Biometrics & Image Analysis

Assignment 1
Performance Characteristics of Biometric Matchers

Description

Given a set of biometric matching scores you have to construct graphs describing the performance of a biometric matcher. The graphs are: estimated densities of genuine and impostor matching scores, FAR and FRR curves, and ROC curve.
Also, calculate the minimum costs (you have to find the optimal decision thresholds) of deploying each biometric matcher in three scenarios of cost function:

- 10*FAR+1*FRR
- 1*FAR+1*FRR
- 1*FAR+10*FRR.

Programming language

You can use any programming language for this assignment. Generally, two approaches are possible:

- Use any traditional programming language (C/C++, Java, etc.) to produce graph data in the form of the array {(x_i, y_i)} and save this data in the file. Then use any specialized graph construction software to plot graph, axes, label, etc. (gnuplot, xmgr or xmgrace, Matlab).
- Use specialized software to both calculate graph data and plot it (Matlab, Octave, etc.).

Data

We will use sets of biometric scores from NIST (BSSR1 set) for this assignment. Each set of scores contains results of matching N users with N enrollees. Enrollee i and user i is the same person, and enrollee i and user j (i != j) are different persons. Each user is matched agains each enrollee once. Thus all the matching scores can be represented as matrix (s_ij); i,j=1,..N, where diagonal elements correspond to genuine matches, and other elements correspond to impostor matches. There are four sets of scores: 2 fingerprint score sets from one matcher corresponding to left and right index fingers (li and ri) and 2 face matching score sets obtained using same face images but different matchers - C and G.

All score sets are packed in a zip file. The names of the included 4 text files correspond to score sets they contain. The format of each file is :

```
num_users num_enrollees
score(user 1, enrollee 1) ... score(user 1, enrollee num_enrollees)
...
...
...
score(user num_users, enrollee 1) ... score(user num_users, enrollee num_enrollees)
```

Submitted materials

- A report in the form of a single document with inserted graph figures and short description of your work. Place all four ROC curves on a single figure so that the performance of different matchers can be compared.
- A source code used to produce the graphs.

Assignment 2
Combinaitons of Biometric Matchers

Description

You have to construct a biometric system incorporating two or more biometric matchers. The biometric matchers and the set of scores used for training and testing is the same as in project 1 . Produce combination systems for at least 2 different subsets of matchers, and for at least 2 different combination algorithms.
To estimate the performance of the combined systems you have to graph their ROC curve: together with ROC curves of single matchers to estimate improvement due to combination.

Required work

2*2=4 combined systems resulting in 4 ROC curves plotted on the same graph. Also compare the performance of combined systems with single biometrics systems (ROC curves obtained in first project). Write a report describing used combination algorithms.

Extra credit work

In addition to required work, implement any of the following types of combination methods: combinations using nonparametric estimations of score densities or posterior class probabilities, classification-based combinations (neural networks, k-nearest neighbor, SVM, etc.), combinations utilizing identification or class-specific background models.

Suggestions

Try simple combination rules (such as Sum rule) with possibly different score normalization functions.