EE624 : SPEECH TECHNOLOGY

PROJECT REPORT

NAME : S. SRI SAI KOUSHIK **BRANCH** : EEE

ROLL NO : 190108050 **DATE** : 13-05-2023

1.

For 1st question, data folder contains all the recordings of 25 utterances in their specific folders.

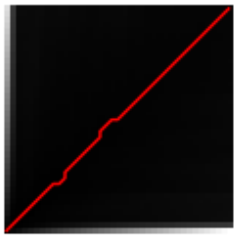
Code working:

The **project1.ipynb** first calculates the mfcc features of utterances and sent it to dtw function from dtw library, it gives the dtw score and alignment path. With the help of matplotlib library we plotted the DTW curves. The output from the is given below.

DTW curves and plots are given from next page:

for [a] :

5860.476947784424



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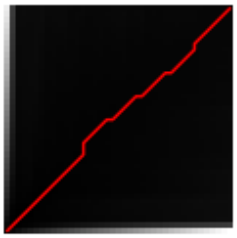

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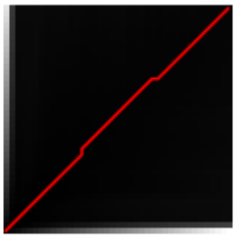

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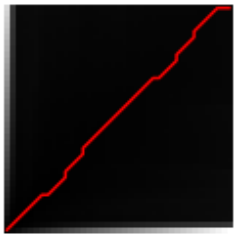

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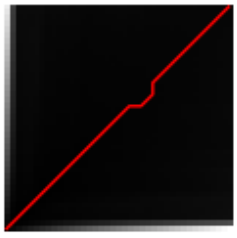

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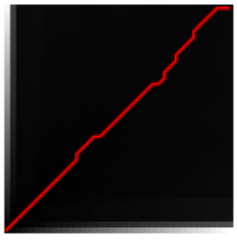

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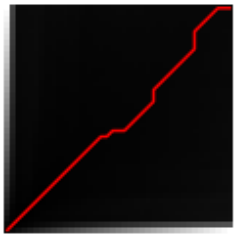

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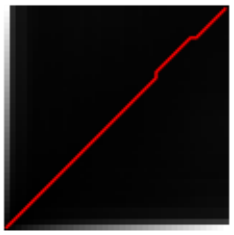

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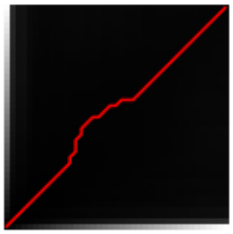

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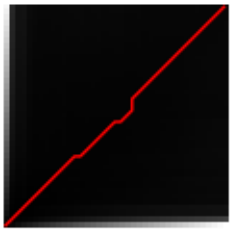

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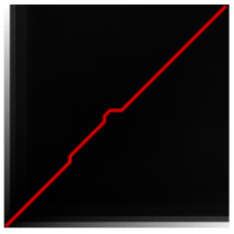

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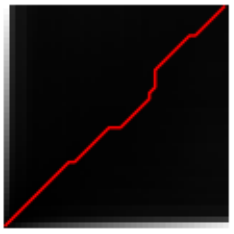

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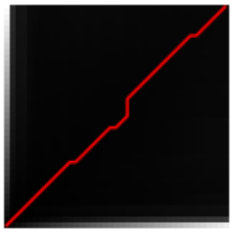

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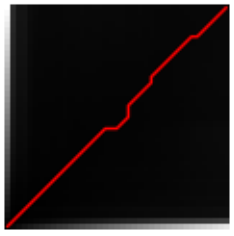

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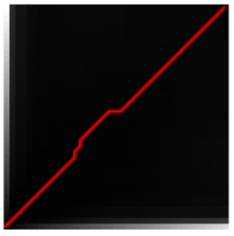

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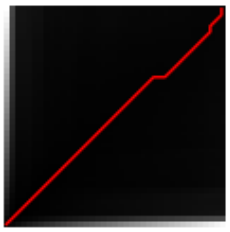

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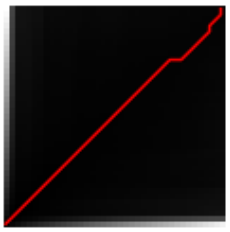

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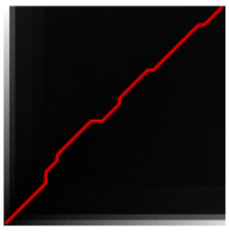

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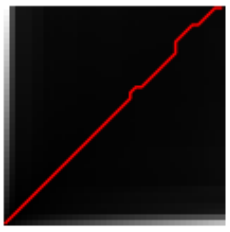

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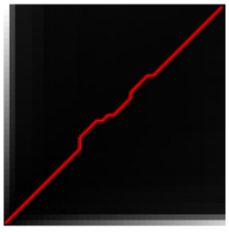

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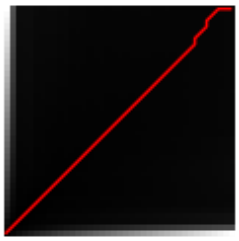

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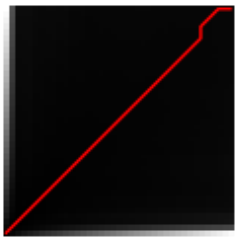

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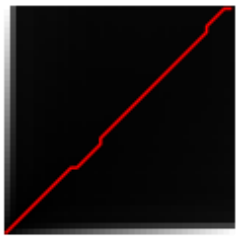

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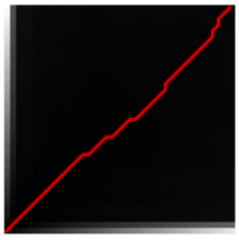

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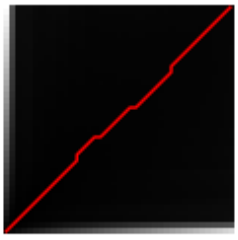

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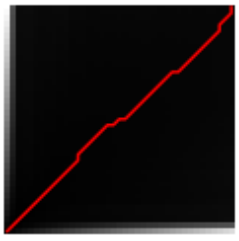

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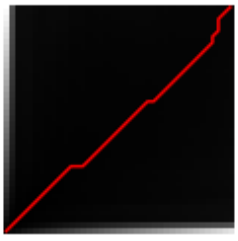

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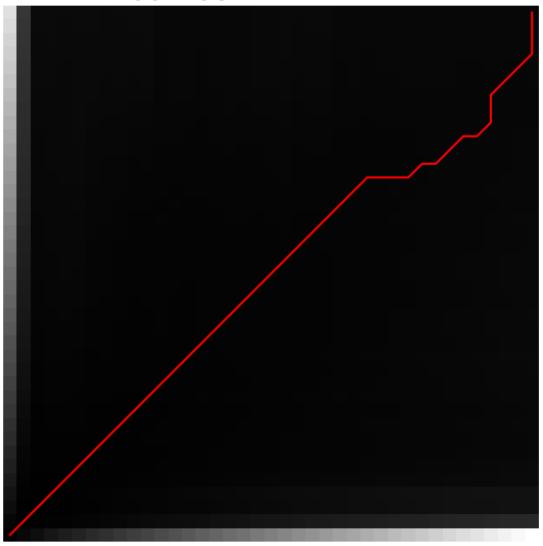
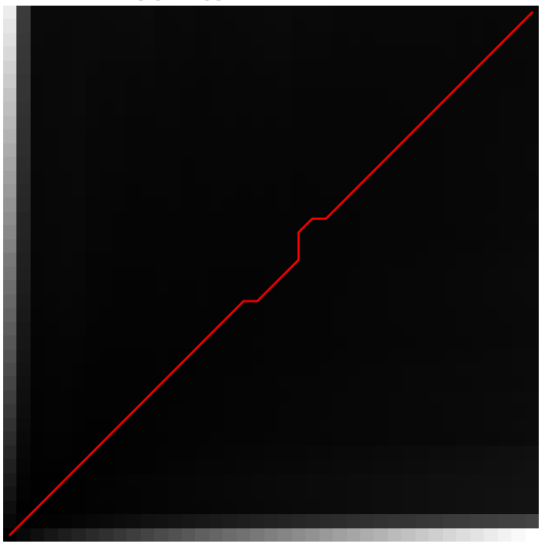
[a] and [e]:7524.409202575684



[a] and [i]:8326.598957061768



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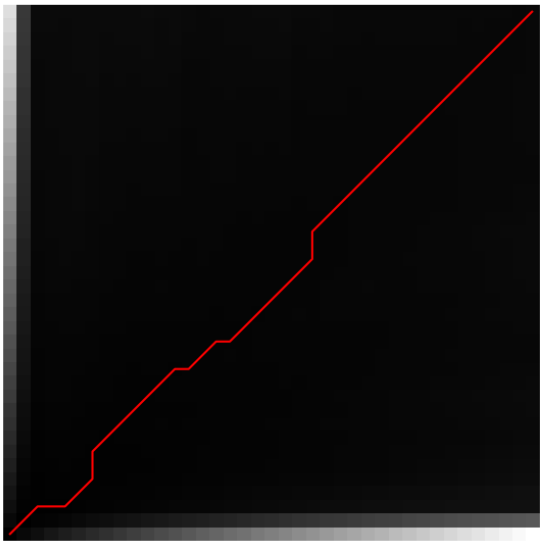

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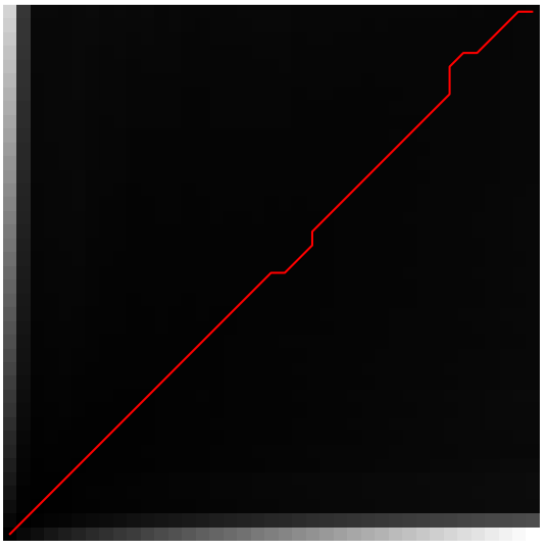

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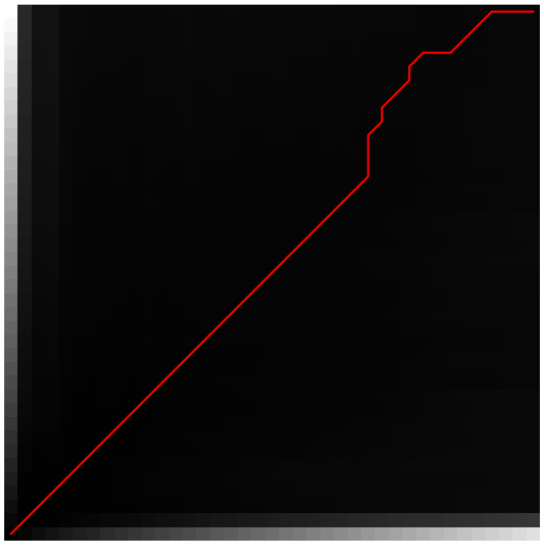

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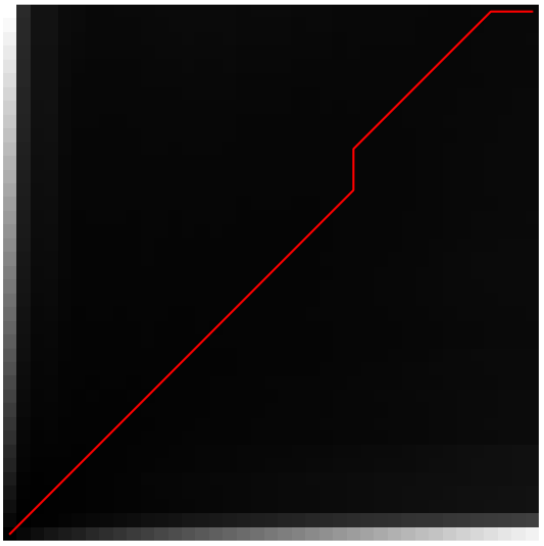

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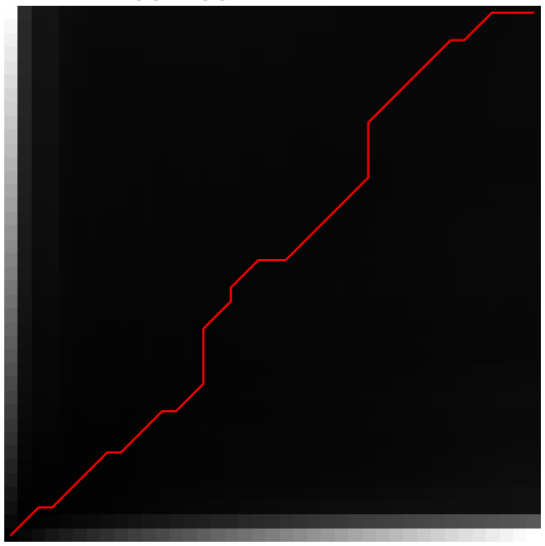

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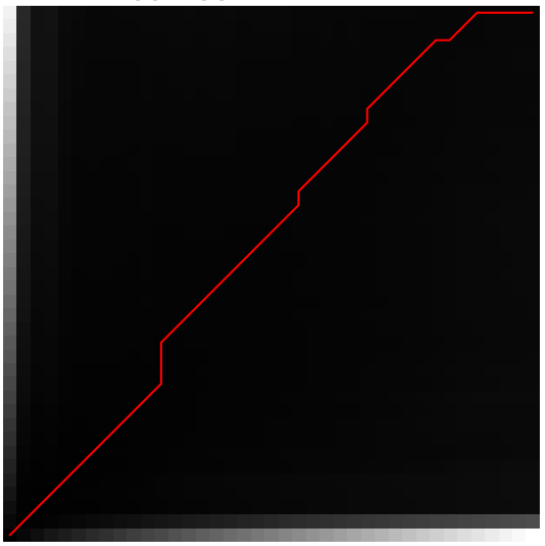

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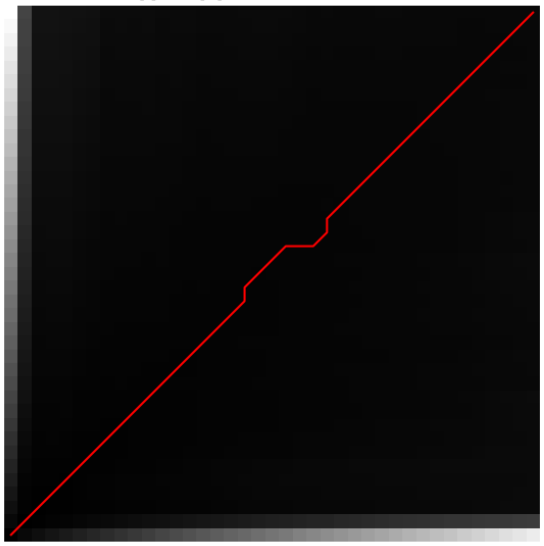

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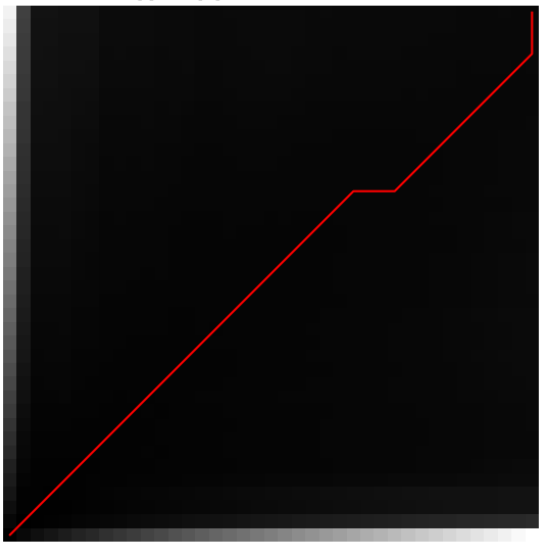

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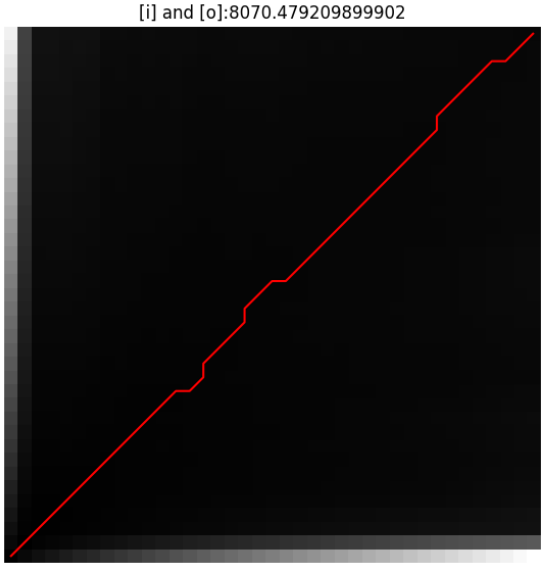

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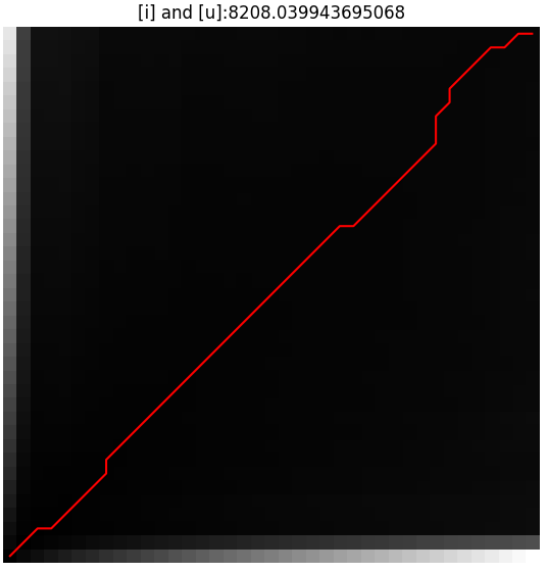

for [o] and different items:

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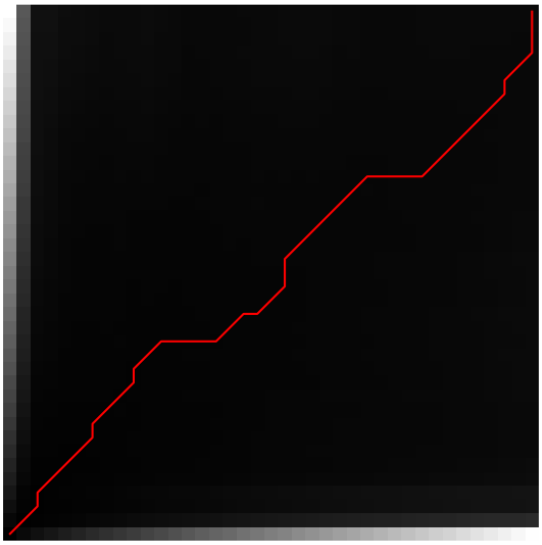
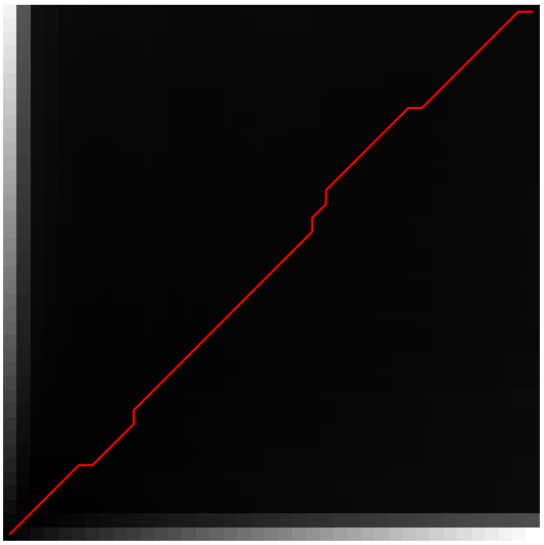


[o] and [i]:8070.479209899902

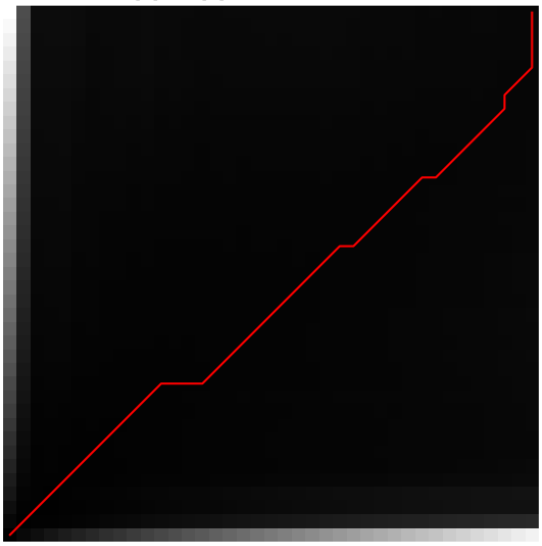
[o] and [u]:7063.869972229004



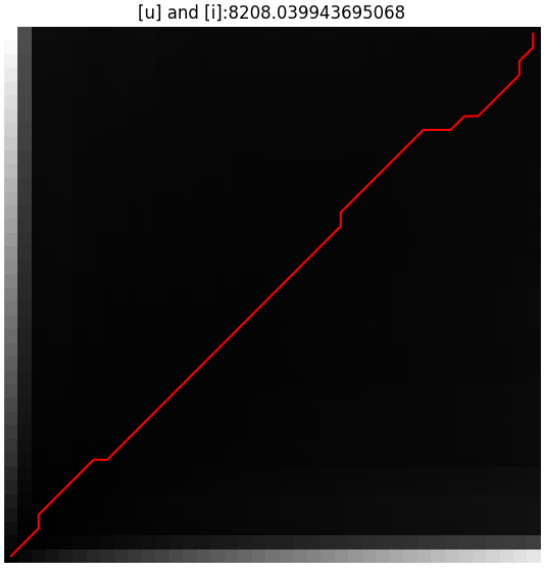
for [u] and different items:

[u] and [a]:8051.348201751709

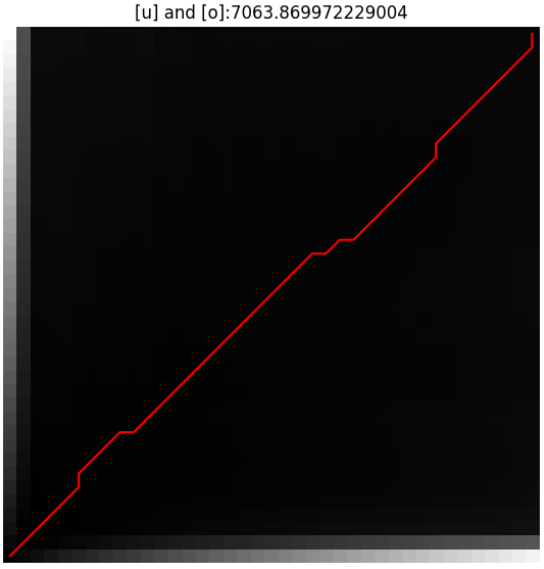
[u] and [e]:8079.996753692627



[u] and [i]:8208.039943695068



[u] and [o]:7063.869972229004



(2)

For 2nd question, the data used is present in the folder named data, each digit is present in its own respective folder.

Code working:

The **project2.ipynb** ,5 samples were taken from each case and mfcc features were calculated, after calculating these mfcc features, 32 component GMM model is trained for each digit, after that 20 samples were used as test data, and confusion matrix for final result is this:

```
[[20  0  0  0  0  0  0  0  0  0]
 [ 0 16  0  0  0  0  0  4  0  0]
 [ 0  0 20  0  0  0  0  0  0  0]
 [ 0  0  0 20  0  0  0  0  0  0]
 [ 0  0  0  0 20  0  0  0  0  0]
 [ 0  0  0  0  0 18  0  2  0  0]
 [ 0  0  0  0  0  0 20  0  0  0]
 [ 0  0  0  0  0  0  0 20  0  0]
 [ 0  0  0  0  0  0  0  0 20  0]
 [ 0  0  0  0  0  0  0  0  0 20]]
```

Observations:

Here, for [1], 4 samples were misplaced as [7]

And for [5], 2 samples were misplaced as [7]

We can improve the efficiency of the model by increasing the training set and increasing number of components in GMM model.

4.

For 4th question, the data used is present in the folder named data4, total 5 speakers data were used with speech containing **“Hello world, how are you”** of 2sec.

Per each speaker, 3 samples were used as training and 8 samples as testing data.

Code working:

The **project4.ipynb** , first it contains the code running speaker identification based on dtw score of normalized mfcc vectors, the confusion matrix for this part is:

```
[[8 0 0 0 0]
 [0 8 0 0 0]
 [6 0 2 0 0]
 [0 0 0 8 0]
 [0 0 0 0 8]]
```

And for second part, we calculated Gaussian posteriograms of testing data, whose GMM’s are trained from labeled training data present in each speaker folder. The confusion matrix obtained here are:

```
[[8 0 0 0 0]
 [0 8 0 0 0]
 [0 1 7 0 0]
 [0 0 0 8 0]
 [0 0 0 0 8]]
```

Clearly, we can see that the model accuracy increased by using GMM and gaussian posteriorgrams for dtw score method, instead of mfcc features.