Assignment #1: Fingerprint Recognition

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I. Introduction

This report covers fingerprint recognition using NIST Biometric Image Software (NBIS) to compare fingerprints and optimize classification accuracy.

II. Methodology

TIFF images were converted to PNG using ImageMagick, followed by minutiae point extraction with MINDTCT and all-to-all comparisons using BOZORTH3. Genuine and impostor scores were plotted, and the threshold was set by identifying the EER while balancing FAR and FRR. Classification accuracy was calculated as the ratio of correct matches to total comparisons, with fingerprints further classified by type using PCASYS, restricting comparisons within the same type for performance evaluation.

III. Experiments

For the analysis, we used the FVC2004 DB1 B database [1], which consists of 80 fingerprint samples. The classification threshold was calculated to be 12.75.

IV. Results and Discussion

Results show a clear distinction between genuine and impostor matches, with optimal classification accuracy achieved using the determined threshold.

A. Results

The plot of bozorth3 match scores for both genuine and impostor comparisons is presented in Figure 1. The similarity matrix for all fingerprint comparisons is presented in Figure 2. The frequency of NFIQ quality scores is presented in Figure 3. The classification accuracy was 0.93, while the accuracy for matching within the same fingertip type was 0.85.

B. Discussion

Although the classification accuracy was expected to be higher when matching only within the same fingertip type, it was not, likely due to the small size of the database.

V. Conclusion

This report demonstrated fingerprint recognition using NBIS, achieving a classification accuracy of 0.93. However, accuracy for matching within the same fingertip type was lower at 0.85.

References

[1] Fingerprint datasets. [Online]. Available: https://github.com/robertvazan/fingerprint-datasets?tab=readme-ov-file#fvc2004-db1-b

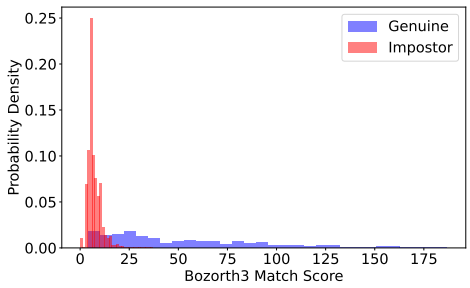

Fig. 1. Distribution of bozorth3 match scores for genuine and impostor comparisons.

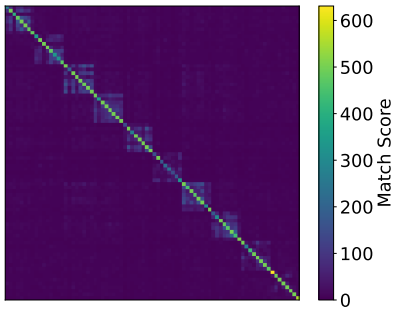

Fig. 2. Symmetric matrix of match scores representing pairwise comparisons between fingerprint images, with higher values indicating greater similarity. Diagonal represents comparison of same fingerprint.

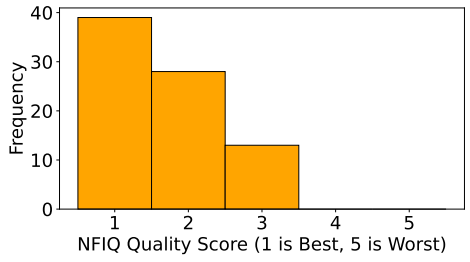

Fig. 3. The quality values were plotted to visually depict the distribution of fingerprint quality across the dataset, where a score of 1 indicates the highest quality and 5 indicates the lowest.