A Survey on Latent Fingerprint Matching Techniques

Swapnil G. Patil [1], Mayank Bhatt [2]

M.Tech Scholar, Computer Science & Engg, Rishiraj Institute of Technology, Indore, India [1]

Assistant Professor, Computer Science & Engg, Rishiraj Institute of Technology, Indore, India [2]

Abstract: This paper crime scenes forensics and law enforcement is (latent fingerprint matching) techniques. In crime scenes and forensics Latent fingerprint identifying is an important latent fingerprint is poor quality image cannot easy to extract. It is matching latent fingerprint image it is necessary to extract features for efficient to improve the matching accuracy. The different latent matching algorithm and techniques are discussed.

Keywords: Fingerprint, latent fingerprint features, segmentation, Latent matching Techniques.

I. INTRODUCTION

In Latent fingerprint is mostly used in crime scenes and forensics Applications. It is Matching essentially Three categories of fingerprint in Biometrics forensic application (i) Roll fingerprint, which fingerprint image are obtained by Rolling a finger from one side to the other nail to nail in order to capture all ridge details of a finger.
(ii) Plain fingerprint which are plain fingerprint which are plain impression are those in which the finger is pressed down on flat surface but cannot Latents inadvertently Handled by crime scenes (Latents print).

Due to Latents fingerprints are smudgy and blurred that are usually with short Area and Long Distortion. The characteristics latent is smaller number of minutiae points compared to full made is full plain fingerprint and rolled full fingerprints. The small Number of minutiae and noise characteristics of latents to their mated Full prints that stored in Law enforcement database[5].A number of algorithm full to full fingerprint but they do not perform well on Latent on full to full matching problems and not easy to extract from poor quality latents[5][9].
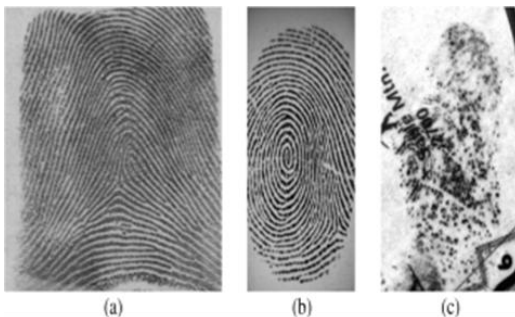

Fig. 1.Three types of fingerprint impressions. Rolled and plain fingerprints are also called full fingerprints. (a) Rolled; (b) plain; (c) latent [5].

II. PREPROCEESING

The Preprocessing is a process enhancement the Latent fingerprint image quality. The Preprocessing Techniques can be using includes 5 Categories.
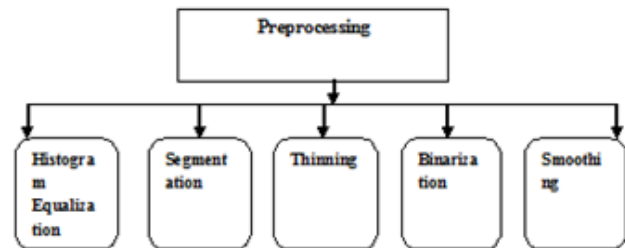

Fig. 2. Preprocessing various Techniques.

The Preprocessing Techniques can be using includes 5 Categories.

A. Histogram Equalization

The Histogram equalization to the Bad(ugly)quality Latent fingerprint image into convert proper sequence in order to the clearing ridge structure.

B. Segmentation

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

C. Thinning

Thinning is a process finger (print) image is Thinning to 1 pixel finger (print) image. Which performance to most usefully 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.

III. FEATURE EXTRACTION

The Feature Extraction Process is Most Important in Latent fingerprint matching Due to Latent Poor quality and it is important to capture all features in latent finger image for an efficient matching.

A. Minutiae Points
B. ROI
C. Ridge Orientation field
D. Singulars Point
E. Edge detection

A minutiae is defined as the points of interest in a fingerprint such as ridge bifurcation(a single ridge that divides into two ridges) The Region of Interest(ROI) is a closed region that is bounded at outer most trim of the latent[7].The Ridge Orientation field describes the global structure of fingerprints. It provides robust discriminatory information other than traditional widely-used [8].The Singularities observed in almost all the fingerprints fall into one of the following categories: (i) no singularity (i.e., arch type of fingerprints), (ii) one core and one delta (i.e., loop and tented arch type), and (iii) two cores and two deltas (i.e., whorl and twin loop type)[7].(iv) The most important Goal of edge detection techniques is detect and localize of finger images edges.

IV. LATENT FINGERPRINT MATCHING

In the Latent print developed law enforcement and crime scenes (Latent prints) have significantly smaller number of minutiae points compared to full (rolled and plain) finger prints. The small number of minutiae and the noise characteristic of latent make it extremely difficult to automatically match latents to their matched full prints that are stored in law enforcement database [5][9].
Fingerprint matching solving the problems-

A. Alignment: Fingerprint alignment consists estimating the parameter (Rotation and translation) that align two fingerprints.

B. Similarity measure: A matching score between two fingerprints computed by computing minutiae and orientation fields.

C. Local minutia Descriptor: The Local descriptor has been widely used in fingerprint matching. The descriptor is used in the four types of fingerprints- 1. Good 2. Bad 3. Small common region 4. Large Plastic distortion [5].

V. LITERATURE SURVEY

Difference Goals New Approaches that use in Additional features and application the latent fingerprint to improves matching.

Anil K. Jain, Fellow, IEEE, and Jianjiang Feng [1], in this paper they Work on "Latent Fingerprint Matching" paper proposed to automated Fingerprint Identification Systems (AFIS) have played an important role in many forensics and civilian applications. Tremendous progress has been made in plain and rolled fingerprint matching; latent fingerprint matching continues to be a difficult problem. Poor quality of ridge impressions, small finger area, and large non-linear distortion are the main difficulties in latent fingerprint matching, compared to plain or rolled fingerprint matching. propose a system for matching latent fingerprints found at crime scenes to rolled fingerprints enrolled in law enforcement databases. In addition to minutiae, they also use extended features, including singularity, ridge quality map, ridge flow map, ridge wavelength map, and skeleton The baseline matching algorithm takes only minutiae as input and consists of the following steps:1) Local minutiae matching: Similarity between each minutia of latent fingerprint and each minutia of rolled fingerprint is computed. 2) Global minutiae matching: Using each of the five most similar minutia pairs found in Step 1 as an initial minutia pair, a greedy matching algorithm is used to find a set of matching minutia pairs. 3) Matching score computation: A matching score is computed for each set of matching minutia pairs and the maximum score is used as the matching score between the latent and rolled prints. A pair of fingerprints is classified by a traditional classifier, such as Artificial Neural Network (ANN) or Support Vector Machine (SVM), as a genuine match or an impostor match based on a feature vector extracted from matching these two fingerprints. The minutiae-based baseline was improved to extended features were used The indicate that singularity, ridge quality map and ridge flow map are the most effective features in improving the matching accuracy [1].

Soweon Yoona, Jianjiang Fenga, and Anil K. Jain*a,b[2], in this paper they Work on "On Latent Fingerprint Enhancement" the proposed a latent fingerprint enhancement algorithm which requires manually marked region of interest (ROI) and singular points The proposed enhancement algorithm is a novel orientation field estimation algorithm, orientation field model to coarse orientation field estimated from skeleton outputted by a commercial fingerprint SDK One of the irreplaceable functionality of fingerprint recognition is its capability to link partial prints found at crime scenes to suspects whose fingerprints are previously enrolled in a large database of rolled fingerprints. Most orientation field estimation algorithms consist of two steps: initial estimation using a gradient-based method followed by regularization. The regularization may be done by a simple weighted averaging filter or more complicated model-based methods. It is better to use only reliable initial estimate or to give it larger weight. To overcome this limitation, estimate a coarse orientation field from skeleton image generated by a commercial SDK.
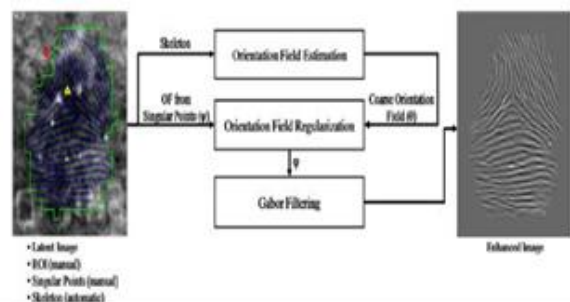

Fig.3. Proposed the system latent enhancement algorithm [2].

The regularization may be done by a simple weighted averaging filter or more complicated model-based methods. it is better to use only reliable initial estimate or to give it larger weight. To overcome this limitation, estimate a coarse orientation field from skeleton image generated by a commercial SDK. Incorporating the proposed enhancement algorithm. The matching accuracy of the commercial matcher was significantly improved [2].

Kai Cao, Eryun Liu, Member, IEEE and Anil K. Jain, Fellow, IEEE [3], in this paper they Work on "Segmentation and Enhancement of Latent Fingerprints: A Coarse to Fine Ridge Structure Dictionary" Latent fingerprint matching has played a critical role in identifying suspects and criminals. They compared to rolled and plain fingerprint matching, latent identification accuracy is significantly lower due to complex background noise, poor ridge quality and overlapping structured noise in latent images. To reduce this markup cost and to improve the consistency in feature markup, fully automatic and highly accurate ("lights-out" capability) latent matching algorithms are needed. In this paper, a dictionary-based approach is proposed for automatic latent segmentation and enhancement towards the goal of achieving "lights-out" latent identification systems. The algorithm can be further improved along the following aspects: 1) a robust patch quality definition, especially for dry fingerprint images, where ridges are broken. 2) A better definition of confidence measure for the segmentation and enhancement results. 3) Improve the computational efficiency of the algorithm. The proposed algorithm outperforms the state-of-the-art segmentation and enhancement algorithms and boosts the performance of a state-of-the-art commercial latent matcher [3].

Alessandra A. Paulino, Eryun Liu, Kai Cao and Anil K. Jain [4], in this work on "Latent Fingerprint Indexing: Fusion of Level 1 and Level 2 Features". In this paper, they introduced an indexing technique, primarily for latents, that combines multiple level 1 and 2 features to filter out a large portion of the background database while maintaining the latent matching accuracy. These consist of combining minutiae, singular points, and orientation field and frequency information. Their approach consists of combining a constrained version of triplet indexing, MCC indexing and a new orientation field descriptor indexing technique that uses hash function, filtering based on singular points and averaged ridge period comparison. Orientation field descriptor indexing is carried out first by converting the descriptor in a binary vector, using a hash function, similar to as above. The indexing score based on each one of these specific features is combined to obtain the final indexing score.

Singular points provide useful characterization of a fingerprint. To order the singular points in a pair of singular points. A better fusion scheme would take into account the differences in the latents so that the weights assigned to different features used in indexing can be adaptively determined, or the different features could be used sequentially. The latent matching accuracy [4].
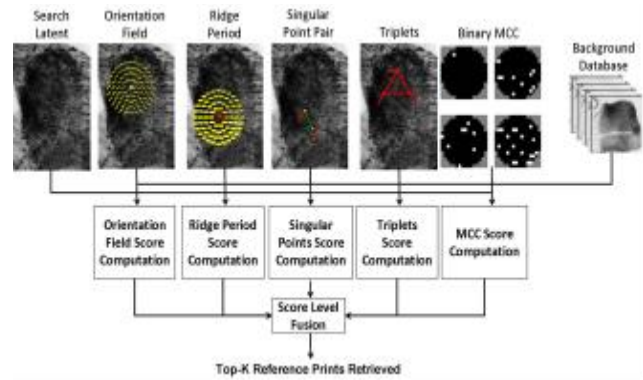

Fig.5. Overview of the proposed indexing scheme [4].

Alessandra A. Paulino, Student Member, IEEE, Jianjiang Feng, Member, IEEE, and Anil K. Jain, Fellow, IEEE[5], in this paper work on on" Latent Fingerprint Matching Using Descriptor-Based Hough Transform". In this paper they proposed a robust alignment algorithm (descriptor-based Hough transform) to align fingerprints and measures similarity between fingerprints by considering both minutiae and orientation field information. To be consistent with the common practice in latent matching (i.e., only minutiae are marked by latent examiners), the orientation field is reconstructed from minutiae. Since the proposed algorithm relies only on manually marked minutiae, it can be easily used in law enforcement applications. Alignment between a latent and a rolled print is a difficult problem because latents often contain a small number of minutiae and undergo large skin distortion. Using these two problems, they propose the descriptor-based Hough transform (DBHT), which is a combination of the generalized Hough transform and a local minutiae descriptor, called Minutia Cylinder Code (MCC).
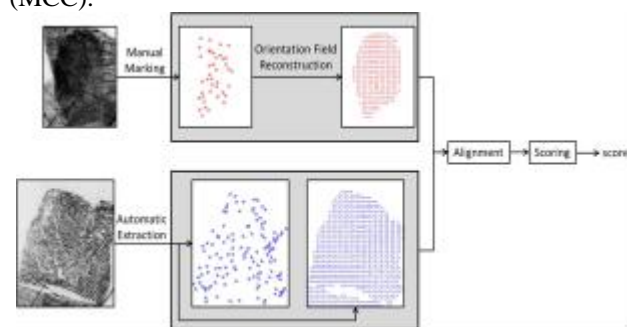

Fig 6. Overview of the proposed approach [5].

VI. PROPOSED METHOD

The proposed work is based on the Template Matching algorithm to improving the matching accuracy. The performance of the proposed matching latents rolled fingerprint and plain fingerprints. The Latent fingerprint techniques available ridge structure in latent fingerprint matching techniques. In finally use to COTS matcher is use to presents in the latent fingerprint matching faster. This method to improving the matching accuracy and performance better also planned new approach Template Matching algorithm method to the database into improving the matching speed result.

VII. CONCLUSION

The latent fingerprints are found at law enforcement agencies crime sense. The fingerprint matching for matching latents rolled finger prints and plain finger prints. Due to its poor/ bad quality images. It is use to different enhance process to obtaining the clear ridge orientation field. The literature survey on different existing latent fingerprint techniques was includes done in this paper. The better goal is to provide fast and loads improve performance matching accuracy.

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BIOGRAPHY

Swapnil G. Patil Pursuing Masters of Technology in Computer Science & Engg, Rishiraj Institute of Technology, Indore [MP], Areas of Interest are Information forensics & security, Image Processing.