pd

November 11, 2020

[4]:
```
# -*- coding: utf-8 -*-
"""
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"""
import numpy as np
import re
from sklearn.cluster import KMeans
import matplotlib.pyplot as plt
from sklearn.metrics import silhouette_samples, silhouette_score
```

[5]:
```
#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;
```

[6]:
```
fileContant = preProcess(readFile("text1.txt"))
#wind - chunks size
wind = 5000
#Divide the each file into chunks of the size wind
chunks, count = partition_str(fileContant, wind)
wordsSet =  set(fileContant.split())
stopWordsSet = set(readFile('stopwords_en.txt').split())
dictionary = wordsSet.difference(stopWordsSet)
```

[7]:
```
# Count the number of dictionary words in files - Frequency Matrix
wordFrequency = np.empty((count,len(dictionary)),dtype=np.int64)
for i in range(count):
    print(i)
    for j,word in enumerate(dictionary):
        wordFrequency[i,j] = len(re.findall(word,chunks[i]))
```

```
0
1
2
3
4
5
6
7
8
9
10
11
12
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16
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31
```
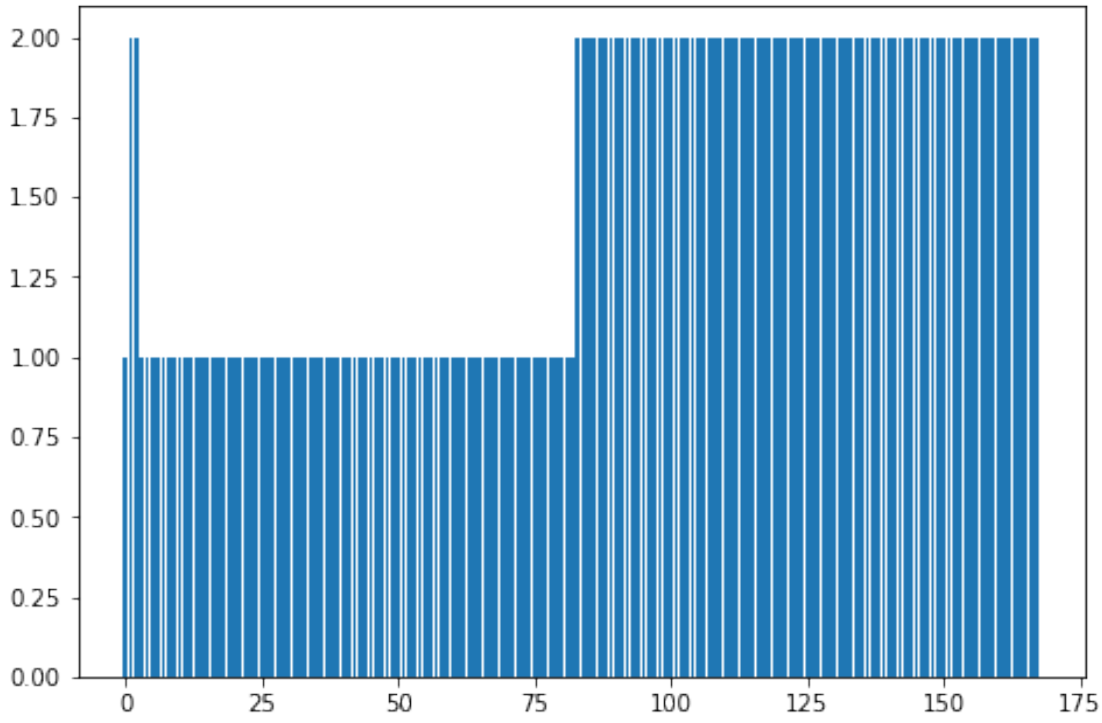

[10]:
```
# find the distance matrix between the text files - Distance Matrix
dist = np.empty((count,count))
for i in range(count):
    for j in range(count):
        # calculate the distance between the frequency vectors
        dist[i,j] = np.linalg.norm(wordFrequency[i,:]-wordFrequency[j,:])
```

```
# 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])
wordFrequency1 = np.empty((count,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((count,count))
for i in range(count):
    for j in range(count):
        dist1[i,j] = np.linalg.norm(wordFrequency1[i,:]-wordFrequency1[j,:])

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

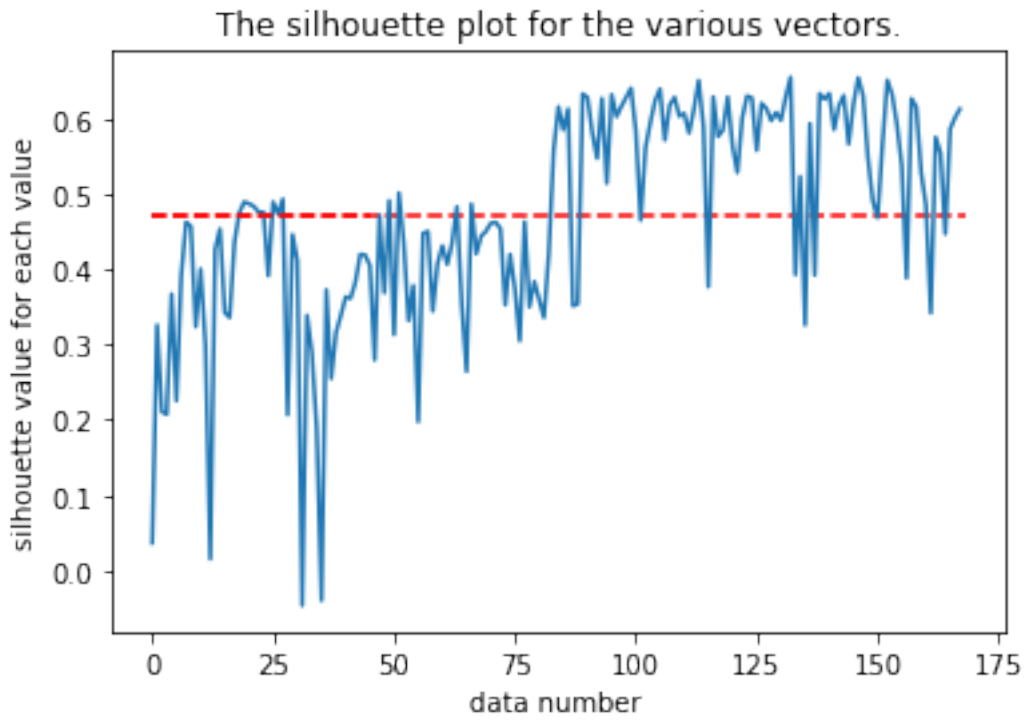
[11]:
```
#finction clust
def clust(dist,n_cl):

#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
```

[16]:
```
dist = np.load('dist2.npy')
labels = clust(dist1, 2)
lab = labels
```

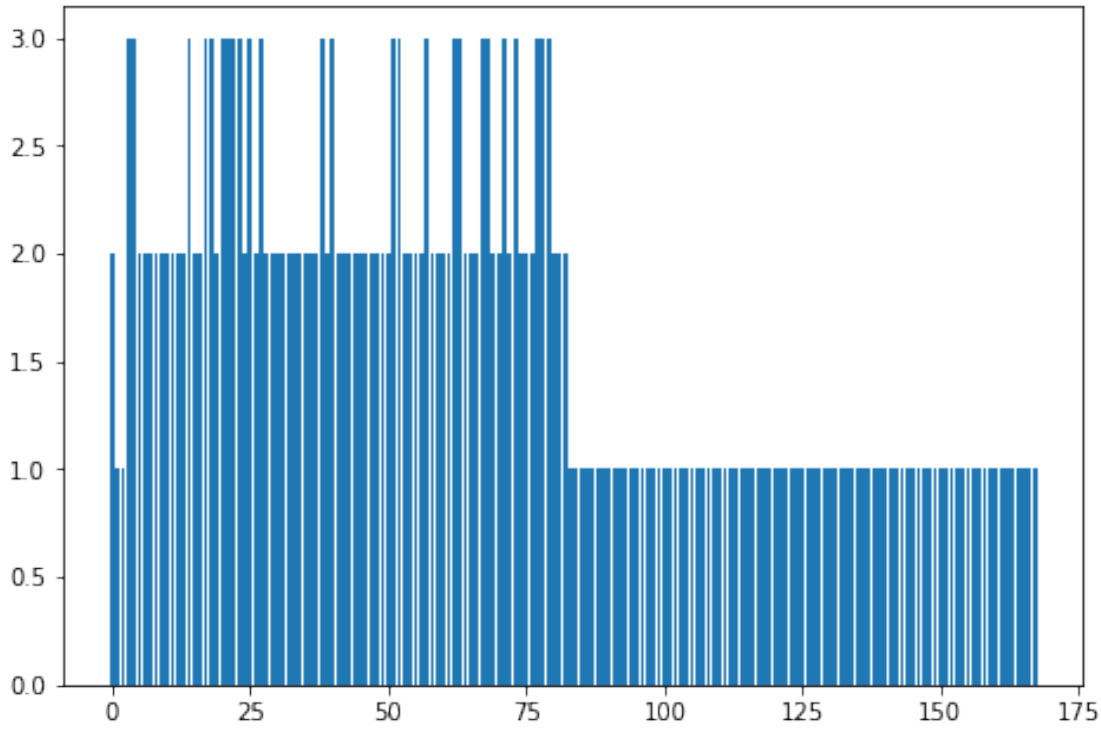



```
0.4712231608404145
```

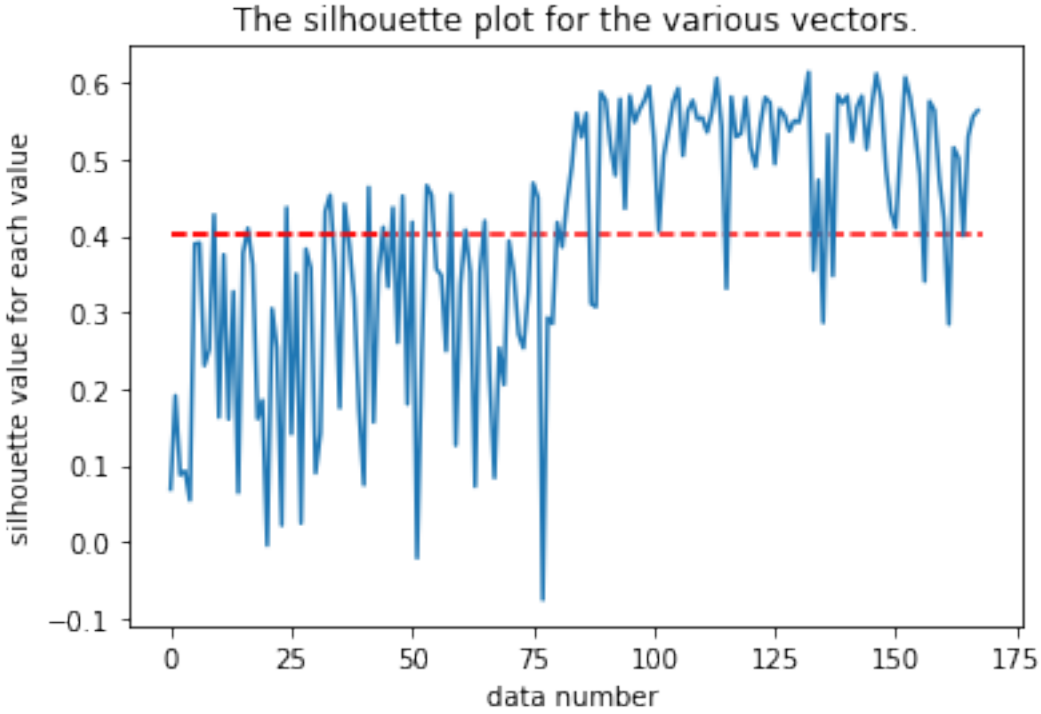



```
For n_clusters = 2 The average silhouette_score is: 0.4712231608404145
```

[13]:
```
labels = clust(dist1, 3)
```

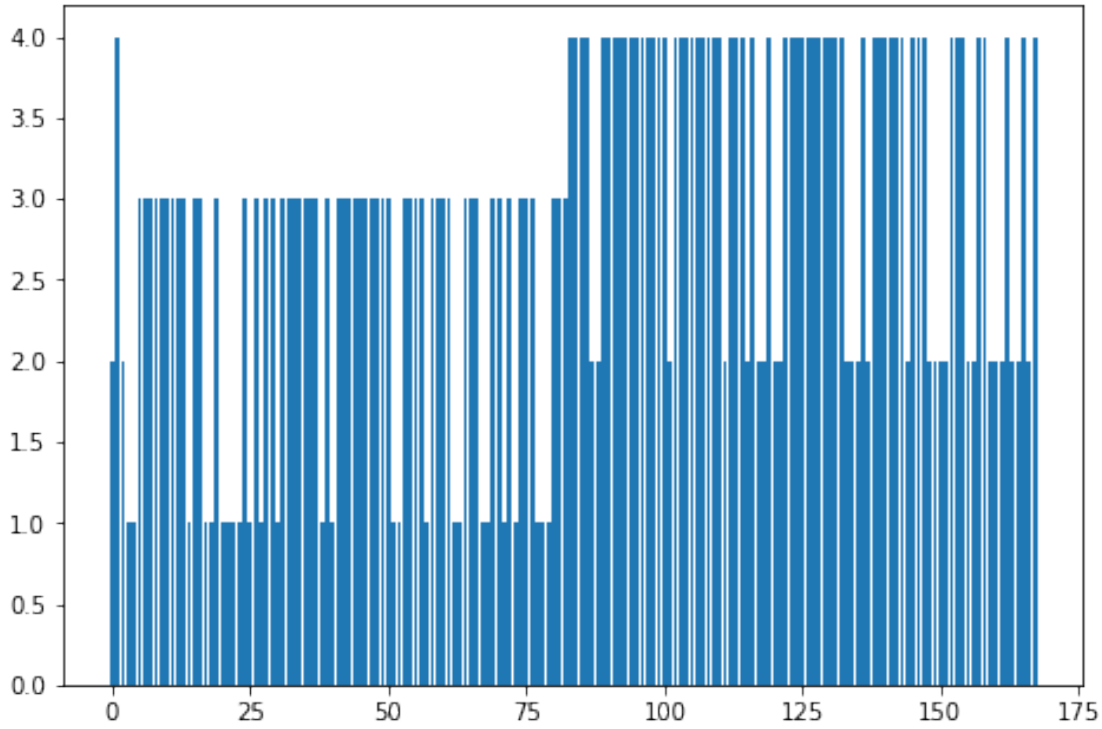



```
0.4006021543430056
```

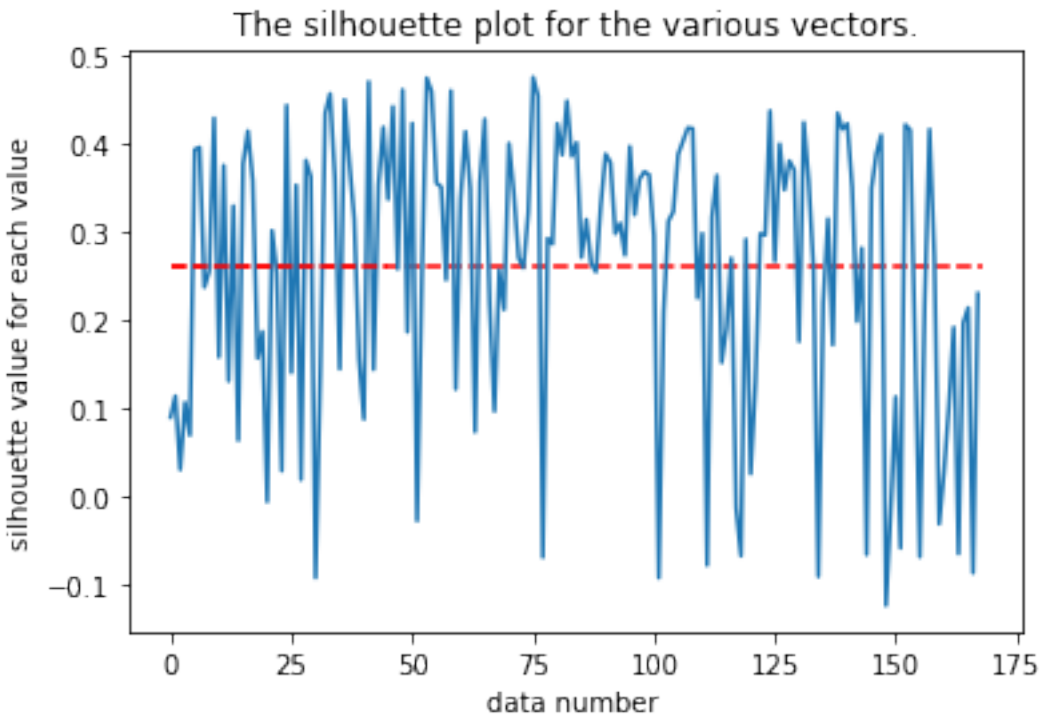


```
For n_clusters = 3 The average silhouette_score is: 0.4006021543430056
```

[14]:
```
labels = clust(dist1, 4)
```




```
0.26073156331512976
```




```
For n_clusters = 4 The average silhouette_score is: 0.26073156331512976
```

1 result 7

after looking at the results we noticed that k=2 has an avg_silhoute = ~0.47 which is the highest among the Ks that we tested

[17]:
```
lab
```

[17]:
```
array([1, 2, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2])
```

[19]:
```
for j,item in enumerate(lab):
    print(j," ",item)
```

```
0   1
1   2
2   2
```

3 1
4 1
5 1
6 1
7 1
8 1
9 1
10 1
11 1
12 1
13 1
14 1
15 1
16 1
17 1
18 1
19 1
20 1
21 1
22 1
23 1
24 1
25 1
26 1
27 1
28 1
29 1
30 1
31 1
32 1
33 1
34 1
35 1
36 1
37 1
38 1
39 1
40 1
41 1
42 1
43 1
44 1
45 1
46 1
47 1
48 1
49 1
50 1

51	1
52	1
53	1
54	1
55	1
56	1
57	1
58	1
59	1
60	1
61	1
62	1
63	1
64	1
65	1
66	1
67	1
68	1
69	1
70	1
71	1
72	1
73	1
74	1
75	1
76	1
77	1
78	1
79	1
80	1
81	1
82	1
83	2
84	2
85	2
86	2
87	2
88	2
89	2
90	2
91	2
92	2
93	2
94	2
95	2
96	2
97	2
98	2

99 2
100 2
101 2
102 2
103 2
104 2
105 2
106 2
107 2
108 2
109 2
110 2
111 2
112 2
113 2
114 2
115 2
116 2
117 2
118 2
119 2
120 2
121 2
122 2
123 2
124 2
125 2
126 2
127 2
128 2
129 2
130 2
131 2
132 2
133 2
134 2
135 2
136 2
137 2
138 2
139 2
140 2
141 2
142 2
143 2
144 2
145 2
146 2

```
147   2
148   2
149   2
150   2
151   2
152   2
153   2
154   2
155   2
156   2
157   2
158   2
159   2
160   2
161   2
162   2
163   2
164   2
165   2
166   2
167   2
```

2 result 8

in chunk 83 was the first time we noticed the begining of the second book and after 415000 charecters

[20]:
```
83*5000
```

[20]:
```
415000
```

[ ]:
```
def bookDetection():
    prev = lab[0]
    counter = 0
    for j,item in enumerate(lab):
        if
```

[ ]:
```

```