Assignment 2: Design and Evaluate an Iris Recognition System
Group member: Yunjie Xu, Guangda Li, Hao Wang

We used open source code of iris recognition by Libor Masek, and we modified and create script of the source code, detail of modification and creation of the is below:

1. createiristemplate.m script—delete all image generation, just keep template and mask matrix value and save it as imagename-houghpara.mat
2. segmentiris.m script-vary thresholding of eyelash from default value 100 to 10
3. gethammingdistance.m-Change shift value from default -8-8 to -100-100, which can increase shift range and find exact position of pattern.

The gallery for recognition system is LG2200 2008 data, we picked one left eye and one right eye for each person as gallery. Probes are LG4000 and LG2200. We discarded images that are blur and most eyelid covered.

When we used default parameter of source code, we get genuine distribution, imposter distribution and ROC curve as blow:
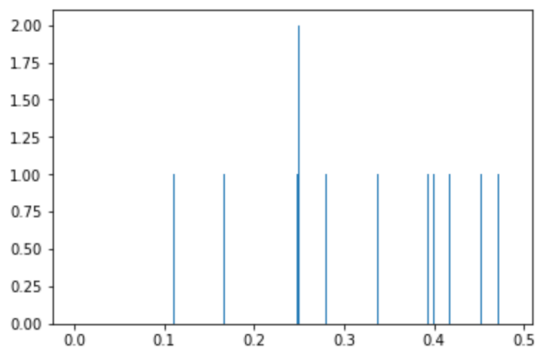

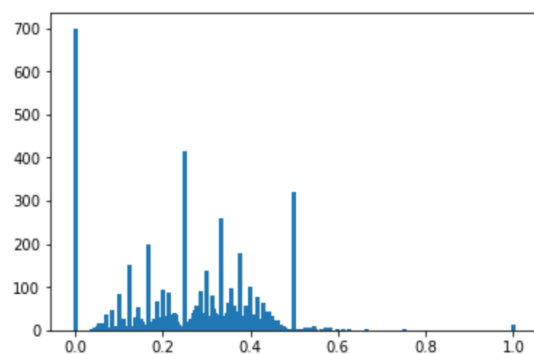Figure.1 genuine distribution of default parameter

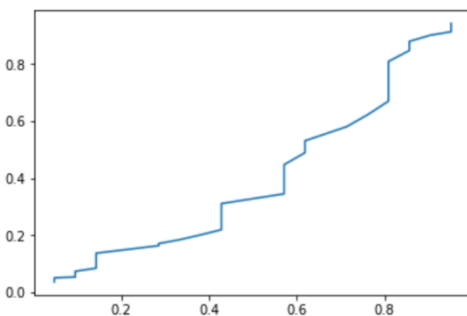Figure.2 imposter distribution of default parameter

Figure.3 ROC of default parameter

Because it has no tendency of verification same person and different person, and we modified code and decreased thresholding to 10 and vary shift range from -10-10 to -100-100, which can decrease mask(error) matrix value and match pattern better. We also tested right eye and left eye together to increase TAR and TRR, the verification results are very promising.
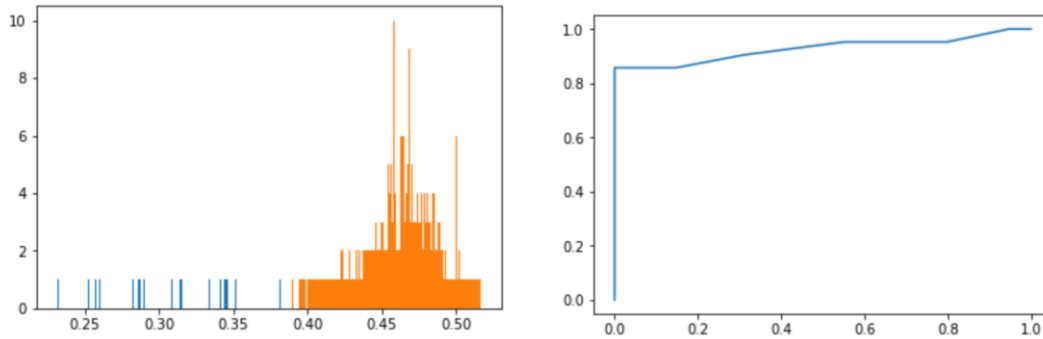

Figure.4 genuine and imposter distribution and ROC of Left eye_LG2200-2008-03-11_13_LG2200-2010-04-27_29_shift=-8-8
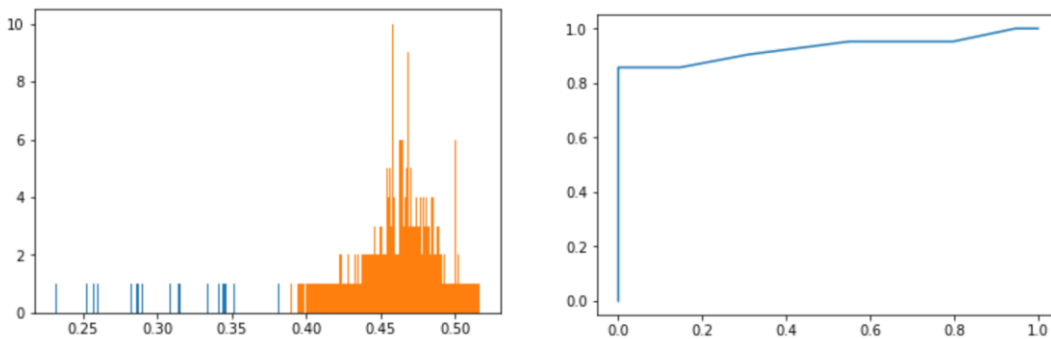

Figure.5 genuine and imposter distribution and ROC of Left eye_LG2200-2008-03-11_13_LG2200-2010-04-27_29_shift=-100-100
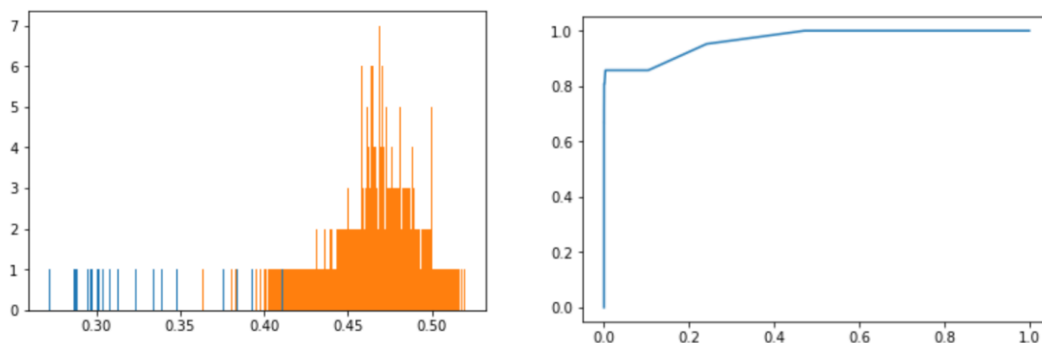

Figure.5 genuine and imposter distribution and ROC of Left eye_LG2200-2008-03-11_13_LG4000-2010-04-27_29_shift=-8-8
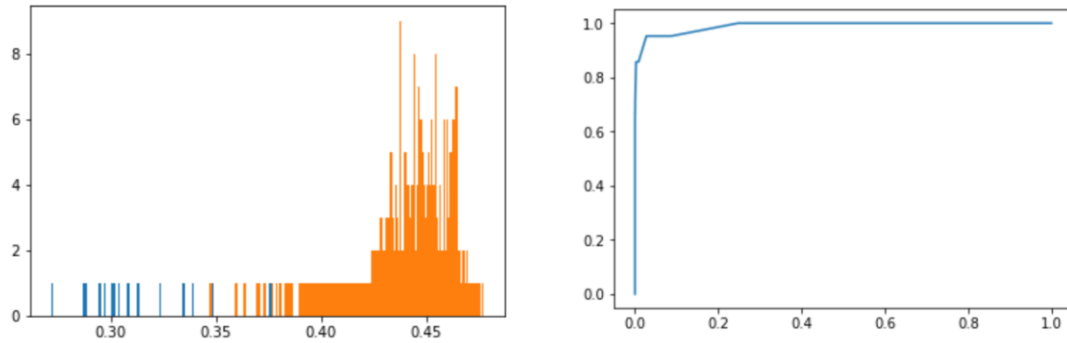
Figure.6 genuine and imposter distribution and ROC of Left eye_LG2200-2008-03-11_13_LG4000-2010-04-27_29_shift=-100-100

We can see decreasing thresholding of eyelash highly increasing TRR and TAR, and increased shift of pattern to find minimal of hamming distance ratio also help to decrease FRR and FAR.

Besides, an article about two eyes can decrease FRR and FAR compared one eye. They used k-folder validation method to decrease FRR and FAR, we also tested right eye and find high hamming distance ratio of two left eye of same person could be low hamming distance ratio of two right eye of same person, vice versa. We don't do k-folder validation, the distribution of genuine and imposter and ROC of Right eye are below:
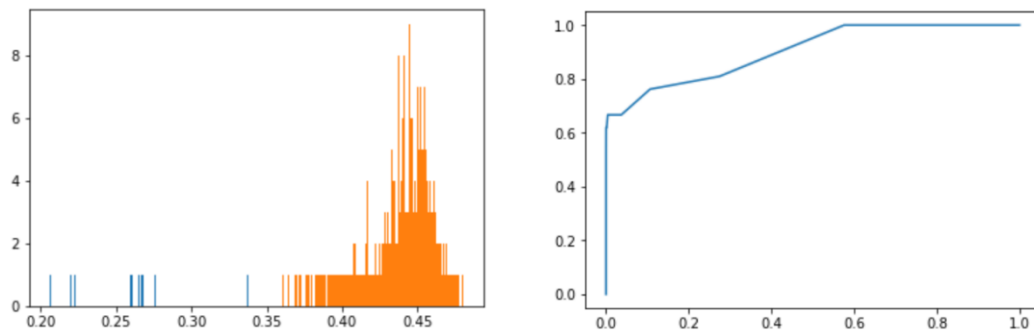

Figure.7 genuine and imposter distribution and ROC of Right eye_LG2200-2008-03-11_13_LG4000-2010-04-27_29_shift=-100-100
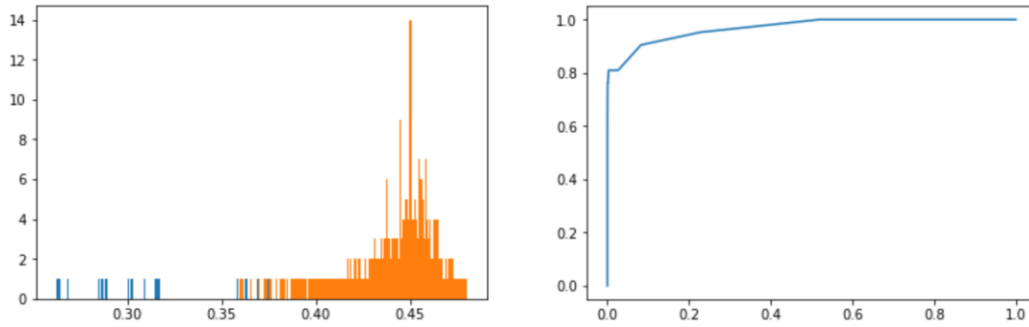
Figure.8 genuine and imposter distribution and ROC of Right eye_LG2200-2008-03-11_13_LG4000-2010-04-27_29_shift=-100-100

We chose LG2200-2008-03-11_13 as gallery and LG2200-2010-04-27_29 and LG4000-2010-04-27_29 as folder, and plot CMC curve.
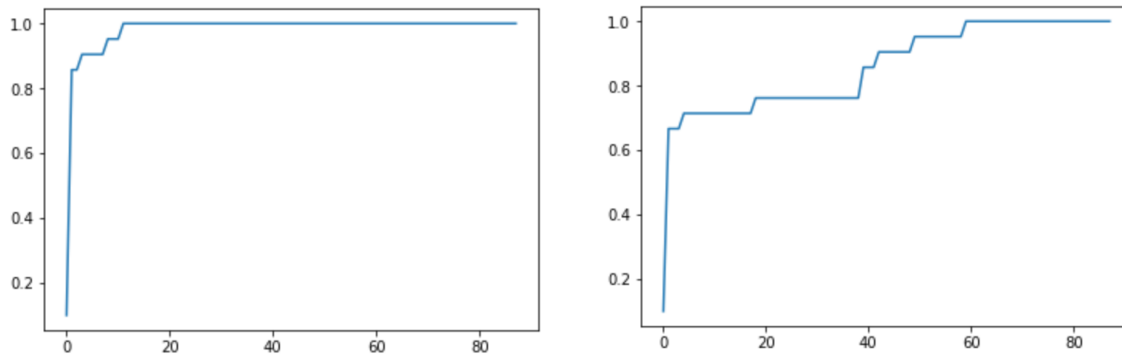

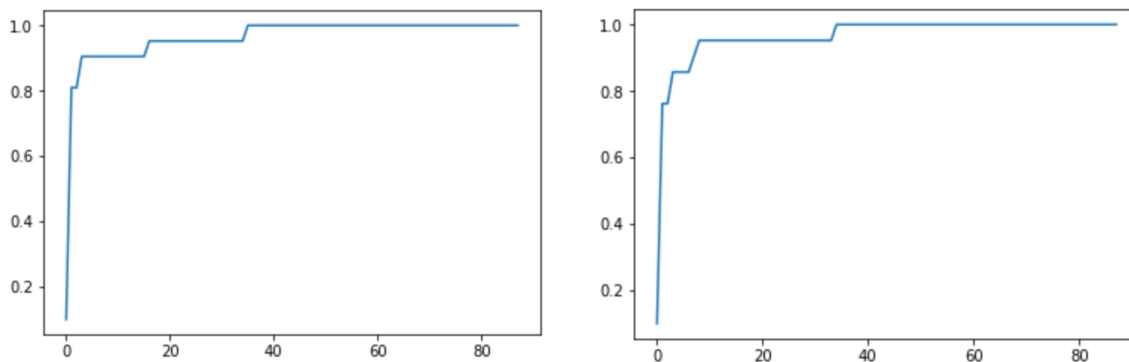Figure.9 CMC of Left and Right eye of _LG2200-2008-03-11_13_LG2200-2010-04-27_29_shift=-100-100

Figure.10 CMC of Left and Right eye of _LG2200-2008-03-11_13_LG4000-2010-04-27_29_shift=-100-100

Because of difference of quality of image, left eye and right eye have different CMC curve, combined different ranking of left and right eye can decreased total ranking value of two image.

Conclusion:

Eye image choosing depends on completeness of iris, if eye in gallery covered more eyelid and eyelash, which would increase FRR, FAR. Thus, thresholding value of eyelash should be adjusted to fit this dataset, we find thresholding is around 10 give relative lowest FRR and FAR. For hamming distance ratio, if we increase shift pattern range, it can increase TAR and FAR, according to our dataset, increased range of shift can give better ROC curve.

Besides parameter adjusting, if we compared different eyes in same person, it can also decrease FRR and FAR.