Assignment #1: Fingerprint Recognition

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I. INTRODUCTION

This assignment explores fingerprint recognition with the NIST Biometric Image Software (NBIS).

II. METHODOLOGY

The dataset was converted from TIFF to PNG using ImageMagick. Minutiae points were extracted with mindtct, and similarity scores were generated via all-vs-all comparisons with bozorth3. Fingerprint quality was assessed using NFIQ, and the optimal threshold was determined by calculating FAR, FRR, and EER. In a second experiment, images were converted to WSQ format, classified by type with PCASYS, and restricted to same-type fingerprints.

III. EXPERIMENTS

The experiments were conducted using the FVC2004 DB1 B dataset [1], comprising 10 fingers with 8 impressions each, in TIFF format at 500 dpi with a resolution of 640x480 pixels.

IV. RESULTS AND DISCUSSION

This section presents the key findings from our analysis.

A. Results

The score distribution plot (Figure 1) shows lower and more concentrated impostor scores, while genuine scores range from 0 to 500. The similarity matrix (Figure 2) reveals higher scores for same-subject comparisons, with diagonal squares indicating genuine matches. Most fingerprint quality scores (Figure 3) fall into categories 1, 2, and 3, predominantly category 1. The EER threshold was computed at 12.75, yielding a classification accuracy of 93.33%. In the second classification, fingerprints were categorized by type, leading to an accuracy of 87.35%.

B. Discussion

Classification accuracy improved when images were not categorized by type, likely due to the complexity of type classification or insufficient dataset splitting.

V. CONCLUSION

This study demonstrates the effectiveness of the fingerprint classification system, achieving high accuracy in differentiating genuine and impostor fingerprints.

REFERENCES

[1] "Fingerprint dataset collection," https://github.com/robertvazan/fingerprint-datasets?tab=readme-ov-file#fvc2004-db1-b, accessed: October 14, 2024.
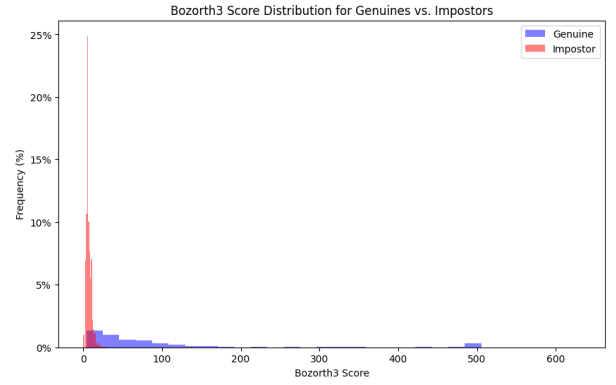

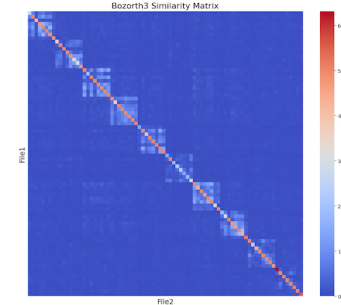Fig. 1. Score distribution for genuines and impostors.
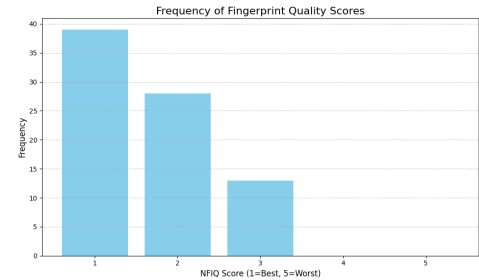

Fig. 2. Similarity matrix for similarity scores.

Fig. 3. Frequency of fingerprint quality scores.