

Assignment 2: Hand Geometry based Person Identification

Deadline: Tuesday, February 13, 5pm.

Objectives of this assignment

- In this assignment you will attempt to recognize an individual from their hand geometry.

Please note that this is an individual project and each person can talk to others, but must ultimately do their own research and write their own assignment report.

In this assignment, you will be provided with the following material:

- I) Hand outlines obtained from previous classes, 26 total outlines taken from 13 subjects, such as the one seen in Figure 1 below.

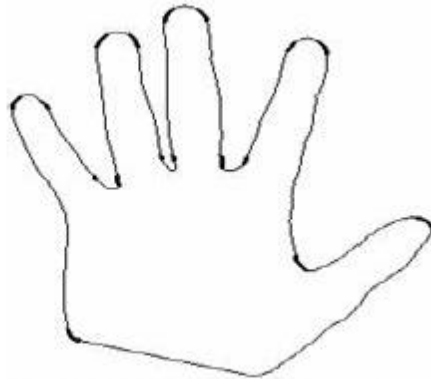


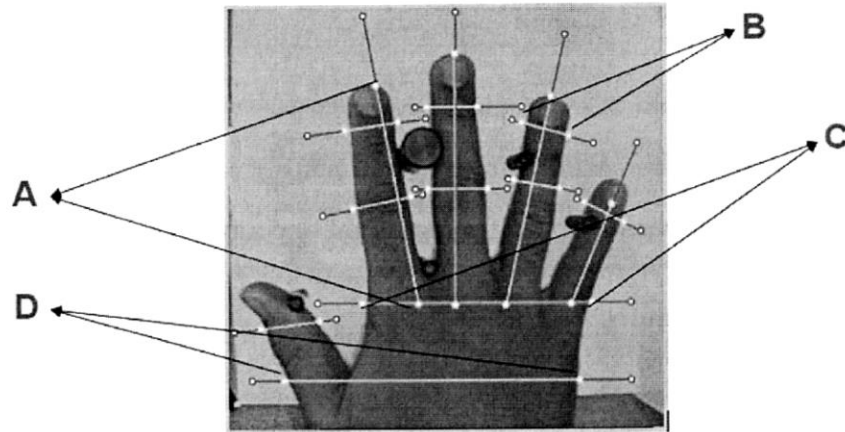
Figure 1: Hand Geometry Recognition

- II) Two different samples were taken from each subject (former students). Each sample was labeled with a unique sample ID provided by the student. The scanned outlines are posted on the course website.
- III) You can use any of the classification algorithms discussed by the instructor or selected by you. Please write your program in a language of your choice, e.g., Matlab. Since this is not a programming course, there is no need to write too complicated software.

Suggestions on the completion of this assignment:

1. Using a ruler, measure and record the following selected features from all records

- A: Distance from index fingertip to bottom knuckle _____cm
 B: Width of ring finger, measured across the top knuckle _____cm
 C: Width of palm across 4 bottom knuckles _____cm
 D: Width of palm from middle knuckle of thumb across hand _____cm



(From TryEngineering-www.tryengineering.org)

2. Assuming samples #1 constitute a training set and samples #2 a testing set, design a hand geometry biometric recognition process for identification and determine the recognition performance of this system in terms of FAR, ROC or any other metric of your choice.
3. If you are familiar with more advanced classification methodologies, such as PCA or LDA, you may apply them to improve the classification performance (extra credit).
4. A reference for the above evaluation metrics, e.g., FAR, ROC, is posted on blackboard.

What to Hand In:

- Each student should submit a report (preferably in electronic form) no longer than 10 pages discussing the process, assumptions, methodology used and results.
- The last page must provide a table summarizing all key results and assumptions for easy cross-referencing

Please put all your files into your local directory ECE1518_Assignment2-by-STUDENTNAME, JIE1001_Assignment2-by-STUDENTNAME, .zip it onto a file named ECE1518_Assignment2-by-STUDENTNAME.zip or JIE1001_Assignment2-by-STUDENTNAME.zip. Upload your zip file on the portal.

Please submit your report via Blackboard at <http://portal.utoronto.ca>. Please logon in advance to Blackboard to understand how to submit your assignment. Waiting until the last minute may lead to unnecessary stress.

Note:

- Please note that late assignments and projects will be deducted 10% per business day.
- Academic integrity is of utmost important. Any issues of plagiarism and inappropriate collaboration will be taken seriously and reported to the appropriate higher authority.
- Questions regarding marking must be formally written on a piece of paper and submitted along with the associated test/assignment to myself or the cognizant TA. There is a 48-hour limit from the time the test/assignment is first returned in which you may request a recheck.

Important: Please note that this is can be either an *individual* project or a group project assuming that the group consists from one ECE student and one iSchool student.

INSTRUCTIONS

If you don't have any machine learning experiences, here are the very basic steps on how to proceed with the exercise on hand recognition without using Matlab or any other machine learning platform.

1: From the given two sample files pick arbitrarily 8 hand samples from file 1 and the corresponding 8 samples from file 2.

2: for each hand sample calculate the four features and identify them as $F1(i,j)$ and $F2(I,j)$ where $i=1,\dots, 8$ and $j=1,2,3,4$

3: for each sample of file and each sample of file 2, calculate the normalized Euclidian distance as follows:

$$D(l,k)=1/4 \text{ SQRT}((F1(l,1)-F2(k,1))^2. +(F1(l,2)-F2(k,2))^2.+ (F1(l,3)-F2(k,3))^2.+ (F1(l,4)-F2(k,4))^2.)$$

$$L,k=1,\dots,8$$

4: In a two dimensional 8x8 matrix where rows represent subjects from file 1 and columns represent subjects from file 2,

For each row $l=1,\dots,8$, identify the minimum value of $D(l,k)$ $k=1,\dots, 8$ and place a check mark in the corresponding table location

Repeat the above process for each column of the table.

Estimate the TP (true positive) value from the marked diagonal entries of the table, the FN from the unmarked diagonal entries, the TN from the unmarked non-diagonal entries of the table and the FP from the marked non diagonal entries of the table.

5: From the TP, TN, FP,FN estimate the FAR and FRR