morse-conversion

August 23, 2024

1 K-Means for the Morse Code

[ ]:
```
pip install gTTS #Module for conversion of Text to MP3
```

[ ]:
```
pip install pydub #Module for conversion of MP3 to Audio (wav)
```

Importing the modules

[3]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
from IPython.display import Audio
from scipy.io import wavfile
import time
```

2 Data input into the Code

[4]:
```
morse_time=time.clock()
```

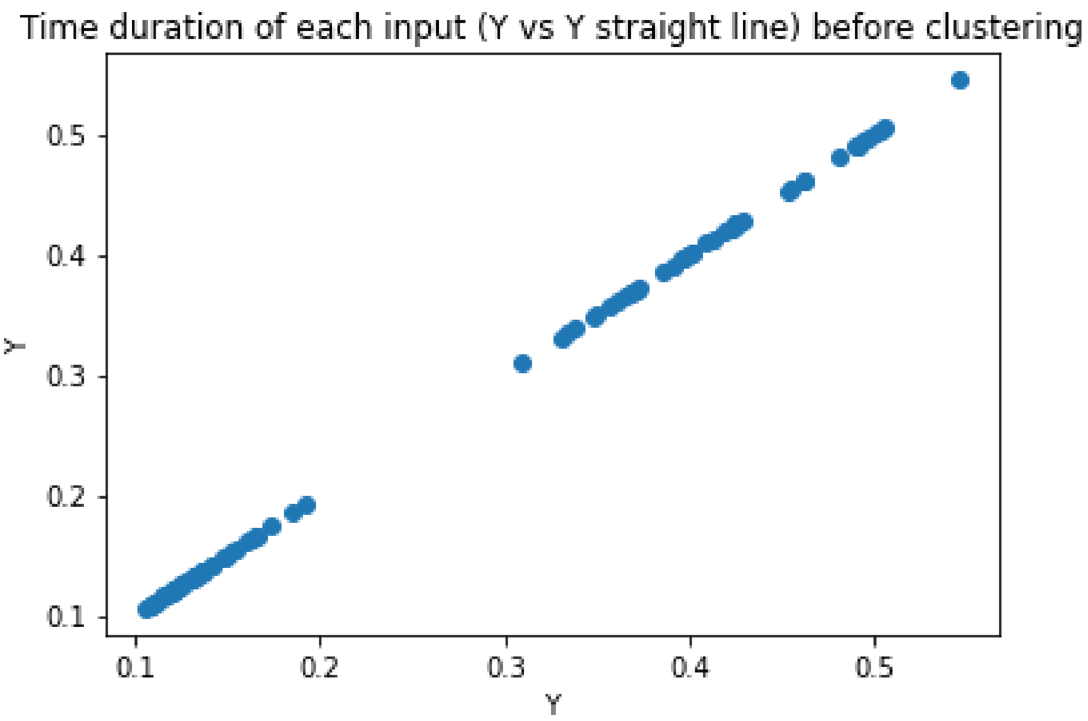
[5]:
```
data=pd.read_csv('NITK_exp.csv')
```

[6]:
```
X=data['X']
Y=data['Y']
```

3 Kmeans on Y (Duration)

- Before Clustering

[7]:
```
plt.scatter(Y,Y)      #Y vs Y (Time for which button is pressed)
plt.xlabel("Y")
plt.ylabel("Y")
plt.title("Time duration of each input (Y vs Y straight line) before␣
 ↪clustering")
plt.show()
```



Time duration of each input (Y vs Y straight line) before clustering

Applying the K-means to the Y data (to categorise into dots & dashes)

[8]:
```
kmeans_Y=KMeans(n_clusters=2,random_state=42)
df_Y=pd.DataFrame({"y":Y,"Y":Y})
kmeans_Y.fit(df_Y)
```

[8]:
```
KMeans(algorithm='auto', copy_x=True, init='k-means++', max_iter=300,
       n_clusters=2, n_init=10, n_jobs=None, precompute_distances='auto',
       random_state=42, tol=0.0001, verbose=0)
```

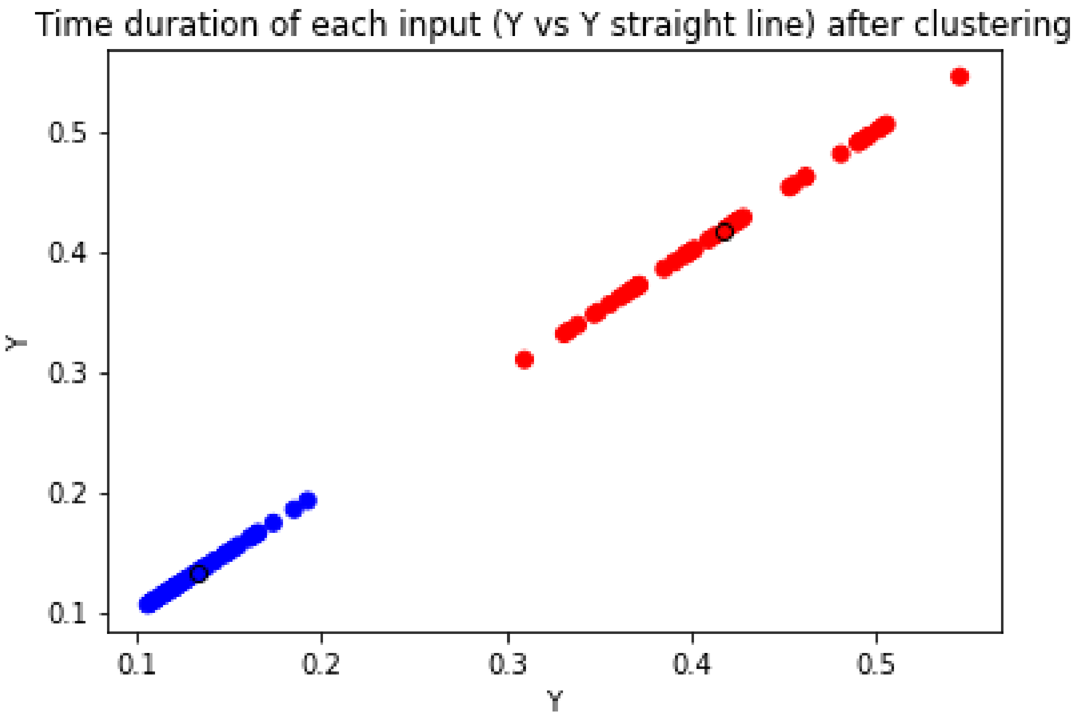
Gathering the labels and the centroids

[9]:
```
labels_Y=kmeans_Y.predict(df_Y)
centroids_Y=kmeans_Y.cluster_centers_
```

- After Clustering

[10]:
```
colmap={1:"r",2:"b"}                                 #dictionary of colors
colors=map(lambda x: colmap[x+1],labels_Y)             #labels if 0, goes to red,␣
 ↪if 1 comes to blue (dot,dash respectively)
colors_list=list(colors)                             #at 0th index in this␣
 ↪list,x=0 it means, colmap[1] i.e., red,at 1st index if x=1, colmap[2] i.e.,␣
 ↪blue.
plt.scatter(df_Y['y'],df_Y["Y"],color=colors_list)
```

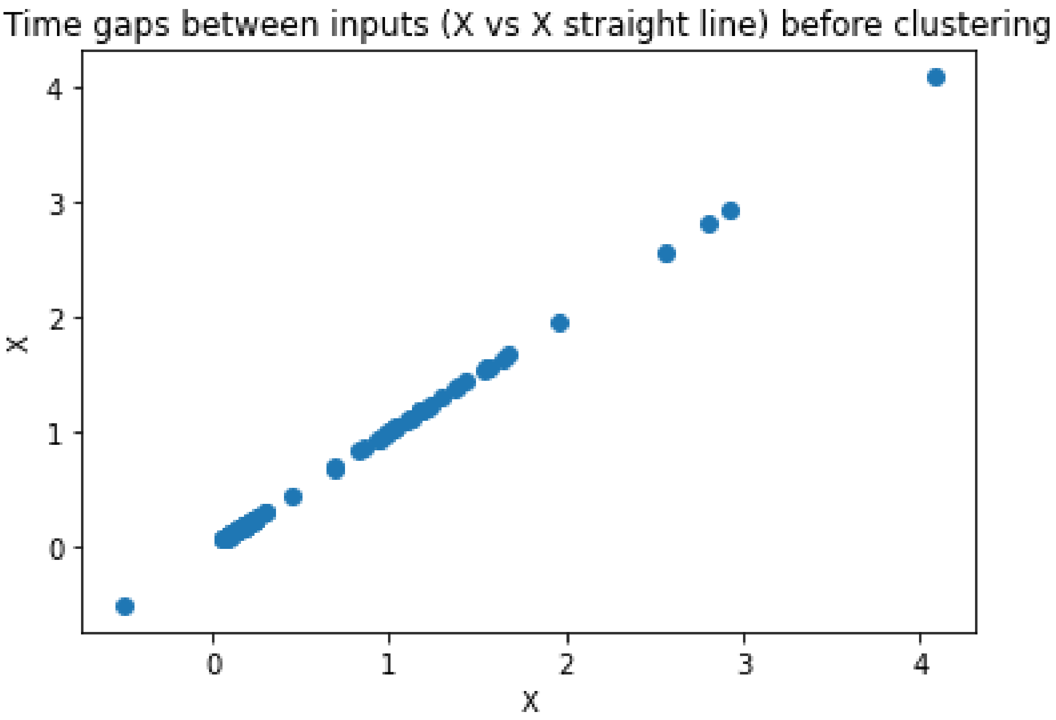
```
b=[-1,-1]
for i,centroid in enumerate(centroids_Y):
  if(centroid[0]==centroids_Y.min()): b[0]=i                                   #if␣
 ↪duration is minimum making the label 0 (dot)
  if(centroid[0]==centroids_Y.max()): b[1]=i                                   #if␣
 ↪duration is maximum making the label 1(dash)
  plt.scatter(*centroid,color=colmap[i+1],edgecolor="k")
plt.xlabel("Y")
plt.ylabel("Y")
plt.title("Time duration of each input (Y vs Y straight line) after clustering")
plt.show()
```



4 Kmeans on X (Time gaps)

- Before Clustering

```
[11]: plt.scatter(X,X)
plt.xlabel("X")
plt.ylabel("X")
plt.title("Time gaps between inputs (X vs X straight line) before clustering")
plt.show()
```



Applying the K-means which results in three clusters

```
[12]: kmeans_X=KMeans(n_clusters=3,random_state=42)
      df_X=pd.DataFrame({"x":X,"X":X})
      kmeans_X.fit(df_X)
```

```
[12]: KMeans(algorithm='auto', copy_x=True, init='k-means++', max_iter=300,
             n_clusters=3, n_init=10, n_jobs=None, precompute_distances='auto',
             random_state=42, tol=0.0001, verbose=0)
```

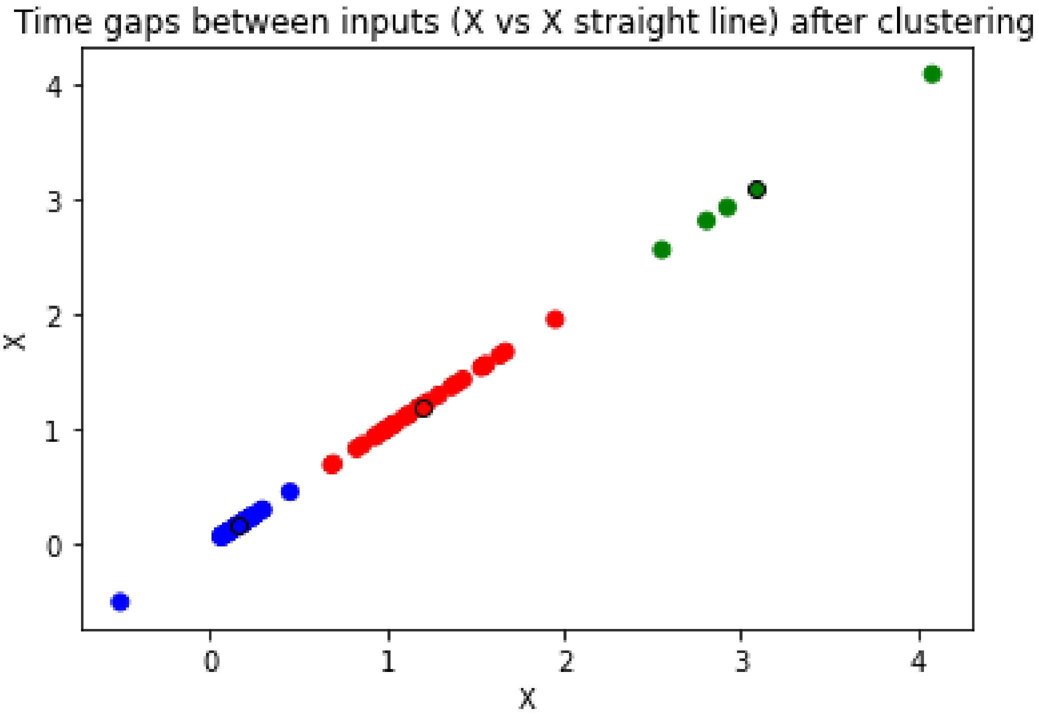
Gathering the labels and centroid information

```
[13]: labels_X=kmeans_X.predict(df_X)
      centroids_X=kmeans_X.cluster_centers_
```

- After Clustering

```
[14]: colmap={1:"r",2:"g",3:"b"}
      colors=map(lambda x: colmap[x+1],labels_X)
      colors_list=list(colors)
      a=[-1,-1,-1]                                                               ␣
       ↪               #initialising the list
      plt.scatter(df_X['x'],df_X["X"],color=colors_list)
      for i,centroid in enumerate(centroids_X):
```

```
  if(centroid[0]==centroids_X.min()): a[0]=i                                   ␣
 ↪               #if gap is minimum making the label 0
  if(centroid[0]==centroids_X.max()):
    a[2]=i
    labels_X[len(labels_X)-1]=i                                                ␣
 ↪ #if gap is maximunm making the label 2
  if(((centroid[0]!=centroids_X.min())&(centroid[0]!=centroids_X.max()))):␣
 ↪a[1]=i
  plt.scatter(*centroid,color=colmap[i+1],edgecolor="k")
plt.xlabel("X")
plt.ylabel("X")
plt.title("Time gaps between inputs (X vs X straight line) after clustering")
plt.show()
```



5 Decoding into Text

Given input has been converted into the following format using Kmeans

[15]:
```
df_labels=pd.DataFrame({"X_labels":labels_X,"Y_labels":labels_Y})
print(df_labels)
```

```
    X_labels  Y_labels
0          2         0
```

```
1          0         1
2          2         1
3          0         0
4          0         0
..       …        …
85         2         0
86         2         1
87         0         0
88         2         1
89         1         0

[90 rows x 2 columns]
```

Dictionary for the morse code evaluation using string compare

```
[16]: morse_dict={"01":"A","1000":"B","1010":"C","100":"D","0":"E","0010":"F","110":
       ↪"G","0000":"H","00":"I","0111":"J","101":"K","0100":"L","11":"M","10":
       ↪"N","111":"O","0110":"P","1101":"Q","010":"R","000":"S","1":"T","001":
       ↪"U","0001":"V","011":"W","1001":"X","1011":"Y","1100":"Z","11111":
       ↪"0","01111":"1","00111":"2","00011":"3","00001":"4","00000":"5","10000":
       ↪"6","11000":"7","11100":"8","11110":"9","010101":".","110011":",","001100":"?
       ↪","011110":"'","101011":"!","10010":"/","10110":"(","101101":")","01000":
       ↪"&","111000":":","101010":";","10001":"=","01010":"+","100001":"-","001101":
       ↪"_","010010":"\"","0001001":"$","011010":"@"}
```

Initialising the charecter string and word string

```
[17]: charecter=''
      word=''
```

Converting the dots and dashes to the charecters

```
[18]: for x,y in zip(labels_X,labels_Y):                  #Taking the labels␣
       ↪sequentially
          k=b.index(y)
          charecter=charecter+np.str(k)
          if(a.index(x)==1):
             # print(charecter)                              #Fetching the index␣
       ↪value to define the type of gap '0->dot dash gap' '1->charecter gap'␣
       ↪'2->word gap' "sentence gap will be improved further"
              try:
                word=word+morse_dict[charecter]           #Exception handling if the␣
       ↪input type or calculation is wrong (i.e. if the combination of dots and dash␣
       ↪doesn't form the charecter)
              except KeyError:
                word=word+''                             #Appending * in place of␣
       ↪error
              charecter=''
```

```
    if(a.index(x)==2):
      try:
          word=word+morse_dict[charecter]           #Exception handling if the␣
↪input type or calculation is wrong (i.e. if the combination of dots and dash␣
↪dosen't form the charecter)
      except KeyError:
          word=word+''
      charecter=''                                 #To add space when word ends
      word=word+' '
```

[19]:

```
#Decoded Text
print(word)
```

```
UNO MORSE CONVERSIE
```

[20]:

```
text_time=time.clock()
```

6 Text to Audio Conversion

- Converting Text to Speech.mp3

[21]:

```
from gtts import gTTS
import os

speech = gTTS(text=word, lang='en', slow=False)

speech.save("speech.mp3")
os.system("mpg321 speech.mp3")
print("Text to MP3 conversion completed")
```

```
Text to MP3 conversion completed
```

[22]:

```
from pydub import AudioSegment
sound = AudioSegment.from_mp3("speech.mp3")
sound.export("output.wav", format="wav")
print('MP3 to Wav conversion completed')
```

```
MP3 to Wav conversion completed
```

[23]:

```
audio_time=time.clock()
```

7 The Final Audio

[ ]:

```
audio=Audio('output.wav')
audio
```

[25]:

```
print("Time taken for converting Morse to Text: {} sec".
 ↪format(text_time-morse_time))
print("Time taken for converting Text to Audio: {} sec".
 ↪format(audio_time-text_time))
print("Total time of Execution (Morse to Audio): {} sec".
 ↪format(audio_time-morse_time))
```

```
Time taken for converting Morse to Text: 0.89192 sec
Time taken for converting Text to Audio: 0.22862199999999966 sec
Total time of Execution (Morse to Audio): 1.1205419999999997 sec
```