12329       -0.697553                -0.457458      -0.396615

       Informational_Duration  ProductRelated  ProductRelated_Duration  \
0                   -0.245029       -0.691473                -0.624767
1                   -0.245029       -0.668997                -0.591336
2                   -0.252130       -0.691473                -0.625290
3                   -0.245029       -0.668997                -0.623374
4                   -0.245029       -0.489182                -0.296984
…                         …             …                        …
```

```
12325               -0.245029        0.477320                 0.307022
12326               -0.245029       -0.601566                -0.381476
12327               -0.245029       -0.579089                -0.528522
12328               -0.245029       -0.376798                -0.444029
12329               -0.245029       -0.646520                -0.613667

       BounceRates  ExitRates  PageValues  SpecialDay  …  TrafficType_14  \
0         3.672477   3.235240   -0.317363   -0.309001  …               0
1        -0.457439   1.174544   -0.317363   -0.309001  …               0
2         3.672477   3.235240   -0.317363   -0.309001  …               0
3         0.575040   1.998823   -0.317363   -0.309001  …               0
4        -0.044447   0.144196   -0.317363   -0.309001  …               0
…            …        …         …         …  …             …
12325    -0.309942  -0.287919    0.341576   -0.309001  …               0
12326    -0.457439  -0.446536   -0.317363   -0.309001  …               0
12327     1.263359   0.899785   -0.317363   -0.309001  …               0
12328    -0.457439  -0.452321   -0.317363   -0.309001  …               0
12329    -0.457439   0.487646   -0.317363   -0.309001  …               0

       TrafficType_15  TrafficType_16  TrafficType_17  TrafficType_18  \
0                   0               0               0               0
1                   0               0               0               0
2                   0               0               0               0
3                   0               0               0               0
4                   0               0               0               0
…               …             …             …             …
12325               0               0               0               0
12326               0               0               0               0
12327               0               0               0               0
12328               0               0               0               0
12329               0               0               0               0

       TrafficType_19  TrafficType_20  VisitorType_New_Visitor  \
0                   0               0                        0
1                   0               0                        0
2                   0               0                        0
3                   0               0                        0
4                   0               0                        0
…               …             …                      …
12325               0               0                        0
12326               0               0                        0
12327               0               0                        0
12328               0               0                        0
12329               0               0                        1

       VisitorType_Other  VisitorType_Returning_Visitor
0                      0                              1
```

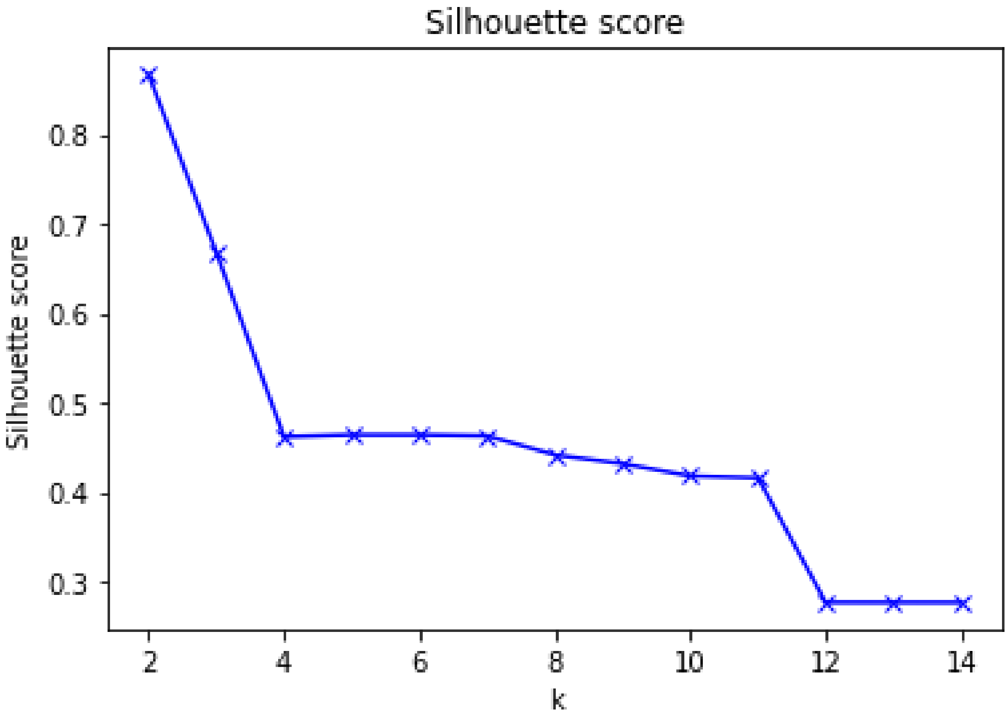
```
1                      0                               1
2                      0                               1
3                      0                               1
4                      0                               1
…                  …                             …
12325                  0                               1
12326                  0                               1
12327                  0                               1
12328                  0                               1
12329                  0                               0

[12316 rows x 75 columns]
```

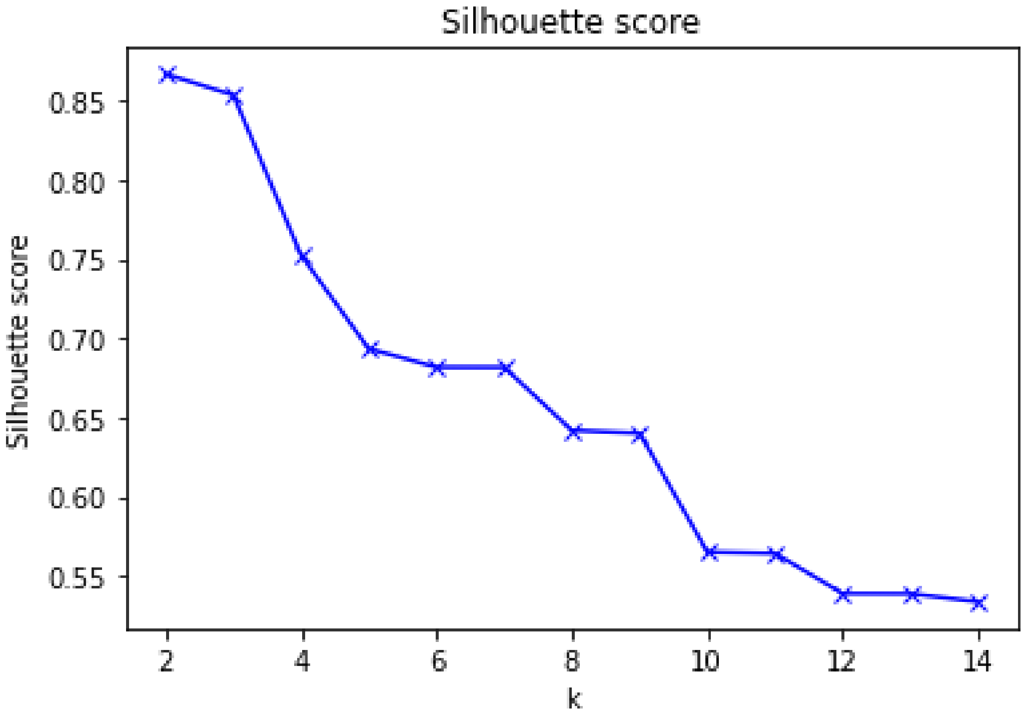
[60]:

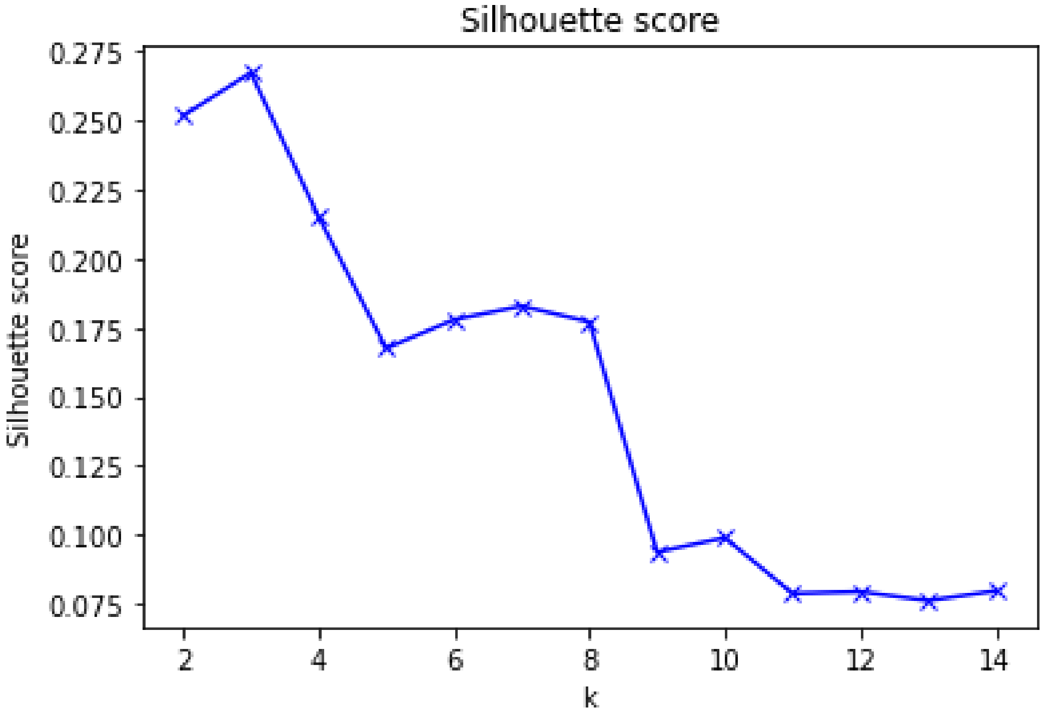
```python
# A w praktyce wygląda to tak:
def count_clustering_scores(X, cluster_num, linkage, score_fun):
    # Napiszmy tę funkcje tak ogólnie, jak to możliwe.
    # Zwróćcie uwagę na przekazanie obiektów typu callable: model i score_fun.
    if isinstance(cluster_num, int):
        cluster_num_iter = [cluster_num]
    else:
        cluster_num_iter = cluster_num

    scores = []
    for k in cluster_num_iter:
        model_instance = AgglomerativeClustering(n_clusters=k, linkage=linkage)
        labels = model_instance.fit_predict(X)
        wcss = score_fun(X, labels)
        scores.append(wcss)

    if isinstance(cluster_num, int):
        return scores[0]
    else:
        return scores
```

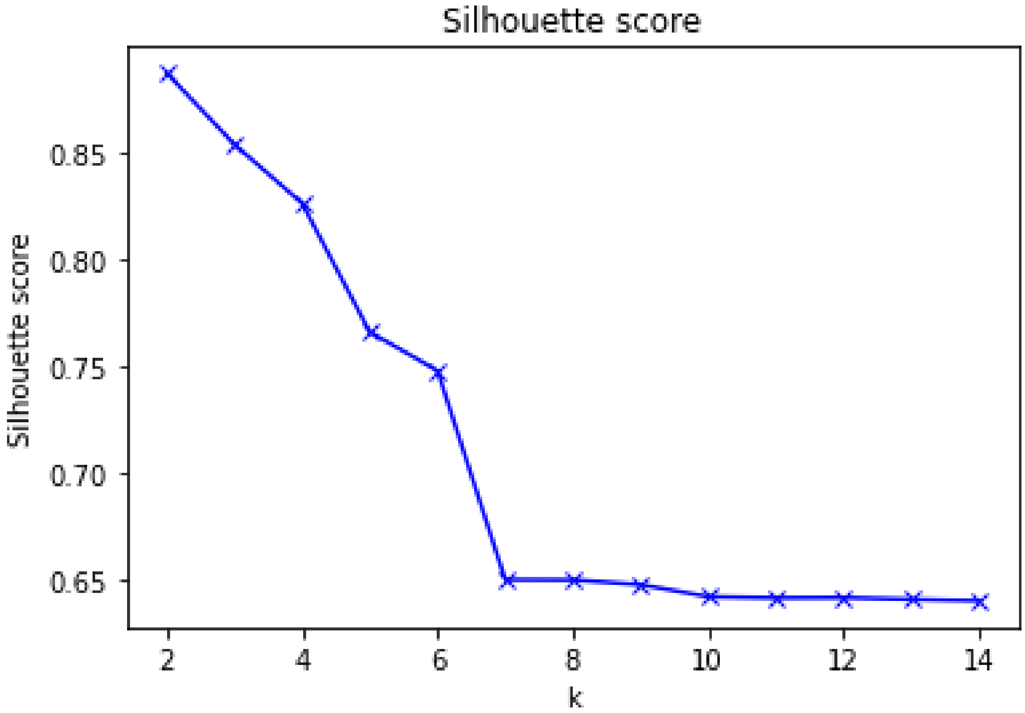
[61]:

```python
from sklearn.metrics import silhouette_score

cluster_num_seq = range(2, 15) # Niektóre metryki nie działają gdy mamy tylko␣
 ↪jeden klaster
for linkage in {'ward', 'complete', 'average', 'single'}:
    silhouette_vec = count_clustering_scores(df_scale, cluster_num_seq,␣
 ↪linkage, silhouette_score)
    plt.plot(cluster_num_seq, silhouette_vec, 'bx-')
    plt.xlabel('k')
    plt.ylabel('Silhouette score')
    plt.title("Silhouette score")
    plt.show()
```


Silhouette score
Silhouette score
0.3
0.4
0.5
0.6
0.7
0.8
2
4
6
8
10
12
14
k


Silhouette score
Silhouette score
0.55
0.60
0.65
0.70
0.75
0.80
0.85
2
4
6
8
10
12
14
k


Silhouette score
Silhouette score
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
2
4
6
8
10
12
14
k


Silhouette score
Silhouette score
0.85
0.80
0.75
0.70
0.65
2
4
6
8
10
12
14
k

[62]:

```
# A w praktyce wygląda to tak:
def count_clustering_scores(X, cluster_num, model, score_fun):
    # Napiszmy tę funkcje tak ogólnie, jak to możliwe.
    # Zwróćcie uwagę na przekazanie obiektów typu callable: model i score_fun.
    if isinstance(cluster_num, int):
        cluster_num_iter = [cluster_num]
    else:
        cluster_num_iter = cluster_num

    scores = []
    for k in cluster_num_iter:
        model_instance = model(n_clusters=k)
        labels = model_instance.fit_predict(X)
        wcss = score_fun(X, labels)
        scores.append(wcss)

    if isinstance(cluster_num, int):
        return scores[0]
    else:
        return scores
```

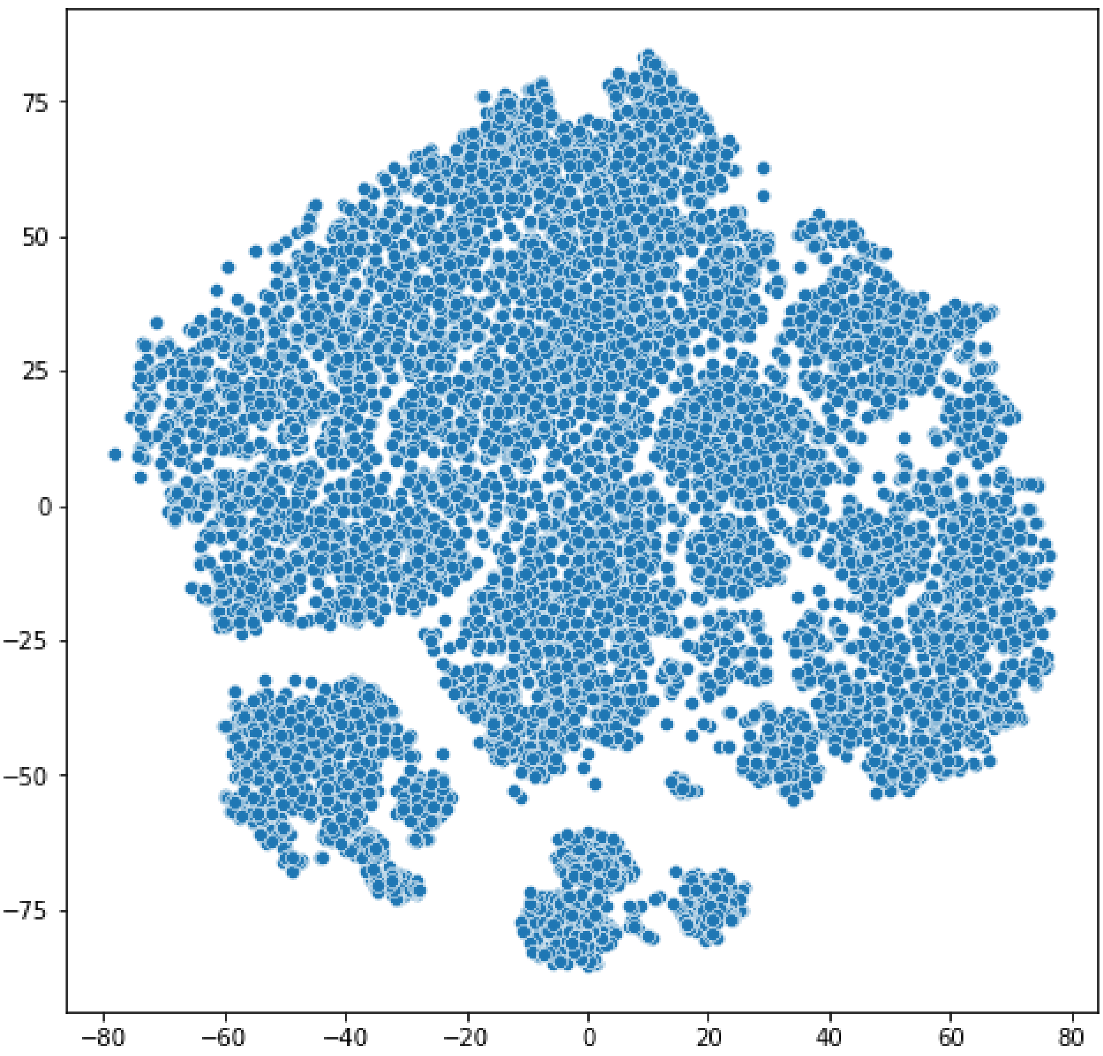
[63]:

```
tsne = TSNE(n_components=2, perplexity=35, random_state=40)
coordsFIN=tsne.fit_transform(df_scale)
plt.figure(figsize=(8,8))
sns.scatterplot(coordsFIN[:, 0], coordsFIN[:, 1], marker = 'o')
```

```
C:\Users\Jan\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variables as keyword args: x, y. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(
```

[63]:

```
<AxesSubplot:>
```

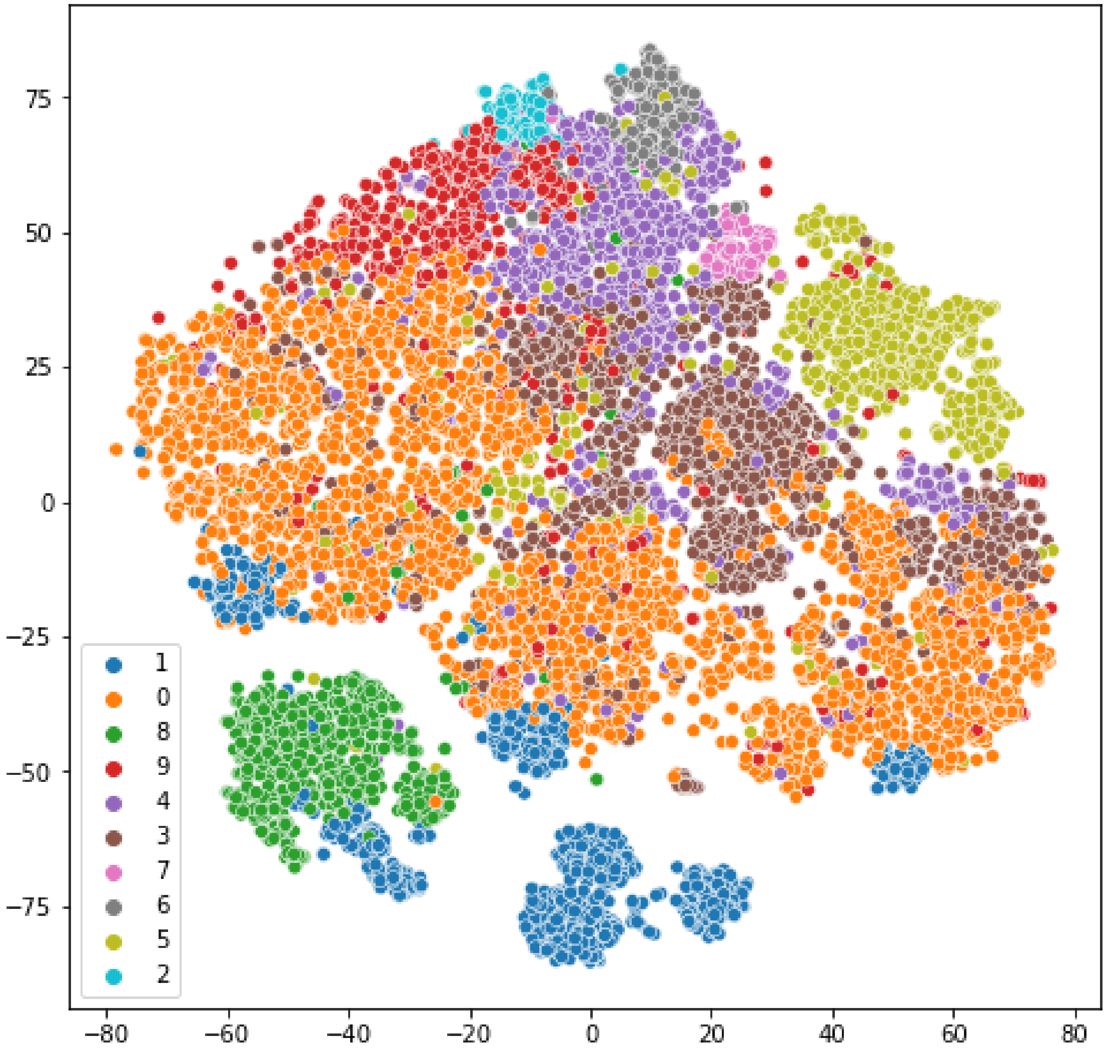


[64]:

```
ac=AgglomerativeClustering(n_clusters=10)
arr=ac.fit_predict(df_scale)
lst=[]
for i in range(len(arr)):
    lst.append(str(arr[i]))
plt.figure(figsize=(8,8))
sns.scatterplot(coordsFIN[:, 0], coordsFIN[:, 1], marker = 'o', hue=lst)
```

```
C:\Users\Jan\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variables as keyword args: x, y. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(
```

[64]: <AxesSubplot:>

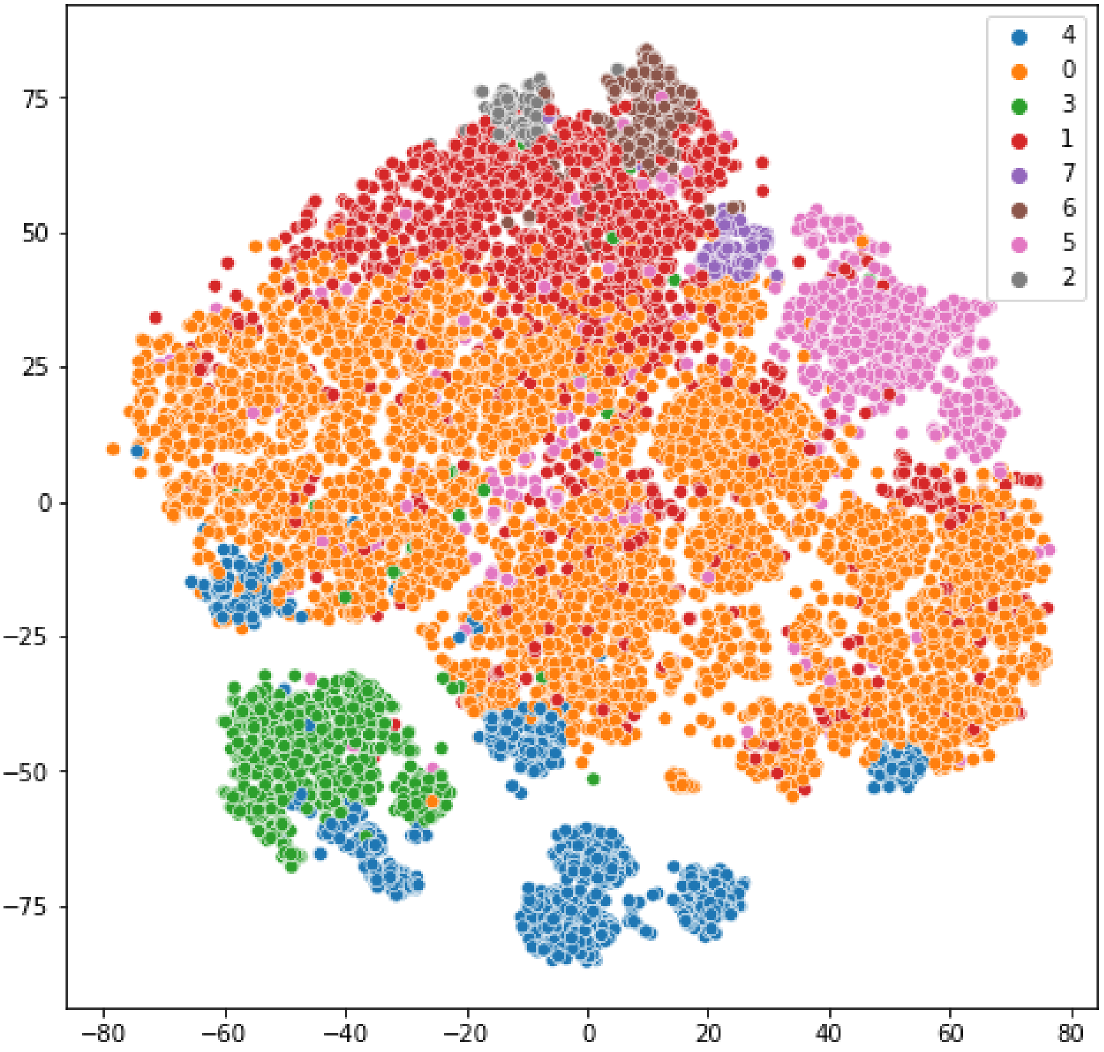


[65]:
```
ac=AgglomerativeClustering(n_clusters=8)
arr=ac.fit_predict(df_scale)
lst=[]
for i in range(len(arr)):
    lst.append(str(arr[i]))
plt.figure(figsize=(8,8))
sns.scatterplot(coordsFIN[:, 0], coordsFIN[:, 1], marker = 'o', hue=lst)
```

```
C:\Users\Jan\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variables as keyword args: x, y. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
```

```
    warnings.warn(
```

[65]:
```
<AxesSubplot:>
```

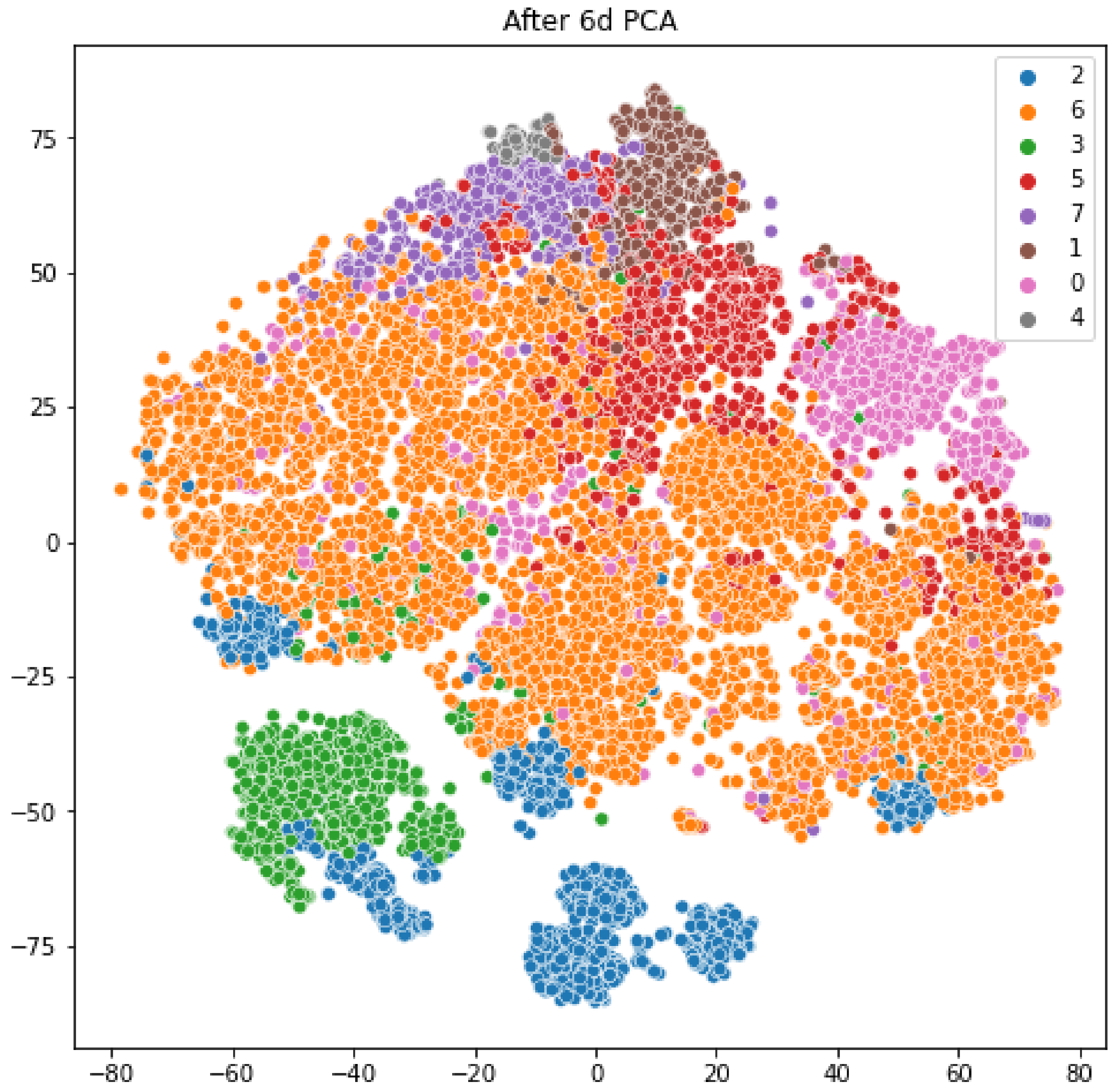


[68]:
```python
from sklearn.decomposition import PCA
def PCA_fun(n):
    pca = PCA(n_components=n)
    pC = pca.fit_transform(df_scale)
    ac=AgglomerativeClustering(n_clusters=8)
    arr=ac.fit_predict(pC)
    lst=[]
    for i in range(len(arr)):
        lst.append(str(arr[i]))
    plt.figure(figsize=(8,8))
    sns.scatterplot(coordsFIN[:, 0], coordsFIN[:, 1], marker = 'o', hue=lst).
↪set_title(f"After {n}d PCA")
```

[69]:

```
PCA_fun(6)
```

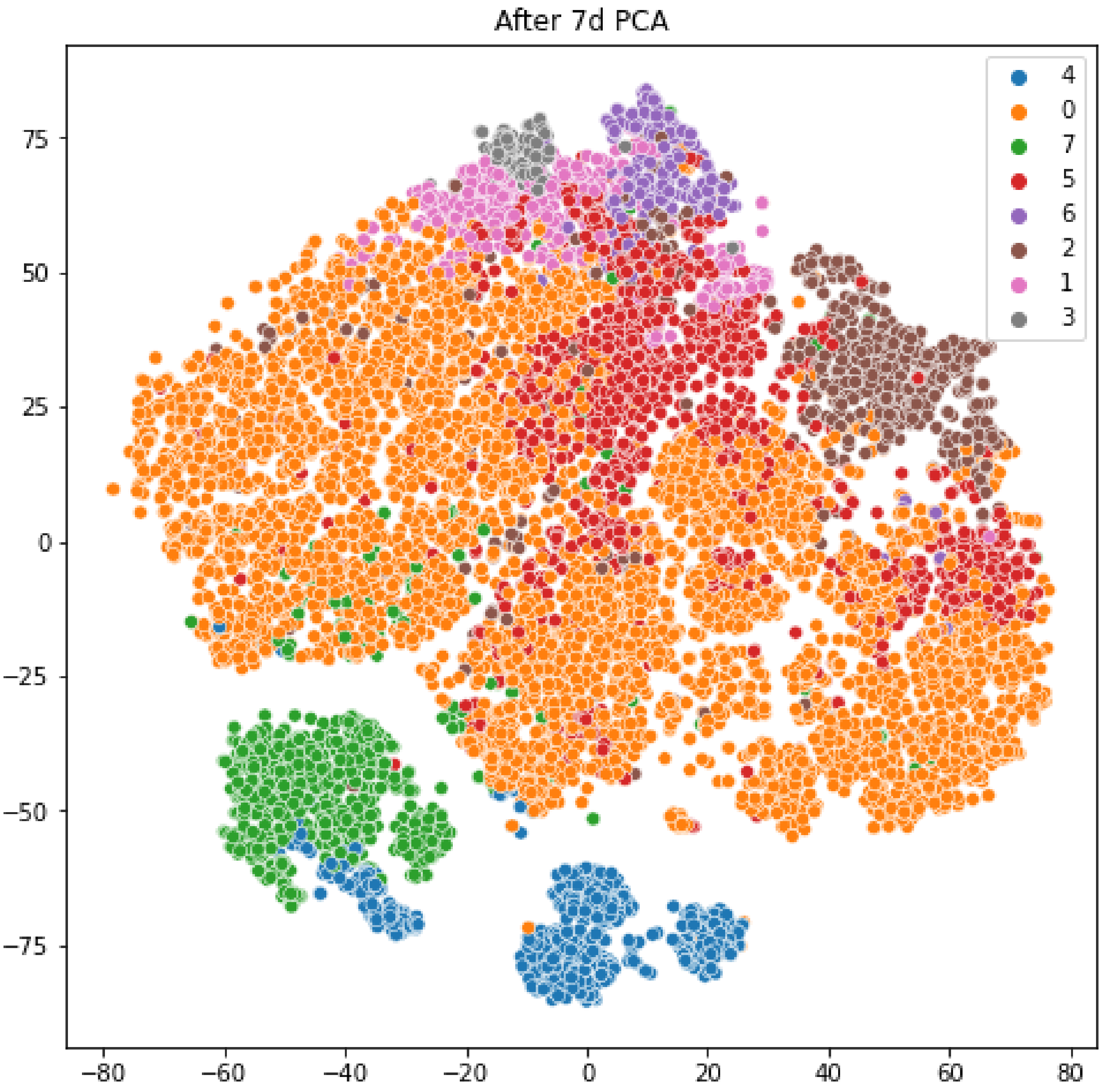
```
C:\Users\Jan\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variables as keyword args: x, y. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(
```



[70]:

```
PCA_fun(7)
```

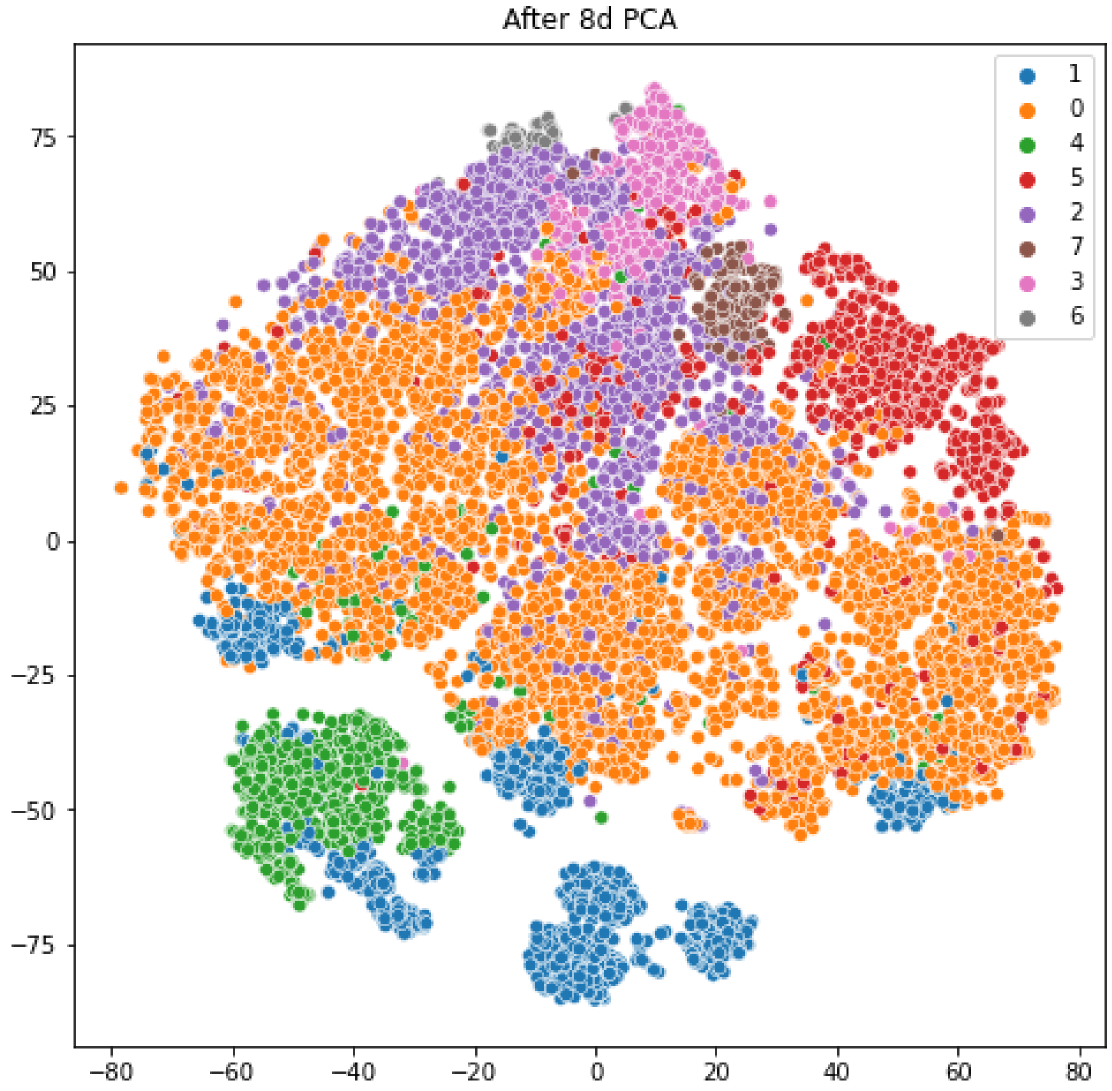
```
C:\Users\Jan\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variables as keyword args: x, y. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(
```



[71]:
```
PCA_fun(8)
```

```
C:\Users\Jan\anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variables as keyword args: x, y. From version
0.12, the only valid positional argument will be `data`, and passing other
arguments without an explicit keyword will result in an error or
misinterpretation.
```

```
warnings.warn(
```



```
[ ]:
```

```
[ ]:
```

```
[ ]: X
```

```
[ ]:
```