Practical 5 – PCA Eigenfaces

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Order of the steps in the pipeline

1. The steps in the above pipeline are in a distinct order.

   (a) [6 points] We have seen that quality of the reconstructed input image depends on the number of principal components used. You have tested variants of 10, 20 and 200 principal components. What is a good criteria to select a proper choice?

   Answer: The number of eigenfaces increases the quality of the result, as seen in the DET-curves where the FNMR and FMR decrease when the number of PCNs increases. When we are to choose the number of principal components we have to remember that there is a trade-off between how much of the redundant information we can eliminate versus not losing too much of the identity information. The elimination of redundant information is done by compressing the images. If we remove too much we and we will end up losing the sensitive information that is needed for the facial recognition part later. If we calculate the False Acceptance Rate (FAR) and the False Rejection Rate (FRR) we can derive the Equal Error Rate (EER) score. As this is where FAR equals FRR, this could be a good criteria to start with when selecting the principal components. Further adjustments can then be made left or right depending on the need for performance.

   (b) [4 points] Compare the recognition accuracy for this PCA based face recognition system with the accuracy of the fingerprint recognition system by providing two standard DET-curves: one DET-curve from today's face recognition, second DET-curve from the Practical 03 - last task. Note: Matlab scripts (EER plot Biocoourse.m and files in folder 'DET-Code') for drawing standard DET-curve can be found from the Practical 03 material.

   Answer: Figure 1 and 2 below depicts the DET-curves of face recognition and fingerprint recognition respectively. We can see from the figures that face recognition is the most accurate recognition system by allowing for the lowest FNMR vs. FMR score, given that the threshold is set somewhere between 1.0 and 2.0 (x-axis). However, the fingerprint recognition system seems to be more stable in that the FNMR and FMR values change in fewer intervals compared to figure 1. The values in figure 2 are consistently higher than the DET-curve of figure 1. In contrast, we see that the FNMR values for face recognition steadily decrease as the number of FMR values increases.

   The choice between the two systems would (solely based on the DET-curve) come down to what is most important for the user. Unless you need an FMR score under 1.0 (ca.) the face recognition system will give you the best results.

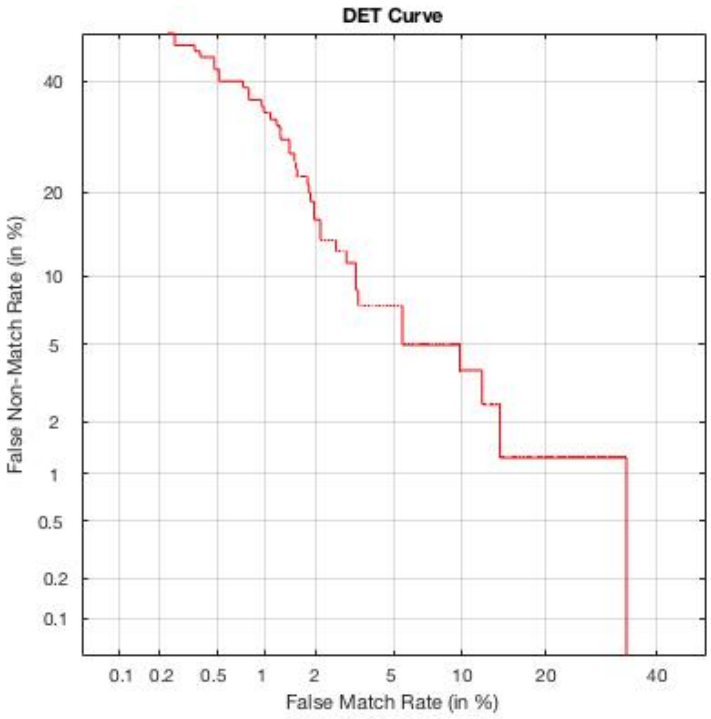

Figure 1: DET-curve - Face Recognition

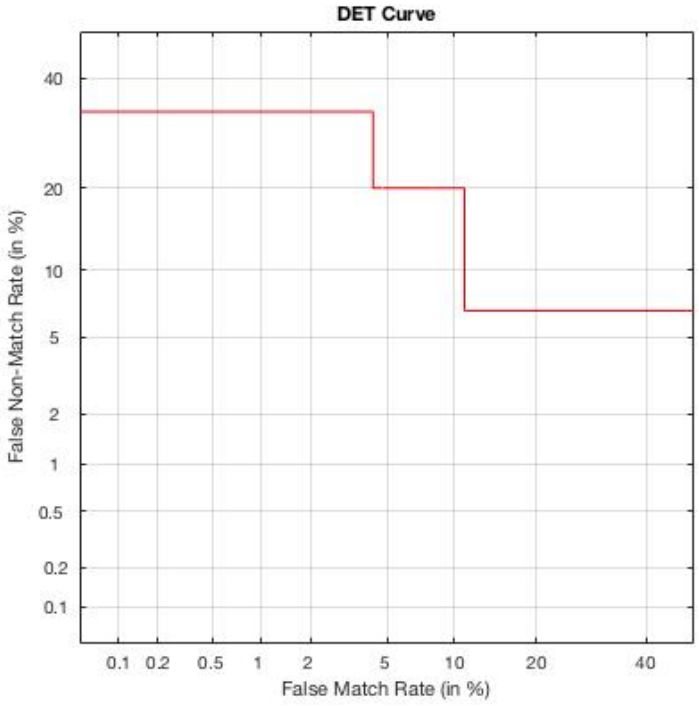

Figure 2: DET-curve - Fingerprint Recognition