

```
In [20]: import numpy as np
import scipy as sp
%matplotlib inline
import matplotlib.pyplot as plt
from collections import defaultdict
from sklearn.utils import shuffle
```

```
In [21]: # open docs file and read its lines
with open("train.dat", "r", encoding="utf8") as fh:
    lines = fh.readlines()
print(len(lines))
```

8580

```
In [22]: lines[4]
```

```
Out[22]: '675 1 993 1 597 1 1230 2 53 1 15298 1 15775 1 1234 2 5114 1 4702
1 1391 3 3815 1 2288 1 3972 1 2767 1 5594 1 1958 1 125 1 6884 1 9
476 1 362 1 18211 2 923 1 924 1 369 2 1400 1 1240 1 2132 1 1244 1
3503 1 66 1 1561 1 3821 1 3345 1 1088 3 5526 1 1485 1 3664 1 1567
1 3 1 4 1 211 1 2937 1 5 2 11031 1 6 2 1886 2 9 4 290 2 9567 1 45
3 3 6895 1 139 1 454 1 931 1 619 1 857 1 3113 2 74 1 3037 1 4406
1 2705 1 78 1 1096 1 79 1 3751 1 8126 6 140 1 5693 1 142 4 1976 1
620 1 6585 1 621 1 14510 1 309 2 384 1 387 1 1101 1 14437 2 785 1
868 1 1500 1 13387 1 1024 1 788 1 789 1 1026 2 2233 1 6113 1 3441
1 1660 1 2155 6 3047 1 2156 4 3362 1 1662 1 2157 1 4336 1 1188 2
5708 1 230 1 315 1 4579 1 317 1 951 2 11 1 13 2 17 2 5310 1 1350
1 2801 1 1435 2 2804 13 1193 1 96 1 1438 2 3535 1 4265 2 5157 1 1
197 1 4663 1 9673 1 162 3 640 1 802 4 1998 1 166 1 8789 1 961 1 1
69 4 13881 1 1041 1 3220 1 1043 2 889 1 28 2 1126 2 15984 1 5080
1 1364 1 3147 1 2734 1 3463 1 1844 1 3069 2 2971 1 5881 1 412 3 4
13 1 6856 1 3949 1 253 1 2979 1 416 1 255 1 570 1 258 2 890 1 121
1 2 1212 1 1050 1 1051 1 1135 7 37 3 1056 3 2901 1 3156 1 1617 1
5173 1 3238 2 2429 1 3158 1 1853 1 1774 1 1378 1 4368 1 4449 1 86
43 1 105 1 5495 1 340 1 7755 1 262 5 264 1 12216 1 428 1 187 1 26
8 1 664 1 18511 1 269 1 188 5 18512 1 18513 1 18514 2 668 2 18515
2 41 1 42 1 1701 1 2431 1 1622 1 49 1 2750 1 1545 1 1941 1 3246 2
1149 1 7125 1 1384 2 2673 1 2674 1 2198 1 1865 1 113 1 3486 1 510
1 1948 1 117 3 271 1 275 1 915 2\n'
```

```
In [24]: docs = list()
for row in lines:
    docs.append(row.rstrip().split(" "))
```

```
In [25]: # sperate indices and values
# from the doc create two lists containing the word-id and freque
data = list()
occurence = list()
for dat in docs:
```

```

data_index = list()
occurrence_index = list()
# pick alternate elements start from index 0
for i in range(0, len(dat), 2):
    data_index.append(int(dat[i]))
# pick alternate elements start from index 1
for j in range(1, len(dat), 2):
    occurrence_index.append(int(dat[j]))
data.append(data_index)
occurrence.append(occurrence_index)

#print the unique data in first doc and corresponding occurrences
print(data[0])
print(occurrence[0])

```

```

[1237, 1390, 1391, 1392, 1393, 1394, 1395, 1396, 1397, 121, 1398,
1399, 205, 206, 369, 1400, 1401, 1402, 61, 1403, 1404, 1405, 140
6, 1407, 1408, 1409, 69, 210, 4, 6, 135, 533, 534, 618, 692, 141
0, 1411, 1412, 1413, 1414, 1415, 1335, 1416, 1417, 1418, 78, 141
9, 1096, 142, 540, 145, 308, 386, 864, 1420, 1421, 1422, 1423, 14
24, 1182, 1425, 1426, 85, 1427, 1428, 1429, 710, 718, 955, 797, 1
430, 1431, 1432, 1433, 1434, 1119, 1435, 1436, 1359, 1199, 722, 9
60, 169, 20, 22, 1125, 1360, 1126, 1361, 1362, 1363, 1364, 1283,
1365, 1366, 1367, 1368, 1369, 413, 570, 175, 338, 30, 1132, 1133,
35, 1370, 1371, 1138, 1372, 1373, 1374, 1375, 1376, 1377, 1378, 1
379, 105, 340, 262, 266, 668, 41, 46, 1380, 1309, 49, 1381, 1382,
1383, 1384, 1385, 1386, 1387, 1388, 1389, 511, 117, 515]
[1, 1, 5, 3, 1, 4, 1, 1, 1, 1, 4, 2, 1, 1, 2, 1, 3, 1, 1, 2, 1,
1, 1, 2, 1, 2, 1, 1, 3, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1,
2, 3, 1, 1, 1, 1, 2, 2, 1, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 3, 1, 1, 1, 1, 1, 1, 1, 1, 1, 6, 1, 1, 1, 4, 1, 1, 1, 3,
1, 6, 6, 1, 3, 1, 1, 1, 1, 2, 1, 2, 1, 3, 1, 5, 1, 1, 1, 1, 2, 1,
1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 3, 1, 1, 1, 1, 1, 1, 1, 1, 1, 3, 1,
1, 1, 1, 1, 1, 1, 2, 1]

```

In [6]:

```

from collections import Counter
from scipy.sparse import csr_matrix
def build_matrix(docs):
    r""" Build sparse matrix from a list of documents,
    each of which is a list of word/terms in the document.
    """

    nrows = len(docs)
    idx = {}
    tid = 0
    nnz = 0
    for d in docs:
        nnz += len(set(d))
        for w in d:
            if w not in idx:
                idx[w] = tid
                tid += 1
    ncols = len(idx)

    # set up memory

```

```

ind = np.zeros(nnz, dtype=np.int)
val = np.zeros(nnz, dtype=np.double)
ptr = np.zeros(nrows+1, dtype=np.int)
i = 0 # document ID / row counter
n = 0 # non-zero counter
# transfer values
for d in docs:
    cnt = Counter(d)
    keys = list(k for k, _ in cnt.most_common())
    l = len(keys)
    for j, k in enumerate(keys):
        ind[j+n] = idx[k]
        val[j+n] = cnt[k]
    ptr[i+1] = ptr[i] + l
    n += l
    i += 1

mat = csr_matrix((val, ind, ptr), shape=(nrows, ncols), dtype=
mat.sort_indices()

return mat

def csr_info(mat, name="", non_empty=False):
    r""" Print out info about this CSR matrix. If non_empty,
    report number of non-empty rows and cols as well
    """
    if non_empty:
        print("%s [nrows %d (%d non-empty), ncols %d (%d non-empt
            name, mat.shape[0],
            sum(1 if mat.indptr[i+1] > mat.indptr[i] else 0
                for i in range(mat.shape[0])),
            mat.shape[1], len(np.unique(mat.indices)),
            len(mat.data)))
    else:
        print( "%s [nrows %d, ncols %d, nnz %d]" % (name,
            mat.shape[0], mat.shape[1], len(mat.data)) )

```

In [7]:

```

mat = build_matrix(docs)
csr_info(mat)

```

<ipython-input-6-00144fcf6f39>:20: DeprecationWarning: `np.int` is a deprecated alias for the builtin `int`. To silence this warning, use `int` by itself. Doing this will not modify any behavior and is safe. When replacing `np.int`, you may wish to use e.g. `np.int64` or `np.int32` to specify the precision. If you wish to review your current use, check the release note link for additional information.

Deprecated in NumPy 1.20; for more details and guidance: <https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations>

```
ind = np.zeros(nnz, dtype=np.int)
```

<ipython-input-6-00144fcf6f39>:22: DeprecationWarning: `np.int` is

s a deprecated alias for the builtin `int`. To silence this warning, use `int` by itself. Doing this will not modify any behavior and is safe. When replacing `np.int`, you may wish to use e.g. `np.int64` or `np.int32` to specify the precision. If you wish to review your current use, check the release note link for additional information.

Deprecated in NumPy 1.20; for more details and guidance: <https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations>

```
ptr = np.zeros(nrows+1, dtype=np.int)
[nrows 8580, ncols 27673, nnz 1155073]
```

In [8]:

```
# scale matrix and normalize its rows
def csr_idf(mat, copy=False, **kargs):
    r""" Scale a CSR matrix by idf.
    Returns scaling factors as dict. If copy is True,
    returns scaled matrix and scaling factors.
    """

    if copy is True:
        mat = mat.copy()
    nrows = mat.shape[0]
    nnz = mat.nnz
    ind, val, ptr = mat.indices, mat.data, mat.indptr
    # document frequency
    df = defaultdict(int)
    for i in ind:
        df[i] += 1
    # inverse document frequency
    for k,v in df.items():
        df[k] = np.log(nrows / float(v)) ## df turns to idf - re
    # scale by idf
    for i in range(0, nnz):
        val[i] *= df[ind[i]]

    return df if copy is False else mat

def csr_l2normalize(mat, copy=False, **kargs):
    r""" Normalize the rows of a CSR matrix by their L-2 norm.
    If copy is True, returns a copy of the normalized matrix.
    """

    if copy is True:
        mat = mat.copy()
    nrows = mat.shape[0]
    nnz = mat.nnz
    ind, val, ptr = mat.indices, mat.data, mat.indptr
    # normalize
    for i in range(nrows):
        rsum = 0.0
        for j in range(ptr[i], ptr[i+1]):
            rsum += val[j]**2
        if rsum == 0.0:
            continue # do not normalize empty rows
        rsum = 1.0/np.sqrt(rsum)
        for j in range(ptr[i], ptr[i+1]):
            val[j] *= rsum
```

```
    if copy is True:
        return mat
```

```
In [9]: mat2 = csr_idf(mat, copy=True)
mat3 = csr_l2normalize(mat2, copy=True)
mat3_pca = mat3.copy()
print(mat.shape)
print(mat3.shape)
```

```
(8580, 27673)
(8580, 27673)
```

```
In [10]: # perform PCA decomposition on the data
from sklearn.decomposition import PCA, IncrementalPCA
pca = PCA(n_components=1500)
principalComponents = pca.fit_transform(mat3_pca.toarray())
```

```
In [11]: mat3=principalComponents
```

```
In [55]: def select_clusters(mat, centroids):

    c1 = list()
    c2 = list()

    similarityMatrix = mat.dot(centroids.T)
    # print("similarityMatrix: ",similarityMatrix)
    for i in range(similarityMatrix.shape[0]):
        similarityRow = similarityMatrix[i]

        #Sort the index of the matrix in ascending order of value
        similaritySorted = np.argsort(similarityRow)[-1]

        if similaritySorted == 0:
            c1.append(i)
        else:
            c2.append(i)

    return c1, c2
```

```
In [56]: from sklearn.cluster import KMeans

def kmeans(mat, n_iter):
    shuffledMatrix = shuffle(mat, random_state=0)
    centroids = shuffledMatrix[:2,:]

    for _ in range(n_iter):
```

```

clusters = list()
c1, c2 = select_clusters(mat, centroids)

if len(c1) > 1:
    clusters.append(c1)
if len(c2) > 1:
    clusters.append(c2)

centroid_list = list()
for i in range(0,2):
    cluster = mat[clusters[i],:]
    cluster_mean = cluster.mean(0)
    centroid_list.append(cluster_mean)

centroids = np.asarray(centroid_list)
#centroids = np.asarray(kmeans)

return c1, c2

```

In [57]:

```

def calculateSSE(mat, clusters):

    sseList = list()
    sseArray = []
    for cluster in clusters:
        rmse = np.sum(np.square(mat[cluster,:] - np.mean(mat[cluster,:], axis=0)))
        # print("rmse: ",rmse)
        sseList.append(rmse)
    # print("sseList: ",sseList)
    sseArray = np.asarray(sseList)# 1,6,8,9,22
    # print("sseArray: ",sseArray)
    remove_cluster_idx = np.argsort(sseArray)[-1]
    # print("remove_cluster_idx: ",remove_cluster_idx)
    return remove_cluster_idx

```

In [61]:

```

from sklearn.cluster import KMeans
def bisecting_kmeans(mat, k, n_iter):

    clusters = list()

    initialcluster = list()
    # appending dimensions to initialcluster
    for i in range(mat.shape[0]):
        initialcluster.append(i)

    clusters.append(initialcluster)
    # print(mat.shape[0])
    # print(clusters)
    while len(clusters) < k:# 3

        remove_cluster_idx = calculateSSE(mat, clusters)
        removed_cluster = clusters[remove_cluster_idx]

```

```

c1, c2 = kmeans(mat[removed_cluster,:], n_iter)
del clusters[remove_cluster_idx]

real_c1 = list()
real_c2 = list()
for index in c1:
    real_c1.append(removed_cluster[index])

for index in c2:
    real_c2.append(removed_cluster[index])

clusters.append(real_c1)
clusters.append(real_c2)

labels = [0] * mat.shape[0]

for index, cluster in enumerate(clusters):
    for idx in cluster:
        labels[idx] = index + 1
return labels

```

In [62]:

```

from sklearn.metrics import silhouette_score
k_values = list()
scores = list()

for k in range(3, 21, 2):
    labels = bisecting_kmeans(mat3, k, 10)
    if (k == 7):
        # write to output file
        outputFile = open("output.dat", "w")
        for docuId, index in enumerate(labels, start=1):
            row = str(index) # str(docuId) + ',' +
            outputFile.write(row + '\n')
        outputFile.close()

    sscore = silhouette_score(mat3, labels)
    k_values.append(k)
    scores.append(sscore)
    print ("For K= %d silhouette_coefficient Score is %f" %(k, ss

```

```

similarityMatrix: [[ 0.00224539  0.00563543]
 [-0.01410789 -0.00333939]
 [-0.01843338  0.00267188]
 ...
 [-0.01520066  0.00645218]
 [-0.00952964 -0.00025749]
 [-0.00705488 -0.01785217]]
similarityMatrix: [[-0.00087274  0.00107679]
 [ 0.00215112 -0.00265404]
 [-0.00223716  0.00276019]
 ...

```

```

[ 0.0009148 -0.00112868]
[ 0.00092416 -0.00114022]
[ 0.00174329 -0.00215086]]
similarityMatrix: [[-0.00173868  0.00297917]
[ 0.00317554 -0.0054412 ]
[-0.00139931  0.00239768]
...
[ 0.00383638 -0.00657353]
[ 0.00352834 -0.00604571]
[ 0.00354366 -0.00607196]]
similarityMatrix: [[-0.00174339  0.00307099]
[ 0.00310459 -0.00546875]
[-0.0010407   0.0018332 ]
...
[ 0.00413289 -0.00728011]
[ 0.00388774 -0.00684827]
[ 0.00366063 -0.00644822]]
similarityMatrix: [[-0.00172248  0.00304798]
[ 0.00307851 -0.0054475 ]
[-0.00097462  0.00172462]
...
[ 0.00413037 -0.00730882]
[ 0.00389703 -0.00689591]
[ 0.00368823 -0.00652643]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
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[ 0.00307245 -0.00544229]
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...
[ 0.00412856 -0.00731299]
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similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]

```



```

[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00643657 -0.01152037]
[-0.01612988 0.00721709]
[ 0.00307641 0.01811557]
...
[ 0.00744527 -0.00497521]
[ 0.01289484 0.00662285]
[ 0.00587296 -0.00643633]]
similarityMatrix: [[ 0.0037576 0.00222148]
[-0.00271786 0.00406783]
[ 0.00050391 0.00582196]
...
[ 0.00701852 0.00053914]
[ 0.00606594 0.00120089]
[ 0.00321758 0.00426774]]
similarityMatrix: [[ 0.00405851 0.00213275]
[-0.00644108 0.00674123]
[-0.0031568 0.008625 ]
...
[ 0.00907095 -0.0005815 ]
[ 0.00750617 0.00045555]
[ 0.00048915 0.00673253]]
similarityMatrix: [[ 0.00365808 0.00254719]
[-0.00706639 0.00692362]
[-0.00387933 0.0089348 ]
...
[ 0.00861081 0.00010833]
[ 0.00718367 0.00094723]
[-0.001127 0.00800284]]
similarityMatrix: [[ 0.00367438 0.0025493 ]
[-0.00707019 0.00672189]
[-0.00393297 0.00879361]
...
[ 0.00817522 0.00061152]
[ 0.00670468 0.00145493]
[-0.00166586 0.00833737]]
similarityMatrix: [[ 0.00382936 0.00243831]
[-0.0071577 0.0065641 ]
[-0.00386899 0.00852676]
...
[ 0.007838 0.00102078]
[ 0.00646687 0.00174213]
[-0.00202049 0.00846687]]
similarityMatrix: [[ 0.00389449 0.0023973 ]
[-0.00699348 0.00630619]
[-0.00370168 0.0082782 ]
...
[ 0.00765132 0.00123523]
[ 0.00629554 0.00192522]
[-0.00202458 0.00837618]]
similarityMatrix: [[ 0.00382935 0.00246619]
[-0.00680048 0.00600309]
[-0.00360788 0.0080693 ]
...
[ 0.00761284 0.0013377 ]
[ 0.00624851 0.00201169]

```

```

[-0.00204815  0.00827893]]
similarityMatrix: [[ 0.00381963  0.00248754]
[-0.00657831  0.00570013]
[-0.00349109  0.00786019]
...
[ 0.00761307  0.00140076]
[ 0.00625977  0.00204557]
[-0.00201142  0.0081461 ]]
similarityMatrix: [[ 0.00383791  0.00248422]
[-0.00640609  0.0054688 ]
[-0.00339082  0.00769162]
...
[ 0.00764393  0.00142713]
[ 0.00628752  0.00205822]
[-0.00198936  0.00804726]]
For K= 3 silhouette_coefficient Score is 0.002958
similarityMatrix: [[ 0.00224539  0.00563543]
[-0.01410789 -0.00333939]
[-0.01843338  0.00267188]
...
[-0.01520066  0.00645218]
[-0.00952964 -0.00025749]
[-0.00705488 -0.01785217]]
similarityMatrix: [[-0.00087274  0.00107679]
[ 0.00215112 -0.00265404]
[-0.00223716  0.00276019]
...
[ 0.0009148  -0.00112868]
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similarityMatrix: [[-0.00173868  0.00297917]
[ 0.00317554 -0.0054412 ]
[-0.00139931  0.00239768]
...
[ 0.00383638 -0.00657353]
[ 0.00352834 -0.00604571]
[ 0.00354366 -0.00607196]]
similarityMatrix: [[-0.00174339  0.00307099]
[ 0.00310459 -0.00546875]
[-0.0010407  0.0018332 ]
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similarityMatrix: [[-0.00172248  0.00304798]
[ 0.00307851 -0.0054475 ]
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```

```

[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
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...
[ 0.00412856 -0.00731299]
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similarityMatrix: [[-0.00172211  0.0030504 ]
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[ 0.00412856 -0.00731299]
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similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
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...
[ 0.00412856 -0.00731299]
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[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00643657 -0.01152037]
[-0.01612988  0.00721709]
[ 0.00307641  0.01811557]
...
[ 0.00744527 -0.00497521]
[ 0.01289484  0.00662285]
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similarityMatrix: [[ 0.0037576  0.00222148]
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[ 0.00050391  0.00582196]
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[ 0.00701852  0.00053914]
[ 0.00606594  0.00120089]
[ 0.00321758  0.00426774]]
similarityMatrix: [[ 0.00405851  0.00213275]
[-0.00644108  0.00674123]
[-0.0031568  0.008625 ]
...
[ 0.00907095 -0.0005815 ]
[ 0.00750617  0.00045555]
[ 0.00048915  0.00673253]]
similarityMatrix: [[ 0.00365808  0.00254719]
[-0.00706639  0.00692362]
[-0.00387933  0.0089348 ]
...
[ 0.00861081  0.00010833]
[ 0.00718367  0.00094723]
[-0.001127  0.00800284]]

```

```

similarityMatrix: [[ 0.00367438  0.0025493 ]
 [-0.00707019  0.00672189]
 [-0.00393297  0.00879361]
 ...
 [ 0.00817522  0.00061152]
 [ 0.00670468  0.00145493]
 [-0.00166586  0.00833737]]
similarityMatrix: [[ 0.00382936  0.00243831]
 [-0.0071577  0.0065641 ]
 [-0.00386899  0.00852676]
 ...
 [ 0.007838  0.00102078]
 [ 0.00646687  0.00174213]
 [-0.00202049  0.00846687]]
similarityMatrix: [[ 0.00389449  0.0023973 ]
 [-0.00699348  0.00630619]
 [-0.00370168  0.0082782 ]
 ...
 [ 0.00765132  0.00123523]
 [ 0.00629554  0.00192522]
 [-0.00202458  0.00837618]]
similarityMatrix: [[ 0.00382935  0.00246619]
 [-0.00680048  0.00600309]
 [-0.00360788  0.0080693 ]
 ...
 [ 0.00761284  0.0013377 ]
 [ 0.00624851  0.00201169]
 [-0.00204815  0.00827893]]
similarityMatrix: [[ 0.00381963  0.00248754]
 [-0.00657831  0.00570013]
 [-0.00349109  0.00786019]
 ...
 [ 0.00761307  0.00140076]
 [ 0.00625977  0.00204557]
 [-0.00201142  0.0081461 ]]
similarityMatrix: [[ 0.00383791  0.00248422]
 [-0.00640609  0.0054688 ]
 [-0.00339082  0.00769162]
 ...
 [ 0.00764393  0.00142713]
 [ 0.00628752  0.00205822]
 [-0.00198936  0.00804726]]
similarityMatrix: [[ 0.00605607  0.00885634]
 [ 0.01109727  0.01479461]
 [ 0.00500945 -0.01494773]
 ...
 [ 0.03624291 -0.01593727]
 [-0.00213283  0.00125555]
 [ 0.03128891  0.00723438]]
similarityMatrix: [[ 0.00614307  0.00047073]
 [ 0.00425857 -0.00039155]
 [ 0.01383926  0.00598723]
 ...
 [ 0.00624565 -0.00274119]
 [ 0.00793129  0.01140434]
 [ 0.0077548  0.00429703]]
similarityMatrix: [[ 0.01196599 -0.00326728]

```

```

[ 0.00807169 -0.00277534]
[ 0.01598906  0.0050012 ]
...
[ 0.0096327  -0.00452629]
[ 0.0066675   0.0120622 ]
[ 0.00963948  0.00319816]]
similarityMatrix: [[ 0.0130945 -0.00372353]
[ 0.00854546 -0.0028778 ]
[ 0.01573615  0.00539164]
...
[ 0.0098868  -0.00441433]
[ 0.00490319  0.01314413]
[ 0.01001249  0.00307549]]
similarityMatrix: [[ 0.01332479 -0.0038232 ]
[ 0.00864307 -0.00290615]
[ 0.01580999  0.00537571]
...
[ 0.01000135 -0.00444471]
[ 0.00446501  0.01341062]
[ 0.01014334  0.00301039]]
similarityMatrix: [[ 0.01321934 -0.00377097]
[ 0.00864507 -0.00291996]
[ 0.01578849  0.00537887]
...
[ 0.00993971 -0.00441895]
[ 0.00445862  0.01342457]
[ 0.01016473  0.00298834]]
similarityMatrix: [[ 0.01320959 -0.00377359]
[ 0.00865805 -0.00293492]
[ 0.01583128  0.0053445 ]
...
[ 0.00994609 -0.00443099]
[ 0.00443505  0.01344524]
[ 0.01018989  0.00296756]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[-0.00100708  0.01637188]
[ 0.00871842  0.01437905]

```

```

[-0.00331851 -0.01399516]
...
[ 0.02294154  0.00623035]
[ 0.00414378  0.01872247]
[ 0.00907894  0.02931298]]
similarityMatrix: [[0.00531083 0.00526585]
[0.0078785  0.00720935]
[0.00275738 0.00255757]
...
[0.00510651 0.00341578]
[0.00757657 0.00574259]
[0.00919796 0.00672124]]
similarityMatrix: [[0.00755787 0.00288601]
[0.01123575 0.00362309]
[0.00268332 0.00262579]
...
[0.00776645 0.00051541]
[0.01125596 0.00175627]
[0.013649  0.00188578]]
similarityMatrix: [[ 0.00910965  0.00117073]
[ 0.01330486  0.00132306]
[ 0.00325692  0.00200732]
...
[ 0.00922227 -0.00112055]
[ 0.01373223 -0.00099997]
[ 0.01579316 -0.00053379]]
similarityMatrix: [[ 1.03969052e-02  4.60350550e-05]
[ 1.46487261e-02  2.40115474e-04]
[ 4.05276653e-03  1.22163839e-03]
...
[ 1.00723102e-02 -1.73730954e-03]
[ 1.49442175e-02 -1.87970687e-03]
[ 1.69467303e-02 -1.31421458e-03]]
similarityMatrix: [[ 0.01236689 -0.00109189]
[ 0.01635528 -0.00041051]
[ 0.00505345  0.00049416]
...
[ 0.01142637 -0.00223031]
[ 0.01690737 -0.00261283]
[ 0.01871519 -0.00178338]]
similarityMatrix: [[ 0.01447542 -0.00205476]
[ 0.01809742 -0.00090309]
[ 0.00618523 -0.00016568]
...
[ 0.01273046 -0.00253966]
[ 0.01875023 -0.0030381 ]
[ 0.02010659 -0.00179533]]
similarityMatrix: [[ 0.01559823 -0.00251316]
[ 0.01885714 -0.00102831]
[ 0.00695603 -0.00059861]
...
[ 0.01348821 -0.00275167]
[ 0.01961326 -0.00317552]
[ 0.02077909 -0.00178592]]
similarityMatrix: [[ 0.01581629 -0.00268858]
[ 0.01895763 -0.00111566]
[ 0.00723247 -0.0008123 ]

```

```

...
[ 0.01359655 -0.0028429 ]
[ 0.0197361 -0.00328144]
[ 0.02079291 -0.00180911]]
similarityMatrix: [[ 0.01594691 -0.00276644]
[ 0.01898485 -0.00111362]
[ 0.00731212 -0.00086342]
...
[ 0.01354292 -0.00278386]
[ 0.01985911 -0.00334847]
[ 0.02086015 -0.00183446]]
For K= 5 silhouette_coefficient Score is -0.011322
similarityMatrix: [[ 0.00224539 0.00563543]
[-0.01410789 -0.00333939]
[-0.01843338 0.00267188]
...
[-0.01520066 0.00645218]
[-0.00952964 -0.00025749]
[-0.00705488 -0.01785217]]
similarityMatrix: [[-0.00087274 0.00107679]
[ 0.00215112 -0.00265404]
[-0.00223716 0.00276019]
...
[ 0.0009148 -0.00112868]
[ 0.00092416 -0.00114022]
[ 0.00174329 -0.00215086]]
similarityMatrix: [[-0.00173868 0.00297917]
[ 0.00317554 -0.0054412 ]
[-0.00139931 0.00239768]
...
[ 0.00383638 -0.00657353]
[ 0.00352834 -0.00604571]
[ 0.00354366 -0.00607196]]
similarityMatrix: [[-0.00174339 0.00307099]
[ 0.00310459 -0.00546875]
[-0.0010407 0.0018332 ]
...
[ 0.00413289 -0.00728011]
[ 0.00388774 -0.00684827]
[ 0.00366063 -0.00644822]]
similarityMatrix: [[-0.00172248 0.00304798]
[ 0.00307851 -0.0054475 ]
[-0.00097462 0.00172462]
...
[ 0.00413037 -0.00730882]
[ 0.00389703 -0.00689591]
[ 0.00368823 -0.00652643]]
similarityMatrix: [[-0.00172211 0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286 0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211 0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286 0.00172324]

```

```

...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00643657 -0.01152037]
[-0.01612988  0.00721709]
[ 0.00307641  0.01811557]
...
[ 0.00744527 -0.00497521]
[ 0.01289484  0.00662285]
[ 0.00587296 -0.00643633]]
similarityMatrix: [[ 0.0037576  0.00222148]
[-0.00271786  0.00406783]
[ 0.00050391  0.00582196]
...
[ 0.00701852  0.00053914]
[ 0.00606594  0.00120089]
[ 0.00321758  0.00426774]]
similarityMatrix: [[ 0.00405851  0.00213275]
[-0.00644108  0.00674123]
[-0.0031568  0.008625 ]
...
[ 0.00907095 -0.0005815 ]
[ 0.00750617  0.00045555]
[ 0.00048915  0.00673253]]
similarityMatrix: [[ 0.00365808  0.00254719]
[-0.00706639  0.00692362]
[-0.00387933  0.0089348 ]
...
[ 0.00861081  0.00010833]
[ 0.00718367  0.00094723]
[-0.001127  0.00800284]]
similarityMatrix: [[ 0.00367438  0.0025493 ]
[-0.00707019  0.00672189]
[-0.00393297  0.00879361]
...

```



```

[ 0.00817522  0.00061152]
[ 0.00670468  0.00145493]
[-0.00166586  0.00833737]]
similarityMatrix: [[ 0.00382936  0.00243831]
[-0.0071577   0.0065641  ]
[-0.00386899  0.00852676]
...
[ 0.007838    0.00102078]
[ 0.00646687  0.00174213]
[-0.00202049  0.00846687]]
similarityMatrix: [[ 0.00389449  0.0023973  ]
[-0.00699348  0.00630619]
[-0.00370168  0.0082782  ]
...
[ 0.00765132  0.00123523]
[ 0.00629554  0.00192522]
[-0.00202458  0.00837618]]
similarityMatrix: [[ 0.00382935  0.00246619]
[-0.00680048  0.00600309]
[-0.00360788  0.0080693  ]
...
[ 0.00761284  0.0013377  ]
[ 0.00624851  0.00201169]
[-0.00204815  0.00827893]]
similarityMatrix: [[ 0.00381963  0.00248754]
[-0.00657831  0.00570013]
[-0.00349109  0.00786019]
...
[ 0.00761307  0.00140076]
[ 0.00625977  0.00204557]
[-0.00201142  0.0081461  ]]
similarityMatrix: [[ 0.00383791  0.00248422]
[-0.00640609  0.0054688  ]
[-0.00339082  0.00769162]
...
[ 0.00764393  0.00142713]
[ 0.00628752  0.00205822]
[-0.00198936  0.00804726]]
similarityMatrix: [[ 0.00605607  0.00885634]
[ 0.01109727  0.01479461]
[ 0.00500945 -0.01494773]
...
[ 0.03624291 -0.01593727]
[-0.00213283  0.00125555]
[ 0.03128891  0.00723438]]
similarityMatrix: [[ 0.00614307  0.00047073]
[ 0.00425857 -0.00039155]
[ 0.01383926  0.00598723]
...
[ 0.00624565 -0.00274119]
[ 0.00793129  0.01140434]
[ 0.0077548   0.00429703]]
similarityMatrix: [[ 0.01196599 -0.00326728]
[ 0.00807169 -0.00277534]
[ 0.01598906  0.0050012  ]
...
[ 0.0096327   -0.00452629]

```

```

[ 0.0066675  0.0120622 ]
[ 0.00963948 0.00319816]]
similarityMatrix: [[ 0.0130945 -0.00372353]
[ 0.00854546 -0.0028778 ]
[ 0.01573615 0.00539164]
...
[ 0.0098868 -0.00441433]
[ 0.00490319 0.01314413]
[ 0.01001249 0.00307549]]
similarityMatrix: [[ 0.01332479 -0.0038232 ]
[ 0.00864307 -0.00290615]
[ 0.01580999 0.00537571]
...
[ 0.01000135 -0.00444471]
[ 0.00446501 0.01341062]
[ 0.01014334 0.00301039]]
similarityMatrix: [[ 0.01321934 -0.00377097]
[ 0.00864507 -0.00291996]
[ 0.01578849 0.00537887]
...
[ 0.00993971 -0.00441895]
[ 0.00445862 0.01342457]
[ 0.01016473 0.00298834]]
similarityMatrix: [[ 0.01320959 -0.00377359]
[ 0.00865805 -0.00293492]
[ 0.01583128 0.0053445 ]
...
[ 0.00994609 -0.00443099]
[ 0.00443505 0.01344524]
[ 0.01018989 0.00296756]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909 0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532 0.01345665]
[ 0.01017578 0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909 0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532 0.01345665]
[ 0.01017578 0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909 0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532 0.01345665]
[ 0.01017578 0.00297315]]
similarityMatrix: [[-0.00100708 0.01637188]
[ 0.00871842 0.01437905]
[-0.00331851 -0.01399516]
...
[ 0.02294154 0.00623035]
[ 0.00414378 0.01872247]

```

```

[ 0.00907894  0.02931298]]
similarityMatrix: [[0.00531083 0.00526585]
[0.0078785  0.00720935]
[0.00275738 0.00255757]
...
[0.00510651 0.00341578]
[0.00757657 0.00574259]
[0.00919796 0.00672124]]
similarityMatrix: [[0.00755787 0.00288601]
[0.01123575 0.00362309]
[0.00268332 0.00262579]
...
[0.00776645 0.00051541]
[0.01125596 0.00175627]
[0.013649  0.00188578]]
similarityMatrix: [[ 0.00910965  0.00117073]
[ 0.01330486  0.00132306]
[ 0.00325692  0.00200732]
...
[ 0.00922227 -0.00112055]
[ 0.01373223 -0.00099997]
[ 0.01579316 -0.00053379]]
similarityMatrix: [[ 1.03969052e-02  4.60350550e-05]
[ 1.46487261e-02  2.40115474e-04]
[ 4.05276653e-03  1.22163839e-03]
...
[ 1.00723102e-02 -1.73730954e-03]
[ 1.49442175e-02 -1.87970687e-03]
[ 1.69467303e-02 -1.31421458e-03]]
similarityMatrix: [[ 0.01236689 -0.00109189]
[ 0.01635528 -0.00041051]
[ 0.00505345  0.00049416]
...
[ 0.01142637 -0.00223031]
[ 0.01690737 -0.00261283]
[ 0.01871519 -0.00178338]]
similarityMatrix: [[ 0.01447542 -0.00205476]
[ 0.01809742 -0.00090309]
[ 0.00618523 -0.00016568]
...
[ 0.01273046 -0.00253966]
[ 0.01875023 -0.0030381 ]
[ 0.02010659 -0.00179533]]
similarityMatrix: [[ 0.01559823 -0.00251316]
[ 0.01885714 -0.00102831]
[ 0.00695603 -0.00059861]
...
[ 0.01348821 -0.00275167]
[ 0.01961326 -0.00317552]
[ 0.02077909 -0.00178592]]
similarityMatrix: [[ 0.01581629 -0.00268858]
[ 0.01895763 -0.00111566]
[ 0.00723247 -0.0008123 ]
...
[ 0.01359655 -0.0028429 ]
[ 0.0197361  -0.00328144]
[ 0.02079291 -0.00180911]]

```

```
similarityMatrix: [[ 0.01594691 -0.00276644]
 [ 0.01898485 -0.00111362]
 [ 0.00731212 -0.00086342]
 ...
 [ 0.01354292 -0.00278386]
 [ 0.01985911 -0.00334847]
 [ 0.02086015 -0.00183446]]
similarityMatrix: [[ 0.0016062 -0.02601113]
 [-0.00302189 0.00484222]
 [-0.00502498 0.00265269]
 ...
 [ 0.01729606 -0.01028539]
 [ 0.03486961 0.00481244]
 [ 0.01762816 -0.0157823 ]]
similarityMatrix: [[ 6.95765764e-03 1.00630756e-03]
 [ 3.64073265e-03 1.66084409e-03]
 [ 3.18152177e-03 9.74414694e-04]
 ...
 [ 9.15702234e-03 -1.90607920e-03]
 [ 1.54732445e-02 7.61416141e-05]
 [ 1.32417852e-02 -2.07989099e-04]]
similarityMatrix: [[ 5.96277924e-03 1.08837919e-03]
 [ 4.66235305e-03 -2.21480038e-04]
 [ 4.32147599e-03 -1.12546903e-03]
 ...
 [ 7.41227112e-03 -1.90126340e-03]
 [ 1.33376359e-02 -3.30331814e-04]
 [ 1.09553301e-02 3.12459293e-05]]
similarityMatrix: [[ 5.40796179e-03 2.36223013e-03]
 [ 5.08229329e-03 3.61123920e-06]
 [ 4.85434303e-03 -9.43915521e-04]
 ...
 [ 8.20352358e-03 -1.46169212e-03]
 [ 1.44794431e-02 3.35639572e-04]
 [ 1.20663142e-02 3.49795405e-04]]
similarityMatrix: [[ 5.03014229e-03 2.92452706e-03]
 [ 5.54414026e-03 -7.92029924e-05]
 [ 5.36012059e-03 -1.01836363e-03]
 ...
 [ 8.73545096e-03 -1.29498311e-03]
 [ 1.52297929e-02 6.05819212e-04]
 [ 1.28358253e-02 4.35352475e-04]]
similarityMatrix: [[ 5.05225604e-03 2.94689662e-03]
 [ 5.67493807e-03 -8.37289293e-05]
 [ 5.51256674e-03 -1.02715585e-03]
 ...
 [ 8.88070243e-03 -1.22417404e-03]
 [ 1.54887766e-02 6.66761182e-04]
 [ 1.30454307e-02 4.95987925e-04]]
similarityMatrix: [[ 0.00508156 0.00293953]
 [ 0.00575905 -0.00010737]
 [ 0.00557885 -0.0010283 ]
 ...
 [ 0.00899669 -0.00123787]
 [ 0.01560813 0.00069132]
 [ 0.01310392 0.0005542 ]]
similarityMatrix: [[ 0.00518103 0.00287948]
```

```

[ 0.00588219 -0.00014385]
[ 0.00566108 -0.00102099]
...
[ 0.00912095 -0.00122387]
[ 0.01579137 0.00070988]
[ 0.01323033 0.00059361]]
similarityMatrix: [[ 0.00519696 0.00290008]
[ 0.00606363 -0.00020587]
[ 0.00583496 -0.0010671 ]
...
[ 0.009326 -0.00124202]
[ 0.01601302 0.00074756]
[ 0.01344123 0.00060429]]
similarityMatrix: [[ 0.00528229 0.0028611 ]
[ 0.00617624 -0.00021529]
[ 0.00591128 -0.00103905]
...
[ 0.00952386 -0.00126438]
[ 0.01622941 0.00077123]
[ 0.01360781 0.00063659]]
similarityMatrix: [[-0.0067412 -0.01494713]
[ 0.02431244 -0.01512905]
[ 0.05057763 -0.012341 ]
...
[ 0.00926811 -0.01772456]
[-0.01426775 0.01302672]
[-0.00734118 -0.01881791]]
similarityMatrix: [[0.02746375 0.00478167]
[0.01059063 0.01605669]
[0.01888633 0.00719763]
...
[0.02773965 0.01199459]
[0.01130037 0.00901776]
[0.01491476 0.01176177]]
similarityMatrix: [[ 3.26910922e-02 -4.13381690e-03]
[ 8.06359338e-05 3.06286663e-02]
[ 1.82924622e-02 7.01868611e-03]
...
[ 3.11656060e-02 6.07799639e-03]
[ 1.33287534e-02 6.10286303e-03]
[ 1.60241915e-02 1.00083471e-02]]
similarityMatrix: [[ 0.03322489 -0.00446901]
[-0.0003798 0.03092998]
[ 0.01829461 0.00712887]
...
[ 0.03147844 0.0059167 ]
[ 0.01326181 0.00626364]
[ 0.01651703 0.00941833]]
similarityMatrix: [[ 0.03333897 -0.00476279]
[-0.00032984 0.03098178]
[ 0.01810894 0.00733336]
...
[ 0.03132771 0.00602045]
[ 0.01292191 0.00668872]
[ 0.01790128 0.00755285]]
similarityMatrix: [[ 0.03315842 -0.00495443]
[-0.00025762 0.03124245]

```

```

[ 0.01780449  0.0076225 ]
...
[ 0.0311433  0.00598055]
[ 0.01263915 0.00700048]
[ 0.01983112 0.00481949]]
similarityMatrix: [[ 0.03307444 -0.00518134]
[-0.00011245  0.03132574]
[ 0.0175386   0.0078969  ]
...
[ 0.03077411  0.00626249]
[ 0.01244063  0.00722299]
[ 0.02171146  0.00209702]]
similarityMatrix: [[ 3.30924567e-02 -5.20613620e-03]
[-4.65733363e-05  3.12350805e-02]
[ 1.75186507e-02  7.92435285e-03]
...
[ 3.08533949e-02  6.15338344e-03]
[ 1.23249011e-02  7.38225310e-03]
[ 2.16719075e-02  2.15144612e-03]]
similarityMatrix: [[ 3.30813839e-02 -5.24009183e-03]
[-1.60973384e-05  3.12332564e-02]
[ 1.74896751e-02  7.95198339e-03]
...
[ 3.08148313e-02  6.17482141e-03]
[ 1.23016286e-02  7.40799695e-03]
[ 2.16297135e-02  2.18454855e-03]]
similarityMatrix: [[ 3.30529190e-02 -5.29942580e-03]
[ 7.84407998e-05  3.11828315e-02]
[ 1.74363862e-02  8.00122322e-03]
...
[ 3.07549627e-02  6.19425276e-03]
[ 1.22554837e-02  7.45930945e-03]
[ 2.15559628e-02  2.23659967e-03]]
For K= 7 silhouette_coefficient Score is -0.004991
similarityMatrix: [[ 0.00224539  0.00563543]
[-0.01410789 -0.00333939]
[-0.01843338  0.00267188]
...
[-0.01520066  0.00645218]
[-0.00952964 -0.00025749]
[-0.00705488 -0.01785217]]
similarityMatrix: [[-0.00087274  0.00107679]
[ 0.00215112 -0.00265404]
[-0.00223716  0.00276019]
...
[ 0.0009148  -0.00112868]
[ 0.00092416 -0.00114022]
[ 0.00174329 -0.00215086]]
similarityMatrix: [[-0.00173868  0.00297917]
[ 0.00317554 -0.0054412  ]
[-0.00139931  0.00239768]
...
[ 0.00383638 -0.00657353]
[ 0.00352834 -0.00604571]
[ 0.00354366 -0.00607196]]
similarityMatrix: [[-0.00174339  0.00307099]
[ 0.00310459 -0.00546875]

```

```

[-0.0010407  0.0018332 ]
...
[ 0.00413289 -0.00728011]
[ 0.00388774 -0.00684827]
[ 0.00366063 -0.00644822]]
similarityMatrix: [[-0.00172248  0.00304798]
[ 0.00307851 -0.0054475 ]
[-0.00097462  0.00172462]
...
[ 0.00413037 -0.00730882]
[ 0.00389703 -0.00689591]
[ 0.00368823 -0.00652643]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00643657 -0.01152037]
[-0.01612988  0.00721709]
[ 0.00307641  0.01811557]
...
[ 0.00744527 -0.00497521]
[ 0.01289484  0.00662285]
[ 0.00587296 -0.00643633]]
similarityMatrix: [[ 0.0037576  0.00222148]
[-0.00271786  0.00406783]
[ 0.00050391  0.00582196]

```

```

...
[ 0.00701852  0.00053914]
[ 0.00606594  0.00120089]
[ 0.00321758  0.00426774]]
similarityMatrix: [[ 0.00405851  0.00213275]
[-0.00644108  0.00674123]
[-0.0031568   0.008625  ]]
...
[ 0.00907095 -0.0005815 ]
[ 0.00750617  0.00045555]
[ 0.00048915  0.00673253]]
similarityMatrix: [[ 0.00365808  0.00254719]
[-0.00706639  0.00692362]
[-0.00387933  0.0089348  ]]
...
[ 0.00861081  0.00010833]
[ 0.00718367  0.00094723]
[-0.001127    0.00800284]]
similarityMatrix: [[ 0.00367438  0.0025493  ]
[-0.00707019  0.00672189]
[-0.00393297  0.00879361]]
...
[ 0.00817522  0.00061152]
[ 0.00670468  0.00145493]
[-0.00166586  0.00833737]]
similarityMatrix: [[ 0.00382936  0.00243831]
[-0.0071577   0.0065641  ]
[-0.00386899  0.00852676]]
...
[ 0.007838    0.00102078]
[ 0.00646687  0.00174213]
[-0.00202049  0.00846687]]
similarityMatrix: [[ 0.00389449  0.0023973  ]
[-0.00699348  0.00630619]
[-0.00370168  0.0082782  ]]
...
[ 0.00765132  0.00123523]
[ 0.00629554  0.00192522]
[-0.00202458  0.00837618]]
similarityMatrix: [[ 0.00382935  0.00246619]
[-0.00680048  0.00600309]
[-0.00360788  0.0080693  ]]
...
[ 0.00761284  0.0013377  ]
[ 0.00624851  0.00201169]
[-0.00204815  0.00827893]]
similarityMatrix: [[ 0.00381963  0.00248754]
[-0.00657831  0.00570013]
[-0.00349109  0.00786019]]
...
[ 0.00761307  0.00140076]
[ 0.00625977  0.00204557]
[-0.00201142  0.0081461  ]]
similarityMatrix: [[ 0.00383791  0.00248422]
[-0.00640609  0.0054688  ]
[-0.00339082  0.00769162]]
...

```



```

[ 0.00764393  0.00142713]
[ 0.00628752  0.00205822]
[-0.00198936  0.00804726]]
similarityMatrix: [[ 0.00605607  0.00885634]
[ 0.01109727  0.01479461]
[ 0.00500945 -0.01494773]
...
[ 0.03624291 -0.01593727]
[-0.00213283  0.00125555]
[ 0.03128891  0.00723438]]
similarityMatrix: [[ 0.00614307  0.00047073]
[ 0.00425857 -0.00039155]
[ 0.01383926  0.00598723]
...
[ 0.00624565 -0.00274119]
[ 0.00793129  0.01140434]
[ 0.0077548   0.00429703]]
similarityMatrix: [[ 0.01196599 -0.00326728]
[ 0.00807169 -0.00277534]
[ 0.01598906  0.0050012 ]
...
[ 0.0096327  -0.00452629]
[ 0.0066675   0.0120622 ]
[ 0.00963948  0.00319816]]
similarityMatrix: [[ 0.0130945  -0.00372353]
[ 0.00854546 -0.0028778 ]
[ 0.01573615  0.00539164]
...
[ 0.0098868  -0.00441433]
[ 0.00490319  0.01314413]
[ 0.01001249  0.00307549]]
similarityMatrix: [[ 0.01332479 -0.0038232 ]
[ 0.00864307 -0.00290615]
[ 0.01580999  0.00537571]
...
[ 0.01000135 -0.00444471]
[ 0.00446501  0.01341062]
[ 0.01014334  0.00301039]]
similarityMatrix: [[ 0.01321934 -0.00377097]
[ 0.00864507 -0.00291996]
[ 0.01578849  0.00537887]
...
[ 0.00993971 -0.00441895]
[ 0.00445862  0.01342457]
[ 0.01016473  0.00298834]]
similarityMatrix: [[ 0.01320959 -0.00377359]
[ 0.00865805 -0.00293492]
[ 0.01583128  0.0053445 ]
...
[ 0.00994609 -0.00443099]
[ 0.00443505  0.01344524]
[ 0.01018989  0.00296756]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]

```

```

[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[-0.00100708  0.01637188]
[ 0.00871842  0.01437905]
[-0.00331851 -0.01399516]
...
[ 0.02294154  0.00623035]
[ 0.00414378  0.01872247]
[ 0.00907894  0.02931298]]
similarityMatrix: [[0.00531083  0.00526585]
[0.0078785  0.00720935]
[0.00275738  0.00255757]
...
[0.00510651  0.00341578]
[0.00757657  0.00574259]
[0.00919796  0.00672124]]
similarityMatrix: [[0.00755787  0.00288601]
[0.01123575  0.00362309]
[0.00268332  0.00262579]
...
[0.00776645  0.00051541]
[0.01125596  0.00175627]
[0.013649  0.00188578]]
similarityMatrix: [[ 0.00910965  0.00117073]
[ 0.01330486  0.00132306]
[ 0.00325692  0.00200732]
...
[ 0.00922227 -0.00112055]
[ 0.01373223 -0.00099997]
[ 0.01579316 -0.00053379]]
similarityMatrix: [[ 1.03969052e-02  4.60350550e-05]
[ 1.46487261e-02  2.40115474e-04]
[ 4.05276653e-03  1.22163839e-03]
...
[ 1.00723102e-02 -1.73730954e-03]
[ 1.49442175e-02 -1.87970687e-03]
[ 1.69467303e-02 -1.31421458e-03]]
similarityMatrix: [[ 0.01236689 -0.00109189]
[ 0.01635528 -0.00041051]
[ 0.00505345  0.00049416]
...
[ 0.01142637 -0.00223031]
[ 0.01690737 -0.00261283]

```

```

[ 0.01871519 -0.00178338]]
similarityMatrix: [[ 0.01447542 -0.00205476]
[ 0.01809742 -0.00090309]
[ 0.00618523 -0.00016568]
...
[ 0.01273046 -0.00253966]
[ 0.01875023 -0.0030381 ]
[ 0.02010659 -0.00179533]]
similarityMatrix: [[ 0.01559823 -0.00251316]
[ 0.01885714 -0.00102831]
[ 0.00695603 -0.00059861]
...
[ 0.01348821 -0.00275167]
[ 0.01961326 -0.00317552]
[ 0.02077909 -0.00178592]]
similarityMatrix: [[ 0.01581629 -0.00268858]
[ 0.01895763 -0.00111566]
[ 0.00723247 -0.0008123 ]
...
[ 0.01359655 -0.0028429 ]
[ 0.0197361 -0.00328144]
[ 0.02079291 -0.00180911]]
similarityMatrix: [[ 0.01594691 -0.00276644]
[ 0.01898485 -0.00111362]
[ 0.00731212 -0.00086342]
...
[ 0.01354292 -0.00278386]
[ 0.01985911 -0.00334847]
[ 0.02086015 -0.00183446]]
similarityMatrix: [[ 0.0016062 -0.02601113]
[-0.00302189 0.00484222]
[-0.00502498 0.00265269]
...
[ 0.01729606 -0.01028539]
[ 0.03486961 0.00481244]
[ 0.01762816 -0.0157823 ]]
similarityMatrix: [[ 6.95765764e-03 1.00630756e-03]
[ 3.64073265e-03 1.66084409e-03]
[ 3.18152177e-03 9.74414694e-04]
...
[ 9.15702234e-03 -1.90607920e-03]
[ 1.54732445e-02 7.61416141e-05]
[ 1.32417852e-02 -2.07989099e-04]]
similarityMatrix: [[ 5.96277924e-03 1.08837919e-03]
[ 4.66235305e-03 -2.21480038e-04]
[ 4.32147599e-03 -1.12546903e-03]
...
[ 7.41227112e-03 -1.90126340e-03]
[ 1.33376359e-02 -3.30331814e-04]
[ 1.09553301e-02 3.12459293e-05]]
similarityMatrix: [[ 5.40796179e-03 2.36223013e-03]
[ 5.08229329e-03 3.61123920e-06]
[ 4.85434303e-03 -9.43915521e-04]
...
[ 8.20352358e-03 -1.46169212e-03]
[ 1.44794431e-02 3.35639572e-04]
[ 1.20663142e-02 3.49795405e-04]]

```

```

similarityMatrix: [[ 5.03014229e-03  2.92452706e-03]
 [ 5.54414026e-03 -7.92029924e-05]
 [ 5.36012059e-03 -1.01836363e-03]
 ...
 [ 8.73545096e-03 -1.29498311e-03]
 [ 1.52297929e-02  6.05819212e-04]
 [ 1.28358253e-02  4.35352475e-04]]
similarityMatrix: [[ 5.05225604e-03  2.94689662e-03]
 [ 5.67493807e-03 -8.37289293e-05]
 [ 5.51256674e-03 -1.02715585e-03]
 ...
 [ 8.88070243e-03 -1.22417404e-03]
 [ 1.54887766e-02  6.66761182e-04]
 [ 1.30454307e-02  4.95987925e-04]]
similarityMatrix: [[ 0.00508156  0.00293953]
 [ 0.00575905 -0.00010737]
 [ 0.00557885 -0.0010283 ]
 ...
 [ 0.00899669 -0.00123787]
 [ 0.01560813  0.00069132]
 [ 0.01310392  0.0005542 ]]
similarityMatrix: [[ 0.00518103  0.00287948]
 [ 0.00588219 -0.00014385]
 [ 0.00566108 -0.00102099]
 ...
 [ 0.00912095 -0.00122387]
 [ 0.01579137  0.00070988]
 [ 0.01323033  0.00059361]]
similarityMatrix: [[ 0.00519696  0.00290008]
 [ 0.00606363 -0.00020587]
 [ 0.00583496 -0.0010671 ]
 ...
 [ 0.009326   -0.00124202]
 [ 0.01601302  0.00074756]
 [ 0.01344123  0.00060429]]
similarityMatrix: [[ 0.00528229  0.0028611 ]
 [ 0.00617624 -0.00021529]
 [ 0.00591128 -0.00103905]
 ...
 [ 0.00952386 -0.00126438]
 [ 0.01622941  0.00077123]
 [ 0.01360781  0.00063659]]
similarityMatrix: [[-0.0067412  -0.01494713]
 [ 0.02431244 -0.01512905]
 [ 0.05057763 -0.012341  ]
 ...
 [ 0.00926811 -0.01772456]
 [-0.01426775  0.01302672]
 [-0.00734118 -0.01881791]]
similarityMatrix: [[0.02746375  0.00478167]
 [0.01059063  0.01605669]
 [0.01888633  0.00719763]
 ...
 [0.02773965  0.01199459]
 [0.01130037  0.00901776]
 [0.01491476  0.01176177]]
similarityMatrix: [[ 3.26910922e-02 -4.13381690e-03]

```

```

[ 8.06359338e-05  3.06286663e-02]
[ 1.82924622e-02  7.01868611e-03]
...
[ 3.11656060e-02  6.07799639e-03]
[ 1.33287534e-02  6.10286303e-03]
[ 1.60241915e-02  1.00083471e-02]]
similarityMatrix: [[ 0.03322489 -0.00446901]
[-0.0003798  0.03092998]
[ 0.01829461  0.00712887]
...
[ 0.03147844  0.0059167 ]
[ 0.01326181  0.00626364]
[ 0.01651703  0.00941833]]
similarityMatrix: [[ 0.03333897 -0.00476279]
[-0.00032984  0.03098178]
[ 0.01810894  0.00733336]
...
[ 0.03132771  0.00602045]
[ 0.01292191  0.00668872]
[ 0.01790128  0.00755285]]
similarityMatrix: [[ 0.03315842 -0.00495443]
[-0.00025762  0.03124245]
[ 0.01780449  0.0076225 ]
...
[ 0.0311433  0.00598055]
[ 0.01263915  0.00700048]
[ 0.01983112  0.00481949]]
similarityMatrix: [[ 0.03307444 -0.00518134]
[-0.00011245  0.03132574]
[ 0.0175386  0.0078969 ]
...
[ 0.03077411  0.00626249]
[ 0.01244063  0.00722299]
[ 0.02171146  0.00209702]]
similarityMatrix: [[ 3.30924567e-02 -5.20613620e-03]
[-4.65733363e-05  3.12350805e-02]
[ 1.75186507e-02  7.92435285e-03]
...
[ 3.08533949e-02  6.15338344e-03]
[ 1.23249011e-02  7.38225310e-03]
[ 2.16719075e-02  2.15144612e-03]]
similarityMatrix: [[ 3.30813839e-02 -5.24009183e-03]
[-1.60973384e-05  3.12332564e-02]
[ 1.74896751e-02  7.95198339e-03]
...
[ 3.08148313e-02  6.17482141e-03]
[ 1.23016286e-02  7.40799695e-03]
[ 2.16297135e-02  2.18454855e-03]]
similarityMatrix: [[ 3.30529190e-02 -5.29942580e-03]
[ 7.84407998e-05  3.11828315e-02]
[ 1.74363862e-02  8.00122322e-03]
...
[ 3.07549627e-02  6.19425276e-03]
[ 1.22554837e-02  7.45930945e-03]
[ 2.15559628e-02  2.23659967e-03]]
similarityMatrix: [[ 0.01943835 -0.02302113]
[-0.01821599  0.00221602]

```

```

[ 0.00644852  0.00048762]
...
[-0.01561462  0.00864548]
[ 0.00190335 -0.00168712]
[ 0.00717292  0.05997815]]
similarityMatrix: [[ 0.00428783 -0.00243128]
[ 0.00092559  0.00238292]
[ 0.00247777  0.00298497]
...
[ 0.01130413  0.01386912]
[ 0.01131946  0.00865406]
[ 0.02023985  0.0245874 ]]
similarityMatrix: [[ 0.00766793 -0.00410251]
[ 0.0013358  0.00200722]
[ 0.00023027  0.00439747]
...
[ 0.00639063  0.01684635]
[ 0.01608304  0.00578124]
[ 0.02117756  0.02365127]]
similarityMatrix: [[ 0.00674275 -0.00436002]
[ 0.00148152  0.00194915]
[-0.00126133  0.00591288]
...
[ 0.00462517  0.01910075]
[ 0.0178068  0.00357235]
[ 0.02268514  0.02267732]]
similarityMatrix: [[ 0.00610648 -0.00446763]
[ 0.00117509  0.00225067]
[-0.00127783  0.00636354]
...
[ 0.0041719  0.02038437]
[ 0.0182313  0.00232901]
[ 0.0242402  0.02129088]]
similarityMatrix: [[ 0.00566541 -0.00424355]
[ 0.00102688  0.00240629]
[-0.00127269  0.00649139]
...
[ 0.00392988  0.02088936]
[ 0.01825099  0.00203485]
[ 0.02489737  0.02063242]]
similarityMatrix: [[ 0.00536635 -0.00413202]
[ 0.00107559  0.00238398]
[-0.00107835  0.00644232]
...
[ 0.00348299  0.02161701]
[ 0.01806699  0.00192476]
[ 0.02520265  0.02026463]]
similarityMatrix: [[ 0.0052975  -0.00414947]
[ 0.0011839  0.00228999]
[-0.00107007  0.00650125]
...
[ 0.00352167  0.02174083]
[ 0.01816893  0.00168151]
[ 0.02532445  0.02010182]]
similarityMatrix: [[ 0.00524929 -0.00415481]
[ 0.0011478  0.0023318 ]
[-0.00113106  0.00660381]

```

```

...
[ 0.00348047  0.02188349]
[ 0.01806068  0.00169599]
[ 0.02551271  0.01988685]]
similarityMatrix: [[ 0.00523458 -0.0041508 ]
[ 0.00115066  0.00233029]
[-0.00112097  0.0066025 ]
...
[ 0.00343443  0.02194965]
[ 0.01801676  0.00172108]
[ 0.02548779  0.01990519]]
similarityMatrix: [[ 0.08088433 -0.01011986]
[ 0.02658291 -0.00591184]
[ 0.00736921  0.00600286]
...
[ 0.00055486  0.01867863]
[-0.00898974 -0.00724908]
[ 0.02463049 -0.00816576]]
similarityMatrix: [[ 0.01809956 -0.00256292]
[ 0.01965672 -0.00365323]
[ 0.02084187  0.0032505 ]
...
[-0.00093377  0.02122345]
[ 0.00908642  0.00613257]
[ 0.02050413  0.00352154]]
similarityMatrix: [[ 0.01543624 -0.00381233]
[ 0.01820439 -0.0060917 ]
[ 0.02460312 -0.0018096 ]
...
[-0.00508693  0.02720955]
[ 0.00990228  0.00516074]
[ 0.02318809 -0.00073561]]
similarityMatrix: [[ 0.01381106 -0.00415906]
[ 0.01672043 -0.00698667]
[ 0.02351974 -0.0032096 ]
...
[-0.0051386   0.03003082]
[ 0.00967234  0.00493799]
[ 0.02197091 -0.00181355]]
similarityMatrix: [[ 0.01369436 -0.00416257]
[ 0.01656642 -0.00699126]
[ 0.02338581 -0.0032472 ]
...
[-0.00496846  0.03008523]
[ 0.00970476  0.00488552]
[ 0.02183987 -0.00183731]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788   0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...

```

```

[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
For K= 9 silhouette_coefficient Score is -0.002312
similarityMatrix: [[ 0.00224539  0.00563543]
[-0.01410789 -0.00333939]
[-0.01843338  0.00267188]
...
[-0.01520066  0.00645218]
[-0.00952964 -0.00025749]
[-0.00705488 -0.01785217]]
similarityMatrix: [[-0.00087274  0.00107679]
[ 0.00215112 -0.00265404]
[-0.00223716  0.00276019]
...
[ 0.0009148  -0.00112868]
[ 0.00092416 -0.00114022]
[ 0.00174329 -0.00215086]]
similarityMatrix: [[-0.00173868  0.00297917]
[ 0.00317554 -0.0054412 ]
[-0.00139931  0.00239768]
...
[ 0.00383638 -0.00657353]
[ 0.00352834 -0.00604571]
[ 0.00354366 -0.00607196]]
similarityMatrix: [[-0.00174339  0.00307099]
[ 0.00310459 -0.00546875]
[-0.0010407  0.0018332 ]
...
[ 0.00413289 -0.00728011]
[ 0.00388774 -0.00684827]
[ 0.00366063 -0.00644822]]
similarityMatrix: [[-0.00172248  0.00304798]
[ 0.00307851 -0.0054475 ]
[-0.00097462  0.00172462]
...

```



```

[ 0.00413037 -0.00730882]
[ 0.00389703 -0.00689591]
[ 0.00368823 -0.00652643]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00643657 -0.01152037]
[-0.01612988  0.00721709]
[ 0.00307641  0.01811557]
...
[ 0.00744527 -0.00497521]
[ 0.01289484  0.00662285]
[ 0.00587296 -0.00643633]]
similarityMatrix: [[ 0.0037576  0.00222148]
[-0.00271786  0.00406783]
[ 0.00050391  0.00582196]
...
[ 0.00701852  0.00053914]
[ 0.00606594  0.00120089]
[ 0.00321758  0.00426774]]
similarityMatrix: [[ 0.00405851  0.00213275]
[-0.00644108  0.00674123]
[-0.0031568  0.008625 ]
...
[ 0.00907095 -0.0005815 ]

```

```

[ 0.00750617  0.00045555]
[ 0.00048915  0.00673253]]
similarityMatrix: [[ 0.00365808  0.00254719]
[-0.00706639  0.00692362]
[-0.00387933  0.0089348 ]
...
[ 0.00861081  0.00010833]
[ 0.00718367  0.00094723]
[-0.001127    0.00800284]]
similarityMatrix: [[ 0.00367438  0.0025493 ]
[-0.00707019  0.00672189]
[-0.00393297  0.00879361]
...
[ 0.00817522  0.00061152]
[ 0.00670468  0.00145493]
[-0.00166586  0.00833737]]
similarityMatrix: [[ 0.00382936  0.00243831]
[-0.0071577   0.0065641 ]
[-0.00386899  0.00852676]
...
[ 0.007838    0.00102078]
[ 0.00646687  0.00174213]
[-0.00202049  0.00846687]]
similarityMatrix: [[ 0.00389449  0.0023973 ]
[-0.00699348  0.00630619]
[-0.00370168  0.0082782 ]
...
[ 0.00765132  0.00123523]
[ 0.00629554  0.00192522]
[-0.00202458  0.00837618]]
similarityMatrix: [[ 0.00382935  0.00246619]
[-0.00680048  0.00600309]
[-0.00360788  0.0080693 ]
...
[ 0.00761284  0.0013377 ]
[ 0.00624851  0.00201169]
[-0.00204815  0.00827893]]
similarityMatrix: [[ 0.00381963  0.00248754]
[-0.00657831  0.00570013]
[-0.00349109  0.00786019]
...
[ 0.00761307  0.00140076]
[ 0.00625977  0.00204557]
[-0.00201142  0.0081461 ]]
similarityMatrix: [[ 0.00383791  0.00248422]
[-0.00640609  0.0054688 ]
[-0.00339082  0.00769162]
...
[ 0.00764393  0.00142713]
[ 0.00628752  0.00205822]
[-0.00198936  0.00804726]]
similarityMatrix: [[ 0.00605607  0.00885634]
[ 0.01109727  0.01479461]
[ 0.00500945 -0.01494773]
...
[ 0.03624291 -0.01593727]
[-0.00213283  0.00125555]

```

```

[ 0.03128891  0.00723438]]
similarityMatrix: [[ 0.00614307  0.00047073]
[ 0.00425857 -0.00039155]
[ 0.01383926  0.00598723]
...
[ 0.00624565 -0.00274119]
[ 0.00793129  0.01140434]
[ 0.0077548   0.00429703]]
similarityMatrix: [[ 0.01196599 -0.00326728]
[ 0.00807169 -0.00277534]
[ 0.01598906  0.0050012 ]
...
[ 0.0096327  -0.00452629]
[ 0.0066675   0.0120622 ]
[ 0.00963948  0.00319816]]
similarityMatrix: [[ 0.0130945  -0.00372353]
[ 0.00854546 -0.0028778 ]
[ 0.01573615  0.00539164]
...
[ 0.0098868  -0.00441433]
[ 0.00490319  0.01314413]
[ 0.01001249  0.00307549]]
similarityMatrix: [[ 0.01332479 -0.0038232 ]
[ 0.00864307 -0.00290615]
[ 0.01580999  0.00537571]
...
[ 0.01000135 -0.00444471]
[ 0.00446501  0.01341062]
[ 0.01014334  0.00301039]]
similarityMatrix: [[ 0.01321934 -0.00377097]
[ 0.00864507 -0.00291996]
[ 0.01578849  0.00537887]
...
[ 0.00993971 -0.00441895]
[ 0.00445862  0.01342457]
[ 0.01016473  0.00298834]]
similarityMatrix: [[ 0.01320959 -0.00377359]
[ 0.00865805 -0.00293492]
[ 0.01583128  0.0053445 ]
...
[ 0.00994609 -0.00443099]
[ 0.00443505  0.01344524]
[ 0.01018989  0.00296756]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]

```

```
similarityMatrix: [[ 0.01319652 -0.00377398]
 [ 0.00864426 -0.00293191]
 [ 0.01580909  0.00535376]
 ...
 [ 0.00994895 -0.00444068]
 [ 0.00442532  0.01345665]
 [ 0.01017578  0.00297315]]
similarityMatrix: [[-0.00100708  0.01637188]
 [ 0.00871842  0.01437905]
 [-0.00331851 -0.01399516]
 ...
 [ 0.02294154  0.00623035]
 [ 0.00414378  0.01872247]
 [ 0.00907894  0.02931298]]
similarityMatrix: [[0.00531083 0.00526585]
 [0.0078785  0.00720935]
 [0.00275738 0.00255757]
 ...
 [0.00510651 0.00341578]
 [0.00757657 0.00574259]
 [0.00919796 0.00672124]]
similarityMatrix: [[0.00755787 0.00288601]
 [0.01123575 0.00362309]
 [0.00268332 0.00262579]
 ...
 [0.00776645 0.00051541]
 [0.01125596 0.00175627]
 [0.013649  0.00188578]]
similarityMatrix: [[ 0.00910965  0.00117073]
 [ 0.01330486  0.00132306]
 [ 0.00325692  0.00200732]
 ...
 [ 0.00922227 -0.00112055]
 [ 0.01373223 -0.00099997]
 [ 0.01579316 -0.00053379]]
similarityMatrix: [[ 1.03969052e-02  4.60350550e-05]
 [ 1.46487261e-02  2.40115474e-04]
 [ 4.05276653e-03  1.22163839e-03]
 ...
 [ 1.00723102e-02 -1.73730954e-03]
 [ 1.49442175e-02 -1.87970687e-03]
 [ 1.69467303e-02 -1.31421458e-03]]
similarityMatrix: [[ 0.01236689 -0.00109189]
 [ 0.01635528 -0.00041051]
 [ 0.00505345  0.00049416]
 ...
 [ 0.01142637 -0.00223031]
 [ 0.01690737 -0.00261283]
 [ 0.01871519 -0.00178338]]
similarityMatrix: [[ 0.01447542 -0.00205476]
 [ 0.01809742 -0.00090309]
 [ 0.00618523 -0.00016568]
 ...
 [ 0.01273046 -0.00253966]
 [ 0.01875023 -0.0030381 ]
 [ 0.02010659 -0.00179533]]
similarityMatrix: [[ 0.01559823 -0.00251316]
```

```

[ 0.01885714 -0.00102831]
[ 0.00695603 -0.00059861]
...
[ 0.01348821 -0.00275167]
[ 0.01961326 -0.00317552]
[ 0.02077909 -0.00178592]]
similarityMatrix: [[ 0.01581629 -0.00268858]
[ 0.01895763 -0.00111566]
[ 0.00723247 -0.0008123 ]
...
[ 0.01359655 -0.0028429 ]
[ 0.0197361 -0.00328144]
[ 0.02079291 -0.00180911]]
similarityMatrix: [[ 0.01594691 -0.00276644]
[ 0.01898485 -0.00111362]
[ 0.00731212 -0.00086342]
...
[ 0.01354292 -0.00278386]
[ 0.01985911 -0.00334847]
[ 0.02086015 -0.00183446]]
similarityMatrix: [[ 0.0016062 -0.02601113]
[-0.00302189 0.00484222]
[-0.00502498 0.00265269]
...
[ 0.01729606 -0.01028539]
[ 0.03486961 0.00481244]
[ 0.01762816 -0.0157823 ]]
similarityMatrix: [[ 6.95765764e-03 1.00630756e-03]
[ 3.64073265e-03 1.66084409e-03]
[ 3.18152177e-03 9.74414694e-04]
...
[ 9.15702234e-03 -1.90607920e-03]
[ 1.54732445e-02 7.61416141e-05]
[ 1.32417852e-02 -2.07989099e-04]]
similarityMatrix: [[ 5.96277924e-03 1.08837919e-03]
[ 4.66235305e-03 -2.21480038e-04]
[ 4.32147599e-03 -1.12546903e-03]
...
[ 7.41227112e-03 -1.90126340e-03]
[ 1.33376359e-02 -3.30331814e-04]
[ 1.09553301e-02 3.12459293e-05]]
similarityMatrix: [[ 5.40796179e-03 2.36223013e-03]
[ 5.08229329e-03 3.61123920e-06]
[ 4.85434303e-03 -9.43915521e-04]
...
[ 8.20352358e-03 -1.46169212e-03]
[ 1.44794431e-02 3.35639572e-04]
[ 1.20663142e-02 3.49795405e-04]]
similarityMatrix: [[ 5.03014229e-03 2.92452706e-03]
[ 5.54414026e-03 -7.92029924e-05]
[ 5.36012059e-03 -1.01836363e-03]
...
[ 8.73545096e-03 -1.29498311e-03]
[ 1.52297929e-02 6.05819212e-04]
[ 1.28358253e-02 4.35352475e-04]]
similarityMatrix: [[ 5.05225604e-03 2.94689662e-03]
[ 5.67493807e-03 -8.37289293e-05]

```

```

[ 5.51256674e-03 -1.02715585e-03]
...
[ 8.88070243e-03 -1.22417404e-03]
[ 1.54887766e-02  6.66761182e-04]
[ 1.30454307e-02  4.95987925e-04]]
similarityMatrix: [[ 0.00508156  0.00293953]
[ 0.00575905 -0.00010737]
[ 0.00557885 -0.0010283  ]
...
[ 0.00899669 -0.00123787]
[ 0.01560813  0.00069132]
[ 0.01310392  0.0005542  ]]
similarityMatrix: [[ 0.00518103  0.00287948]
[ 0.00588219 -0.00014385]
[ 0.00566108 -0.00102099]
...
[ 0.00912095 -0.00122387]
[ 0.01579137  0.00070988]
[ 0.01323033  0.00059361]]
similarityMatrix: [[ 0.00519696  0.00290008]
[ 0.00606363 -0.00020587]
[ 0.00583496 -0.0010671  ]
...
[ 0.009326   -0.00124202]
[ 0.01601302  0.00074756]
[ 0.01344123  0.00060429]]
similarityMatrix: [[ 0.00528229  0.0028611  ]
[ 0.00617624 -0.00021529]
[ 0.00591128 -0.00103905]
...
[ 0.00952386 -0.00126438]
[ 0.01622941  0.00077123]
[ 0.01360781  0.00063659]]
similarityMatrix: [[-0.0067412  -0.01494713]
[ 0.02431244 -0.01512905]
[ 0.05057763 -0.012341  ]
...
[ 0.00926811 -0.01772456]
[-0.01426775  0.01302672]
[-0.00734118 -0.01881791]]
similarityMatrix: [[0.02746375  0.00478167]
[0.01059063  0.01605669]
[0.01888633  0.00719763]
...
[0.02773965  0.01199459]
[0.01130037  0.00901776]
[0.01491476  0.01176177]]
similarityMatrix: [[ 3.26910922e-02 -4.13381690e-03]
[ 8.06359338e-05  3.06286663e-02]
[ 1.82924622e-02  7.01868611e-03]
...
[ 3.11656060e-02  6.07799639e-03]
[ 1.33287534e-02  6.10286303e-03]
[ 1.60241915e-02  1.00083471e-02]]
similarityMatrix: [[ 0.03322489 -0.00446901]
[-0.0003798   0.03092998]
[ 0.01829461  0.00712887]

```

```

...
[ 0.03147844  0.0059167 ]
[ 0.01326181  0.00626364]
[ 0.01651703  0.00941833]]
similarityMatrix: [[ 0.03333897 -0.00476279]
[-0.00032984  0.03098178]
[ 0.01810894  0.00733336]
...
[ 0.03132771  0.00602045]
[ 0.01292191  0.00668872]
[ 0.01790128  0.00755285]]
similarityMatrix: [[ 0.03315842 -0.00495443]
[-0.00025762  0.03124245]
[ 0.01780449  0.0076225 ]
...
[ 0.0311433   0.00598055]
[ 0.01263915  0.00700048]
[ 0.01983112  0.00481949]]
similarityMatrix: [[ 0.03307444 -0.00518134]
[-0.00011245  0.03132574]
[ 0.0175386   0.0078969 ]
...
[ 0.03077411  0.00626249]
[ 0.01244063  0.00722299]
[ 0.02171146  0.00209702]]
similarityMatrix: [[ 3.30924567e-02 -5.20613620e-03]
[-4.65733363e-05  3.12350805e-02]
[ 1.75186507e-02  7.92435285e-03]
...
[ 3.08533949e-02  6.15338344e-03]
[ 1.23249011e-02  7.38225310e-03]
[ 2.16719075e-02  2.15144612e-03]]
similarityMatrix: [[ 3.30813839e-02 -5.24009183e-03]
[-1.60973384e-05  3.12332564e-02]
[ 1.74896751e-02  7.95198339e-03]
...
[ 3.08148313e-02  6.17482141e-03]
[ 1.23016286e-02  7.40799695e-03]
[ 2.16297135e-02  2.18454855e-03]]
similarityMatrix: [[ 3.30529190e-02 -5.29942580e-03]
[ 7.84407998e-05  3.11828315e-02]
[ 1.74363862e-02  8.00122322e-03]
...
[ 3.07549627e-02  6.19425276e-03]
[ 1.22554837e-02  7.45930945e-03]
[ 2.15559628e-02  2.23659967e-03]]
similarityMatrix: [[ 0.01943835 -0.02302113]
[-0.01821599  0.00221602]
[ 0.00644852  0.00048762]
...
[-0.01561462  0.00864548]
[ 0.00190335 -0.00168712]
[ 0.00717292  0.05997815]]
similarityMatrix: [[ 0.00428783 -0.00243128]
[ 0.00092559  0.00238292]
[ 0.00247777  0.00298497]
...

```

```

[ 0.01130413  0.01386912]
[ 0.01131946  0.00865406]
[ 0.02023985  0.0245874 ]]
similarityMatrix: [[ 0.00766793 -0.00410251]
[ 0.0013358   0.00200722]
[ 0.00023027  0.00439747]
...
[ 0.00639063  0.01684635]
[ 0.01608304  0.00578124]
[ 0.02117756  0.02365127]]
similarityMatrix: [[ 0.00674275 -0.00436002]
[ 0.00148152  0.00194915]
[-0.00126133  0.00591288]
...
[ 0.00462517  0.01910075]
[ 0.0178068   0.00357235]
[ 0.02268514  0.02267732]]
similarityMatrix: [[ 0.00610648 -0.00446763]
[ 0.00117509  0.00225067]
[-0.00127783  0.00636354]
...
[ 0.0041719   0.02038437]
[ 0.0182313   0.00232901]
[ 0.0242402   0.02129088]]
similarityMatrix: [[ 0.00566541 -0.00424355]
[ 0.00102688  0.00240629]
[-0.00127269  0.00649139]
...
[ 0.00392988  0.02088936]
[ 0.01825099  0.00203485]
[ 0.02489737  0.02063242]]
similarityMatrix: [[ 0.00536635 -0.00413202]
[ 0.00107559  0.00238398]
[-0.00107835  0.00644232]
...
[ 0.00348299  0.02161701]
[ 0.01806699  0.00192476]
[ 0.02520265  0.02026463]]
similarityMatrix: [[ 0.0052975   -0.00414947]
[ 0.0011839   0.00228999]
[-0.00107007  0.00650125]
...
[ 0.00352167  0.02174083]
[ 0.01816893  0.00168151]
[ 0.02532445  0.02010182]]
similarityMatrix: [[ 0.00524929 -0.00415481]
[ 0.0011478   0.0023318 ]
[-0.00113106  0.00660381]
...
[ 0.00348047  0.02188349]
[ 0.01806068  0.00169599]
[ 0.02551271  0.01988685]]
similarityMatrix: [[ 0.00523458 -0.0041508 ]
[ 0.00115066  0.00233029]
[-0.00112097  0.0066025 ]
...
[ 0.00343443  0.02194965]

```



```

[ 0.01801676  0.00172108]
[ 0.02548779  0.01990519]]
similarityMatrix: [[ 0.08088433 -0.01011986]
[ 0.02658291 -0.00591184]
[ 0.00736921  0.00600286]
...
[ 0.00055486  0.01867863]
[-0.00898974 -0.00724908]
[ 0.02463049 -0.00816576]]
similarityMatrix: [[ 0.01809956 -0.00256292]
[ 0.01965672 -0.00365323]
[ 0.02084187  0.0032505 ]
...
[-0.00093377  0.02122345]
[ 0.00908642  0.00613257]
[ 0.02050413  0.00352154]]
similarityMatrix: [[ 0.01543624 -0.00381233]
[ 0.01820439 -0.0060917 ]
[ 0.02460312 -0.0018096 ]
...
[-0.00508693  0.02720955]
[ 0.00990228  0.00516074]
[ 0.02318809 -0.00073561]]
similarityMatrix: [[ 0.01381106 -0.00415906]
[ 0.01672043 -0.00698667]
[ 0.02351974 -0.0032096 ]
...
[-0.0051386   0.03003082]
[ 0.00967234  0.00493799]
[ 0.02197091 -0.00181355]]
similarityMatrix: [[ 0.01369436 -0.00416257]
[ 0.01656642 -0.00699126]
[ 0.02338581 -0.0032472 ]
...
[-0.00496846  0.03008523]
[ 0.00970476  0.00488552]
[ 0.02183987 -0.00183731]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788   0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788   0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788   0.03014191]
[ 0.00968668  0.00489369]

```

```

[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788 0.03014191]
[ 0.00968668 0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788 0.03014191]
[ 0.00968668 0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[-0.00634014 0.07643617]
[-0.01579576 0.04520651]
[ 0.03109328 0.11607755]
...
[ 0.01137357 0.02648924]
[-0.01453735 0.02529706]
[-0.01723964 -0.02386918]]
similarityMatrix: [[0.02151525 0.0394835 ]
[0.01190147 0.02041904]
[0.0302499 0.05250781]
...
[0.02184837 0.0356393 ]
[0.00484972 0.01629838]
[0.03136158 0.01585393]]
similarityMatrix: [[0.01460321 0.04199451]
[0.00995399 0.0209595 ]
[0.02384256 0.05456467]
...
[0.0125672 0.03951065]
[0.00241121 0.01693724]
[0.04970573 0.00763423]]
similarityMatrix: [[0.01574564 0.04143592]
[0.00963696 0.02111452]
[0.02450137 0.05424255]
...
[0.01047202 0.04053508]
[0.00274779 0.01677266]
[0.05694943 0.00409242]]
similarityMatrix: [[0.01654919 0.03997526]
[0.00964658 0.02061009]
[0.02448772 0.05295183]
...
[0.00844253 0.04008513]
[0.0024063 0.01630608]
[0.06339961 0.00366148]]
similarityMatrix: [[0.01767628 0.03866552]
[0.00885062 0.02048648]
[0.02456226 0.05183923]
...
[0.00763148 0.03917882]
[0.00207963 0.01589702]
[0.07003905 0.00348367]]

```

```
similarityMatrix: [[0.01878065 0.03772752]
 [0.00883907 0.0201739 ]
 [0.02480662 0.05101621]
 ...
 [0.00640715 0.03872802]
 [0.00146021 0.01572723]
 [0.07579819 0.00337861]]
similarityMatrix: [[0.01998018 0.03717984]
 [0.00930804 0.01992609]
 [0.0253966 0.05060194]
 ...
 [0.00548711 0.03874617]
 [0.00164674 0.01554495]
 [0.07785314 0.00334006]]
similarityMatrix: [[0.02101831 0.03678855]
 [0.00940446 0.0198567 ]
 [0.02589733 0.05035126]
 ...
 [0.00560653 0.03858657]
 [0.00163585 0.01549749]
 [0.078858 0.00329523]]
similarityMatrix: [[0.0217088 0.03657018]
 [0.00957339 0.01980328]
 [0.02624783 0.05024042]
 ...
 [0.00591705 0.03848838]
 [0.00171993 0.0154709 ]
 [0.07887043 0.0032913 ]]
similarityMatrix: [[ 0.05085348 0.00372658]
 [ 0.00536073 0.00754521]
 [ 0.09354742 -0.00867713]
 ...
 [ 0.01206455 0.00607911]
 [ 0.05324559 0.00016335]
 [ 0.00908397 0.00118917]]
similarityMatrix: [[0.01786775 0.00559839]
 [0.0057725 0.01331542]
 [0.02147001 0.00660115]
 ...
 [0.01492734 0.01552457]
 [0.01481598 0.00203232]
 [0.00985758 0.01069336]]
similarityMatrix: [[0.01914329 0.00517399]
 [0.00475378 0.01389274]
 [0.02226429 0.00710067]
 ...
 [0.01486304 0.01554822]
 [0.01685991 0.00062567]
 [0.00847609 0.01246876]]
similarityMatrix: [[0.01927185 0.00521277]
 [0.00487972 0.01359134]
 [0.02213477 0.00749635]
 ...
 [0.01548621 0.01471911]
 [0.01706754 0.00059422]
 [0.00819823 0.01277454]]
similarityMatrix: [[0.01920415 0.00540433]
```

```

[0.00495976 0.01342324]
[0.02188994 0.00792194]
...
[0.0166337 0.01323641]
[0.01710608 0.00066581]
[0.00818034 0.01276397]]
similarityMatrix: [[0.01912705 0.00560414]
[0.0049484 0.01337577]
[0.02171662 0.00824616]
...
[0.0169113 0.01290592]
[0.01722293 0.00063666]
[0.00818309 0.01272687]]
similarityMatrix: [[0.01916749 0.00560206]
[0.00505859 0.01320486]
[0.02174744 0.00825612]
...
[0.01703494 0.01276328]
[0.01724659 0.00066709]
[0.00805821 0.01286912]]
similarityMatrix: [[0.0190493 0.00575239]
[0.00515395 0.01308358]
[0.02176859 0.00822922]
...
[0.01726284 0.01247341]
[0.01714253 0.00079946]
[0.00813752 0.01276825]]
similarityMatrix: [[0.01900631 0.00578293]
[0.00522292 0.01301007]
[0.02169386 0.00829982]
...
[0.01769311 0.01191562]
[0.01693815 0.00103037]
[0.00801675 0.01293081]]
similarityMatrix: [[0.01899844 0.00584109]
[0.00531719 0.01286218]
[0.0218629 0.00813432]
...
[0.01778076 0.01182554]
[0.01690004 0.00113663]
[0.00794019 0.01300997]]
For K= 11 silhouette_coefficient Score is -0.002640
similarityMatrix: [[ 0.00224539 0.00563543]
[-0.01410789 -0.00333939]
[-0.01843338 0.00267188]
...
[-0.01520066 0.00645218]
[-0.00952964 -0.00025749]
[-0.00705488 -0.01785217]]
similarityMatrix: [[-0.00087274 0.00107679]
[ 0.00215112 -0.00265404]
[-0.00223716 0.00276019]
...
[ 0.0009148 -0.00112868]
[ 0.00092416 -0.00114022]
[ 0.00174329 -0.00215086]]
similarityMatrix: [[-0.00173868 0.00297917]

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```

[ 0.00317554 -0.0054412 ]
[-0.00139931  0.00239768]
...
[ 0.00383638 -0.00657353]
[ 0.00352834 -0.00604571]
[ 0.00354366 -0.00607196]]
similarityMatrix: [[-0.00174339  0.00307099]
[ 0.00310459 -0.00546875]
[-0.0010407  0.0018332 ]
...
[ 0.00413289 -0.00728011]
[ 0.00388774 -0.00684827]
[ 0.00366063 -0.00644822]]
similarityMatrix: [[-0.00172248  0.00304798]
[ 0.00307851 -0.0054475 ]
[-0.00097462  0.00172462]
...
[ 0.00413037 -0.00730882]
[ 0.00389703 -0.00689591]
[ 0.00368823 -0.00652643]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00643657 -0.01152037]
[-0.01612988  0.00721709]

```

```

[ 0.00307641  0.01811557]
...
[ 0.00744527 -0.00497521]
[ 0.01289484  0.00662285]
[ 0.00587296 -0.00643633]]
similarityMatrix: [[ 0.0037576  0.00222148]
[-0.00271786  0.00406783]
[ 0.00050391  0.00582196]
...
[ 0.00701852  0.00053914]
[ 0.00606594  0.00120089]
[ 0.00321758  0.00426774]]
similarityMatrix: [[ 0.00405851  0.00213275]
[-0.00644108  0.00674123]
[-0.0031568   0.008625  ]
...
[ 0.00907095 -0.0005815 ]
[ 0.00750617  0.00045555]
[ 0.00048915  0.00673253]]
similarityMatrix: [[ 0.00365808  0.00254719]
[-0.00706639  0.00692362]
[-0.00387933  0.0089348  ]
...
[ 0.00861081  0.00010833]
[ 0.00718367  0.00094723]
[-0.001127    0.00800284]]
similarityMatrix: [[ 0.00367438  0.0025493  ]
[-0.00707019  0.00672189]
[-0.00393297  0.00879361]
...
[ 0.00817522  0.00061152]
[ 0.00670468  0.00145493]
[-0.00166586  0.00833737]]
similarityMatrix: [[ 0.00382936  0.00243831]
[-0.0071577   0.0065641  ]
[-0.00386899  0.00852676]
...
[ 0.007838    0.00102078]
[ 0.00646687  0.00174213]
[-0.00202049  0.00846687]]
similarityMatrix: [[ 0.00389449  0.0023973  ]
[-0.00699348  0.00630619]
[-0.00370168  0.0082782  ]
...
[ 0.00765132  0.00123523]
[ 0.00629554  0.00192522]
[-0.00202458  0.00837618]]
similarityMatrix: [[ 0.00382935  0.00246619]
[-0.00680048  0.00600309]
[-0.00360788  0.0080693  ]
...
[ 0.00761284  0.0013377  ]
[ 0.00624851  0.00201169]
[-0.00204815  0.00827893]]
similarityMatrix: [[ 0.00381963  0.00248754]
[-0.00657831  0.00570013]
[-0.00349109  0.00786019]

```

```

...
[ 0.00761307 0.00140076]
[ 0.00625977 0.00204557]
[-0.00201142 0.0081461 ]]
similarityMatrix: [[ 0.00383791 0.00248422]
[-0.00640609 0.0054688 ]
[-0.00339082 0.00769162]
...
[ 0.00764393 0.00142713]
[ 0.00628752 0.00205822]
[-0.00198936 0.00804726]]
similarityMatrix: [[ 0.00605607 0.00885634]
[ 0.01109727 0.01479461]
[ 0.00500945 -0.01494773]
...
[ 0.03624291 -0.01593727]
[-0.00213283 0.00125555]
[ 0.03128891 0.00723438]]
similarityMatrix: [[ 0.00614307 0.00047073]
[ 0.00425857 -0.00039155]
[ 0.01383926 0.00598723]
...
[ 0.00624565 -0.00274119]
[ 0.00793129 0.01140434]
[ 0.0077548 0.00429703]]
similarityMatrix: [[ 0.01196599 -0.00326728]
[ 0.00807169 -0.00277534]
[ 0.01598906 0.0050012 ]
...
[ 0.0096327 -0.00452629]
[ 0.0066675 0.0120622 ]
[ 0.00963948 0.00319816]]
similarityMatrix: [[ 0.0130945 -0.00372353]
[ 0.00854546 -0.0028778 ]
[ 0.01573615 0.00539164]
...
[ 0.0098868 -0.00441433]
[ 0.00490319 0.01314413]
[ 0.01001249 0.00307549]]
similarityMatrix: [[ 0.01332479 -0.0038232 ]
[ 0.00864307 -0.00290615]
[ 0.01580999 0.00537571]
...
[ 0.01000135 -0.00444471]
[ 0.00446501 0.01341062]
[ 0.01014334 0.00301039]]
similarityMatrix: [[ 0.01321934 -0.00377097]
[ 0.00864507 -0.00291996]
[ 0.01578849 0.00537887]
...
[ 0.00993971 -0.00441895]
[ 0.00445862 0.01342457]
[ 0.01016473 0.00298834]]
similarityMatrix: [[ 0.01320959 -0.00377359]
[ 0.00865805 -0.00293492]
[ 0.01583128 0.0053445 ]
...

```

```

[ 0.00994609 -0.00443099]
[ 0.00443505  0.01344524]
[ 0.01018989  0.00296756]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[-0.00100708  0.01637188]
[ 0.00871842  0.01437905]
[-0.00331851 -0.01399516]
...
[ 0.02294154  0.00623035]
[ 0.00414378  0.01872247]
[ 0.00907894  0.02931298]]
similarityMatrix: [[0.00531083 0.00526585]
[0.0078785  0.00720935]
[0.00275738 0.00255757]
...
[0.00510651 0.00341578]
[0.00757657 0.00574259]
[0.00919796 0.00672124]]
similarityMatrix: [[0.00755787 0.00288601]
[0.01123575 0.00362309]
[0.00268332 0.00262579]
...
[0.00776645 0.00051541]
[0.01125596 0.00175627]
[0.013649  0.00188578]]
similarityMatrix: [[ 0.00910965  0.00117073]
[ 0.01330486  0.00132306]
[ 0.00325692  0.00200732]
...
[ 0.00922227 -0.00112055]
[ 0.01373223 -0.00099997]
[ 0.01579316 -0.00053379]]
similarityMatrix: [[ 1.03969052e-02  4.60350550e-05]
[ 1.46487261e-02  2.40115474e-04]
[ 4.05276653e-03  1.22163839e-03]
...
[ 1.00723102e-02 -1.73730954e-03]

```



```

[ 1.49442175e-02 -1.87970687e-03]
[ 1.69467303e-02 -1.31421458e-03]]
similarityMatrix: [[ 0.01236689 -0.00109189]
[ 0.01635528 -0.00041051]
[ 0.00505345  0.00049416]
...
[ 0.01142637 -0.00223031]
[ 0.01690737 -0.00261283]
[ 0.01871519 -0.00178338]]
similarityMatrix: [[ 0.01447542 -0.00205476]
[ 0.01809742 -0.00090309]
[ 0.00618523 -0.00016568]
...
[ 0.01273046 -0.00253966]
[ 0.01875023 -0.0030381 ]
[ 0.02010659 -0.00179533]]
similarityMatrix: [[ 0.01559823 -0.00251316]
[ 0.01885714 -0.00102831]
[ 0.00695603 -0.00059861]
...
[ 0.01348821 -0.00275167]
[ 0.01961326 -0.00317552]
[ 0.02077909 -0.00178592]]
similarityMatrix: [[ 0.01581629 -0.00268858]
[ 0.01895763 -0.00111566]
[ 0.00723247 -0.0008123 ]
...
[ 0.01359655 -0.0028429 ]
[ 0.0197361  -0.00328144]
[ 0.02079291 -0.00180911]]
similarityMatrix: [[ 0.01594691 -0.00276644]
[ 0.01898485 -0.00111362]
[ 0.00731212 -0.00086342]
...
[ 0.01354292 -0.00278386]
[ 0.01985911 -0.00334847]
[ 0.02086015 -0.00183446]]
similarityMatrix: [[ 0.0016062  -0.02601113]
[-0.00302189  0.00484222]
[-0.00502498  0.00265269]
...
[ 0.01729606 -0.01028539]
[ 0.03486961  0.00481244]
[ 0.01762816 -0.0157823 ]]
similarityMatrix: [[ 6.95765764e-03  1.00630756e-03]
[ 3.64073265e-03  1.66084409e-03]
[ 3.18152177e-03  9.74414694e-04]
...
[ 9.15702234e-03 -1.90607920e-03]
[ 1.54732445e-02  7.61416141e-05]
[ 1.32417852e-02 -2.07989099e-04]]
similarityMatrix: [[ 5.96277924e-03  1.08837919e-03]
[ 4.66235305e-03 -2.21480038e-04]
[ 4.32147599e-03 -1.12546903e-03]
...
[ 7.41227112e-03 -1.90126340e-03]
[ 1.33376359e-02 -3.30331814e-04]

```

```

[ 1.09553301e-02  3.12459293e-05]]
similarityMatrix: [[ 5.40796179e-03  2.36223013e-03]
[ 5.08229329e-03  3.61123920e-06]
[ 4.85434303e-03 -9.43915521e-04]
...
[ 8.20352358e-03 -1.46169212e-03]
[ 1.44794431e-02  3.35639572e-04]
[ 1.20663142e-02  3.49795405e-04]]
similarityMatrix: [[ 5.03014229e-03  2.92452706e-03]
[ 5.54414026e-03 -7.92029924e-05]
[ 5.36012059e-03 -1.01836363e-03]
...
[ 8.73545096e-03 -1.29498311e-03]
[ 1.52297929e-02  6.05819212e-04]
[ 1.28358253e-02  4.35352475e-04]]
similarityMatrix: [[ 5.05225604e-03  2.94689662e-03]
[ 5.67493807e-03 -8.37289293e-05]
[ 5.51256674e-03 -1.02715585e-03]
...
[ 8.88070243e-03 -1.22417404e-03]
[ 1.54887766e-02  6.66761182e-04]
[ 1.30454307e-02  4.95987925e-04]]
similarityMatrix: [[ 0.00508156  0.00293953]
[ 0.00575905 -0.00010737]
[ 0.00557885 -0.0010283 ]
...
[ 0.00899669 -0.00123787]
[ 0.01560813  0.00069132]
[ 0.01310392  0.0005542 ]]
similarityMatrix: [[ 0.00518103  0.00287948]
[ 0.00588219 -0.00014385]
[ 0.00566108 -0.00102099]
...
[ 0.00912095 -0.00122387]
[ 0.01579137  0.00070988]
[ 0.01323033  0.00059361]]
similarityMatrix: [[ 0.00519696  0.00290008]
[ 0.00606363 -0.00020587]
[ 0.00583496 -0.0010671 ]
...
[ 0.009326    -0.00124202]
[ 0.01601302  0.00074756]
[ 0.01344123  0.00060429]]
similarityMatrix: [[ 0.00528229  0.0028611 ]
[ 0.00617624 -0.00021529]
[ 0.00591128 -0.00103905]
...
[ 0.00952386 -0.00126438]
[ 0.01622941  0.00077123]
[ 0.01360781  0.00063659]]
similarityMatrix: [[-0.0067412  -0.01494713]
[ 0.02431244 -0.01512905]
[ 0.05057763 -0.012341  ]
...
[ 0.00926811 -0.01772456]
[-0.01426775  0.01302672]
[-0.00734118 -0.01881791]]

```

```

similarityMatrix: [[0.02746375 0.00478167]
 [0.01059063 0.01605669]
 [0.01888633 0.00719763]
 ...
 [0.02773965 0.01199459]
 [0.01130037 0.00901776]
 [0.01491476 0.01176177]]
similarityMatrix: [[ 3.26910922e-02 -4.13381690e-03]
 [ 8.06359338e-05 3.06286663e-02]
 [ 1.82924622e-02 7.01868611e-03]
 ...
 [ 3.11656060e-02 6.07799639e-03]
 [ 1.33287534e-02 6.10286303e-03]
 [ 1.60241915e-02 1.00083471e-02]]
similarityMatrix: [[ 0.03322489 -0.00446901]
 [-0.0003798 0.03092998]
 [ 0.01829461 0.00712887]
 ...
 [ 0.03147844 0.0059167 ]
 [ 0.01326181 0.00626364]
 [ 0.01651703 0.00941833]]
similarityMatrix: [[ 0.03333897 -0.00476279]
 [-0.00032984 0.03098178]
 [ 0.01810894 0.00733336]
 ...
 [ 0.03132771 0.00602045]
 [ 0.01292191 0.00668872]
 [ 0.01790128 0.00755285]]
similarityMatrix: [[ 0.03315842 -0.00495443]
 [-0.00025762 0.03124245]
 [ 0.01780449 0.0076225 ]
 ...
 [ 0.0311433 0.00598055]
 [ 0.01263915 0.00700048]
 [ 0.01983112 0.00481949]]
similarityMatrix: [[ 0.03307444 -0.00518134]
 [-0.00011245 0.03132574]
 [ 0.0175386 0.0078969 ]
 ...
 [ 0.03077411 0.00626249]
 [ 0.01244063 0.00722299]
 [ 0.02171146 0.00209702]]
similarityMatrix: [[ 3.30924567e-02 -5.20613620e-03]
 [-4.65733363e-05 3.12350805e-02]
 [ 1.75186507e-02 7.92435285e-03]
 ...
 [ 3.08533949e-02 6.15338344e-03]
 [ 1.23249011e-02 7.38225310e-03]
 [ 2.16719075e-02 2.15144612e-03]]
similarityMatrix: [[ 3.30813839e-02 -5.24009183e-03]
 [-1.60973384e-05 3.12332564e-02]
 [ 1.74896751e-02 7.95198339e-03]
 ...
 [ 3.08148313e-02 6.17482141e-03]
 [ 1.23016286e-02 7.40799695e-03]
 [ 2.16297135e-02 2.18454855e-03]]
similarityMatrix: [[ 3.30529190e-02 -5.29942580e-03]

```

```

[ 7.84407998e-05  3.11828315e-02]
[ 1.74363862e-02  8.00122322e-03]
...
[ 3.07549627e-02  6.19425276e-03]
[ 1.22554837e-02  7.45930945e-03]
[ 2.15559628e-02  2.23659967e-03]]
similarityMatrix: [[ 0.01943835 -0.02302113]
[-0.01821599  0.00221602]
[ 0.00644852  0.00048762]
...
[-0.01561462  0.00864548]
[ 0.00190335 -0.00168712]
[ 0.00717292  0.05997815]]
similarityMatrix: [[ 0.00428783 -0.00243128]
[ 0.00092559  0.00238292]
[ 0.00247777  0.00298497]
...
[ 0.01130413  0.01386912]
[ 0.01131946  0.00865406]
[ 0.02023985  0.0245874  ]]
similarityMatrix: [[ 0.00766793 -0.00410251]
[ 0.0013358  0.00200722]
[ 0.00023027  0.00439747]
...
[ 0.00639063  0.01684635]
[ 0.01608304  0.00578124]
[ 0.02117756  0.02365127]]
similarityMatrix: [[ 0.00674275 -0.00436002]
[ 0.00148152  0.00194915]
[-0.00126133  0.00591288]
...
[ 0.00462517  0.01910075]
[ 0.0178068  0.00357235]
[ 0.02268514  0.02267732]]
similarityMatrix: [[ 0.00610648 -0.00446763]
[ 0.00117509  0.00225067]
[-0.00127783  0.00636354]
...
[ 0.0041719  0.02038437]
[ 0.0182313  0.00232901]
[ 0.0242402  0.02129088]]
similarityMatrix: [[ 0.00566541 -0.00424355]
[ 0.00102688  0.00240629]
[-0.00127269  0.00649139]
...
[ 0.00392988  0.02088936]
[ 0.01825099  0.00203485]
[ 0.02489737  0.02063242]]
similarityMatrix: [[ 0.00536635 -0.00413202]
[ 0.00107559  0.00238398]
[-0.00107835  0.00644232]
...
[ 0.00348299  0.02161701]
[ 0.01806699  0.00192476]
[ 0.02520265  0.02026463]]
similarityMatrix: [[ 0.0052975  -0.00414947]
[ 0.0011839  0.00228999]

```

```

[-0.00107007  0.00650125]
...
[ 0.00352167  0.02174083]
[ 0.01816893  0.00168151]
[ 0.02532445  0.02010182]]
similarityMatrix: [[ 0.00524929 -0.00415481]
[ 0.0011478  0.0023318 ]
[-0.00113106  0.00660381]
...
[ 0.00348047  0.02188349]
[ 0.01806068  0.00169599]
[ 0.02551271  0.01988685]]
similarityMatrix: [[ 0.00523458 -0.0041508 ]
[ 0.00115066  0.00233029]
[-0.00112097  0.0066025 ]
...
[ 0.00343443  0.02194965]
[ 0.01801676  0.00172108]
[ 0.02548779  0.01990519]]
similarityMatrix: [[ 0.08088433 -0.01011986]
[ 0.02658291 -0.00591184]
[ 0.00736921  0.00600286]
...
[ 0.00055486  0.01867863]
[-0.00898974 -0.00724908]
[ 0.02463049 -0.00816576]]
similarityMatrix: [[ 0.01809956 -0.00256292]
[ 0.01965672 -0.00365323]
[ 0.02084187  0.0032505 ]
...
[-0.00093377  0.02122345]
[ 0.00908642  0.00613257]
[ 0.02050413  0.00352154]]
similarityMatrix: [[ 0.01543624 -0.00381233]
[ 0.01820439 -0.0060917 ]
[ 0.02460312 -0.0018096 ]
...
[-0.00508693  0.02720955]
[ 0.00990228  0.00516074]
[ 0.02318809 -0.00073561]]
similarityMatrix: [[ 0.01381106 -0.00415906]
[ 0.01672043 -0.00698667]
[ 0.02351974 -0.0032096 ]
...
[-0.0051386  0.03003082]
[ 0.00967234  0.00493799]
[ 0.02197091 -0.00181355]]
similarityMatrix: [[ 0.01369436 -0.00416257]
[ 0.01656642 -0.00699126]
[ 0.02338581 -0.0032472 ]
...
[-0.00496846  0.03008523]
[ 0.00970476  0.00488552]
[ 0.02183987 -0.00183731]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]

```

```

...
[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[-0.00634014  0.07643617]
[-0.01579576  0.04520651]
[ 0.03109328  0.11607755]
...
[ 0.01137357  0.02648924]
[-0.01453735  0.02529706]
[-0.01723964 -0.02386918]]
similarityMatrix: [[0.02151525  0.0394835 ]
[0.01190147  0.02041904]
[0.0302499  0.05250781]
...
[0.02184837  0.0356393 ]
[0.00484972  0.01629838]
[0.03136158  0.01585393]]
similarityMatrix: [[0.01460321  0.04199451]
[0.00995399  0.0209595 ]
[0.02384256  0.05456467]
...
[0.0125672  0.03951065]
[0.00241121  0.01693724]
[0.04970573  0.00763423]]
similarityMatrix: [[0.01574564  0.04143592]
[0.00963696  0.02111452]
[0.02450137  0.05424255]
...

```

```

[0.01047202 0.04053508]
[0.00274779 0.01677266]
[0.05694943 0.00409242]]
similarityMatrix: [[0.01654919 0.03997526]
[0.00964658 0.02061009]
[0.02448772 0.05295183]
...
[0.00844253 0.04008513]
[0.0024063 0.01630608]
[0.06339961 0.00366148]]
similarityMatrix: [[0.01767628 0.03866552]
[0.00885062 0.02048648]
[0.02456226 0.05183923]
...
[0.00763148 0.03917882]
[0.00207963 0.01589702]
[0.07003905 0.00348367]]
similarityMatrix: [[0.01878065 0.03772752]
[0.00883907 0.0201739 ]
[0.02480662 0.05101621]
...
[0.00640715 0.03872802]
[0.00146021 0.01572723]
[0.07579819 0.00337861]]
similarityMatrix: [[0.01998018 0.03717984]
[0.00930804 0.01992609]
[0.0253966 0.05060194]
...
[0.00548711 0.03874617]
[0.00164674 0.01554495]
[0.07785314 0.00334006]]
similarityMatrix: [[0.02101831 0.03678855]
[0.00940446 0.0198567 ]
[0.02589733 0.05035126]
...
[0.00560653 0.03858657]
[0.00163585 0.01549749]
[0.078858 0.00329523]]
similarityMatrix: [[0.0217088 0.03657018]
[0.00957339 0.01980328]
[0.02624783 0.05024042]
...
[0.00591705 0.03848838]
[0.00171993 0.0154709 ]
[0.07887043 0.0032913 ]]
similarityMatrix: [[ 0.05085348 0.00372658]
[ 0.00536073 0.00754521]
[ 0.09354742 -0.00867713]
...
[ 0.01206455 0.00607911]
[ 0.05324559 0.00016335]
[ 0.00908397 0.00118917]]
similarityMatrix: [[0.01786775 0.00559839]
[0.0057725 0.01331542]
[0.02147001 0.00660115]
...
[0.01492734 0.01552457]

```

```
[0.01481598 0.00203232]
[0.00985758 0.01069336]]
similarityMatrix: [[0.01914329 0.00517399]
[0.00475378 0.01389274]
[0.02226429 0.00710067]
...
[0.01486304 0.01554822]
[0.01685991 0.00062567]
[0.00847609 0.01246876]]
similarityMatrix: [[0.01927185 0.00521277]
[0.00487972 0.01359134]
[0.02213477 0.00749635]
...
[0.01548621 0.01471911]
[0.01706754 0.00059422]
[0.00819823 0.01277454]]
similarityMatrix: [[0.01920415 0.00540433]
[0.00495976 0.01342324]
[0.02188994 0.00792194]
...
[0.0166337 0.01323641]
[0.01710608 0.00066581]
[0.00818034 0.01276397]]
similarityMatrix: [[0.01912705 0.00560414]
[0.0049484 0.01337577]
[0.02171662 0.00824616]
...
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[0.01722293 0.00063666]
[0.00818309 0.01272687]]
similarityMatrix: [[0.01916749 0.00560206]
[0.00505859 0.01320486]
[0.02174744 0.00825612]
...
[0.01703494 0.01276328]
[0.01724659 0.00066709]
[0.00805821 0.01286912]]
similarityMatrix: [[0.0190493 0.00575239]
[0.00515395 0.01308358]
[0.02176859 0.00822922]
...
[0.01726284 0.01247341]
[0.01714253 0.00079946]
[0.00813752 0.01276825]]
similarityMatrix: [[0.01900631 0.00578293]
[0.00522292 0.01301007]
[0.02169386 0.00829982]
...
[0.01769311 0.01191562]
[0.01693815 0.00103037]
[0.00801675 0.01293081]]
similarityMatrix: [[0.01899844 0.00584109]
[0.00531719 0.01286218]
[0.0218629 0.00813432]
...
[0.01778076 0.01182554]
[0.01690004 0.00113663]
```



```
[0.00794019 0.01300997]]
similarityMatrix: [[0.00906088 0.00791111]
[0.03665937 0.02377019]
[0.03597429 0.01807009]
...
[0.03722618 0.02894244]
[0.07621573 0.04216387]
[0.1017299 0.00162251]]
similarityMatrix: [[0.0182644 0.01277938]
[0.02163955 0.01523674]
[0.00772046 0.00691395]
...
[0.01411561 0.01270741]
[0.02371047 0.01443751]
[0.02686205 0.0122345 ]]
similarityMatrix: [[0.02051635 0.00993182]
[0.0243179 0.01184577]
[0.00789243 0.00671005]
...
[0.01485451 0.01175939]
[0.02609288 0.01154632]
[0.02920142 0.00958862]]
similarityMatrix: [[0.02158072 0.00895869]
[0.02597368 0.0101905 ]
[0.00761706 0.00710067]
...
[0.01550292 0.01104783]
[0.02679981 0.01116617]
[0.029982 0.00929461]]
similarityMatrix: [[0.02154228 0.00870429]
[0.0257801 0.01006463]
[0.00773373 0.00693403]
...
[0.01562138 0.0107836 ]
[0.0266993 0.01092096]
[0.02952179 0.00940245]]
similarityMatrix: [[0.02152053 0.0087109 ]
[0.02584042 0.00995751]
[0.00773509 0.00693084]
...
[0.01571973 0.01064488]
[0.02678192 0.01078417]
[0.02949383 0.00940469]]
similarityMatrix: [[0.02151033 0.00854496]
[0.02576698 0.00983431]
[0.0075951 0.00710965]
...
[0.0157507 0.0105316 ]
[0.02681495 0.01051479]
[0.02924353 0.00946262]]
similarityMatrix: [[0.02151324 0.00844934]
[0.02572143 0.00978433]
[0.00758548 0.00711943]
...
[0.01591014 0.01027556]
[0.02679355 0.010429 ]
[0.02912459 0.00948632]]
```

```
similarityMatrix: [[0.0216032  0.00832568]
 [0.0257128  0.00979618]
 [0.00764438 0.00703847]
 ...
 [0.01586392 0.01033909]
 [0.0267262  0.01052158]
 [0.02910151 0.00951805]]
similarityMatrix: [[0.02164505 0.00822072]
 [0.02570376 0.00975225]
 [0.00750076 0.00723494]
 ...
 [0.01591417 0.01025001]
 [0.02672512 0.0104656 ]
 [0.02900916 0.00957632]]
similarityMatrix: [[-0.00213554  0.01671114]
 [-0.01367062 -0.00745796]
 [-0.016446   -0.01001327]
 ...
 [-0.01270633  0.08792401]
 [-0.01510022  0.09370482]
 [-0.01781428  0.08909927]]
similarityMatrix: [[ 0.00368458  0.00930218]
 [ 0.00386681  0.01159271]
 [ 0.00341697  0.01167946]
 ...
 [-0.00178343  0.03555802]
 [-0.00068273  0.05523925]
 [-0.00283659  0.05144746]]
similarityMatrix: [[ 0.00407836  0.00835361]
 [ 0.00407892  0.01102356]
 [ 0.00367674  0.01099728]
 ...
 [-0.00176467  0.03505372]
 [-0.00136689  0.05607391]
 [-0.00300119  0.05114264]]
similarityMatrix: [[ 0.00417839  0.00816737]
 [ 0.00408744  0.01106939]
 [ 0.00371078  0.01098888]
 ...
 [-0.00170207  0.03525725]
 [-0.00133624  0.05654306]
 [-0.00289996  0.05142119]]
similarityMatrix: [[ 0.00417839  0.00816737]
 [ 0.00408744  0.01106939]
 [ 0.00371078  0.01098888]
 ...
 [-0.00170207  0.03525725]
 [-0.00133624  0.05654306]
 [-0.00289996  0.05142119]]
similarityMatrix: [[ 0.00417839  0.00816737]
 [ 0.00408744  0.01106939]
 [ 0.00371078  0.01098888]
 ...
 [-0.00170207  0.03525725]
 [-0.00133624  0.05654306]
 [-0.00289996  0.05142119]]
similarityMatrix: [[ 0.00417839  0.00816737]
```

```

[ 0.00408744 0.01106939]
[ 0.00371078 0.01098888]
...
[-0.00170207 0.03525725]
[-0.00133624 0.05654306]
[-0.00289996 0.05142119]]
similarityMatrix: [[ 0.00417839 0.00816737]
[ 0.00408744 0.01106939]
[ 0.00371078 0.01098888]
...
[-0.00170207 0.03525725]
[-0.00133624 0.05654306]
[-0.00289996 0.05142119]]
similarityMatrix: [[ 0.00417839 0.00816737]
[ 0.00408744 0.01106939]
[ 0.00371078 0.01098888]
...
[-0.00170207 0.03525725]
[-0.00133624 0.05654306]
[-0.00289996 0.05142119]]
similarityMatrix: [[ 0.00417839 0.00816737]
[ 0.00408744 0.01106939]
[ 0.00371078 0.01098888]
...
[-0.00170207 0.03525725]
[-0.00133624 0.05654306]
[-0.00289996 0.05142119]]
For K= 13 silhouette_coefficient Score is -0.005260
similarityMatrix: [[ 0.00224539 0.00563543]
[-0.01410789 -0.00333939]
[-0.01843338 0.00267188]
...
[-0.01520066 0.00645218]
[-0.00952964 -0.00025749]
[-0.00705488 -0.01785217]]
similarityMatrix: [[-0.00087274 0.00107679]
[ 0.00215112 -0.00265404]
[-0.00223716 0.00276019]
...
[ 0.0009148 -0.00112868]
[ 0.00092416 -0.00114022]
[ 0.00174329 -0.00215086]]
similarityMatrix: [[-0.00173868 0.00297917]
[ 0.00317554 -0.0054412 ]
[-0.00139931 0.00239768]
...
[ 0.00383638 -0.00657353]
[ 0.00352834 -0.00604571]
[ 0.00354366 -0.00607196]]
similarityMatrix: [[-0.00174339 0.00307099]
[ 0.00310459 -0.00546875]
[-0.0010407 0.0018332 ]
...
[ 0.00413289 -0.00728011]
[ 0.00388774 -0.00684827]
[ 0.00366063 -0.00644822]]
similarityMatrix: [[-0.00172248 0.00304798]

```

```

[ 0.00307851 -0.0054475 ]
[-0.00097462  0.00172462]
...
[ 0.00413037 -0.00730882]
[ 0.00389703 -0.00689591]
[ 0.00368823 -0.00652643]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00643657 -0.01152037]
[-0.01612988  0.00721709]
[ 0.00307641  0.01811557]
...
[ 0.00744527 -0.00497521]
[ 0.01289484  0.00662285]
[ 0.00587296 -0.00643633]]
similarityMatrix: [[ 0.0037576  0.00222148]
[-0.00271786  0.00406783]
[ 0.00050391  0.00582196]
...
[ 0.00701852  0.00053914]
[ 0.00606594  0.00120089]
[ 0.00321758  0.00426774]]
similarityMatrix: [[ 0.00405851  0.00213275]
[-0.00644108  0.00674123]

```

```

[-0.0031568  0.008625 ]
...
[ 0.00907095 -0.0005815 ]
[ 0.00750617  0.00045555]
[ 0.00048915  0.00673253]]
similarityMatrix: [[ 0.00365808  0.00254719]
[-0.00706639  0.00692362]
[-0.00387933  0.0089348 ]
...
[ 0.00861081  0.00010833]
[ 0.00718367  0.00094723]
[-0.001127    0.00800284]]
similarityMatrix: [[ 0.00367438  0.0025493 ]
[-0.00707019  0.00672189]
[-0.00393297  0.00879361]
...
[ 0.00817522  0.00061152]
[ 0.00670468  0.00145493]
[-0.00166586  0.00833737]]
similarityMatrix: [[ 0.00382936  0.00243831]
[-0.0071577   0.0065641 ]
[-0.00386899  0.00852676]
...
[ 0.007838    0.00102078]
[ 0.00646687  0.00174213]
[-0.00202049  0.00846687]]
similarityMatrix: [[ 0.00389449  0.0023973 ]
[-0.00699348  0.00630619]
[-0.00370168  0.0082782 ]
...
[ 0.00765132  0.00123523]
[ 0.00629554  0.00192522]
[-0.00202458  0.00837618]]
similarityMatrix: [[ 0.00382935  0.00246619]
[-0.00680048  0.00600309]
[-0.00360788  0.0080693 ]
...
[ 0.00761284  0.0013377 ]
[ 0.00624851  0.00201169]
[-0.00204815  0.00827893]]
similarityMatrix: [[ 0.00381963  0.00248754]
[-0.00657831  0.00570013]
[-0.00349109  0.00786019]
...
[ 0.00761307  0.00140076]
[ 0.00625977  0.00204557]
[-0.00201142  0.0081461 ]]]
similarityMatrix: [[ 0.00383791  0.00248422]
[-0.00640609  0.0054688 ]
[-0.00339082  0.00769162]
...
[ 0.00764393  0.00142713]
[ 0.00628752  0.00205822]
[-0.00198936  0.00804726]]
similarityMatrix: [[ 0.00605607  0.00885634]
[ 0.01109727  0.01479461]
[ 0.00500945 -0.01494773]

```

```

...
[ 0.03624291 -0.01593727]
[-0.00213283  0.00125555]
[ 0.03128891  0.00723438]]
similarityMatrix: [[ 0.00614307  0.00047073]
[ 0.00425857 -0.00039155]
[ 0.01383926  0.00598723]
...
[ 0.00624565 -0.00274119]
[ 0.00793129  0.01140434]
[ 0.0077548  0.00429703]]
similarityMatrix: [[ 0.01196599 -0.00326728]
[ 0.00807169 -0.00277534]
[ 0.01598906  0.0050012 ]
...
[ 0.0096327  -0.00452629]
[ 0.0066675   0.0120622 ]
[ 0.00963948  0.00319816]]
similarityMatrix: [[ 0.0130945  -0.00372353]
[ 0.00854546 -0.0028778 ]
[ 0.01573615  0.00539164]
...
[ 0.0098868  -0.00441433]
[ 0.00490319  0.01314413]
[ 0.01001249  0.00307549]]
similarityMatrix: [[ 0.01332479 -0.0038232 ]
[ 0.00864307 -0.00290615]
[ 0.01580999  0.00537571]
...
[ 0.01000135 -0.00444471]
[ 0.00446501  0.01341062]
[ 0.01014334  0.00301039]]
similarityMatrix: [[ 0.01321934 -0.00377097]
[ 0.00864507 -0.00291996]
[ 0.01578849  0.00537887]
...
[ 0.00993971 -0.00441895]
[ 0.00445862  0.01342457]
[ 0.01016473  0.00298834]]
similarityMatrix: [[ 0.01320959 -0.00377359]
[ 0.00865805 -0.00293492]
[ 0.01583128  0.0053445 ]
...
[ 0.00994609 -0.00443099]
[ 0.00443505  0.01344524]
[ 0.01018989  0.00296756]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...

```

```

[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[-0.00100708  0.01637188]
[ 0.00871842  0.01437905]
[-0.00331851 -0.01399516]
...
[ 0.02294154  0.00623035]
[ 0.00414378  0.01872247]
[ 0.00907894  0.02931298]]
similarityMatrix: [[0.00531083 0.00526585]
[0.0078785  0.00720935]
[0.00275738 0.00255757]
...
[0.00510651 0.00341578]
[0.00757657 0.00574259]
[0.00919796 0.00672124]]
similarityMatrix: [[0.00755787 0.00288601]
[0.01123575 0.00362309]
[0.00268332 0.00262579]
...
[0.00776645 0.00051541]
[0.01125596 0.00175627]
[0.013649  0.00188578]]
similarityMatrix: [[ 0.00910965  0.00117073]
[ 0.01330486  0.00132306]
[ 0.00325692  0.00200732]
...
[ 0.00922227 -0.00112055]
[ 0.01373223 -0.00099997]
[ 0.01579316 -0.00053379]]
similarityMatrix: [[ 1.03969052e-02  4.60350550e-05]
[ 1.46487261e-02  2.40115474e-04]
[ 4.05276653e-03  1.22163839e-03]
...
[ 1.00723102e-02 -1.73730954e-03]
[ 1.49442175e-02 -1.87970687e-03]
[ 1.69467303e-02 -1.31421458e-03]]
similarityMatrix: [[ 0.01236689 -0.00109189]
[ 0.01635528 -0.00041051]
[ 0.00505345  0.00049416]
...
[ 0.01142637 -0.00223031]
[ 0.01690737 -0.00261283]
[ 0.01871519 -0.00178338]]
similarityMatrix: [[ 0.01447542 -0.00205476]
[ 0.01809742 -0.00090309]
[ 0.00618523 -0.00016568]
...
[ 0.01273046 -0.00253966]

```

```

[ 0.01875023 -0.0030381 ]
[ 0.02010659 -0.00179533]]
similarityMatrix: [[ 0.01559823 -0.00251316]
[ 0.01885714 -0.00102831]
[ 0.00695603 -0.00059861]
...
[ 0.01348821 -0.00275167]
[ 0.01961326 -0.00317552]
[ 0.02077909 -0.00178592]]
similarityMatrix: [[ 0.01581629 -0.00268858]
[ 0.01895763 -0.00111566]
[ 0.00723247 -0.0008123 ]
...
[ 0.01359655 -0.0028429 ]
[ 0.0197361 -0.00328144]
[ 0.02079291 -0.00180911]]
similarityMatrix: [[ 0.01594691 -0.00276644]
[ 0.01898485 -0.00111362]
[ 0.00731212 -0.00086342]
...
[ 0.01354292 -0.00278386]
[ 0.01985911 -0.00334847]
[ 0.02086015 -0.00183446]]
similarityMatrix: [[ 0.0016062 -0.02601113]
[-0.00302189 0.00484222]
[-0.00502498 0.00265269]
...
[ 0.01729606 -0.01028539]
[ 0.03486961 0.00481244]
[ 0.01762816 -0.0157823 ]]
similarityMatrix: [[ 6.95765764e-03 1.00630756e-03]
[ 3.64073265e-03 1.66084409e-03]
[ 3.18152177e-03 9.74414694e-04]
...
[ 9.15702234e-03 -1.90607920e-03]
[ 1.54732445e-02 7.61416141e-05]
[ 1.32417852e-02 -2.07989099e-04]]
similarityMatrix: [[ 5.96277924e-03 1.08837919e-03]
[ 4.66235305e-03 -2.21480038e-04]
[ 4.32147599e-03 -1.12546903e-03]
...
[ 7.41227112e-03 -1.90126340e-03]
[ 1.33376359e-02 -3.30331814e-04]
[ 1.09553301e-02 3.12459293e-05]]
similarityMatrix: [[ 5.40796179e-03 2.36223013e-03]
[ 5.08229329e-03 3.61123920e-06]
[ 4.85434303e-03 -9.43915521e-04]
...
[ 8.20352358e-03 -1.46169212e-03]
[ 1.44794431e-02 3.35639572e-04]
[ 1.20663142e-02 3.49795405e-04]]
similarityMatrix: [[ 5.03014229e-03 2.92452706e-03]
[ 5.54414026e-03 -7.92029924e-05]
[ 5.36012059e-03 -1.01836363e-03]
...
[ 8.73545096e-03 -1.29498311e-03]
[ 1.52297929e-02 6.05819212e-04]

```



```

[ 1.28358253e-02  4.35352475e-04]]
similarityMatrix: [[ 5.05225604e-03  2.94689662e-03]
[ 5.67493807e-03 -8.37289293e-05]
[ 5.51256674e-03 -1.02715585e-03]
...
[ 8.88070243e-03 -1.22417404e-03]
[ 1.54887766e-02  6.66761182e-04]
[ 1.30454307e-02  4.95987925e-04]]
similarityMatrix: [[ 0.00508156  0.00293953]
[ 0.00575905 -0.00010737]
[ 0.00557885 -0.0010283 ]
...
[ 0.00899669 -0.00123787]
[ 0.01560813  0.00069132]
[ 0.01310392  0.0005542 ]]
similarityMatrix: [[ 0.00518103  0.00287948]
[ 0.00588219 -0.00014385]
[ 0.00566108 -0.00102099]
...
[ 0.00912095 -0.00122387]
[ 0.01579137  0.00070988]
[ 0.01323033  0.00059361]]
similarityMatrix: [[ 0.00519696  0.00290008]
[ 0.00606363 -0.00020587]
[ 0.00583496 -0.0010671 ]
...
[ 0.009326   -0.00124202]
[ 0.01601302  0.00074756]
[ 0.01344123  0.00060429]]
similarityMatrix: [[ 0.00528229  0.0028611 ]
[ 0.00617624 -0.00021529]
[ 0.00591128 -0.00103905]
...
[ 0.00952386 -0.00126438]
[ 0.01622941  0.00077123]
[ 0.01360781  0.00063659]]
similarityMatrix: [[-0.0067412  -0.01494713]
[ 0.02431244 -0.01512905]
[ 0.05057763 -0.012341 ]
...
[ 0.00926811 -0.01772456]
[-0.01426775  0.01302672]
[-0.00734118 -0.01881791]]
similarityMatrix: [[0.02746375  0.00478167]
[0.01059063  0.01605669]
[0.01888633  0.00719763]
...
[0.02773965  0.01199459]
[0.01130037  0.00901776]
[0.01491476  0.01176177]]
similarityMatrix: [[ 3.26910922e-02 -4.13381690e-03]
[ 8.06359338e-05  3.06286663e-02]
[ 1.82924622e-02  7.01868611e-03]
...
[ 3.11656060e-02  6.07799639e-03]
[ 1.33287534e-02  6.10286303e-03]
[ 1.60241915e-02  1.00083471e-02]]

```

```

similarityMatrix: [[ 0.03322489 -0.00446901]
[-0.0003798  0.03092998]
[ 0.01829461  0.00712887]
...
[ 0.03147844  0.0059167 ]
[ 0.01326181  0.00626364]
[ 0.01651703  0.00941833]]
similarityMatrix: [[ 0.03333897 -0.00476279]
[-0.00032984  0.03098178]
[ 0.01810894  0.00733336]
...
[ 0.03132771  0.00602045]
[ 0.01292191  0.00668872]
[ 0.01790128  0.00755285]]
similarityMatrix: [[ 0.03315842 -0.00495443]
[-0.00025762  0.03124245]
[ 0.01780449  0.0076225 ]
...
[ 0.0311433  0.00598055]
[ 0.01263915  0.00700048]
[ 0.01983112  0.00481949]]
similarityMatrix: [[ 0.03307444 -0.00518134]
[-0.00011245  0.03132574]
[ 0.0175386  0.0078969 ]
...
[ 0.03077411  0.00626249]
[ 0.01244063  0.00722299]
[ 0.02171146  0.00209702]]
similarityMatrix: [[ 3.30924567e-02 -5.20613620e-03]
[-4.65733363e-05  3.12350805e-02]
[ 1.75186507e-02  7.92435285e-03]
...
[ 3.08533949e-02  6.15338344e-03]
[ 1.23249011e-02  7.38225310e-03]
[ 2.16719075e-02  2.15144612e-03]]
similarityMatrix: [[ 3.30813839e-02 -5.24009183e-03]
[-1.60973384e-05  3.12332564e-02]
[ 1.74896751e-02  7.95198339e-03]
...
[ 3.08148313e-02  6.17482141e-03]
[ 1.23016286e-02  7.40799695e-03]
[ 2.16297135e-02  2.18454855e-03]]
similarityMatrix: [[ 3.30529190e-02 -5.29942580e-03]
[ 7.84407998e-05  3.11828315e-02]
[ 1.74363862e-02  8.00122322e-03]
...
[ 3.07549627e-02  6.19425276e-03]
[ 1.22554837e-02  7.45930945e-03]
[ 2.15559628e-02  2.23659967e-03]]
similarityMatrix: [[ 0.01943835 -0.02302113]
[-0.01821599  0.00221602]
[ 0.00644852  0.00048762]
...
[-0.01561462  0.00864548]
[ 0.00190335 -0.00168712]
[ 0.00717292  0.05997815]]
similarityMatrix: [[ 0.00428783 -0.00243128]

```

```

[ 0.00092559  0.00238292]
[ 0.00247777  0.00298497]
...
[ 0.01130413  0.01386912]
[ 0.01131946  0.00865406]
[ 0.02023985  0.0245874 ]]
similarityMatrix: [[ 0.00766793 -0.00410251]
[ 0.0013358  0.00200722]
[ 0.00023027  0.00439747]
...
[ 0.00639063  0.01684635]
[ 0.01608304  0.00578124]
[ 0.02117756  0.02365127]]]
similarityMatrix: [[ 0.00674275 -0.00436002]
[ 0.00148152  0.00194915]
[-0.00126133  0.00591288]
...
[ 0.00462517  0.01910075]
[ 0.0178068  0.00357235]
[ 0.02268514  0.02267732]]]
similarityMatrix: [[ 0.00610648 -0.00446763]
[ 0.00117509  0.00225067]
[-0.00127783  0.00636354]
...
[ 0.0041719  0.02038437]
[ 0.0182313  0.00232901]
[ 0.0242402  0.02129088]]]
similarityMatrix: [[ 0.00566541 -0.00424355]
[ 0.00102688  0.00240629]
[-0.00127269  0.00649139]
...
[ 0.00392988  0.02088936]
[ 0.01825099  0.00203485]
[ 0.02489737  0.02063242]]]
similarityMatrix: [[ 0.00536635 -0.00413202]
[ 0.00107559  0.00238398]
[-0.00107835  0.00644232]
...
[ 0.00348299  0.02161701]
[ 0.01806699  0.00192476]
[ 0.02520265  0.02026463]]]
similarityMatrix: [[ 0.0052975  -0.00414947]
[ 0.0011839  0.00228999]
[-0.00107007  0.00650125]
...
[ 0.00352167  0.02174083]
[ 0.01816893  0.00168151]
[ 0.02532445  0.02010182]]]
similarityMatrix: [[ 0.00524929 -0.00415481]
[ 0.0011478  0.0023318 ]
[-0.00113106  0.00660381]
...
[ 0.00348047  0.02188349]
[ 0.01806068  0.00169599]
[ 0.02551271  0.01988685]]]
similarityMatrix: [[ 0.00523458 -0.0041508 ]
[ 0.00115066  0.00233029]

```

```

[-0.00112097  0.0066025 ]
...
[ 0.00343443  0.02194965]
[ 0.01801676  0.00172108]
[ 0.02548779  0.01990519]]
similarityMatrix: [[ 0.08088433 -0.01011986]
[ 0.02658291 -0.00591184]
[ 0.00736921  0.00600286]
...
[ 0.00055486  0.01867863]
[-0.00898974 -0.00724908]
[ 0.02463049 -0.00816576]]
similarityMatrix: [[ 0.01809956 -0.00256292]
[ 0.01965672 -0.00365323]
[ 0.02084187  0.0032505 ]
...
[-0.00093377  0.02122345]
[ 0.00908642  0.00613257]
[ 0.02050413  0.00352154]]
similarityMatrix: [[ 0.01543624 -0.00381233]
[ 0.01820439 -0.0060917 ]
[ 0.02460312 -0.0018096 ]
...
[-0.00508693  0.02720955]
[ 0.00990228  0.00516074]
[ 0.02318809 -0.00073561]]
similarityMatrix: [[ 0.01381106 -0.00415906]
[ 0.01672043 -0.00698667]
[ 0.02351974 -0.0032096 ]
...
[-0.0051386   0.03003082]
[ 0.00967234  0.00493799]
[ 0.02197091 -0.00181355]]
similarityMatrix: [[ 0.01369436 -0.00416257]
[ 0.01656642 -0.00699126]
[ 0.02338581 -0.0032472 ]
...
[-0.00496846  0.03008523]
[ 0.00970476  0.00488552]
[ 0.02183987 -0.00183731]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788   0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788   0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]

```

```

...
[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
[-0.0049788  0.03014191]
[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[-0.00634014  0.07643617]
[-0.01579576  0.04520651]
[ 0.03109328  0.11607755]
...
[ 0.01137357  0.02648924]
[-0.01453735  0.02529706]
[-0.01723964 -0.02386918]]
similarityMatrix: [[0.02151525  0.0394835 ]
[0.01190147  0.02041904]
[0.0302499  0.05250781]
...
[0.02184837  0.0356393 ]
[0.00484972  0.01629838]
[0.03136158  0.01585393]]
similarityMatrix: [[0.01460321  0.04199451]
[0.00995399  0.0209595 ]
[0.02384256  0.05456467]
...
[0.0125672  0.03951065]
[0.00241121  0.01693724]
[0.04970573  0.00763423]]
similarityMatrix: [[0.01574564  0.04143592]
[0.00963696  0.02111452]
[0.02450137  0.05424255]
...
[0.01047202  0.04053508]
[0.00274779  0.01677266]
[0.05694943  0.00409242]]
similarityMatrix: [[0.01654919  0.03997526]
[0.00964658  0.02061009]
[0.02448772  0.05295183]
...
[0.00844253  0.04008513]
[0.0024063  0.01630608]
[0.06339961  0.00366148]]
similarityMatrix: [[0.01767628  0.03866552]
[0.00885062  0.02048648]
[0.02456226  0.05183923]
...

```

```

[0.00763148 0.03917882]
[0.00207963 0.01589702]
[0.07003905 0.00348367]]
similarityMatrix: [[0.01878065 0.03772752]
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[0.02480662 0.05101621]
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similarityMatrix: [[0.01998018 0.03717984]
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[0.0253966 0.05060194]
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[0.00548711 0.03874617]
[0.00164674 0.01554495]
[0.07785314 0.00334006]]
similarityMatrix: [[0.02101831 0.03678855]
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...
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[0.00163585 0.01549749]
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similarityMatrix: [[0.0217088 0.03657018]
[0.00957339 0.01980328]
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...
[0.00591705 0.03848838]
[0.00171993 0.0154709 ]
[0.07887043 0.0032913 ]]
similarityMatrix: [[ 0.05085348 0.00372658]
[ 0.00536073 0.00754521]
[ 0.09354742 -0.00867713]
...
[ 0.01206455 0.00607911]
[ 0.05324559 0.00016335]
[ 0.00908397 0.00118917]]
similarityMatrix: [[0.01786775 0.00559839]
[0.0057725 0.01331542]
[0.02147001 0.00660115]
...
[0.01492734 0.01552457]
[0.01481598 0.00203232]
[0.00985758 0.01069336]]
similarityMatrix: [[0.01914329 0.00517399]
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[0.02226429 0.00710067]
...
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[0.01685991 0.00062567]
[0.00847609 0.01246876]]
similarityMatrix: [[0.01927185 0.00521277]
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[0.02213477 0.00749635]
...
[0.01548621 0.01471911]

```

```
[0.01706754 0.00059422]
[0.00819823 0.01277454]]
similarityMatrix: [[0.01920415 0.00540433]
[0.00495976 0.01342324]
[0.02188994 0.00792194]
...
[0.0166337 0.01323641]
[0.01710608 0.00066581]
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similarityMatrix: [[0.01912705 0.00560414]
[0.0049484 0.01337577]
[0.02171662 0.00824616]
...
[0.0169113 0.01290592]
[0.01722293 0.00063666]
[0.00818309 0.01272687]]
similarityMatrix: [[0.01916749 0.00560206]
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[0.02174744 0.00825612]
...
[0.01703494 0.01276328]
[0.01724659 0.00066709]
[0.00805821 0.01286912]]
similarityMatrix: [[0.0190493 0.00575239]
[0.00515395 0.01308358]
[0.02176859 0.00822922]
...
[0.01726284 0.01247341]
[0.01714253 0.00079946]
[0.00813752 0.01276825]]
similarityMatrix: [[0.01900631 0.00578293]
[0.00522292 0.01301007]
[0.02169386 0.00829982]
...
[0.01769311 0.01191562]
[0.01693815 0.00103037]
[0.00801675 0.01293081]]
similarityMatrix: [[0.01899844 0.00584109]
[0.00531719 0.01286218]
[0.0218629 0.00813432]
...
[0.01778076 0.01182554]
[0.01690004 0.00113663]
[0.00794019 0.01300997]]
similarityMatrix: [[0.00906088 0.00791111]
[0.03665937 0.02377019]
[0.03597429 0.01807009]
...
[0.03722618 0.02894244]
[0.07621573 0.04216387]
[0.1017299 0.00162251]]
similarityMatrix: [[0.0182644 0.01277938]
[0.02163955 0.01523674]
[0.00772046 0.00691395]
...
[0.01411561 0.01270741]
[0.02371047 0.01443751]
```

```
[0.02686205 0.0122345 ]]
similarityMatrix: [[0.02051635 0.00993182]
[0.0243179 0.01184577]
[0.00789243 0.00671005]
...
[0.01485451 0.01175939]
[0.02609288 0.01154632]
[0.02920142 0.00958862]]
similarityMatrix: [[0.02158072 0.00895869]
[0.02597368 0.0101905 ]
[0.00761706 0.00710067]
...
[0.01550292 0.01104783]
[0.02679981 0.01116617]
[0.029982 0.00929461]]
similarityMatrix: [[0.02154228 0.00870429]
[0.0257801 0.01006463]
[0.00773373 0.00693403]
...
[0.01562138 0.0107836 ]
[0.0266993 0.01092096]
[0.02952179 0.00940245]]
similarityMatrix: [[0.02152053 0.0087109 ]
[0.02584042 0.00995751]
[0.00773509 0.00693084]
...
[0.01571973 0.01064488]
[0.02678192 0.01078417]
[0.02949383 0.00940469]]
similarityMatrix: [[0.02151033 0.00854496]
[0.02576698 0.00983431]
[0.0075951 0.00710965]
...
[0.0157507 0.0105316 ]
[0.02681495 0.01051479]
[0.02924353 0.00946262]]
similarityMatrix: [[0.02151324 0.00844934]
[0.02572143 0.00978433]
[0.00758548 0.00711943]
...
[0.01591014 0.01027556]
[0.02679355 0.010429 ]
[0.02912459 0.00948632]]
similarityMatrix: [[0.0216032 0.00832568]
[0.0257128 0.00979618]
[0.00764438 0.00703847]
...
[0.01586392 0.01033909]
[0.0267262 0.01052158]
[0.02910151 0.00951805]]
similarityMatrix: [[0.02164505 0.00822072]
[0.02570376 0.00975225]
[0.00750076 0.00723494]
...
[0.01591417 0.01025001]
[0.02672512 0.0104656 ]
[0.02900916 0.00957632]]]
```



```
similarityMatrix: [[-0.00213554    0.01671114]
 [-0.01367062 -0.00745796]
 [-0.016446   -0.01001327]
 ...
 [-0.01270633  0.08792401]
 [-0.01510022  0.09370482]
 [-0.01781428  0.08909927]]
similarityMatrix: [[ 0.00368458  0.00930218]
 [ 0.00386681  0.01159271]
 [ 0.00341697  0.01167946]
 ...
 [-0.00178343  0.03555802]
 [-0.00068273  0.05523925]
 [-0.00283659  0.05144746]]
similarityMatrix: [[ 0.00407836  0.00835361]
 [ 0.00407892  0.01102356]
 [ 0.00367674  0.01099728]
 ...
 [-0.00176467  0.03505372]
 [-0.00136689  0.05607391]
 [-0.00300119  0.05114264]]
similarityMatrix: [[ 0.00417839  0.00816737]
 [ 0.00408744  0.01106939]
 [ 0.00371078  0.01098888]
 ...
 [-0.00170207  0.03525725]
 [-0.00133624  0.05654306]
 [-0.00289996  0.05142119]]
similarityMatrix: [[ 0.00417839  0.00816737]
 [ 0.00408744  0.01106939]
 [ 0.00371078  0.01098888]
 ...
 [-0.00170207  0.03525725]
 [-0.00133624  0.05654306]
 [-0.00289996  0.05142119]]
similarityMatrix: [[ 0.00417839  0.00816737]
 [ 0.00408744  0.01106939]
 [ 0.00371078  0.01098888]
 ...
 [-0.00170207  0.03525725]
 [-0.00133624  0.05654306]
 [-0.00289996  0.05142119]]
similarityMatrix: [[ 0.00417839  0.00816737]
 [ 0.00408744  0.01106939]
 [ 0.00371078  0.01098888]
 ...
 [-0.00170207  0.03525725]
 [-0.00133624  0.05654306]
 [-0.00289996  0.05142119]]
similarityMatrix: [[ 0.00417839  0.00816737]
```

```

[ 0.00408744 0.01106939]
[ 0.00371078 0.01098888]
...
[-0.00170207 0.03525725]
[-0.00133624 0.05654306]
[-0.00289996 0.05142119]]
similarityMatrix: [[ 0.00417839 0.00816737]
[ 0.00408744 0.01106939]
[ 0.00371078 0.01098888]
...
[-0.00170207 0.03525725]
[-0.00133624 0.05654306]
[-0.00289996 0.05142119]]
similarityMatrix: [[ 0.0724726 0.03614165]
[-0.0138277 -0.00166876]
[ 0.05285619 0.07644375]
...
[ 0.01818646 0.02234911]
[ 0.03680603 0.10984142]
[ 0.01165907 0.03510082]]
similarityMatrix: [[0.04701864 0.03104664]
[0.02108843 0.01918701]
[0.04347684 0.05320114]
...
[0.01456895 0.01476124]
[0.02603723 0.04468176]
[0.01717878 0.01477803]]
similarityMatrix: [[0.05001386 0.02707807]
[0.02631612 0.01537322]
[0.04488004 0.05340392]
...
[0.01763486 0.01268122]
[0.02473941 0.04780627]
[0.02424817 0.00964109]]
similarityMatrix: [[0.04871928 0.02721062]
[0.02600694 0.01520593]
[0.04395161 0.05440805]
...
[0.01854957 0.01181731]
[0.02483183 0.04857689]
[0.02419813 0.00914675]]
similarityMatrix: [[0.04869511 0.02727455]
[0.02583116 0.01535972]
[0.04357899 0.05466278]
...
[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[0.04869511 0.02727455]
[0.02583116 0.01535972]
[0.04357899 0.05466278]
...
[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[0.04869511 0.02727455]
[0.02583116 0.01535972]

```

```

[0.04357899 0.05466278]
...
[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[0.04869511 0.02727455]
[0.02583116 0.01535972]
[0.04357899 0.05466278]
...
[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[0.04869511 0.02727455]
[0.02583116 0.01535972]
[0.04357899 0.05466278]
...
[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[0.04869511 0.02727455]
[0.02583116 0.01535972]
[0.04357899 0.05466278]
...
[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[ 0.02016267 -0.02022859]
[ 0.0188879 0.01358187]
[ 0.03898091 0.02073822]
...
[-0.00413721 0.02065526]
[-0.00089714 0.06331196]
[ 0.00405244 0.03088642]]
similarityMatrix: [[0.01050905 0.00077376]
[0.01345899 0.00817856]
[0.02095023 0.02173335]
...
[0.03231862 0.03788787]
[0.01404203 0.0213816 ]
[0.0228873 0.0276318 ]]
similarityMatrix: [[ 0.01198344 -0.00098797]
[ 0.01515082 0.00640085]
[ 0.02070263 0.02199395]
...
[ 0.03754822 0.03329896]
[ 0.01617317 0.01972143]
[ 0.02334619 0.0274053 ]]
similarityMatrix: [[ 0.01242071 -0.00208626]
[ 0.01559314 0.00550992]
[ 0.02152522 0.02122132]
...
[ 0.04848262 0.02195047]
[ 0.01885701 0.01716709]
[ 0.02362277 0.02732801]]
similarityMatrix: [[ 0.01263324 -0.00193596]
[ 0.01626148 0.00511005]
[ 0.02272159 0.02006979]

```

```

...
[ 0.05347405  0.01776648]
[ 0.02224891  0.01392268]
[ 0.02369556  0.02716652]]
similarityMatrix: [[ 0.01265927 -0.0010723 ]
[ 0.01752983  0.00471111]
[ 0.02370531  0.01939577]
...
[ 0.05925663  0.01502764]
[ 0.02454446  0.01247983]
[ 0.02366009  0.02698561]]
similarityMatrix: [[ 0.01265016 -0.00086621]
[ 0.01755358  0.00487698]
[ 0.02411492  0.01912127]
...
[ 0.06326659  0.01236988]
[ 0.02650114  0.01104531]
[ 0.02393998  0.02670736]]
similarityMatrix: [[ 0.01259502 -0.00110391]
[ 0.01730685  0.00482192]
[ 0.02473119  0.01848547]
...
[ 0.06505276  0.00975864]
[ 0.02746851  0.00988657]
[ 0.02393556  0.02676954]]
similarityMatrix: [[ 0.01277697 -0.00132   ]
[ 0.01676247  0.00524189]
[ 0.02530985  0.01795635]
...
[ 0.06622179  0.00850887]
[ 0.02838943  0.00901212]
[ 0.02426202  0.02649798]]
similarityMatrix: [[ 0.01275015 -0.00112039]
[ 0.01665941  0.0054736  ]
[ 0.02662525  0.01693689]
...
[ 0.06758328  0.00808259]
[ 0.02855154  0.00911834]
[ 0.02473876  0.02606697]]
For K= 15 silhouette_coefficient Score is -0.002829
similarityMatrix: [[ 0.00224539  0.00563543]
[-0.01410789 -0.00333939]
[-0.01843338  0.00267188]
...
[-0.01520066  0.00645218]
[-0.00952964 -0.00025749]
[-0.00705488 -0.01785217]]
similarityMatrix: [[-0.00087274  0.00107679]
[ 0.00215112 -0.00265404]
[-0.00223716  0.00276019]
...
[ 0.0009148  -0.00112868]
[ 0.00092416 -0.00114022]
[ 0.00174329 -0.00215086]]
similarityMatrix: [[-0.00173868  0.00297917]
[ 0.00317554 -0.0054412  ]
[-0.00139931  0.00239768]

```

```

...
[ 0.00383638 -0.00657353]
[ 0.00352834 -0.00604571]
[ 0.00354366 -0.00607196]]
similarityMatrix: [[-0.00174339  0.00307099]
[ 0.00310459 -0.00546875]
[-0.0010407  0.0018332 ]
...
[ 0.00413289 -0.00728011]
[ 0.00388774 -0.00684827]
[ 0.00366063 -0.00644822]]
similarityMatrix: [[-0.00172248  0.00304798]
[ 0.00307851 -0.0054475 ]
[-0.00097462  0.00172462]
...
[ 0.00413037 -0.00730882]
[ 0.00389703 -0.00689591]
[ 0.00368823 -0.00652643]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00643657 -0.01152037]
[-0.01612988  0.00721709]
[ 0.00307641  0.01811557]
...

```

```

[ 0.00744527 -0.00497521]
[ 0.01289484 0.00662285]
[ 0.00587296 -0.00643633]]
similarityMatrix: [[ 0.0037576 0.00222148]
[-0.00271786 0.00406783]
[ 0.00050391 0.00582196]
...
[ 0.00701852 0.00053914]
[ 0.00606594 0.00120089]
[ 0.00321758 0.00426774]]
similarityMatrix: [[ 0.00405851 0.00213275]
[-0.00644108 0.00674123]
[-0.0031568 0.008625 ]
...
[ 0.00907095 -0.0005815 ]
[ 0.00750617 0.00045555]
[ 0.00048915 0.00673253]]
similarityMatrix: [[ 0.00365808 0.00254719]
[-0.00706639 0.00692362]
[-0.00387933 0.0089348 ]
...
[ 0.00861081 0.00010833]
[ 0.00718367 0.00094723]
[-0.001127 0.00800284]]
similarityMatrix: [[ 0.00367438 0.0025493 ]
[-0.00707019 0.00672189]
[-0.00393297 0.00879361]
...
[ 0.00817522 0.00061152]
[ 0.00670468 0.00145493]
[-0.00166586 0.00833737]]
similarityMatrix: [[ 0.00382936 0.00243831]
[-0.0071577 0.0065641 ]
[-0.00386899 0.00852676]
...
[ 0.007838 0.00102078]
[ 0.00646687 0.00174213]
[-0.00202049 0.00846687]]
similarityMatrix: [[ 0.00389449 0.0023973 ]
[-0.00699348 0.00630619]
[-0.00370168 0.0082782 ]
...
[ 0.00765132 0.00123523]
[ 0.00629554 0.00192522]
[-0.00202458 0.00837618]]
similarityMatrix: [[ 0.00382935 0.00246619]
[-0.00680048 0.00600309]
[-0.00360788 0.0080693 ]
...
[ 0.00761284 0.0013377 ]
[ 0.00624851 0.00201169]
[-0.00204815 0.00827893]]
similarityMatrix: [[ 0.00381963 0.00248754]
[-0.00657831 0.00570013]
[-0.00349109 0.00786019]
...
[ 0.00761307 0.00140076]

```

```

[ 0.00625977  0.00204557]
[-0.00201142  0.0081461 ]]
similarityMatrix: [[ 0.00383791  0.00248422]
[-0.00640609  0.0054688 ]
[-0.00339082  0.00769162]
...
[ 0.00764393  0.00142713]
[ 0.00628752  0.00205822]
[-0.00198936  0.00804726]]
similarityMatrix: [[ 0.00605607  0.00885634]
[ 0.01109727  0.01479461]
[ 0.00500945 -0.01494773]
...
[ 0.03624291 -0.01593727]
[-0.00213283  0.00125555]
[ 0.03128891  0.00723438]]
similarityMatrix: [[ 0.00614307  0.00047073]
[ 0.00425857 -0.00039155]
[ 0.01383926  0.00598723]
...
[ 0.00624565 -0.00274119]
[ 0.00793129  0.01140434]
[ 0.0077548   0.00429703]]
similarityMatrix: [[ 0.01196599 -0.00326728]
[ 0.00807169 -0.00277534]
[ 0.01598906  0.0050012 ]
...
[ 0.0096327  -0.00452629]
[ 0.0066675   0.0120622 ]
[ 0.00963948  0.00319816]]
similarityMatrix: [[ 0.0130945  -0.00372353]
[ 0.00854546 -0.0028778 ]
[ 0.01573615  0.00539164]
...
[ 0.0098868  -0.00441433]
[ 0.00490319  0.01314413]
[ 0.01001249  0.00307549]]
similarityMatrix: [[ 0.01332479 -0.0038232 ]
[ 0.00864307 -0.00290615]
[ 0.01580999  0.00537571]
...
[ 0.01000135 -0.00444471]
[ 0.00446501  0.01341062]
[ 0.01014334  0.00301039]]
similarityMatrix: [[ 0.01321934 -0.00377097]
[ 0.00864507 -0.00291996]
[ 0.01578849  0.00537887]
...
[ 0.00993971 -0.00441895]
[ 0.00445862  0.01342457]
[ 0.01016473  0.00298834]]
similarityMatrix: [[ 0.01320959 -0.00377359]
[ 0.00865805 -0.00293492]
[ 0.01583128  0.0053445 ]
...
[ 0.00994609 -0.00443099]
[ 0.00443505  0.01344524]

```

```

[ 0.01018989  0.00296756]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909  0.00535376]
...
[ 0.00994895 -0.00444068]
[ 0.00442532  0.01345665]
[ 0.01017578  0.00297315]]
similarityMatrix: [[-0.00100708  0.01637188]
[ 0.00871842  0.01437905]
[-0.00331851 -0.01399516]
...
[ 0.02294154  0.00623035]
[ 0.00414378  0.01872247]
[ 0.00907894  0.02931298]]
similarityMatrix: [[0.00531083 0.00526585]
[0.0078785  0.00720935]
[0.00275738 0.00255757]
...
[0.00510651 0.00341578]
[0.00757657 0.00574259]
[0.00919796 0.00672124]]
similarityMatrix: [[0.00755787 0.00288601]
[0.01123575 0.00362309]
[0.00268332 0.00262579]
...
[0.00776645 0.00051541]
[0.01125596 0.00175627]
[0.013649  0.00188578]]
similarityMatrix: [[ 0.00910965  0.00117073]
[ 0.01330486  0.00132306]
[ 0.00325692  0.00200732]
...
[ 0.00922227 -0.00112055]
[ 0.01373223 -0.00099997]
[ 0.01579316 -0.00053379]]
similarityMatrix: [[ 1.03969052e-02  4.60350550e-05]
[ 1.46487261e-02  2.40115474e-04]
[ 4.05276653e-03  1.22163839e-03]
...
[ 1.00723102e-02 -1.73730954e-03]
[ 1.49442175e-02 -1.87970687e-03]
[ 1.69467303e-02 -1.31421458e-03]]

```



```

similarityMatrix: [[ 0.01236689 -0.00109189]
 [ 0.01635528 -0.00041051]
 [ 0.00505345  0.00049416]
 ...
 [ 0.01142637 -0.00223031]
 [ 0.01690737 -0.00261283]
 [ 0.01871519 -0.00178338]]
similarityMatrix: [[ 0.01447542 -0.00205476]
 [ 0.01809742 -0.00090309]
 [ 0.00618523 -0.00016568]
 ...
 [ 0.01273046 -0.00253966]
 [ 0.01875023 -0.0030381 ]
 [ 0.02010659 -0.00179533]]
similarityMatrix: [[ 0.01559823 -0.00251316]
 [ 0.01885714 -0.00102831]
 [ 0.00695603 -0.00059861]
 ...
 [ 0.01348821 -0.00275167]
 [ 0.01961326 -0.00317552]
 [ 0.02077909 -0.00178592]]
similarityMatrix: [[ 0.01581629 -0.00268858]
 [ 0.01895763 -0.00111566]
 [ 0.00723247 -0.0008123 ]
 ...
 [ 0.01359655 -0.0028429 ]
 [ 0.0197361  -0.00328144]
 [ 0.02079291 -0.00180911]]
similarityMatrix: [[ 0.01594691 -0.00276644]
 [ 0.01898485 -0.00111362]
 [ 0.00731212 -0.00086342]
 ...
 [ 0.01354292 -0.00278386]
 [ 0.01985911 -0.00334847]
 [ 0.02086015 -0.00183446]]
similarityMatrix: [[ 0.0016062  -0.02601113]
 [-0.00302189  0.00484222]
 [-0.00502498  0.00265269]
 ...
 [ 0.01729606 -0.01028539]
 [ 0.03486961  0.00481244]
 [ 0.01762816 -0.0157823 ]]
similarityMatrix: [[ 6.95765764e-03  1.00630756e-03]
 [ 3.64073265e-03  1.66084409e-03]
 [ 3.18152177e-03  9.74414694e-04]
 ...
 [ 9.15702234e-03 -1.90607920e-03]
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 [ 1.32417852e-02 -2.07989099e-04]]
similarityMatrix: [[ 5.96277924e-03  1.08837919e-03]
 [ 4.66235305e-03 -2.21480038e-04]
 [ 4.32147599e-03 -1.12546903e-03]
 ...
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 [ 1.33376359e-02 -3.30331814e-04]
 [ 1.09553301e-02  3.12459293e-05]]
similarityMatrix: [[ 5.40796179e-03  2.36223013e-03]

```

```

[ 5.08229329e-03  3.61123920e-06]
[ 4.85434303e-03 -9.43915521e-04]
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[ 8.20352358e-03 -1.46169212e-03]
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[ 1.20663142e-02  3.49795405e-04]]
similarityMatrix: [[ 5.03014229e-03  2.92452706e-03]
[ 5.54414026e-03 -7.92029924e-05]
[ 5.36012059e-03 -1.01836363e-03]
...
[ 8.73545096e-03 -1.29498311e-03]
[ 1.52297929e-02  6.05819212e-04]
[ 1.28358253e-02  4.35352475e-04]]
similarityMatrix: [[ 5.05225604e-03  2.94689662e-03]
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[ 5.51256674e-03 -1.02715585e-03]
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[ 0.00557885 -0.0010283 ]
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[ 0.01310392  0.0005542  ]]
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similarityMatrix: [[ 0.00519696  0.00290008]
[ 0.00606363 -0.00020587]
[ 0.00583496 -0.0010671 ]
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[ 0.009326   -0.00124202]
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[ 0.01344123  0.00060429]]
similarityMatrix: [[ 0.00528229  0.0028611 ]
[ 0.00617624 -0.00021529]
[ 0.00591128 -0.00103905]
...
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[ 0.01360781  0.00063659]]
similarityMatrix: [[-0.0067412  -0.01494713]
[ 0.02431244 -0.01512905]
[ 0.05057763 -0.012341  ]
...
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[0.01059063  0.01605669]

```

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[0.01888633 0.00719763]
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[0.01130037 0.00901776]
[0.01491476 0.01176177]]
similarityMatrix: [[ 3.26910922e-02 -4.13381690e-03]
[ 8.06359338e-05 3.06286663e-02]
[ 1.82924622e-02 7.01868611e-03]
...
[ 3.11656060e-02 6.07799639e-03]
[ 1.33287534e-02 6.10286303e-03]
[ 1.60241915e-02 1.00083471e-02]]
similarityMatrix: [[ 0.03322489 -0.00446901]
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[ 0.03147844 0.0059167 ]
[ 0.01326181 0.00626364]
[ 0.01651703 0.00941833]]
similarityMatrix: [[ 0.03333897 -0.00476279]
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[ 0.01292191 0.00668872]
[ 0.01790128 0.00755285]]
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[ 0.0311433 0.00598055]
[ 0.01263915 0.00700048]
[ 0.01983112 0.00481949]]
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[ 0.02171146 0.00209702]]
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[ 1.75186507e-02 7.92435285e-03]
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[ 1.23249011e-02 7.38225310e-03]
[ 2.16719075e-02 2.15144612e-03]]
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[ 1.74896751e-02 7.95198339e-03]
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[ 3.08148313e-02 6.17482141e-03]
[ 1.23016286e-02 7.40799695e-03]
[ 2.16297135e-02 2.18454855e-03]]
similarityMatrix: [[ 3.30529190e-02 -5.29942580e-03]
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[ 1.74363862e-02 8.00122322e-03]

```

```

...
[ 3.07549627e-02  6.19425276e-03]
[ 1.22554837e-02  7.45930945e-03]
[ 2.15559628e-02  2.23659967e-03]]
similarityMatrix: [[ 0.01943835 -0.02302113]
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[ 0.00644852  0.00048762]
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[-0.01561462  0.00864548]
[ 0.00190335 -0.00168712]
[ 0.00717292  0.05997815]]
similarityMatrix: [[ 0.00428783 -0.00243128]
[ 0.00092559  0.00238292]
[ 0.00247777  0.00298497]
...
[ 0.01130413  0.01386912]
[ 0.01131946  0.00865406]
[ 0.02023985  0.0245874  ]]
similarityMatrix: [[ 0.00766793 -0.00410251]
[ 0.0013358  0.00200722]
[ 0.00023027  0.00439747]
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[ 0.01608304  0.00578124]
[ 0.02117756  0.02365127]]
similarityMatrix: [[ 0.00674275 -0.00436002]
[ 0.00148152  0.00194915]
[-0.00126133  0.00591288]
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[ 0.0178068  0.00357235]
[ 0.02268514  0.02267732]]
similarityMatrix: [[ 0.00610648 -0.00446763]
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[ 0.0182313  0.00232901]
[ 0.0242402  0.02129088]]
similarityMatrix: [[ 0.00566541 -0.00424355]
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[ 0.02489737  0.02063242]]
similarityMatrix: [[ 0.00536635 -0.00413202]
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[-0.00107835  0.00644232]
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[ 0.00348299  0.02161701]
[ 0.01806699  0.00192476]
[ 0.02520265  0.02026463]]
similarityMatrix: [[ 0.0052975  -0.00414947]
[ 0.0011839  0.00228999]
[-0.00107007  0.00650125]
...

```

```

[ 0.00352167  0.02174083]
[ 0.01816893  0.00168151]
[ 0.02532445  0.02010182]]
similarityMatrix: [[ 0.00524929 -0.00415481]
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[-0.00113106  0.00660381]
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[ 0.00348047  0.02188349]
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[ 0.02551271  0.01988685]]
similarityMatrix: [[ 0.00523458 -0.0041508  ]
[ 0.00115066  0.00233029]
[-0.00112097  0.0066025  ]
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[ 0.00343443  0.02194965]
[ 0.01801676  0.00172108]
[ 0.02548779  0.01990519]]
similarityMatrix: [[ 0.08088433 -0.01011986]
[ 0.02658291 -0.00591184]
[ 0.00736921  0.00600286]
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[ 0.02084187  0.0032505  ]
...
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[ 0.00908642  0.00613257]
[ 0.02050413  0.00352154]]
similarityMatrix: [[ 0.01543624 -0.00381233]
[ 0.01820439 -0.0060917  ]
[ 0.02460312 -0.0018096  ]
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[ 0.02318809 -0.00073561]]
similarityMatrix: [[ 0.01381106 -0.00415906]
[ 0.01672043 -0.00698667]
[ 0.02351974 -0.0032096  ]
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[ 0.00967234  0.00493799]
[ 0.02197091 -0.00181355]]
similarityMatrix: [[ 0.01369436 -0.00416257]
[ 0.01656642 -0.00699126]
[ 0.02338581 -0.0032472  ]
...
[-0.00496846  0.03008523]
[ 0.00970476  0.00488552]
[ 0.02183987 -0.00183731]]
similarityMatrix: [[ 0.01366325 -0.00416167]
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[ 0.02334987 -0.00325442]
...
[-0.0049788   0.03014191]

```

```

[ 0.00968668  0.00489369]
[ 0.02180387 -0.00184042]]
similarityMatrix: [[ 0.01366325 -0.00416167]
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[ 0.02334987 -0.00325442]
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[ 0.02334987 -0.00325442]
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[ 0.01652302 -0.00698814]
[ 0.02334987 -0.00325442]
...
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[ 0.02180387 -0.00184042]]
similarityMatrix: [[-0.00634014  0.07643617]
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similarityMatrix: [[0.01574564 0.04143592]
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```

```

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...
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[0.01717878 0.01477803]]
similarityMatrix: [[0.05001386 0.02707807]
[0.02631612 0.01537322]
[0.04488004 0.05340392]
...
[0.01763486 0.01268122]
[0.02473941 0.04780627]
[0.02424817 0.00964109]]
similarityMatrix: [[0.04871928 0.02721062]
[0.02600694 0.01520593]
[0.04395161 0.05440805]
...
[0.01854957 0.01181731]
[0.02483183 0.04857689]
[0.02419813 0.00914675]]
similarityMatrix: [[0.04869511 0.02727455]
[0.02583116 0.01535972]
[0.04357899 0.05466278]
...

```

```

[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[0.04869511 0.02727455]
[0.02583116 0.01535972]
[0.04357899 0.05466278]
...
[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[0.04869511 0.02727455]
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...
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similarityMatrix: [[0.04869511 0.02727455]
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...
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[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[0.04869511 0.02727455]
[0.02583116 0.01535972]
[0.04357899 0.05466278]
...
[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[ 0.02016267 -0.02022859]
[ 0.0188879 0.01358187]
[ 0.03898091 0.02073822]
...
[-0.00413721 0.02065526]
[-0.00089714 0.06331196]
[ 0.00405244 0.03088642]]
similarityMatrix: [[0.01050905 0.00077376]
[0.01345899 0.00817856]
[0.02095023 0.02173335]
...
[0.03231862 0.03788787]
[0.01404203 0.0213816 ]
[0.0228873 0.0276318 ]]
similarityMatrix: [[ 0.01198344 -0.00098797]
[ 0.01515082 0.00640085]
[ 0.02070263 0.02199395]
...
[ 0.03754822 0.03329896]

```

```

[ 0.01617317  0.01972143]
[ 0.02334619  0.0274053 ]]
similarityMatrix: [[ 0.01242071 -0.00208626]
[ 0.01559314  0.00550992]
[ 0.02152522  0.02122132]
...
[ 0.04848262  0.02195047]
[ 0.01885701  0.01716709]
[ 0.02362277  0.02732801]]
similarityMatrix: [[ 0.01263324 -0.00193596]
[ 0.01626148  0.00511005]
[ 0.02272159  0.02006979]
...
[ 0.05347405  0.01776648]
[ 0.02224891  0.01392268]
[ 0.02369556  0.02716652]]
similarityMatrix: [[ 0.01265927 -0.0010723 ]
[ 0.01752983  0.00471111]
[ 0.02370531  0.01939577]
...
[ 0.05925663  0.01502764]
[ 0.02454446  0.01247983]
[ 0.02366009  0.02698561]]
similarityMatrix: [[ 0.01265016 -0.00086621]
[ 0.01755358  0.00487698]
[ 0.02411492  0.01912127]
...
[ 0.06326659  0.01236988]
[ 0.02650114  0.01104531]
[ 0.02393998  0.02670736]]
similarityMatrix: [[ 0.01259502 -0.00110391]
[ 0.01730685  0.00482192]
[ 0.02473119  0.01848547]
...
[ 0.06505276  0.00975864]
[ 0.02746851  0.00988657]
[ 0.02393556  0.02676954]]
similarityMatrix: [[ 0.01277697 -0.00132   ]
[ 0.01676247  0.00524189]
[ 0.02530985  0.01795635]
...
[ 0.06622179  0.00850887]
[ 0.02838943  0.00901212]
[ 0.02426202  0.02649798]]
similarityMatrix: [[ 0.01275015 -0.00112039]
[ 0.01665941  0.0054736 ]
[ 0.02662525  0.01693689]
...
[ 0.06758328  0.00808259]
[ 0.02855154  0.00911834]
[ 0.02473876  0.02606697]]
similarityMatrix: [[ 0.00036617  0.00765002]
[ 0.02638225  0.00557028]
[ 0.02765683  0.00984574]
...
[-0.00506051  0.02329564]
[ 0.00538583  0.01320802]

```

```

[-0.00648398  0.03372492]]
similarityMatrix: [[0.00145999  0.00360148]
[0.00550104  0.00822802]
[0.00388773  0.01118899]
...
[0.01885357  0.03599712]
[0.01979298  0.03182167]
[0.01530073  0.03206549]]
similarityMatrix: [[0.00139027  0.00387929]
[0.00390212  0.01111683]
[0.00279364  0.01357376]
...
[0.01774501  0.0391451 ]
[0.01899756  0.03405998]
[0.01458627  0.03452346]]
similarityMatrix: [[0.00140159  0.00396017]
[0.00410425  0.01104861]
[0.00292335  0.01377984]
...
[0.01786166  0.03980596]
[0.01959332  0.03360696]
[0.01460236  0.03530465]]
similarityMatrix: [[0.00136102  0.00407509]
[0.00423618  0.01091718]
[0.00295273  0.01389835]
...
[0.01811157  0.03969651]
[0.01976952  0.03350666]
[0.01451832  0.03578719]]
similarityMatrix: [[0.00135516  0.00407717]
[0.00425177  0.01086762]
[0.00294433  0.01387902]
...
[0.01810448  0.03964113]
[0.0197202  0.03355308]
[0.01443354  0.03587443]]
similarityMatrix: [[0.00135516  0.00407717]
[0.00425177  0.01086762]
[0.00294433  0.01387902]
...
[0.01810448  0.03964113]
[0.0197202  0.03355308]
[0.01443354  0.03587443]]
similarityMatrix: [[0.00135516  0.00407717]
[0.00425177  0.01086762]
[0.00294433  0.01387902]
...
[0.01810448  0.03964113]
[0.0197202  0.03355308]
[0.01443354  0.03587443]]
similarityMatrix: [[0.00135516  0.00407717]
[0.00425177  0.01086762]
[0.00294433  0.01387902]
...
[0.01810448  0.03964113]
[0.0197202  0.03355308]
[0.01443354  0.03587443]]

```

```
similarityMatrix: [[0.00135516 0.00407717]
[0.00425177 0.01086762]
[0.00294433 0.01387902]
...
[0.01810448 0.03964113]
[0.0197202 0.03355308]
[0.01443354 0.03587443]]
similarityMatrix: [[-0.00386223 0.05196955]
[-0.01208056 0.01301738]
[-0.00864888 0.07728339]
...
[ 0.07501562 0.06743108]
[ 0.04265917 -0.02113316]
[-0.00286139 0.00725867]]
similarityMatrix: [[ 0.00651897 0.04072105]
[-0.00035075 0.01781439]
[-0.0002584 0.06640069]
...
[ 0.00570145 0.04794132]
[ 0.01059513 0.03430749]
[ 0.00310867 0.01105791]]
similarityMatrix: [[ 0.00460635 0.03916698]
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[-0.00146244 0.06261136]
...
[-0.00092373 0.04730669]
[-0.00410831 0.03726129]
[ 0.00124594 0.01112408]]
similarityMatrix: [[ 0.00466785 0.03897518]
[-0.00077827 0.01672333]
[-0.00150249 0.06230119]
...
[-0.0016506 0.04727861]
[-0.00408541 0.03704665]
[ 0.0015001 0.01099951]]
similarityMatrix: [[ 0.00466785 0.03897518]
[-0.00077827 0.01672333]
[-0.00150249 0.06230119]
...
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[-0.00408541 0.03704665]
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[-0.00150249 0.06230119]
...
[-0.0016506 0.04727861]
[-0.00408541 0.03704665]
[ 0.0015001 0.01099951]]
```

```

[-0.00077827  0.01672333]
[-0.00150249  0.06230119]
...
[-0.0016506   0.04727861]
[-0.00408541  0.03704665]
[ 0.0015001   0.01099951]]
similarityMatrix: [[ 0.00466785  0.03897518]
[-0.00077827  0.01672333]
[-0.00150249  0.06230119]
...
[-0.0016506   0.04727861]
[-0.00408541  0.03704665]
[ 0.0015001   0.01099951]]
similarityMatrix: [[ 0.00466785  0.03897518]
[-0.00077827  0.01672333]
[-0.00150249  0.06230119]
...
[-0.0016506   0.04727861]
[-0.00408541  0.03704665]
[ 0.0015001   0.01099951]]
For K= 17 silhouette_coefficient Score is 0.000503
similarityMatrix: [[ 0.00224539  0.00563543]
[-0.01410789 -0.00333939]
[-0.01843338  0.00267188]
...
[-0.01520066  0.00645218]
[-0.00952964 -0.00025749]
[-0.00705488 -0.01785217]]
similarityMatrix: [[-0.00087274  0.00107679]
[ 0.00215112 -0.00265404]
[-0.00223716  0.00276019]
...
[ 0.0009148  -0.00112868]
[ 0.00092416 -0.00114022]
[ 0.00174329 -0.00215086]]
similarityMatrix: [[-0.00173868  0.00297917]
[ 0.00317554 -0.0054412 ]
[-0.00139931  0.00239768]
...
[ 0.00383638 -0.00657353]
[ 0.00352834 -0.00604571]
[ 0.00354366 -0.00607196]]
similarityMatrix: [[-0.00174339  0.00307099]
[ 0.00310459 -0.00546875]
[-0.0010407  0.0018332 ]
...
[ 0.00413289 -0.00728011]
[ 0.00388774 -0.00684827]
[ 0.00366063 -0.00644822]]
similarityMatrix: [[-0.00172248  0.00304798]
[ 0.00307851 -0.0054475 ]
[-0.00097462  0.00172462]
...
[ 0.00413037 -0.00730882]
[ 0.00389703 -0.00689591]
[ 0.00368823 -0.00652643]]
similarityMatrix: [[-0.00172211  0.0030504 ]

```



```

[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00172211  0.0030504 ]
[ 0.00307245 -0.00544229]
[-0.00097286  0.00172324]
...
[ 0.00412856 -0.00731299]
[ 0.00389601 -0.00690107]
[ 0.00368598 -0.00652904]]
similarityMatrix: [[-0.00643657 -0.01152037]
[-0.01612988  0.00721709]
[ 0.00307641  0.01811557]
...
[ 0.00744527 -0.00497521]
[ 0.01289484  0.00662285]
[ 0.00587296 -0.00643633]]
similarityMatrix: [[ 0.0037576  0.00222148]
[-0.00271786  0.00406783]
[ 0.00050391  0.00582196]
...
[ 0.00701852  0.00053914]
[ 0.00606594  0.00120089]
[ 0.00321758  0.00426774]]
similarityMatrix: [[ 0.00405851  0.00213275]
[-0.00644108  0.00674123]
[-0.0031568  0.008625 ]
...
[ 0.00907095 -0.0005815 ]
[ 0.00750617  0.00045555]
[ 0.00048915  0.00673253]]
similarityMatrix: [[ 0.00365808  0.00254719]
[-0.00706639  0.00692362]

```

```

[-0.00387933  0.0089348 ]
...
[ 0.00861081  0.00010833]
[ 0.00718367  0.00094723]
[-0.001127    0.00800284]]
similarityMatrix: [[ 0.00367438  0.0025493 ]
[-0.00707019  0.00672189]
[-0.00393297  0.00879361]
...
[ 0.00817522  0.00061152]
[ 0.00670468  0.00145493]
[-0.00166586  0.00833737]]
similarityMatrix: [[ 0.00382936  0.00243831]
[-0.0071577   0.0065641 ]
[-0.00386899  0.00852676]
...
[ 0.007838    0.00102078]
[ 0.00646687  0.00174213]
[-0.00202049  0.00846687]]
similarityMatrix: [[ 0.00389449  0.0023973 ]
[-0.00699348  0.00630619]
[-0.00370168  0.0082782 ]
...
[ 0.00765132  0.00123523]
[ 0.00629554  0.00192522]
[-0.00202458  0.00837618]]
similarityMatrix: [[ 0.00382935  0.00246619]
[-0.00680048  0.00600309]
[-0.00360788  0.0080693 ]
...
[ 0.00761284  0.0013377 ]
[ 0.00624851  0.00201169]
[-0.00204815  0.00827893]]
similarityMatrix: [[ 0.00381963  0.00248754]
[-0.00657831  0.00570013]
[-0.00349109  0.00786019]
...
[ 0.00761307  0.00140076]
[ 0.00625977  0.00204557]
[-0.00201142  0.0081461 ]]
similarityMatrix: [[ 0.00383791  0.00248422]
[-0.00640609  0.0054688 ]
[-0.00339082  0.00769162]
...
[ 0.00764393  0.00142713]
[ 0.00628752  0.00205822]
[-0.00198936  0.00804726]]
similarityMatrix: [[ 0.00605607  0.00885634]
[ 0.01109727  0.01479461]
[ 0.00500945 -0.01494773]
...
[ 0.03624291 -0.01593727]
[-0.00213283  0.00125555]
[ 0.03128891  0.00723438]]
similarityMatrix: [[ 0.00614307  0.00047073]
[ 0.00425857 -0.00039155]
[ 0.01383926  0.00598723]

```

```

...
[ 0.00624565 -0.00274119]
[ 0.00793129 0.01140434]
[ 0.0077548 0.00429703]]
similarityMatrix: [[ 0.01196599 -0.00326728]
[ 0.00807169 -0.00277534]
[ 0.01598906 0.0050012 ]
...
[ 0.0096327 -0.00452629]
[ 0.0066675 0.0120622 ]
[ 0.00963948 0.00319816]]
similarityMatrix: [[ 0.0130945 -0.00372353]
[ 0.00854546 -0.0028778 ]
[ 0.01573615 0.00539164]
...
[ 0.0098868 -0.00441433]
[ 0.00490319 0.01314413]
[ 0.01001249 0.00307549]]
similarityMatrix: [[ 0.01332479 -0.0038232 ]
[ 0.00864307 -0.00290615]
[ 0.01580999 0.00537571]
...
[ 0.01000135 -0.00444471]
[ 0.00446501 0.01341062]
[ 0.01014334 0.00301039]]
similarityMatrix: [[ 0.01321934 -0.00377097]
[ 0.00864507 -0.00291996]
[ 0.01578849 0.00537887]
...
[ 0.00993971 -0.00441895]
[ 0.00445862 0.01342457]
[ 0.01016473 0.00298834]]
similarityMatrix: [[ 0.01320959 -0.00377359]
[ 0.00865805 -0.00293492]
[ 0.01583128 0.0053445 ]
...
[ 0.00994609 -0.00443099]
[ 0.00443505 0.01344524]
[ 0.01018989 0.00296756]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909 0.00535376]
...
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[ 0.01017578 0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
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[ 0.01580909 0.00535376]
...
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[ 0.00442532 0.01345665]
[ 0.01017578 0.00297315]]
similarityMatrix: [[ 0.01319652 -0.00377398]
[ 0.00864426 -0.00293191]
[ 0.01580909 0.00535376]
...

```

```

[ 0.00994895 -0.00444068]
[ 0.00442532 0.01345665]
[ 0.01017578 0.00297315]]
similarityMatrix: [[-0.00100708 0.01637188]
[ 0.00871842 0.01437905]
[-0.00331851 -0.01399516]
...
[ 0.02294154 0.00623035]
[ 0.00414378 0.01872247]
[ 0.00907894 0.02931298]]
similarityMatrix: [[0.00531083 0.00526585]
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...
[0.00510651 0.00341578]
[0.00757657 0.00574259]
[0.00919796 0.00672124]]
similarityMatrix: [[0.00755787 0.00288601]
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[0.013649 0.00188578]]
similarityMatrix: [[ 0.00910965 0.00117073]
[ 0.01330486 0.00132306]
[ 0.00325692 0.00200732]
...
[ 0.00922227 -0.00112055]
[ 0.01373223 -0.00099997]
[ 0.01579316 -0.00053379]]
similarityMatrix: [[ 1.03969052e-02 4.60350550e-05]
[ 1.46487261e-02 2.40115474e-04]
[ 4.05276653e-03 1.22163839e-03]
...
[ 1.00723102e-02 -1.73730954e-03]
[ 1.49442175e-02 -1.87970687e-03]
[ 1.69467303e-02 -1.31421458e-03]]
similarityMatrix: [[ 0.01236689 -0.00109189]
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[ 0.00505345 0.00049416]
...
[ 0.01142637 -0.00223031]
[ 0.01690737 -0.00261283]
[ 0.01871519 -0.00178338]]
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[ 0.00618523 -0.00016568]
...
[ 0.01273046 -0.00253966]
[ 0.01875023 -0.0030381 ]
[ 0.02010659 -0.00179533]]
similarityMatrix: [[ 0.01559823 -0.00251316]
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[ 0.00695603 -0.00059861]
...
[ 0.01348821 -0.00275167]

```

```

[ 0.01961326 -0.00317552]
[ 0.02077909 -0.00178592]]
similarityMatrix: [[ 0.01581629 -0.00268858]
[ 0.01895763 -0.00111566]
[ 0.00723247 -0.0008123 ]
...
[ 0.01359655 -0.0028429 ]
[ 0.0197361 -0.00328144]
[ 0.02079291 -0.00180911]]
similarityMatrix: [[ 0.01594691 -0.00276644]
[ 0.01898485 -0.00111362]
[ 0.00731212 -0.00086342]
...
[ 0.01354292 -0.00278386]
[ 0.01985911 -0.00334847]
[ 0.02086015 -0.00183446]]
similarityMatrix: [[ 0.0016062 -0.02601113]
[-0.00302189 0.00484222]
[-0.00502498 0.00265269]
...
[ 0.01729606 -0.01028539]
[ 0.03486961 0.00481244]
[ 0.01762816 -0.0157823 ]]
similarityMatrix: [[ 6.95765764e-03 1.00630756e-03]
[ 3.64073265e-03 1.66084409e-03]
[ 3.18152177e-03 9.74414694e-04]
...
[ 9.15702234e-03 -1.90607920e-03]
[ 1.54732445e-02 7.61416141e-05]
[ 1.32417852e-02 -2.07989099e-04]]
similarityMatrix: [[ 5.96277924e-03 1.08837919e-03]
[ 4.66235305e-03 -2.21480038e-04]
[ 4.32147599e-03 -1.12546903e-03]
...
[ 7.41227112e-03 -1.90126340e-03]
[ 1.33376359e-02 -3.30331814e-04]
[ 1.09553301e-02 3.12459293e-05]]
similarityMatrix: [[ 5.40796179e-03 2.36223013e-03]
[ 5.08229329e-03 3.61123920e-06]
[ 4.85434303e-03 -9.43915521e-04]
...
[ 8.20352358e-03 -1.46169212e-03]
[ 1.44794431e-02 3.35639572e-04]
[ 1.20663142e-02 3.49795405e-04]]
similarityMatrix: [[ 5.03014229e-03 2.92452706e-03]
[ 5.54414026e-03 -7.92029924e-05]
[ 5.36012059e-03 -1.01836363e-03]
...
[ 8.73545096e-03 -1.29498311e-03]
[ 1.52297929e-02 6.05819212e-04]
[ 1.28358253e-02 4.35352475e-04]]
similarityMatrix: [[ 5.05225604e-03 2.94689662e-03]
[ 5.67493807e-03 -8.37289293e-05]
[ 5.51256674e-03 -1.02715585e-03]
...
[ 8.88070243e-03 -1.22417404e-03]
[ 1.54887766e-02 6.66761182e-04]

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[ 1.30454307e-02  4.95987925e-04]]
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[ 0.00575905 -0.00010737]
[ 0.00557885 -0.0010283 ]
...
[ 0.00899669 -0.00123787]
[ 0.01560813  0.00069132]
[ 0.01310392  0.0005542 ]]
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[ 0.00588219 -0.00014385]
[ 0.00566108 -0.00102099]
...
[ 0.00912095 -0.00122387]
[ 0.01579137  0.00070988]
[ 0.01323033  0.00059361]]
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[ 0.00606363 -0.00020587]
[ 0.00583496 -0.0010671 ]
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[ 0.009326    -0.00124202]
[ 0.01601302  0.00074756]
[ 0.01344123  0.00060429]]
similarityMatrix: [[ 0.00528229  0.0028611 ]
[ 0.00617624 -0.00021529]
[ 0.00591128 -0.00103905]
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[ 0.01622941  0.00077123]
[ 0.01360781  0.00063659]]
similarityMatrix: [[-0.0067412  -0.01494713]
[ 0.02431244 -0.01512905]
[ 0.05057763 -0.012341 ]
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[ 0.00926811 -0.01772456]
[-0.01426775  0.01302672]
[-0.00734118 -0.01881791]]
similarityMatrix: [[0.02746375  0.00478167]
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[0.01888633  0.00719763]
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[0.02773965  0.01199459]
[0.01130037  0.00901776]
[0.01491476  0.01176177]]
similarityMatrix: [[ 3.26910922e-02 -4.13381690e-03]
[ 8.06359338e-05  3.06286663e-02]
[ 1.82924622e-02  7.01868611e-03]
...
[ 3.11656060e-02  6.07799639e-03]
[ 1.33287534e-02  6.10286303e-03]
[ 1.60241915e-02  1.00083471e-02]]
similarityMatrix: [[ 0.03322489 -0.00446901]
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[ 0.01829461  0.00712887]
...
[ 0.03147844  0.0059167 ]
[ 0.01326181  0.00626364]
[ 0.01651703  0.00941833]]

```

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similarityMatrix: [[ 0.03333897 -0.00476279]
[-0.00032984  0.03098178]
[ 0.01810894  0.00733336]
...
[ 0.03132771  0.00602045]
[ 0.01292191  0.00668872]
[ 0.01790128  0.00755285]]
similarityMatrix: [[ 0.03315842 -0.00495443]
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...
[ 0.0311433   0.00598055]
[ 0.01263915  0.00700048]
[ 0.01983112  0.00481949]]
similarityMatrix: [[ 0.03307444 -0.00518134]
[-0.00011245  0.03132574]
[ 0.0175386   0.0078969 ]
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[ 0.02171146  0.00209702]]
similarityMatrix: [[ 3.30924567e-02 -5.20613620e-03]
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[ 1.75186507e-02  7.92435285e-03]
...
[ 3.08533949e-02  6.15338344e-03]
[ 1.23249011e-02  7.38225310e-03]
[ 2.16719075e-02  2.15144612e-03]]
similarityMatrix: [[ 3.30813839e-02 -5.24009183e-03]
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[ 1.74896751e-02  7.95198339e-03]
...
[ 3.08148313e-02  6.17482141e-03]
[ 1.23016286e-02  7.40799695e-03]
[ 2.16297135e-02  2.18454855e-03]]
similarityMatrix: [[ 3.30529190e-02 -5.29942580e-03]
[ 7.84407998e-05  3.11828315e-02]
[ 1.74363862e-02  8.00122322e-03]
...
[ 3.07549627e-02  6.19425276e-03]
[ 1.22554837e-02  7.45930945e-03]
[ 2.15559628e-02  2.23659967e-03]]
similarityMatrix: [[ 0.01943835 -0.02302113]
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[ 0.00644852  0.00048762]
...
[-0.01561462  0.00864548]
[ 0.00190335 -0.00168712]
[ 0.00717292  0.05997815]]
similarityMatrix: [[ 0.00428783 -0.00243128]
[ 0.00092559  0.00238292]
[ 0.00247777  0.00298497]
...
[ 0.01130413  0.01386912]
[ 0.01131946  0.00865406]
[ 0.02023985  0.0245874 ]]
similarityMatrix: [[ 0.00766793 -0.00410251]

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[ 0.0013358 0.00200722]
[ 0.00023027 0.00439747]
...
[ 0.00639063 0.01684635]
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[ 0.02117756 0.02365127]]
similarityMatrix: [[ 0.00674275 -0.00436002]
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[ 0.00462517 0.01910075]
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[ 0.02268514 0.02267732]]
similarityMatrix: [[ 0.00610648 -0.00446763]
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[ 0.0041719 0.02038437]
[ 0.0182313 0.00232901]
[ 0.0242402 0.02129088]]
similarityMatrix: [[ 0.00566541 -0.00424355]
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[ 0.00392988 0.02088936]
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[ 0.02489737 0.02063242]]
similarityMatrix: [[ 0.00536635 -0.00413202]
[ 0.00107559 0.00238398]
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[ 0.01806699 0.00192476]
[ 0.02520265 0.02026463]]
similarityMatrix: [[ 0.0052975 -0.00414947]
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[ 0.01801676 0.00172108]
[ 0.02548779 0.01990519]]
similarityMatrix: [[ 0.08088433 -0.01011986]
[ 0.02658291 -0.00591184]

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```

[ 0.00736921  0.00600286]
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[ 0.00055486  0.01867863]
[-0.00898974 -0.00724908]
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similarityMatrix: [[ 0.01809956 -0.00256292]
[ 0.01965672 -0.00365323]
[ 0.02084187  0.0032505 ]
...
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[ 0.02050413  0.00352154]]
similarityMatrix: [[ 0.01543624 -0.00381233]
[ 0.01820439 -0.0060917 ]
[ 0.02460312 -0.0018096 ]
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similarityMatrix: [[ 0.01381106 -0.00415906]
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[ 0.02183987 -0.00183731]]
similarityMatrix: [[ 0.01366325 -0.00416167]
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[ 0.02334987 -0.00325442]
...
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[ 0.00968668  0.00489369]
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similarityMatrix: [[ 0.01366325 -0.00416167]
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[ 0.02334987 -0.00325442]

```

```

...
[-0.0049788  0.03014191]
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similarityMatrix: [[-0.00634014  0.07643617]
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similarityMatrix: [[0.01574564  0.04143592]
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similarityMatrix: [[0.01767628  0.03866552]
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similarityMatrix: [[0.01878065  0.03772752]
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...

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[0.07579819 0.00337861]]
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 [ 0.00341697    0.01167946]
 ...
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 [-0.00068273    0.05523925]
 [-0.00283659    0.05144746]]
similarityMatrix: [[ 0.00407836    0.00835361]
 [ 0.00407892    0.01102356]
 [ 0.00367674    0.01099728]
 ...
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 [-0.00136689    0.05607391]
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similarityMatrix: [[ 0.00417839    0.00816737]
 [ 0.00408744    0.01106939]
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similarityMatrix: [[ 0.00417839    0.00816737]
```

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[ 0.00408744 0.01106939]
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similarityMatrix: [[0.04869511 0.02727455]
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[0.04357899 0.05466278]
...
[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[0.04869511 0.02727455]
[0.02583116 0.01535972]
[0.04357899 0.05466278]
...
[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[0.04869511 0.02727455]
[0.02583116 0.01535972]
[0.04357899 0.05466278]
...
[0.01861545 0.01178271]
[0.02464126 0.04866786]
[0.02430588 0.00909879]]
similarityMatrix: [[ 0.02016267 -0.02022859]
[ 0.0188879 0.01358187]
[ 0.03898091 0.02073822]
...
[-0.00413721 0.02065526]
[-0.00089714 0.06331196]
[ 0.00405244 0.03088642]]
similarityMatrix: [[0.01050905 0.00077376]
[0.01345899 0.00817856]
[0.02095023 0.02173335]
...
[0.03231862 0.03788787]
[0.01404203 0.0213816 ]
[0.0228873 0.0276318 ]]
similarityMatrix: [[ 0.01198344 -0.00098797]
[ 0.01515082 0.00640085]
[ 0.02070263 0.02199395]
...
[ 0.03754822 0.03329896]
[ 0.01617317 0.01972143]
[ 0.02334619 0.0274053 ]]
similarityMatrix: [[ 0.01242071 -0.00208626]
[ 0.01559314 0.00550992]
[ 0.02152522 0.02122132]
...
[ 0.04848262 0.02195047]
[ 0.01885701 0.01716709]
[ 0.02362277 0.02732801]]
similarityMatrix: [[ 0.01263324 -0.00193596]
[ 0.01626148 0.00511005]
[ 0.02272159 0.02006979]
...
[ 0.05347405 0.01776648]
[ 0.02224891 0.01392268]
[ 0.02369556 0.02716652]]
similarityMatrix: [[ 0.01265927 -0.0010723 ]
[ 0.01752983 0.00471111]
[ 0.02370531 0.01939577]

```



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...
[ 0.05925663  0.01502764]
[ 0.02454446  0.01247983]
[ 0.02366009  0.02698561]]
similarityMatrix: [[ 0.01265016 -0.00086621]
[ 0.01755358  0.00487698]
[ 0.02411492  0.01912127]
...
[ 0.06326659  0.01236988]
[ 0.02650114  0.01104531]
[ 0.02393998  0.02670736]]
similarityMatrix: [[ 0.01259502 -0.00110391]
[ 0.01730685  0.00482192]
[ 0.02473119  0.01848547]
...
[ 0.06505276  0.00975864]
[ 0.02746851  0.00988657]
[ 0.02393556  0.02676954]]
similarityMatrix: [[ 0.01277697 -0.00132   ]
[ 0.01676247  0.00524189]
[ 0.02530985  0.01795635]
...
[ 0.06622179  0.00850887]
[ 0.02838943  0.00901212]
[ 0.02426202  0.02649798]]
similarityMatrix: [[ 0.01275015 -0.00112039]
[ 0.01665941  0.0054736  ]
[ 0.02662525  0.01693689]
...
[ 0.06758328  0.00808259]
[ 0.02855154  0.00911834]
[ 0.02473876  0.02606697]]
similarityMatrix: [[ 0.00036617  0.00765002]
[ 0.02638225  0.00557028]
[ 0.02765683  0.00984574]
...
[-0.00506051  0.02329564]
[ 0.00538583  0.01320802]
[-0.00648398  0.03372492]]
similarityMatrix: [[0.00145999 0.00360148]
[0.00550104 0.00822802]
[0.00388773 0.01118899]
...
[0.01885357 0.03599712]
[0.01979298 0.03182167]
[0.01530073 0.03206549]]
similarityMatrix: [[0.00139027 0.00387929]
[0.00390212 0.01111683]
[0.00279364 0.01357376]
...
[0.01774501 0.0391451  ]
[0.01899756 0.03405998]
[0.01458627 0.03452346]]
similarityMatrix: [[0.00140159 0.00396017]
[0.00410425 0.01104861]
[0.00292335 0.01377984]
...

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[0.01786166 0.03980596]
[0.01959332 0.03360696]
[0.01460236 0.03530465]]
similarityMatrix: [[0.00136102 0.00407509]
[0.00423618 0.01091718]
[0.00295273 0.01389835]
...
[0.01811157 0.03969651]
[0.01976952 0.03350666]
[0.01451832 0.03578719]]
similarityMatrix: [[0.00135516 0.00407717]
[0.00425177 0.01086762]
[0.00294433 0.01387902]
...
[0.01810448 0.03964113]
[0.0197202 0.03355308]
[0.01443354 0.03587443]]
similarityMatrix: [[0.00135516 0.00407717]
[0.00425177 0.01086762]
[0.00294433 0.01387902]
...
[0.01810448 0.03964113]
[0.0197202 0.03355308]
[0.01443354 0.03587443]]
similarityMatrix: [[0.00135516 0.00407717]
[0.00425177 0.01086762]
[0.00294433 0.01387902]
...
[0.01810448 0.03964113]
[0.0197202 0.03355308]
[0.01443354 0.03587443]]
similarityMatrix: [[0.00135516 0.00407717]
[0.00425177 0.01086762]
[0.00294433 0.01387902]
...
[0.01810448 0.03964113]
[0.0197202 0.03355308]
[0.01443354 0.03587443]]
similarityMatrix: [[-0.00386223 0.05196955]
[-0.01208056 0.01301738]
[-0.00864888 0.07728339]
...
[ 0.07501562 0.06743108]
[ 0.04265917 -0.02113316]
[-0.00286139 0.00725867]]
similarityMatrix: [[ 0.00651897 0.04072105]
[-0.00035075 0.01781439]
[-0.0002584 0.06640069]
...
[ 0.00570145 0.04794132]

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```
[ 0.01059513    0.03430749]
[ 0.00310867    0.01105791]]
similarityMatrix: [[ 0.00460635   0.03916698]
[-0.00097854   0.01687207]
[-0.00146244   0.06261136]
...
[-0.00092373   0.04730669]
[-0.00410831   0.03726129]
[ 0.00124594   0.01112408]]
similarityMatrix: [[ 0.00466785   0.03897518]
[-0.00077827   0.01672333]
[-0.00150249   0.06230119]
...
[-0.0016506     0.04727861]
[-0.00408541    0.03704665]
[ 0.0015001      0.01099951]]
similarityMatrix: [[ 0.00466785   0.03897518]
[-0.00077827   0.01672333]
[-0.00150249   0.06230119]
...
[-0.0016506     0.04727861]
[-0.00408541    0.03704665]
[ 0.0015001      0.01099951]]
similarityMatrix: [[ 0.00466785   0.03897518]
[-0.00077827   0.01672333]
[-0.00150249   0.06230119]
...
[-0.0016506     0.04727861]
[-0.00408541    0.03704665]
[ 0.0015001      0.01099951]]
similarityMatrix: [[ 0.00466785   0.03897518]
[-0.00077827   0.01672333]
[-0.00150249   0.06230119]
...
[-0.0016506     0.04727861]
[-0.00408541    0.03704665]
[ 0.0015001      0.01099951]]
similarityMatrix: [[ 0.00466785   0.03897518]
[-0.00077827   0.01672333]
[-0.00150249   0.06230119]
...
[-0.0016506     0.04727861]
[-0.00408541    0.03704665]
[ 0.0015001      0.01099951]]
```

```
[ 0.0015001  0.01099951]]
similarityMatrix: [[0.02496155 0.00772217]
[0.04049818 0.01522598]
[0.0639814  0.03396898]
...
[0.0313642  0.03864437]
[0.09727227 0.10286922]
[0.00133408 0.00815965]]
similarityMatrix: [[0.04218884 0.03028988]
[0.02474497 0.02073176]
[0.03092541 0.02749274]
...
[0.02111343 0.02755316]
[0.06519457 0.04594426]
[0.02879823 0.03264413]]
similarityMatrix: [[0.05118818 0.01214795]
[0.02455737 0.02095341]
[0.02955745 0.0300579 ]
...
[0.01856379 0.03280573]
[0.06989101 0.03599758]
[0.03021213 0.03000376]]
similarityMatrix: [[0.05368177 0.00333798]
[0.02418076 0.0214853 ]
[0.02741518 0.03484898]
...
[0.01959302 0.03172145]
[0.06600948 0.04175277]
[0.0316998  0.02668836]]
similarityMatrix: [[0.05433252 0.00325153]
[0.02407375 0.02178332]
[0.02633634 0.03695856]
...
[0.02010434 0.03031682]
[0.06358743 0.04754782]
[0.03247272 0.02516885]]
similarityMatrix: [[0.05508643 0.00342441]
[0.02418219 0.02163962]
[0.02583382 0.0376242 ]
...
[0.02046071 0.02925327]
[0.06222238 0.0508524 ]
[0.03345219 0.0234248 ]]
similarityMatrix: [[0.05570876 0.0032544 ]
[0.02430942 0.02144122]
[0.02572713 0.03759347]
...
[0.02076722 0.02847083]
[0.06086376 0.05375731]
[0.03406976 0.02241446]]
similarityMatrix: [[0.05642524 0.00439333]
[0.02412579 0.02191095]
[0.02515486 0.03808596]
...
[0.02107549 0.02754736]
[0.05848358 0.05844199]
[0.03486372 0.0215067 ]]
```

```
similarityMatrix: [[0.05821474 0.00726625]
 [0.02410456 0.02218172]
 [0.02333511 0.03946793]
 ...
 [0.02166924 0.02594568]
 [0.05270446 0.06725561]
 [0.03831043 0.0176906 ]]
similarityMatrix: [[0.06090175 0.01097196]
 [0.02368568 0.02293717]
 [0.02101029 0.0400385 ]
 ...
 [0.02422968 0.02233831]
 [0.03912162 0.08136022]
 [0.04476132 0.01284447]]
similarityMatrix: [[ 0.00840603 -0.00332683]
 [ 0.0132263  0.04190185]
 [ 0.03566846  0.0184155 ]
 ...
 [ 0.07034431  0.02720409]
 [ 0.02091621  0.01208402]
 [ 0.07261625  0.01961963]]
similarityMatrix: [[0.003664  0.00459628]
 [0.02111557 0.02506026]
 [0.05897849 0.03795515]
 ...
 [0.08895745 0.04185284]
 [0.03900539 0.01444621]
 [0.08993972 0.0424404 ]]
similarityMatrix: [[0.00260646 0.00639824]
 [0.02238161 0.02225319]
 [0.06500166 0.02970981]
 ...
 [0.09627726 0.03460031]
 [0.04454449 0.00753452]
 [0.09952287 0.0311258 ]]
similarityMatrix: [[0.00315085 0.00507893]
 [0.02409732 0.01986084]
 [0.0695626  0.0284592 ]
 ...
 [0.1019701  0.03561598]
 [0.04692231 0.00960302]
 [0.10721425 0.03031522]]
similarityMatrix: [[0.0042457  0.00361  ]
 [0.0247324  0.01953787]
 [0.07293521 0.02858223]
 ...
 [0.10692845 0.03638223]
 [0.04861498 0.01131379]
 [0.11312985 0.0310056 ]]
similarityMatrix: [[0.00591553 0.00163457]
 [0.02428232 0.02003799]
 [0.07271711 0.02857256]
 ...
 [0.10676775 0.03614699]
 [0.04843475 0.01130188]
 [0.11291627 0.03076305]]
similarityMatrix: [[0.00599682 0.00151157]
```

```

[0.02423041 0.02007425]
[0.07242457 0.02865428]
...
[0.10637902 0.03618312]
[0.04810211 0.01147399]
[0.11253588 0.03071932]]
similarityMatrix: [[0.00596182 0.00153996]
[0.02413468 0.02017655]
[0.07234764 0.02861361]
...
[0.10627664 0.03609267]
[0.04806694 0.01140489]
[0.11239678 0.03063763]]
similarityMatrix: [[0.00596182 0.00153996]
[0.02413468 0.02017655]
[0.07234764 0.02861361]
...
[0.10627664 0.03609267]
[0.04806694 0.01140489]
[0.11239678 0.03063763]]
similarityMatrix: [[0.00596182 0.00153996]
[0.02413468 0.02017655]
[0.07234764 0.02861361]
...
[0.10627664 0.03609267]
[0.04806694 0.01140489]
[0.11239678 0.03063763]]
For K= 19 silhouette_coefficient Score is 0.003629

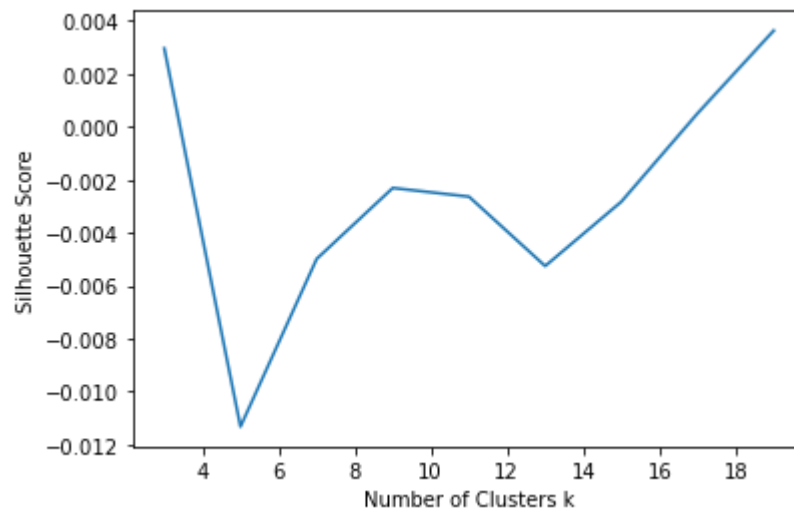
```

```

In [17]: # Plotting silhouette score
import matplotlib.pyplot as plt
%matplotlib inline
plt.plot(k_values, scores)
plt.xlabel('Number of Clusters k')
plt.ylabel('Silhouette Score')

```

Out[17]: Text(0, 0.5, 'Silhouette Score')



```
In [19]: # How to get the ideal number of documents
from sklearn.decomposition import PCA, IncrementalPCA
mat3_pca.shape
pca = PCA(n_components=7200)

principalComponents = pca.fit_transform(mat3_pca.toarray())

principalComponents

principalComponents.shape

cs = np.cumsum(pca.explained_variance_/np.sum(pca.explained_varia
cs[cs>0.7]

for e in range(len(cs)):
    if cs[e]> 0.99:
        print(e)
        break

cs[2087]
```

6603

Out[19]: 0.7072794257746017

In []: