notebook

November 4, 2020

[4]:

```
# -*- coding: utf-8 -*-
"""
Created on Fri Oct  9 16:49:38 2020

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"""
import numpy as np
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
from sklearn.metrics import silhouette_samples, silhouette_score

#load file dist1.npy(from lab3_ex011.py)
dist1=np.load('dist1.npy')
```

[5]:

```
#finction clust
def clust(dist,n_cl):

#cluster the data into k clusters, specify the k
    kmeans = KMeans(n_clusters = n_cl)
    kmeans.fit(dist)
    #labels_ = best_label // its the symbol for each point (vector) to which␣
 ↪center
    #from couple of seeds and its detail the number cluster
    labels = kmeans.labels_ +1
    # its will be shaped like [1,46(data vectors)] something like this yes
#show the clustering results
    fig = plt.figure()
    # defines the size of the plot in squares where [0,0,1,1] will be a regular␣
 ↪plot
    ax = fig.add_axes([0,0,1,1])
    ax.bar(range(len(labels)),labels)
    plt.show()

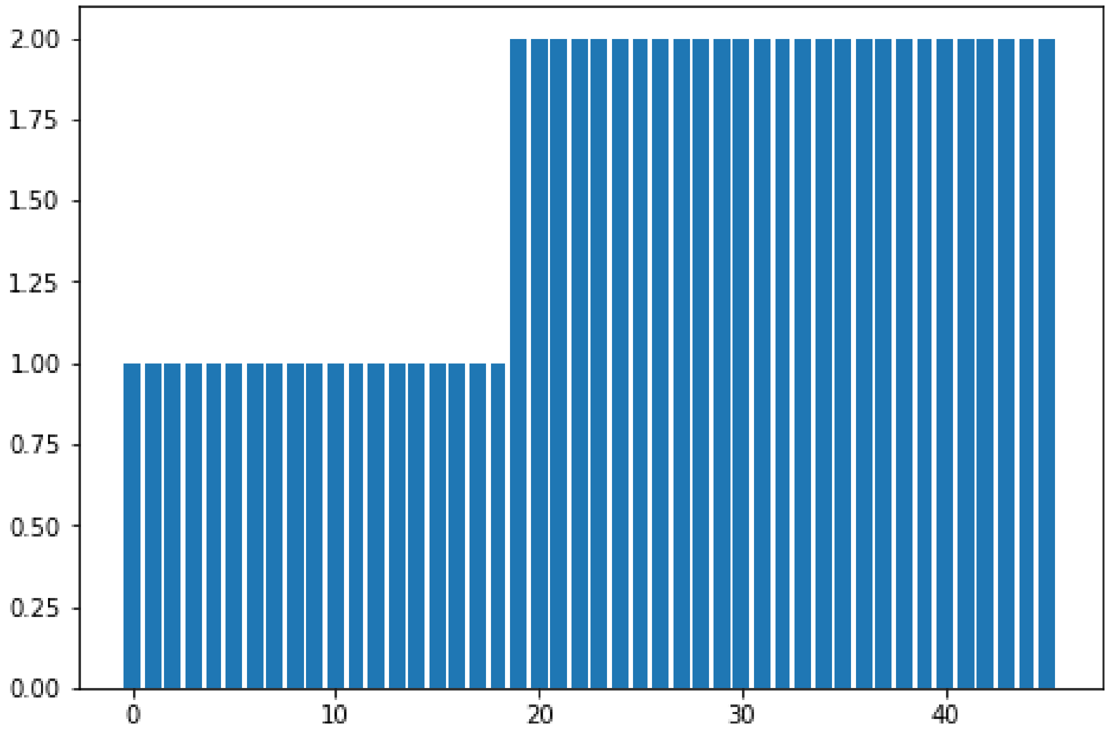
# calculate the silhouette values
    silhouette_avg_ = silhouette_score(dist, labels)
    sample_silhouette_values_ = silhouette_samples(dist, labels)
    print(silhouette_avg_)
```

```
# show the silhouette values
    plt.plot(sample_silhouette_values_)
    plt.plot([silhouette_avg_]*46, 'r--') #useless line
    plt.title("The silhouette plot for the various vectors.")
    plt.xlabel("data number ")
    plt.ylabel("silhouette value for each value")
    y=silhouette_avg_
    xmin=0
    xmax=len(labels)
# The vertical line for average silhouette score of all the values
    plt.hlines(y, xmin, xmax, colors='red', linestyles="--")
    plt.show()

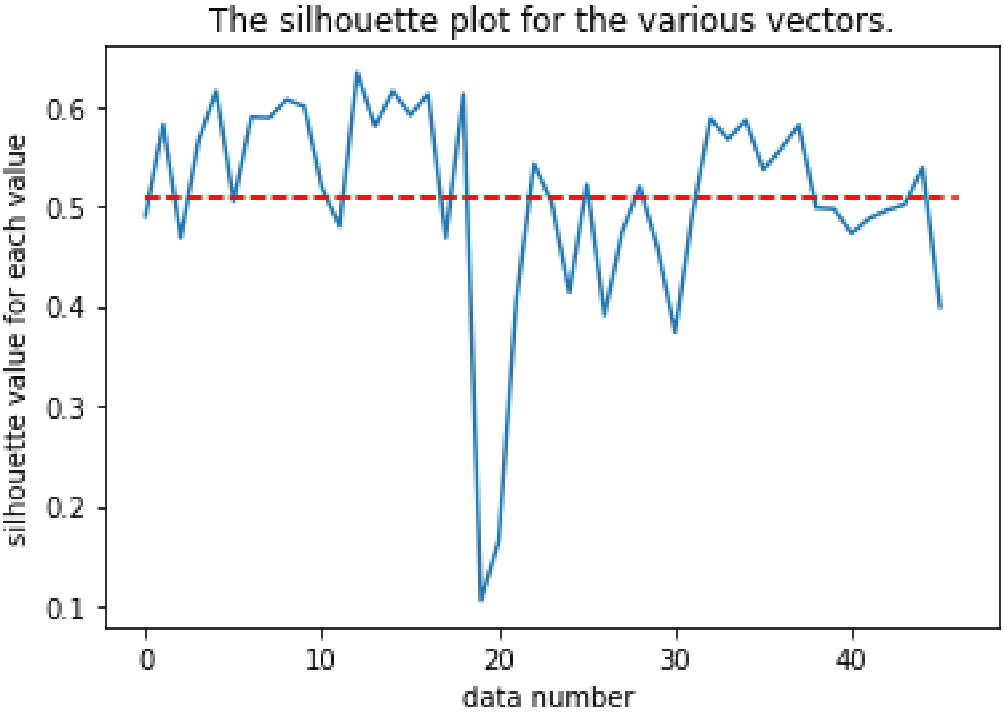
    print("For n_clusters =", n_cl,
      "The average silhouette_score is:", silhouette_avg_)
    return labels
```

[23]:

```
labels2 = clust(dist1, 2)
```



```
0.5086548846354738
```



```
For n_clusters = 2 The average silhouette_score is: 0.5086548846354738
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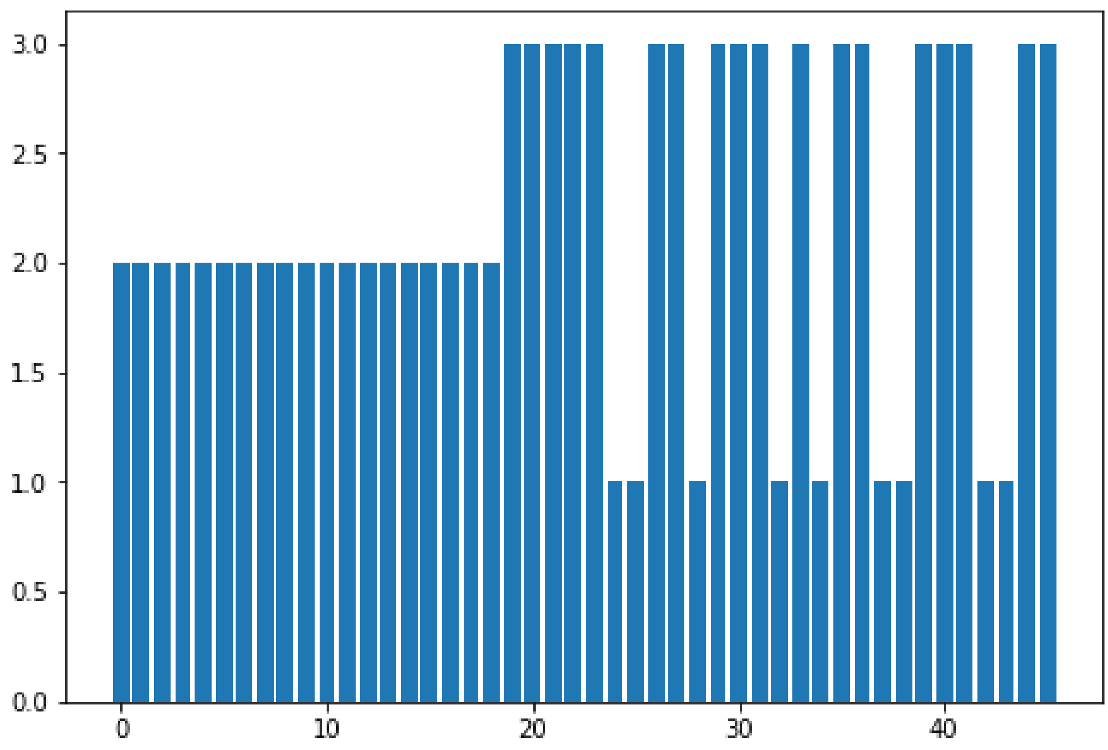
[13]:

```
labels2 = clust(dist1, 3)
```



```
0.3067475245079877
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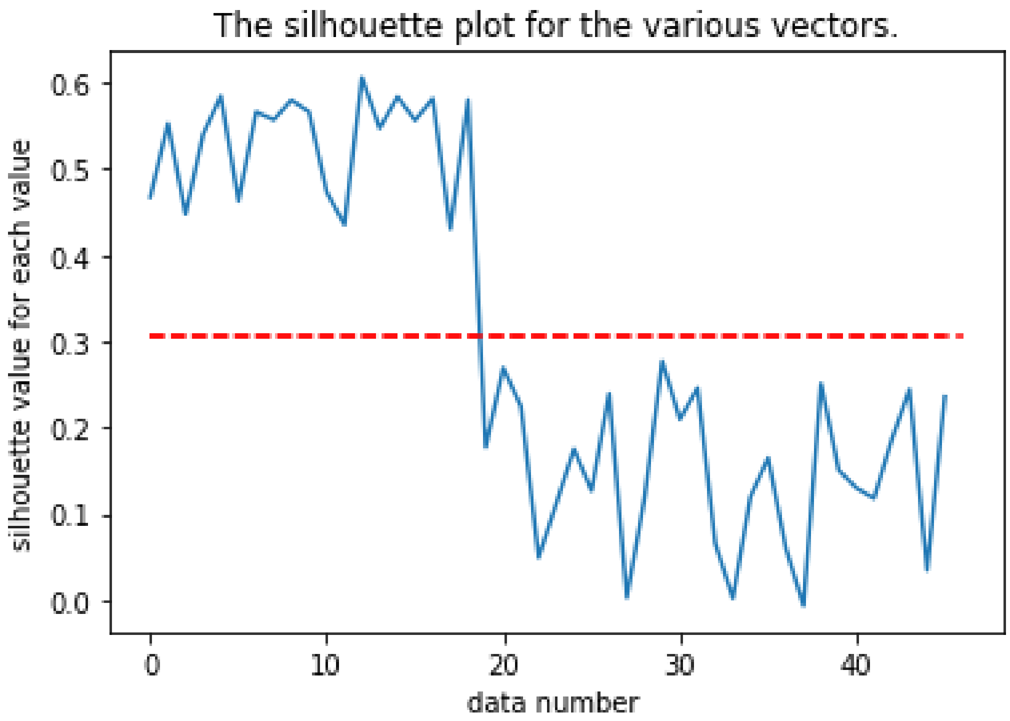

```
For n_clusters = 3 The average silhouette_score is: 0.3067475245079877
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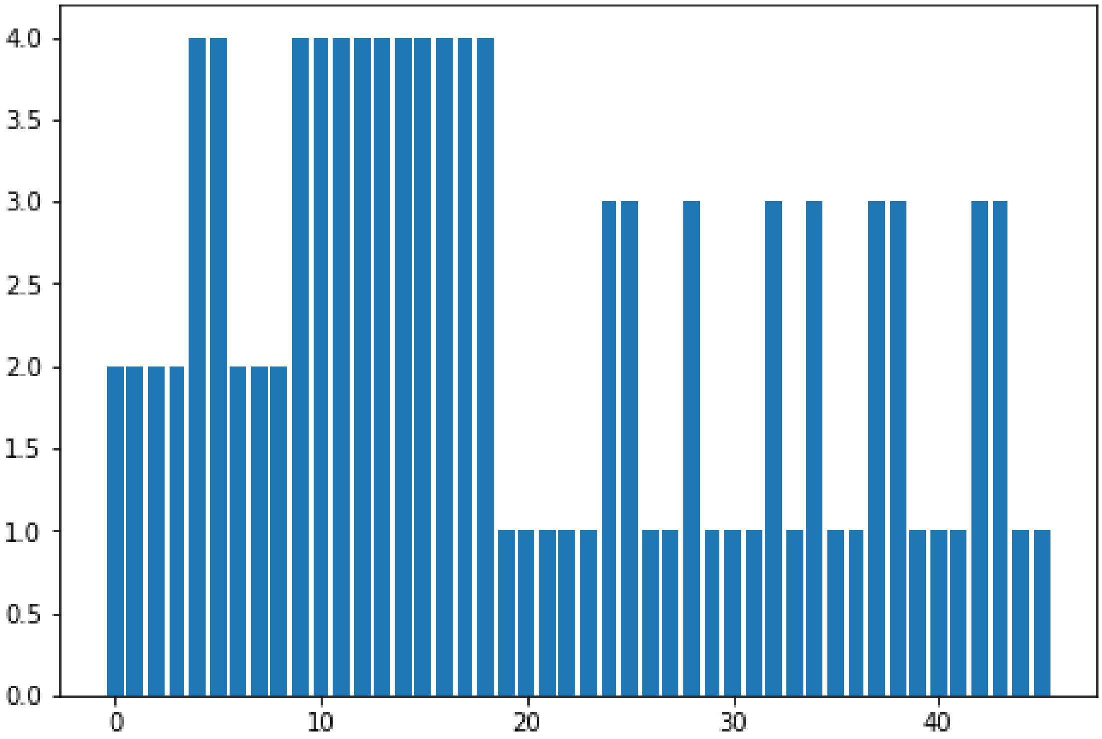
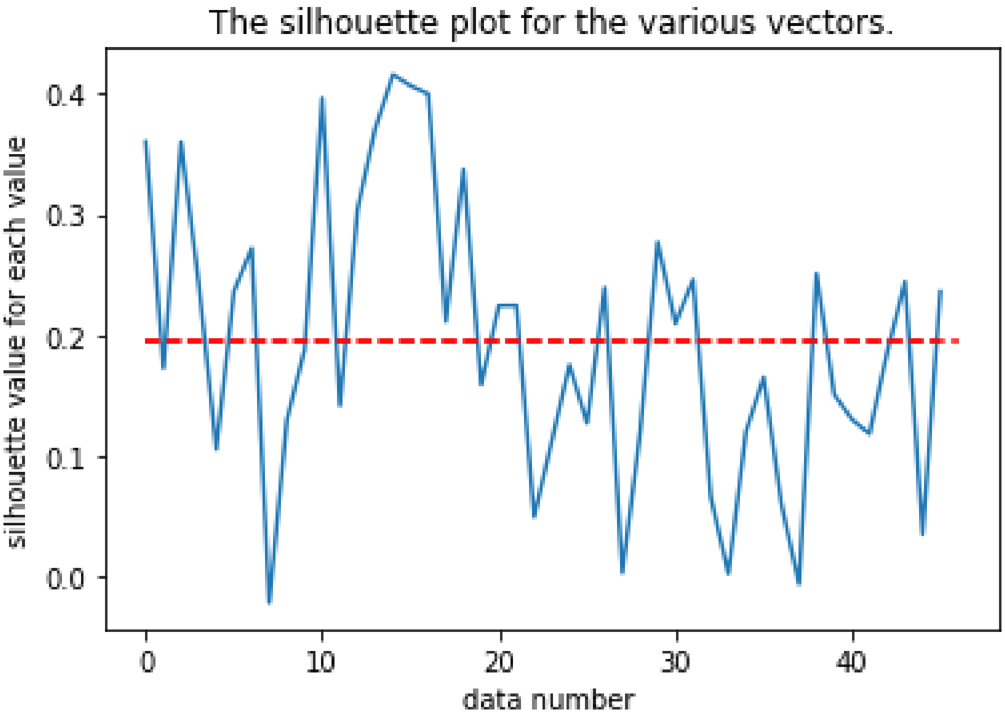
[24]:

```
labels2 = clust(dist1, 4)
```



```
0.1947751256086064
```



```
For n_clusters = 4 The average silhouette_score is: 0.1947751256086064
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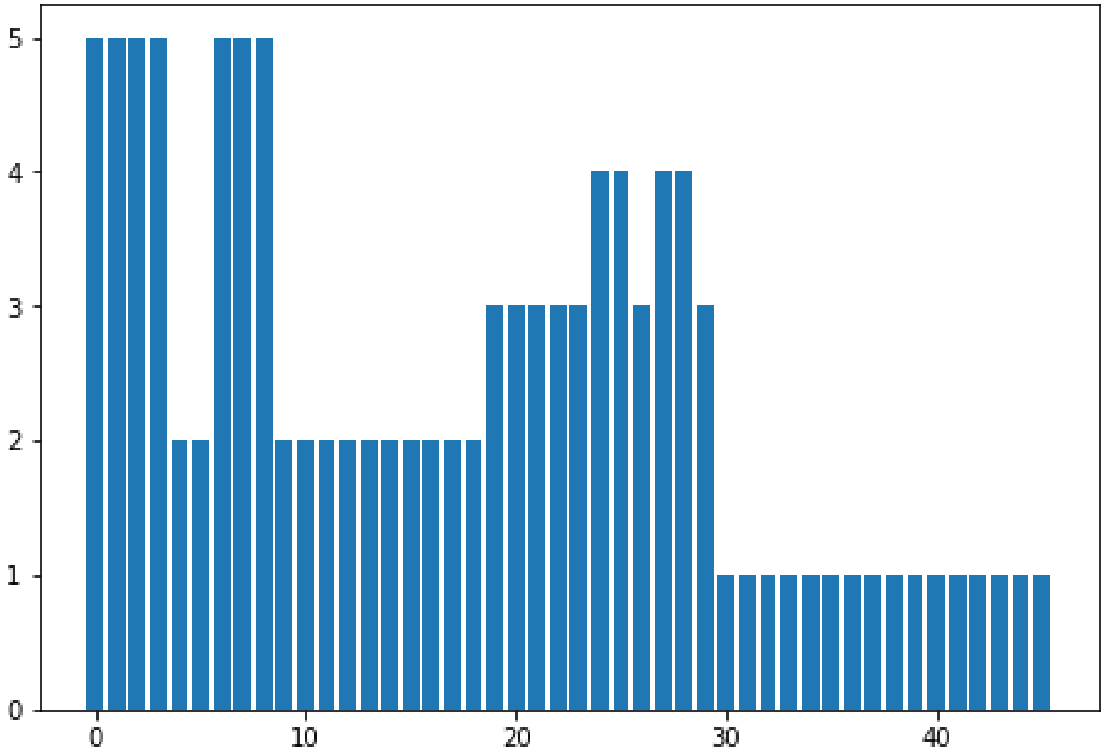
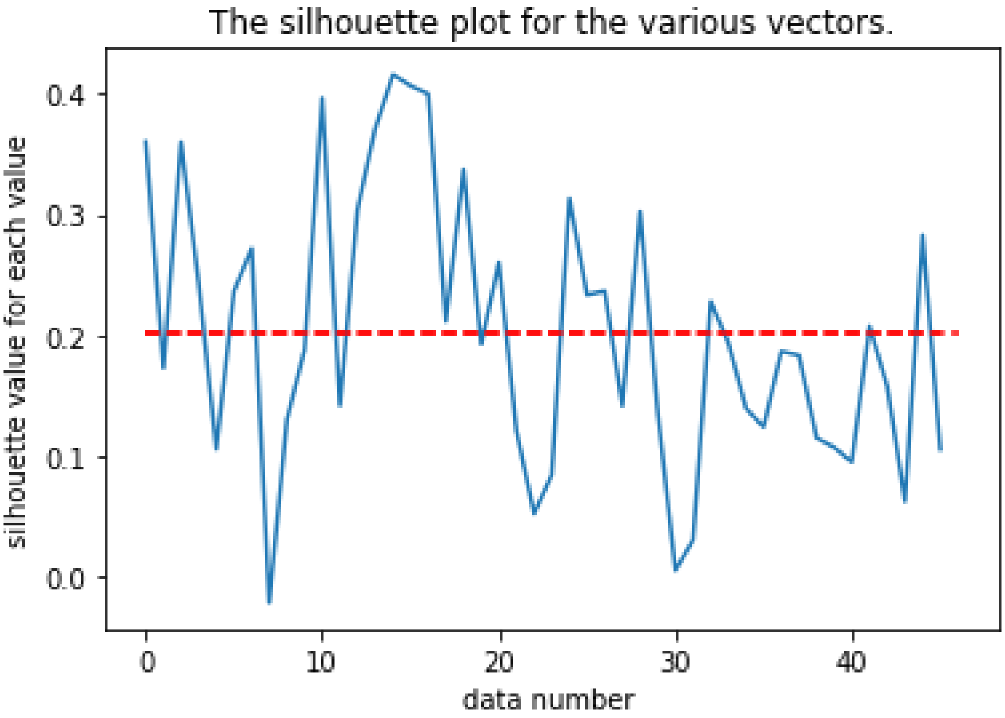
[26]:

```
labels2 = clust(dist1, 5)
```

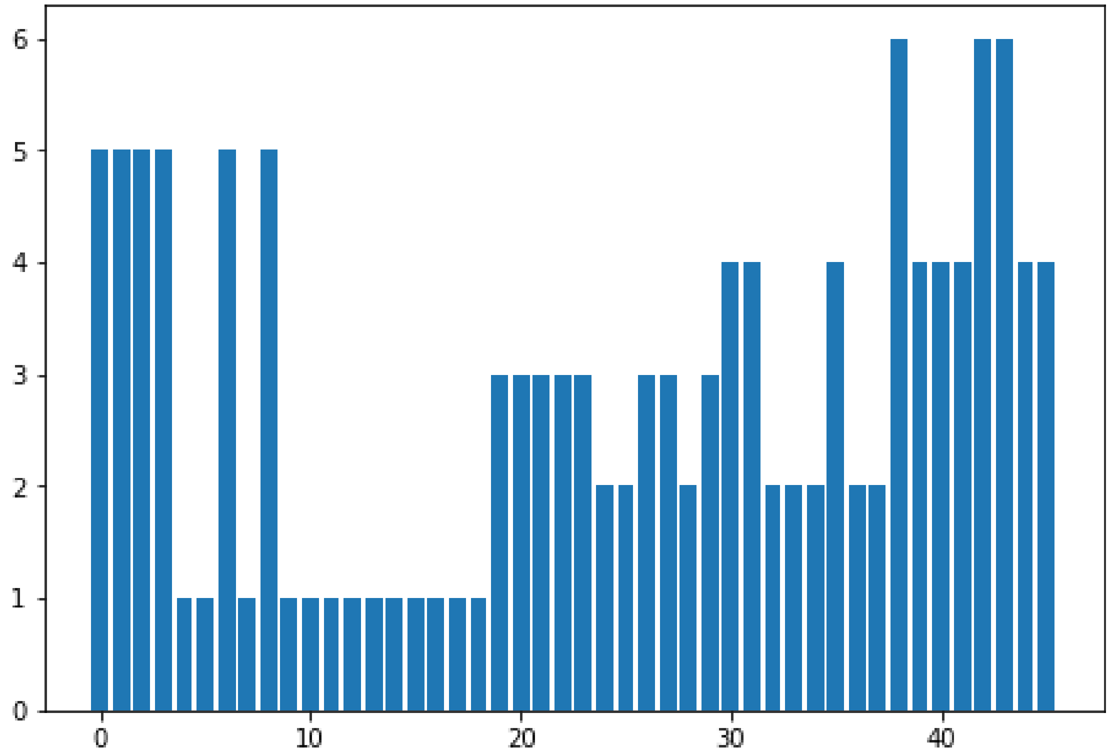


```
0.2027582792538868
```



```
For n_clusters = 5 The average silhouette_score is: 0.2027582792538868
```

[27]:
```
labels2 = clust(dist1, 6)
```



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0.19413998226945137
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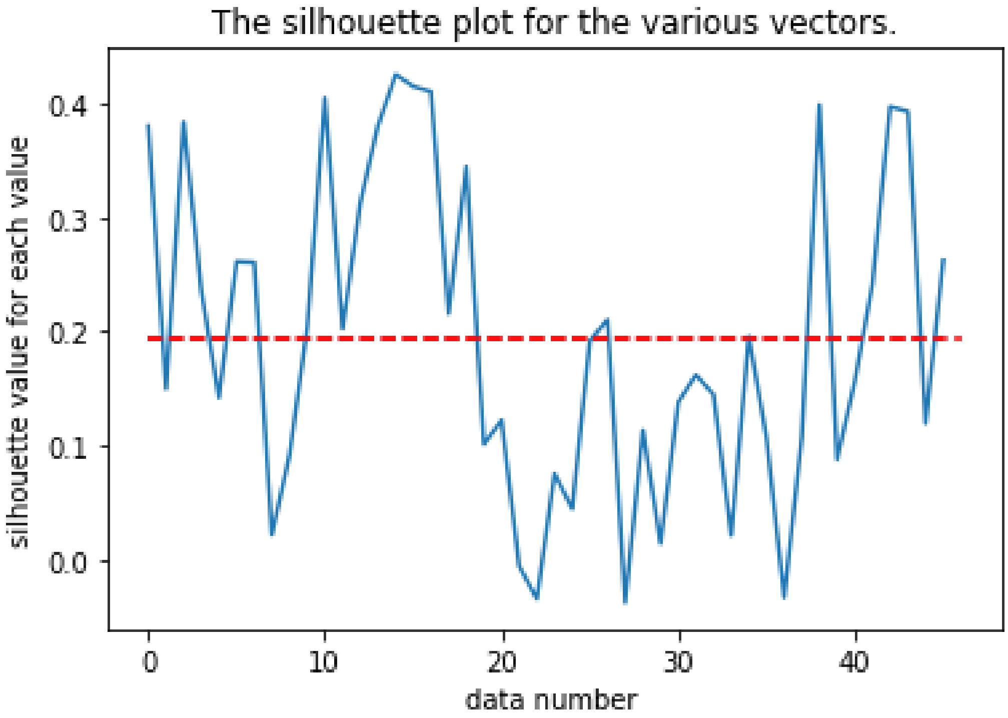

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For n_clusters = 6 The average silhouette_score is: 0.19413998226945137
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[28]:
```
labels2 = clust(dist1, 20)
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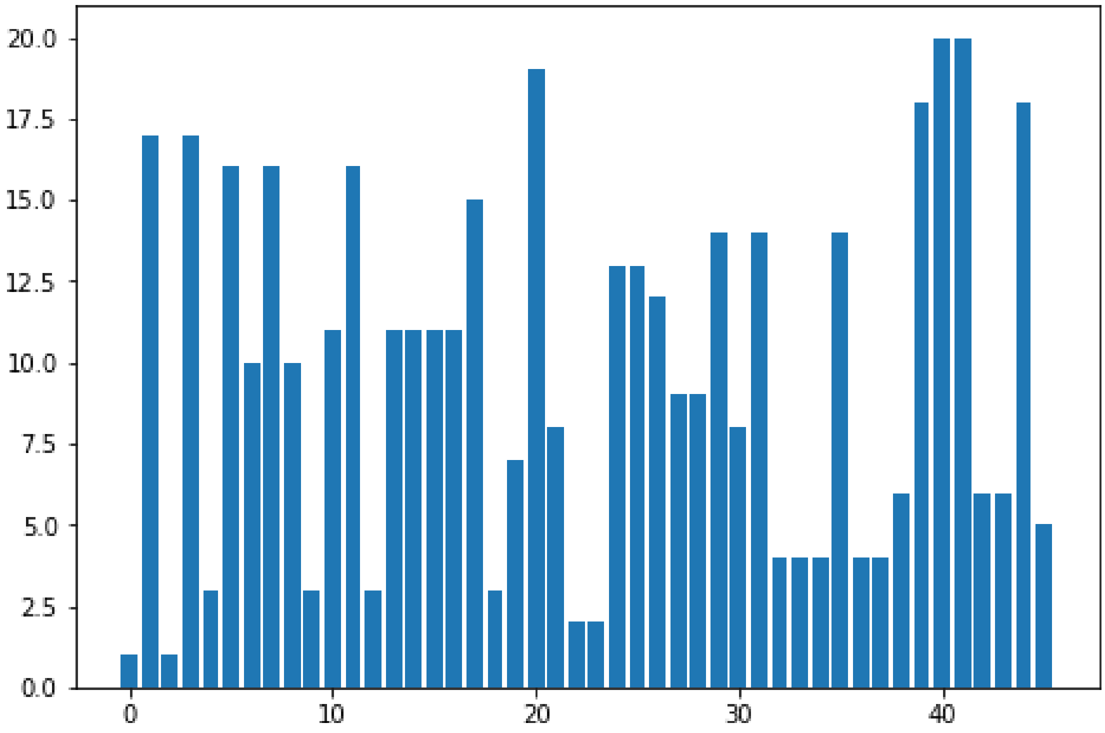
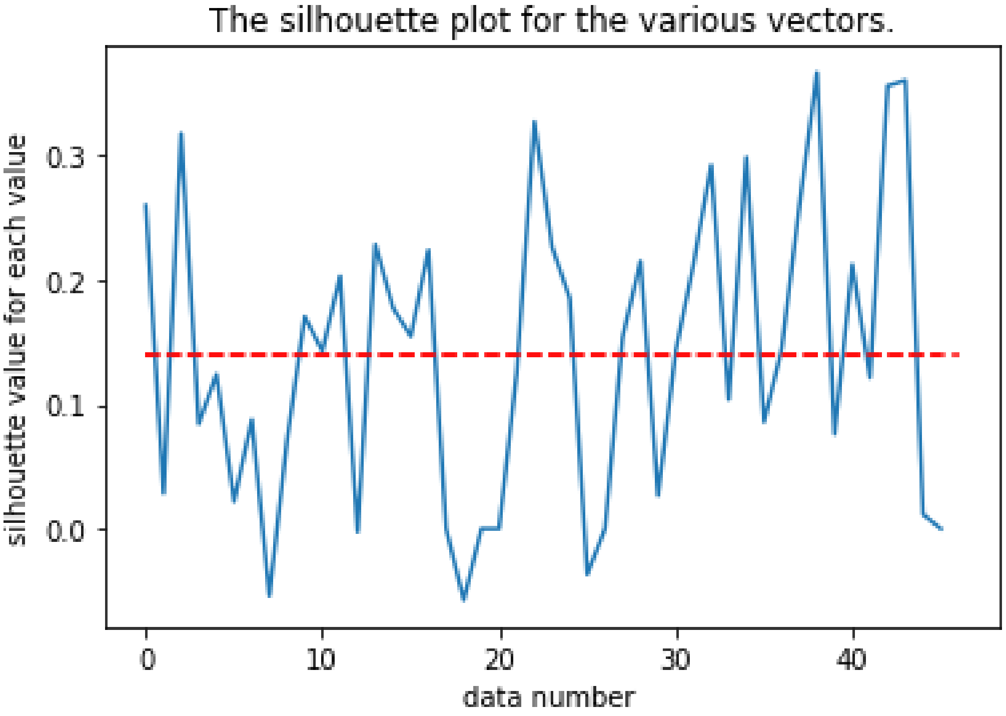


```
0.14028744286532577
```



```
For n_clusters = 20 The average silhouette_score is: 0.14028744286532577
```

[30]:

```
# import regular expressins packge
# import numbers package
import re
import numpy as np

from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
from sklearn.metrics import silhouette_samples, silhouette_score


#functions defonotion
def readFile(fileName):
    file = open(fileName,'r',encoding="cp437")
    fileStr = ""
    for line in file:
        fileStr += line
    return fileStr

# Remove extra spaces
# Remove non-letter chars
# Change to lower
def preProcess(fileStr):
    fileStr = re.sub(" +"," ", fileStr)
    fileStr = re.sub("[^a-zA-Z ]","", fileStr)
    fileStr = fileStr.lower()
    return fileStr

#Divide the file in chuncks of the same size wind
def partition_str(fileStr, wind):
    n = wind
    chunks = [fileStr[i:i+n] for i in range(0, (len(fileStr)//n)*n, n)]
    #print(chunks)
    count = len(chunks)
    return chunks, count;

rows = 3
fileContent = [""]*rows

#read  and preprocess files
fileContent[0] = preProcess(readFile('Eliot.txt'))
fileContent[1] = preProcess(readFile('Tolkien.txt'))
fileContent[2] = preProcess(readFile("DB.txt"))

#wind - chunks size
```

```
wind = 50000
#Divide the each file into chunks of the size wind
chunks1, count1 = partition_str(fileContent[0] , wind)
chunks2, count2 = partition_str(fileContent[1] , wind)
chunks3, count3 = partition_str(fileContent[2] , wind)


# Concatinate all te chunks
rows = count1 + count2 + count3
chunks = chunks1 + chunks2 + chunks3

# Construct dictionary lines 54 - 65
# Concatinate files contents
numFiles = 3
allFilesStr = ""
for i in range(numFiles):
    allFilesStr += fileContent[i]

# Generate a set of all words in files
wordsSet =  set(allFilesStr.split())

# Read stop words file - words that can be removed
stopWordsSet = set(readFile('stopwords_en.txt').split())
# Remove the stop words from the word list
dictionary = wordsSet.difference(stopWordsSet)

# Count the number of dictionary words in files - Frequency Matrix
wordFrequency = np.empty((rows,len(dictionary)),dtype=np.int64)
for i in range(rows):
    print(i)
    for j,word in enumerate(dictionary):

        wordFrequency[i,j] = len(re.findall(word,chunks[i]))

# find the distance matrix between the text files - Distance Matrix
dist = np.empty((rows,rows))
for i in range(rows):
    for j in range(rows):
        # calculate the distance between the frequency vectors
        dist[i,j] = np.linalg.norm(wordFrequency[i,:]-wordFrequency[j,:])

# find the sum of the frequency colomns and select colomns having sum > 100
minSum = 100
sumArray =  wordFrequency.sum(axis=0)
indexArray = np.where(sumArray > minSum)

indexArraySize = len(indexArray[0])
```

```python
wordFrequency1 = np.empty((rows,indexArraySize),dtype=np.int64)

# generate a frequencey file with the selected coloumns
for j in range(indexArraySize):
    wordFrequency1[:,j] = wordFrequency[:,indexArray[0][j]]

 # find the another distance matrix between the text files
dist1 = np.empty((rows,rows))
for i in range(rows):
    for j in range(rows):
        dist1[i,j] = np.linalg.norm(wordFrequency1[i,:]-wordFrequency1[j,:])

np.save('dist2',dist1,allow_pickle = True)
```

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0
1
2
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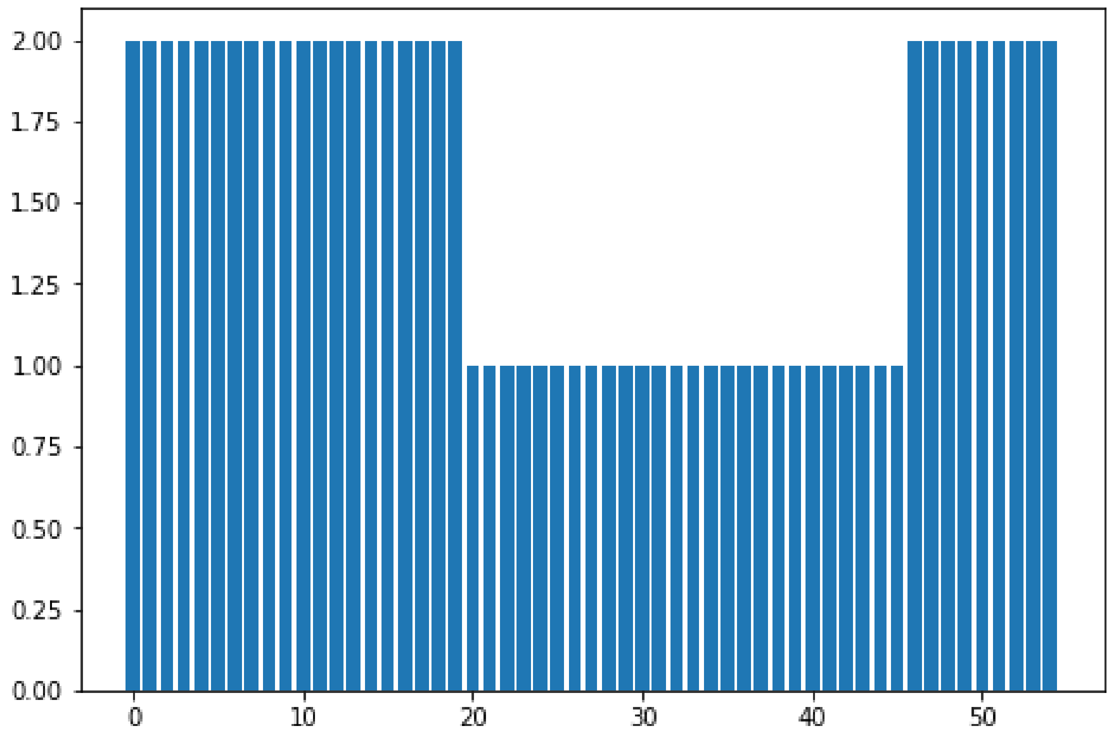
[31]:

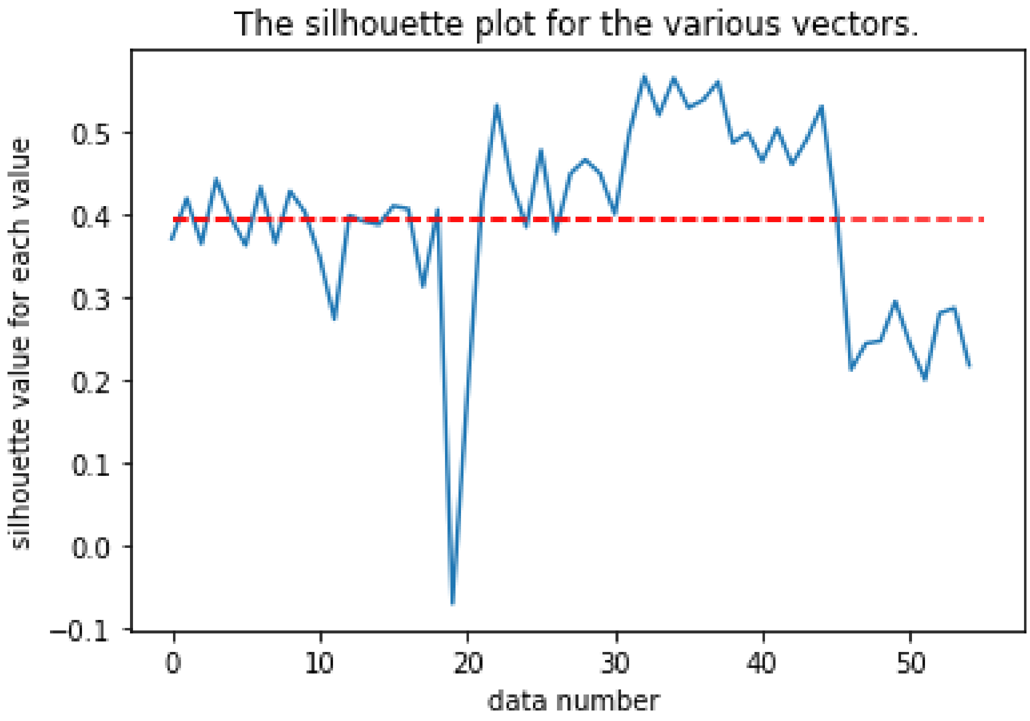
```
dist2=np.load('dist2.npy')
```

[33]:

```
labels2 = clust(dist2, 2)
```



```
0.3930581688497115
```



```
For n_clusters = 2 The average silhouette_score is: 0.3930581688497115
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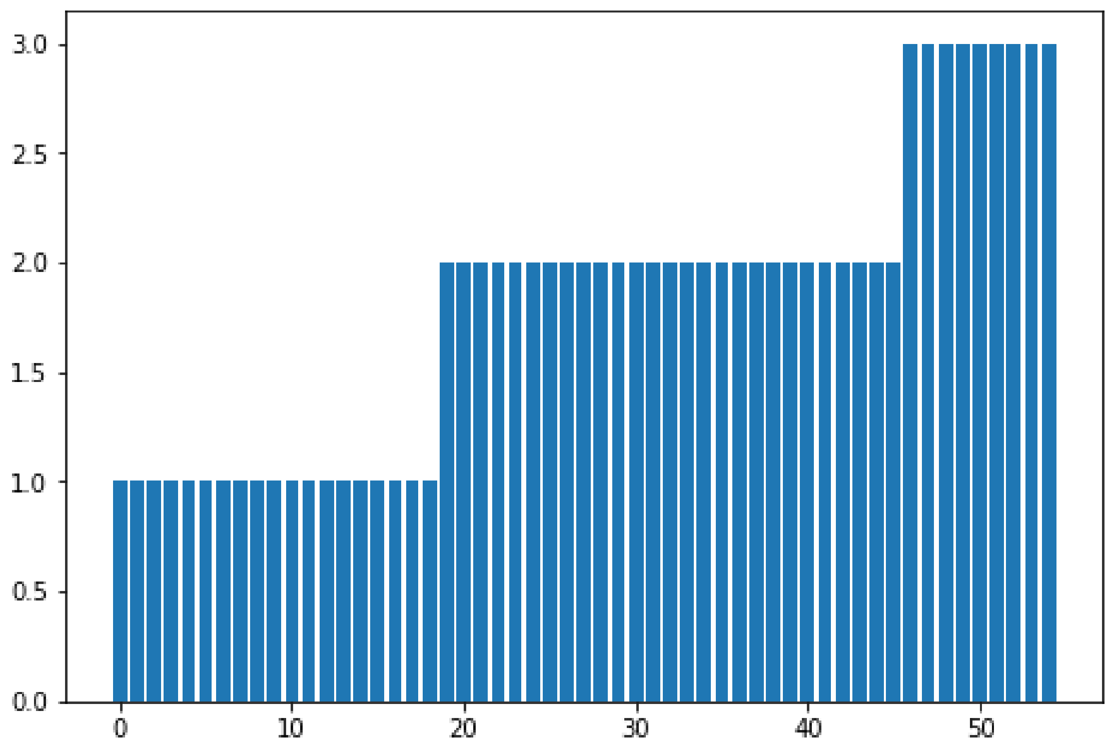
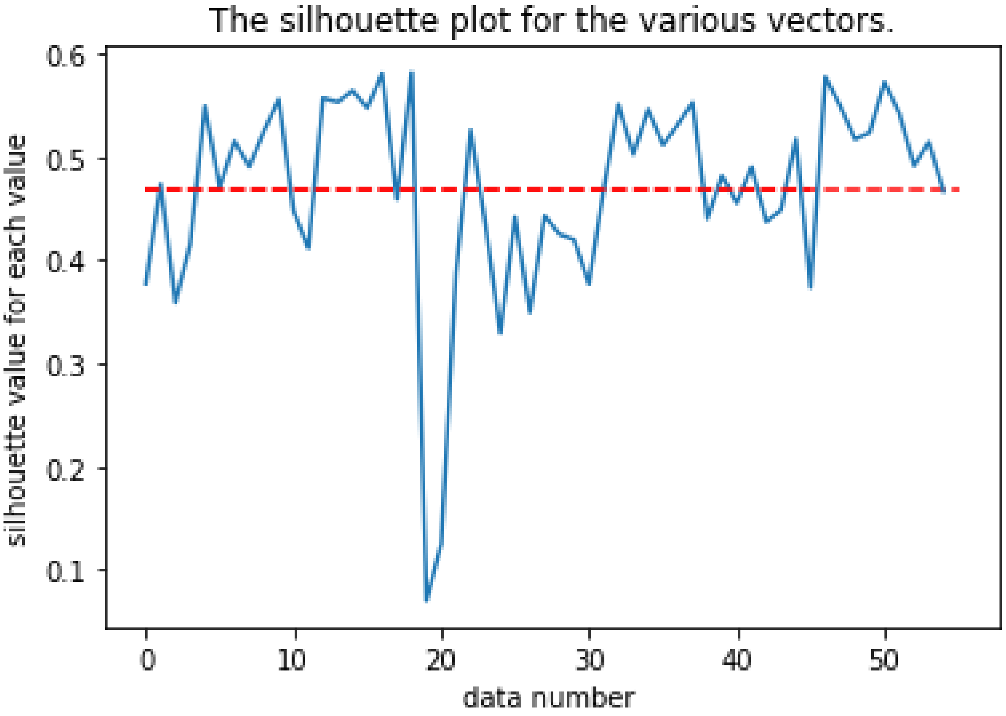
[34]:
```
labels2 = clust(dist1, 3)
```



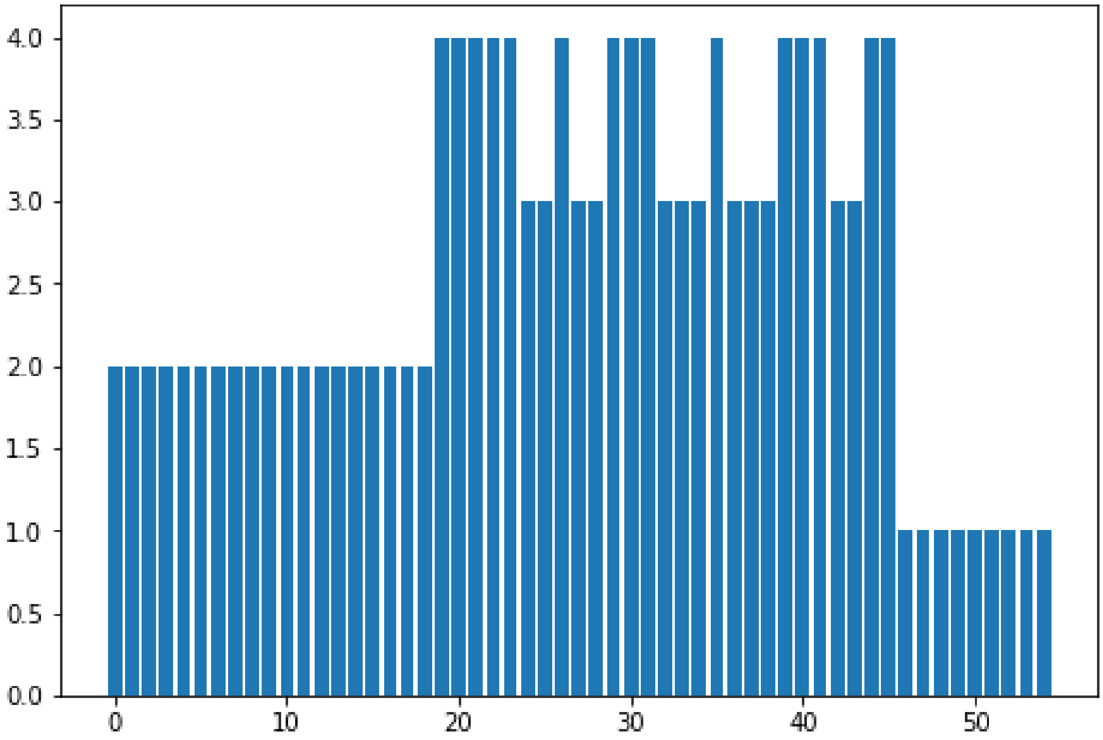
```
0.46958267242826374
```



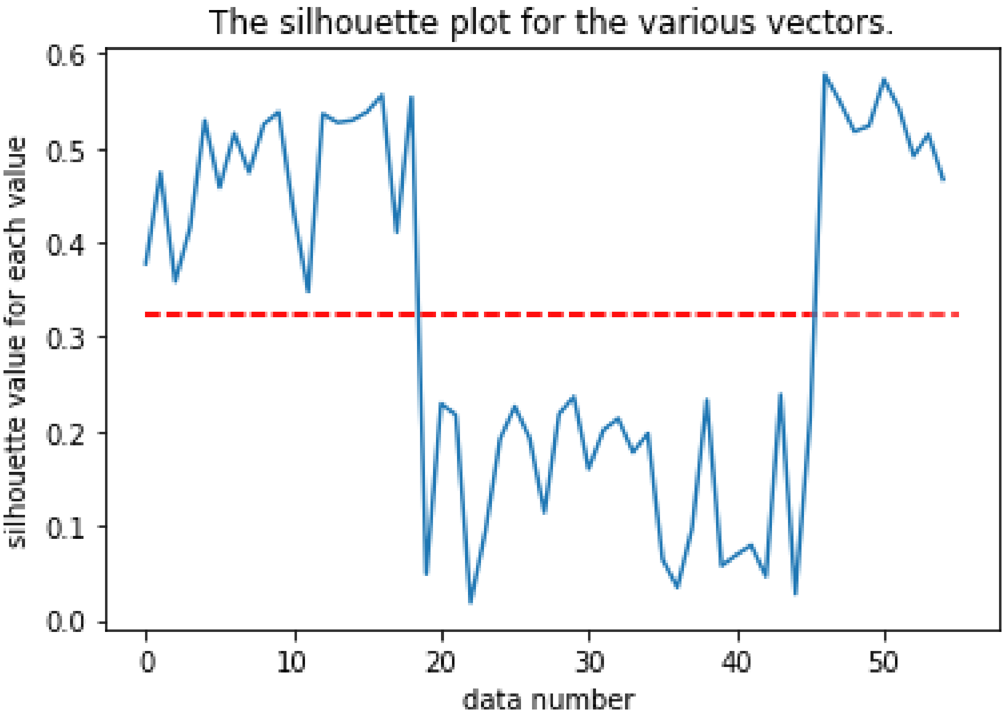
```
For n_clusters = 3 The average silhouette_score is: 0.46958267242826374
```

[36]:

```
labels2 = clust(dist1, 4)
```

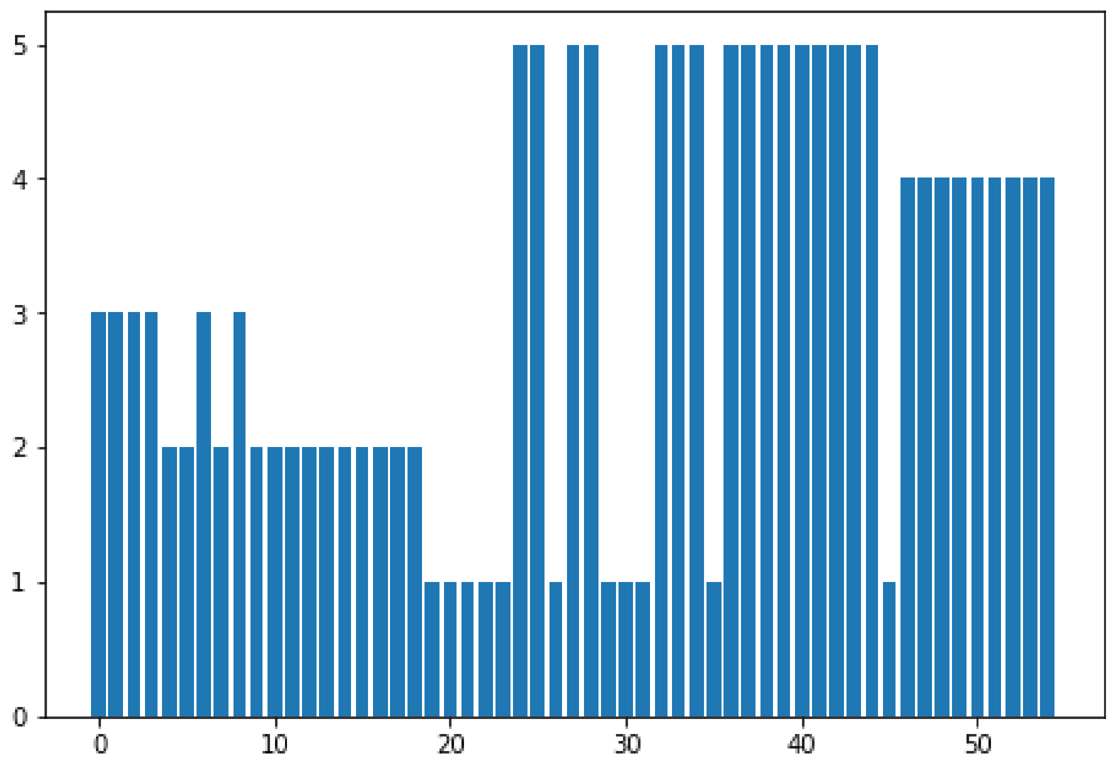


```
0.32282528052683634
```

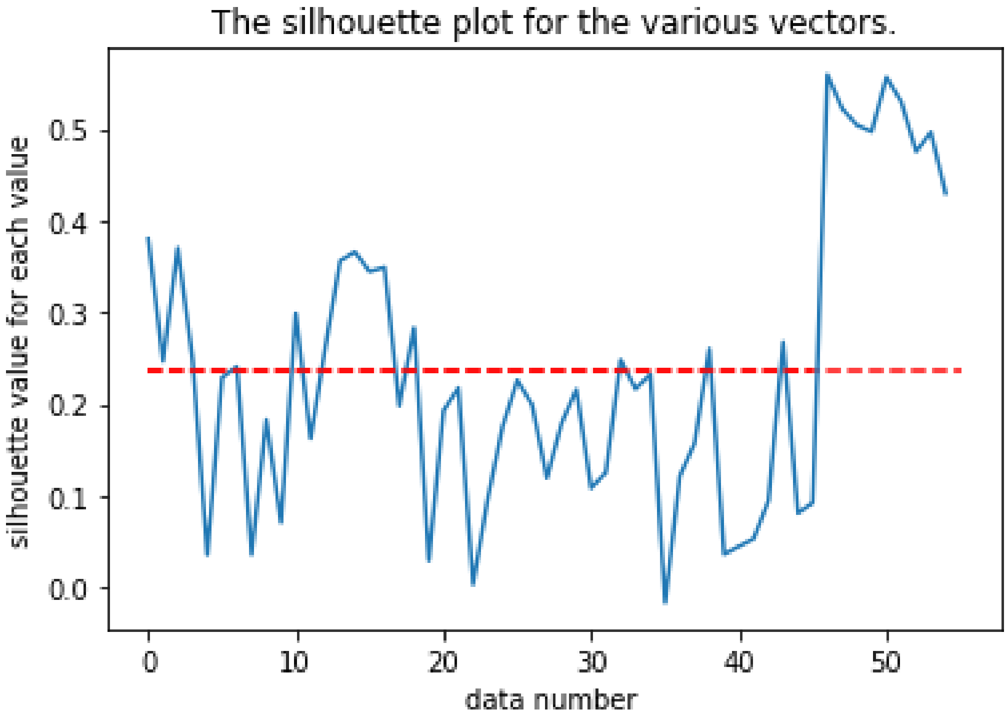


```
For n_clusters = 4 The average silhouette_score is: 0.32282528052683634
```

[37]:
```
labels2 = clust(dist1, 5)
```



```
0.2364056740380302
```



```
For n_clusters = 5 The average silhouette_score is: 0.2364056740380302
```

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[ ]:
```