

EE435: Biometric Signal Processing

Project 11: Final Project

Assigned: Fri 4/13/12

Due: Sat 5/05/12

For your final project, you may work in groups of up to two people. This project is the design and testing of a hand geometry recognition system. Let me know your group composition by the end of the class period today.

I. Hand Geometry System

1. In this project, you will be provided a training set and a test set of hand geometry images. Using Short Term File Sharing, download the file called "EE435-FinalProject-HandGeometryDatabase.zip". Each image has been captured when the hand was placed on the same rigid board with fixed pegs to guide hand placement. Use the information that these pegs are in the same location in each image however you see fit.
2. Determine a sufficient number of features for recognition and design an algorithm that will take any of the input hand geometry images and extract these features. For each hand, the feature measurements would be used to create a pattern vector, and recognition would be based on some distance measure between pattern vectors. Your system will either recognize an input hand (and provide the subject number), or not recognize the hand.
3. Your project must include a database and three functions: *FindHand*, *FeatureExtract*, and *HandID*.

Using your *FindHand* and *FeatureExtract* functions on the training images provided, you will create a database of known hands. The known subjects' features must be contained in each row of the database (one hand per row). How you organize your database is completely up to you, but it will be used by your *HandID* function in order to make recognition decisions.

Usages:

```
y=FindHand(x)
```

input: x is the filename (a string) from an image in the database provided

output: a logical array that has the same dimensions (rows and columns) as the input hand image, where the hand is all 1s and everything (or most everything) else is 0s. It is okay to have some noise in the output image.

error checking: the input file must exist in your path (note: the MATLAB *exist* function will tell you if the file "exists." If not, you should not run *imread*, but set the output y to null and display an error message that includes the name of the non-existent filename, e.g.: "Error in FindHand: file 0024_im.jpg does not exist".

```
y=FeatureExtract(x)
```

input: x is a logical array that has the same dimensions as the hand images in this database...it should be the output of the *FindHand* function.

output: y is a one-dimensional vector that contains the values of the features that your algorithm uses. If your algorithm uses M features, this vector should be a $1 \times M$ vector (1 row by M columns).

error checking: the input should be a logical array that has the same dimensions as the hand images in this database. If not, the output should be null and an error message displayed.

```
y=HandID(x, db)
```

input: x is a one-dimensional vector that contains the values of the features your algorithm uses, and should have been created with the *FeatureExtract* function.

db is your hand database, created from your training set.

output: the subject number (a string) from the database that matches the input, or 0 if the hand is not identified.

error checking: the input x should be a one-dimensional $1 \times M$ vector. If not, the output should be null and an error message displayed.

4. Once an algorithm is designed, test it using all of the hands in the training set, and tweak the algorithm to maximize accuracy. After the algorithm is finalized, test it on the test set using the training set database, and determine accuracy, FRR and FAR. Note: In general, hand geometry is not the most accurate of biometrics, and you should not expect your system to work perfectly.

For the final project, you must present a PowerPoint presentation during the final exam period on Saturday, May 5, 2012 at 1330. You must also submit a formal report for the project, which will be due by the end of the final exam period. The format for this report is specified in the course policy statement. More details on the expectations for the presentation will follow.

In addition, turn in a hardcopy of your functions' code, and email me your functions AND your database.