Biometrics (CSE 40537/60537)

University of Notre Dame, Fall 2014

Assignment 3: Build your own handwritten signatures recognition method

(Interim report: by the end of Sunday, November 2, 2014)

(Full report: by the end of Wednesday, November 5, 2014)

1 Description

In this assignment you will program your own handwritten signatures recognition method. Your tasks will comprise a) selecting global signature features and classifying samples in this feature space, and b) using Dynamic Time Warping to compare signature time series.

This assignment assumes **working in pairs**. We will use an example DTW-based signature recognition software, and WACOM Intuos tablet to register the data. First, you and your learning partner will register the enrollment signature tokens. Next, you will show your signatures to your learning partner to let him/her train skilled forgeries. After a few minutes of training you both will use the example system again to verify yourself and to forge your learning partner's signature. This procedure should result in the following data:

- your **enrollment signature tokens** (5 tokens),
- your **genuine signature tokens** created when you try to be verified by the system (3 tokens),
- all genuine signature tokens prepared by your learning partner, used as the **random forgeries** (5 + 3 = 8 tokens),
- **skilled forgeries** prepared by your learning partner (3 tokens).

Your software package contains two folders:

- `mfiles`: MATLAB scripts prepared by the instructor,
- `data-raw`: all the tokens mentioned above gathered in two folders: `bitN` and `bitM`, where `N` and `M` are your IDs selected during the class.

`BIO_SIGNATURES_Example.m` gives you the guidelines how to use different MATLAB functions and expressions when programming your own method. `BIO_SIGNATURE_DTW.m` implements the Dynamic Time Warping (you do not need to modify this function). `BIO_SIGNATURES_EER.m` should be used to plot your FMR and FNMR curves.

Interim report should contain an account for all problems that you encountered when implementing your programs. If there is no problem, please send me one sentence acknowledging this.

2 Tasks to be solved

1. Propose global signature features and a classification method to recognize genuine tokens, random forgeries and skilled forgeries:

   a) use as many global features as you want (justify your selection),

   b) transform raw samples into points in the feature space (defined by your selection of global features),

   c) use enrollment tokens to create the reference template; for instance you may select the best representative among five samples, or create the average template (centroid),

   d) implement a simple classifier, for instance use Euclidean metric to calculate the distance between reference template and other samples; certainly, you may want to use more sophisticated linear or nonlinear classifiers if you want (kNN, SVM, etc.),

   e) compare your reference template with your genuine tokens to check if your system recognizes you,

   f) compare your reference template with all genuine signature tokens of your learning partner (8 samples) to check if your system recognizes random forgeries,

   g) compare your reference template with all skilled forgeries prepared by your learning partner to check if your system performs well.

2. Use Dynamic Time Warping instead of global features:

   a) play with different combinations of signature components (X, Y and pen tip pressure) and select the best combination (justify your selection),

   b) make the same recognition experiments as in Task 1 (e-f-g) to check the performance of your system,

   c) compare the two approaches: global features vs. Dynamic Time Warping.

Attach the resulting FNMR/FMR graphs generated by `BIO_SIGNATURES_EER.m` for all tasks. Please attach also your MATLAB programs when sending the answers.