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Exercise 6

If we test our system on face images whose faces are not in our training set, we will still get some matching identity since we simply use the least squared error metric. To counter this, we need to introduce a threshold mechanism on the values of the least squared error metric. For a particular test image, if the value exceeds the threshold, we would conclude that there is no matching identity for that image in the train database.

Let us define a test image for which no matching identity is found by the algorithm as a "Negative" and a test image for which one is found as a "Positive". Then, a "False Positive" refers to a test image for which there is actually no matching identity, but the algorithm still finds one (i.e. the least squared error metric should have exceeded the threshold, but did not). Similarly, a "False Negative" refers to a test image for which there is actually a matching identity, but the algorithm doesn't find one (i.e. the least squared error metric exceeded the threshold, but shouldn't have).

For this part, we work on the face recognition system based on the SVD routine, with the dimension value $k = 50$. We calculate the False Positive and False Negative rates (i.e. the total number of false positives / false negatives divided by the total number of positives / negatives) for various threshold values in the range $[1 \times 10^6, 14 \times 10^6]$. The aim is to find an optimum threshold value which minimizes both the rates.

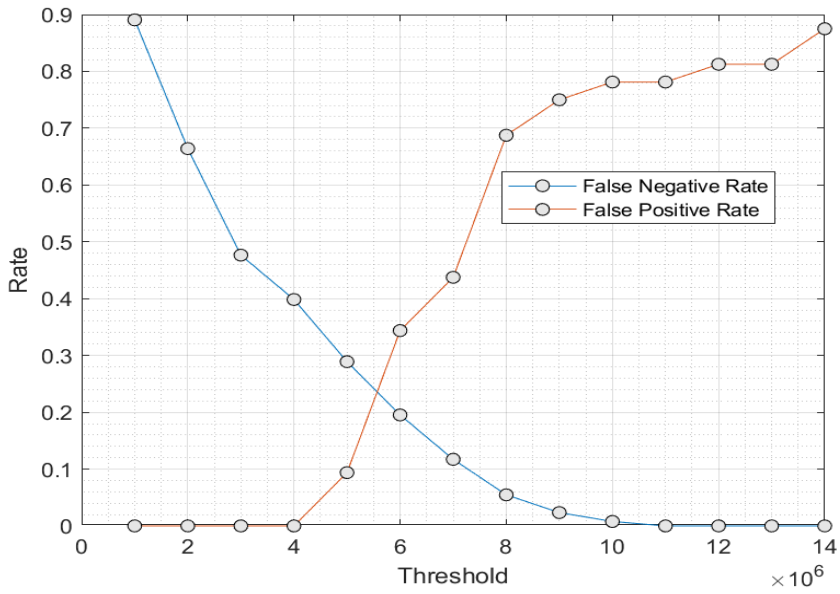

Figure 1: The False Positive and False Negative rates for different values of the threshold, while testing on the entire test set from the ORL database consisting of 4 images each of the first 32 persons (belonging to the train set) and 4 images each of the remaining 8 persons (not belonging to the train set). We can clearly observe that the optimal threshold value is around 5.5×10^6, where both the false rates approximately equal 0.2, which in turn implies a pretty good accuracy in correctly identifying faces with no matching identity in the training set.