

# Hybrid Fingerprint Matching Algorithm Survey

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## ABSTRACT

We introduce the study of combined techniques for efficient fingerprint matching. This paper basic four methods to improve the performance of fingerprint matching. Fingerprint Matching based on minutiae matching, Binarization and Feature Extraction can develop a system with speed and accuracy in all.

**Keyword - Minutiae Matching, Binarization, Feature Extraction.**

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## I. INTRODUCTION

Fingerprints are oldest and widely used form of biometric identification. Everyone is known to have unique, immutable fingerprint. Automatic and Secure person identification is an essential means to meet today's increasing need of security. Use of biometric feature has many advantages over conventional personal identification and verification methods. Biometric feature are time invariant throughout the whole life, easy to record and always available for the owner. The probability of finding the persons with the same fingerprints is 1 in 1 million. Manual fingerprint verification, use for police work, has some disadvantages like high cost and time consumption. The goal is to replace the manual verification process by an automatic system.

Automatic fingerprint identification and authentication (AFIA) is a biometric technology which has been considered for a long time but still it is an active research area. In the fingerprints identification system, the matching algorithm is the most important stage. The pre-processing is a process enhancement the Latent fingerprint image quality. The pre-processing Technique can be using includes 5 Categories.

### A. Histogram Equalization

The Histogram Equalization to the bad quality Latent fingerprint image into convert proper sequence in order to the clearing ridge structure.

### B. Segmentation

The Segmentation is a separation of fingerprint in between foreground and background image.

### C. Thinning

Thinning is a process in which finger image is thinning to 1 pixel finger image. This performance is used for most use full and useless ridges clearing.

### D. Smoothing

The impression smoothing are those in which based on the ridge orientation field are flow across flat surface of fingerprint images.

### E. Binarization

Binarization is technique to fingerprint gray-scale image converting into binary images.

The paper basically describes the four different methods for fingerprint reorganization and efficient matching.

1. Efficient Minutiae based Fingerprint Matching.
2. Fingerprint matching based on local point model.
3. Minutiae Extraction from Fingerprint Image.
4. A Fingerprint Recognition Algorithm combining phase based image matching and feature based matching.

Efficient Minutiae-Based Fingerprint matching

The matching process consist of three major steps: the first step is finding pair of possibly corresponding minutiae in both fingerprint patterns, the second step is combining these pairs to valid tuples of four minutiae each, containing two minutiae from each pattern. The third step is the matching itself. It is realized by a monotonous tree search that finds consistent combinations of tuples with a maximum number of different minutiae pairs. The approach has low and scalable memory requirements and it is computationally inexpensive.

Matching Approach

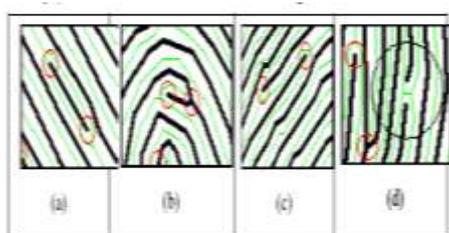
In the first step it determines possible pairs of corresponding minutiae in a reference fingerprint template (with  $N_{ref}$  minutiae) and in a test fingerprint (with  $N_{test}$  minutiae). During the second step these pairs of minutiae are combined. During last step an as large as possible set of consistent tuples is determined. The more consistent minutiae pair is found, the better the two fingerprint templates match each other. The actual fingerprint verification is performed by simply applying a threshold to matching. Test fingerprints with a matching ratio larger than the threshold are accepted, other are rejected.

$$r_{matching} = \frac{N_{matching}}{\min(N_{ref}, N_{test})}$$

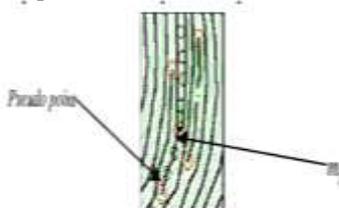
Fingerprint matching based on local point model

This method uses partial TPS warping method instead of TPS method.

Associated ridge-valley structure and pseudo minutiae some configuration of figured minutiae with their rigid valley pair associated are described in fig.1



Sampling ridge-valley pair associated and appending corresponding point pairs



Note that 10 is the length (usually chosen as the double distance of ridges space) and  $l_{max} = 410$ .

Minutiae Extraction From Fingerprint Image

There are number of techniques present in the literature for extracting fingerprint minutiae.

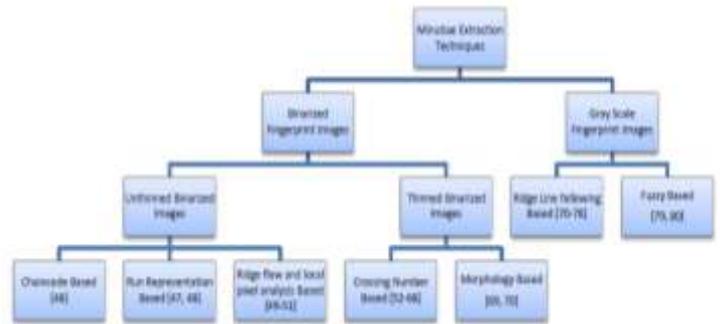


Fig 1. Classification of minutia extraction techniques

Good quality fingerprint images need only minor pre-processing and enhancement for accurate feature detection algorithm. But low quality fingerprint images need pre-processing to increase contrast, and reduce different types of noises as noisy pixels also generate a lot of spurious minutiae as they also get enhanced during the pre-processing steps.

A Fingerprint Recognition Algorithm Combining phase based image Matching and Feature Based Matching.

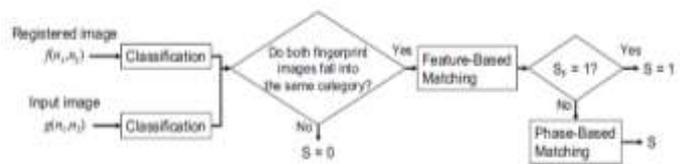


Fig.2 Flow diagram of the proposed algorithm

Classification

In our algorithm, we classify the fingerprints into 7 categories: “Arch”, “Left Loop”, “Right Loop”,

“Left Loop or Right Loop”, “Anchor Left Loop”, “Arch or Right Loop”, and “Other”.

Feature-based matching

This stage evaluate the matching score SF of feature-based matching as described in section 3. If  $SF = 1$ , then we set the overall score as  $S = 1$  and terminate matching operation, otherwise we proceed to the stage (III).

Phase-based matching

This stage evaluate the matching score SP of phase-based fingerprint matching the overall matching score S is computed as a linear combination of SF and SP, given by  $S = \alpha \times SF + (1 - \alpha) \times SP$ , (7)

Where  $0 \leq \alpha \leq 1$ . In our experiments,  
We employ  $\alpha = 0.5$ .

### Conclusion

We can develop fast and accurate system based on techniques studied in literature survey. The system can be developed using multiple techniques for fast and robust fingerprint matching.

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