Biometric Security (SIL 775)

Assignment-2

Sachin Singh(2021MCS2147), Shivankar Garg(2021MCS2151)

In this assignment, we had to implement Online Signature Verification.

Dataset Used – SVC2004
Dataset Description:
x-Coordinate, y-coordinate, Time Stamp, Button Status, Azimuth, Altitude, Pressure

I have implemented the following modules.

1. Pre-process:- In this, I have read the user's signature file and stored it in to list of list. I have also calculated the centre of mass of x and y coordinate and after that I have normalized the x and y coordinates with respect to the centre of mass. I have also used gaussian filter to smoothen the data set.

2. Feature Extraction: - In this module, I have extracted features from pre-processed data.
For the calculation of critical speed, I have implemented a separate module which calculates the critical speed. For the calculation of derivatives, I have used

dx/dt=delta(x)/delta(t)

3.Critical Speed:- In this module, the critical speed (v*) is calculated. For critical speed calculation, I have used y coordinates.

Critical speed(v*) = $\mathbf{y}_{(i+1)}$-$\mathbf{y}_{(i)}$ / ($\mathbf{t}_{i+1}$-$\mathbf{t}_{i}$)

4. Feature Normalization:- In this module features are standardized which means average=0 and the standard deviation is unit.

$$z = \frac{x - \mu}{\sigma}$$

μ is the mean (average) and σ is the standard deviation from the mean**.**

5. Feature_Cost_matrix:- I have calculated the cost matrix for the features of query and reference signatures. I have used Euclidean distance to calculate the distance between features.

6. DTW matrix:- In this,I have implemented the dynamic time wrapping which gives the dtw matrix for features which gives the min distance between features.

7. Calculate_weight:- For calculating weights I have used Adaboost classifier. I have used the distances of features as input for this model and for same user I have assigned 0 and for different 1.0 means same signature. 1 means different.
I have prepared the data for training which consist of 10 user's signature each user has 10 signature.
8. Similarity_score:- For this first, I have calculated the dissimilar distance of two signatures and then I subtracted it from 1.

For Calculating Weights of feature:

As mentioned above I have used the ada boost classifier. I have prepared the train and test data which is distances of features. I have trained the model then the weight of feature is extracted from model.

Feature name and their indexes

0) Pressure
1) Altitude
2) Azimuth
3) Speed (vx)
4) Speed(vy)
5) Absolute speed(v)
6) Accelaeration in x
7) Acceleration in y
8) Derivative of pressure w.r.t. time
9) Derivative of pressure w.r.t. x
10) Derivative of pressure w.r.t. y
11) Critical speed