Biometrics (CSE 40537/60537)

University of Notre Dame, Fall 2014

Assignment 5: Presentation attack detection (PAD) in iris recognition

Interim report: by the end of Sunday, December 7, 2014

Full report: by the end of Wednesday, December 10, 2014

1 Description

In this assignment you will build your own method detecting presentation attacks in iris biometrics. You will get a small subset of authentic and fake samples (paper printouts), which were used in the Iris Liveness Detection Competition[1]. You will acquire also images of your own fake irides during the class.

In this last assignment you are free to use any software you like to implement your solution. Below you can find some remarks related to the MATLAB language, but you are not limited to use MATLAB. As in the assignment #4, please use APCER and NPCER metrics (related to the PAD) and not FNMR/FMR (as they relate to the biometric recognition accuracy) to report the performance of your solution.

2 Tasks to be solved

1. Implement a simple PAD method based on image frequency analysis (see slides 70-74 of the lecture No. 8). Consider the following steps for a single image:
   - load the BMP image (`imread` in MATLAB),
   - load the corresponding TXT file containing the segmentation data (`load` in MATLAB); each segmentation file contains six numbers: p_x p_y p_r i_x i_y i_r, where (p_x, p_y) is the pupil center, p_r is the pupil radius, (i_x, i_y) is the iris center and i_r is the iris radius,
   - decide how to use the segmentation data (see slide #71) and apply your decision,
   - calculate 2D Fourier Transform (`fft2` in MATLAB),
   - make sure that DC component is in the center of the frequency spectrum (`fftshift` in MATLAB should help),
   - calculate the liveness score according to the equation presented on slide #72, assuming that 'alien frequencies' (resulting from the printing process) are higher than frequencies related to the alive iris.

(continued on the next page)

[1] LivDet-Iris 2013; http://people.clarkson.edu/projects/biosal/iris

2. Use LivDet-Iris data to train your method, that is to set f_0, f_1 and df parameters. Observing amplitude spectra for authentic and fake samples can help in appropriate selection f_0, f_1 and df (use `mesh(log(abs(fftshift(fft2(I)))))` in MATLAB to display the 3D log-amplitude spectrum of the image `I`). Try to obtain minimum APCER when NPCER=0 is required (we do not want to introduce any additional false rejections to our biometric system, and we agree to accidentally accept fakes).

3. Check if your trained method correctly recognizes your samples (authentic and fake).

Please attach your programs to the answer sheet (task 1) along with short description. Describe how did you train your method and provide NPCER and APCER you have got in task 2. Provide NPCER and APCER calculated for your samples (task 3). Did your method recognize your samples correctly? If not, try to explain why the performance is not perfect.