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A Classical Approach for Rolled, Plain to Latent Fingerprint Matching

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Abstract: This Paper present Crime Scenes, Law enforcement and forensics Application (Rolled, Plain and Latent fingerprint matching) Biometrics latent fingerprint identifying to catching the criminals. Due to Latent fingerprint is poor quality image means Blurred, Smudgy image cannot easily to extract. The main goal provide Latent fingerprint image matching to Rolled, Plain and Latent fingerprint. It is matching latent fingerprint (Image) it is necessary to extracting features to efficient to improving matching Accuracy and similarity. In this present work done Template matching (A Classical Approach) is used to matching Phase Angle and correlation.

Keywords: Rolled, Plained, Latent fingerprint, Template Matching, Fourier Transform, Phase angle, Correlation

I. INTRODUCTION

In Law enforcement and Crime Scenes using fingerprint recognize techniques to identifying suspects since the early 20th century. In main goal Latent fingerprint is mostly used in forensics and law enforcement database NIST27A Crime Scenes Application.

There are Three Types of fingerprint.

A. Rolled fingerprint

Rolled fingerprint images are obtained by a rolled from one side to another side. (nail to nail).

B. Plain fingerprint

Plain fingerprint impression which is those in which that surface fingerprint it is pressed down on finger flat surface it is not rolled.

C. Latent fingerprint

Latent fingerprint image impressions on surface of object which are indvently handled or touch by human or criminals at crime scenes.

Latent fingerprint matching proposed orientation field from rolled, plain and latent fingerprint images. Latent fingerprint matching by using template matching (A Classical Approach to improving then matching accuracy and compute similarity calculated) by Correlation and Phase angle method. 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 [2].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[2][4].

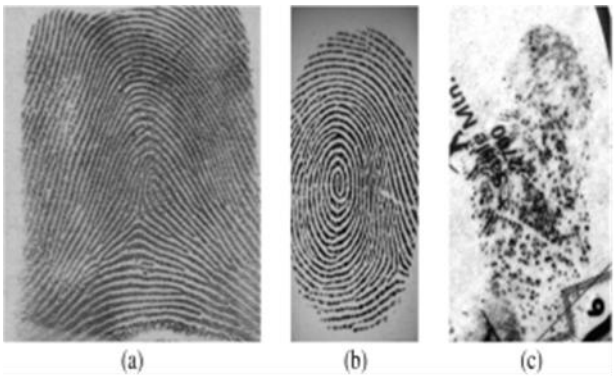

Fig. 1.Three types of fingerprint impressions. Rolled and plain fingerprints are also called full fingerprints. (a) Rolled; (b) plain; (c) latent [2].

II. RELATED WORK

In this section, we survey on related work in this area published research area on full fingerprint and latent fingerprint matching.

A. Full fingerprint Matching

The majority of the algorithms developed for fingerprint Matching is based on minutiae. Most proposed algorithms for fingerprint matching that use non minutiae Features also use minutiae. For example, some algorithms combine ridge orientation with minutiae information either at feature level by including ridge orientation information in local minutiae descriptors [15], [16] or at score level by combining scores from minutiae matching and global orientation field matching [16], [17].
In most of these studies, the initial step consists of using local minutiae descriptors to obtain the alignment between two fingerprints by considering the most similar minutiae pair; then, a global consolidation step is performed to obtain a better matching performance. Since these algorithms are usually tuned and evaluated using FVC databases (plain fingerprints) or NIST Special Database 4 (rolled fingerprints), their performances on latent fingerprints are unknown [2] [4].

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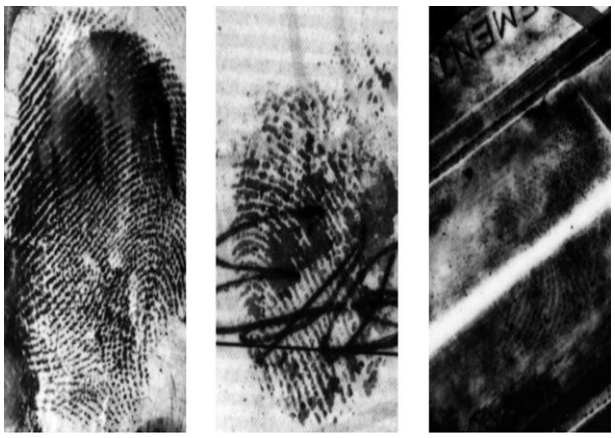
B. Latent Fingerprint Matching

Latents are partial that are use blurred, ugly with containing large distortion and small area. Due to these characteristics latent have significantly small number of minutiae points compared to full (plain and rolled fingerprints) The small number of full prints minutiae & the noise characteristics of latents make it extremely difficult to automatic match latents to their mated full that are stored in law enforcement and Crime Scenes.
Recent research and development efforts on latent fingerprints can be classified into three streams according to the manual input required from fingerprint examiners: consistent with existing practice, increasing manual input, or reducing manual input. Because of large variations in latent fingerprint quality and specific requirements of practical applications (crime scenes, border crossing points, battle fields), each of the three streams has its value [2].



(a) (b) (c)

Fig.2. Latent fingerprints of three different quality levels (a) Good; (b) bad; (c) ugly [2].

III.METHODOLOGY

A. Correlation

Correlation is a measure of the degree to which 2 variable are agree cannot important (necessary) in original value but if general behavior.The 2 variables are the corresponding pixel values in 2 image source and Template.

Correlation Analysis is computed to,

$$y(t) = G(q)\,u(t) + v(t) \qquad (1)$$

Where u (t) & y (t) there 2 input and output,
v(t) is the additive noise G(q) is the transfer (moves) function of the system,

At the G (q) u (t) represent,

$$G(q)u(t) = \sum_{k=1}^{\infty} g(k)u(t-k) \qquad (2)$$

q is the Shift operator

$$G(q) = \sum_{k=1}^{\infty} g(k)q^{-k} \qquad q^{-1}u(t)=u(t-1) \qquad (3)$$

The Algorithm estimate impulse Coefficient, noncasual FIR Model,

$$y(t)=g(-m)u(t+m)+\ldots.+g(-1)u(t+1)+g(0)u(t)+ g(1)u(t-1)+\ldots..+g(n)u(t-n) \qquad (4)$$

B. Template Matching

Template matching it is used to comparing the selected portions of small images against one another. A template matching is a main goal to sample image may be used to recognize similar object in source image. The Template matching image compared to source image is small enough are used in template matching. Template matching process transfer (moves) the template image to the all possibility particular positions index.

Template matching is the Classical Approach to the problems recognizing and locating of an image (object).Template matching techniques is the 2D (Dimensional) cases.it is use to many application like that image compression, computer vision, object tracking, stereo correspondence application.

C. A Fast Fourier Transform and Phase - Correlation

A Fast Fourier Transform has different properties that can be exploited for image registration. The Phase and Correlation relies on the translation property of the fast Fourier transform. The Discrete Fourier Transform (DFT) computed with a fast Fourier transforms (FFT) algorithm,

fft (fft (x),').' (5)

This computes the 1-dimensional DFT of each column. The execution time for Fourier transform depending on the length of the transform.

The compute the 2-dimensional convolution of matrices, then one matrices describe a two-dimensional finite impulse response ,then the phase and correlation of the using ,if the other matrix is filtered in 2-dimensional.

If a & b are function of 2-dimensional variables, n1 & n2

$$c(n_1, n_2) = \sum_{k_1=-\infty}^{\infty} \sum_{k_2=-\infty}^{\infty} a(k_1, k_2)\, b(n_1 - k_1, n_2 - k_2) \qquad (6)$$

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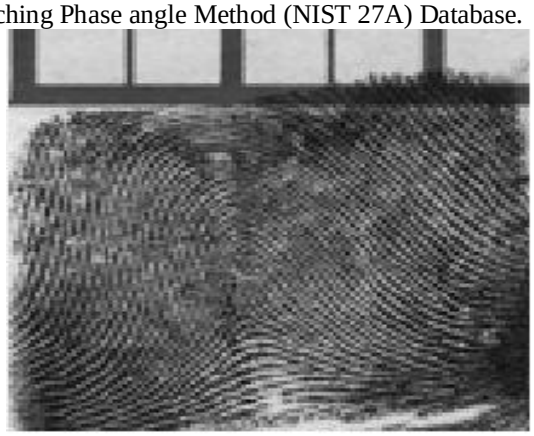
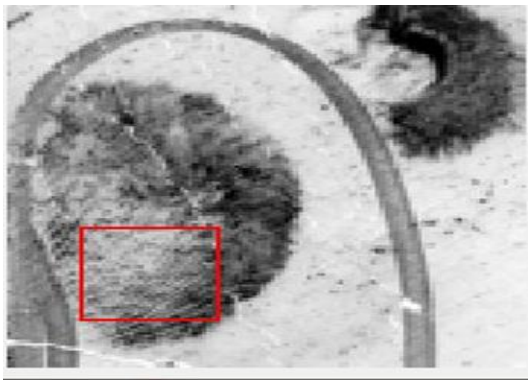
IV. RESULT AND DISCUSSION

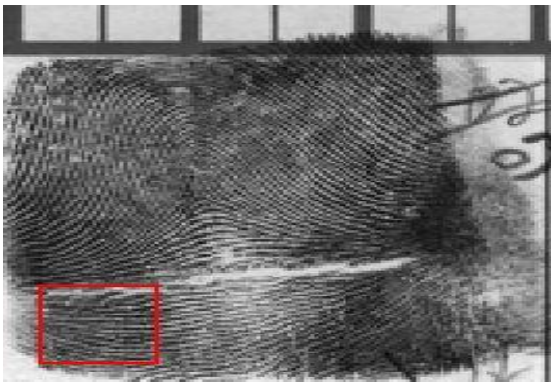
A. Template Matching with Rolled to Latent fingerprint matching Phase angle Method (NIST 27A) Database.



(a) Input Rolled Fingerprint Image



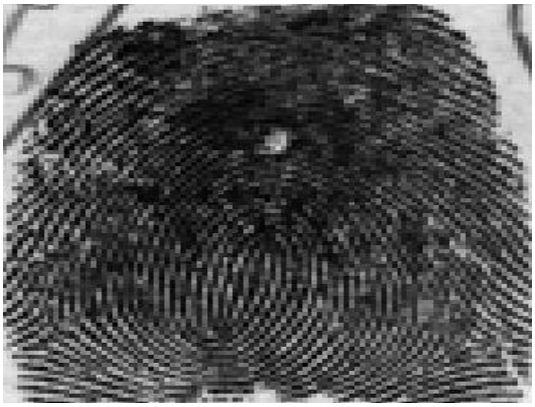
(b) Input Template Latent Fingerprint Image



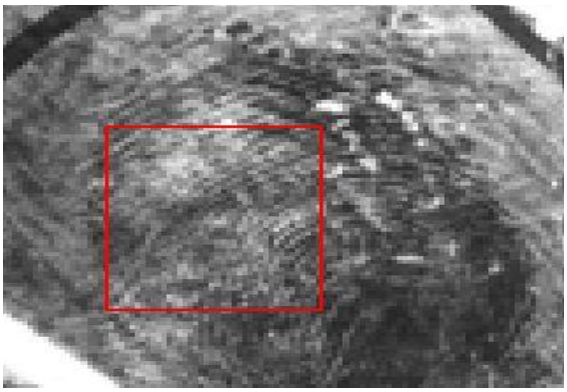
(c) Rolled fingerprint matching to Latent fingerprint By Template matching Phase Angle Method

Fig1: Rolled to Latent Fingerprint Matching

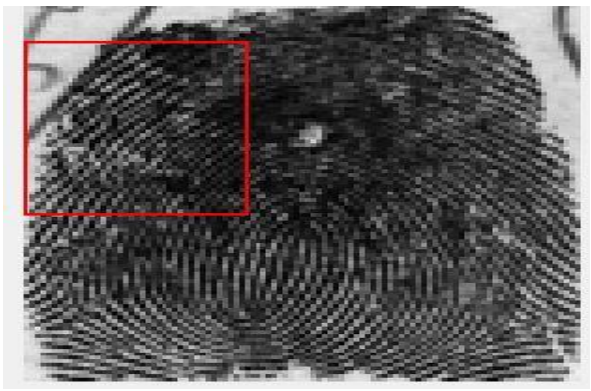
B. Template Matching with Plain to Latent fingerprint matching Phase angle Method (NIST 27 A) Database.



(a) Input Plain Fingerprint Image



(b) Input Template Latent Fingerprint Image



(c) Plain fingerprint matching to Latent fingerprint by Template matching phase angle Method

Fig 2: Plain to Latent Fingerprint Matching

Table I
Rolled, Plain to Latent Fingerprint Matching Accuracy and compute Similarity

Database (Images)	Phase angle Method (%)
Rolled to Latent fingerprint Matching.	61.4
Plain to Latent fingerprint Matching.	70.0

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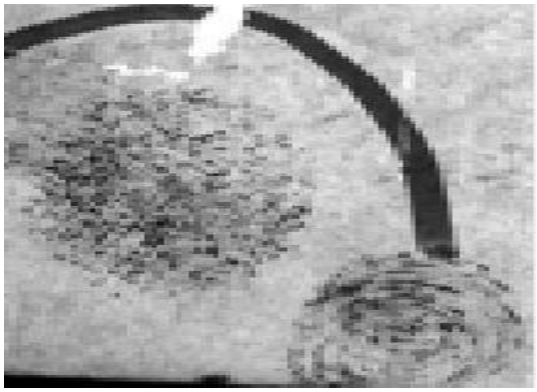
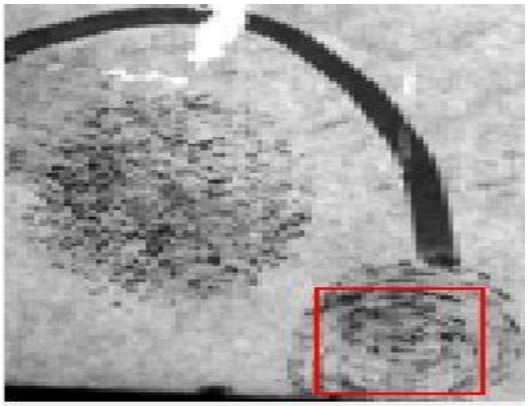
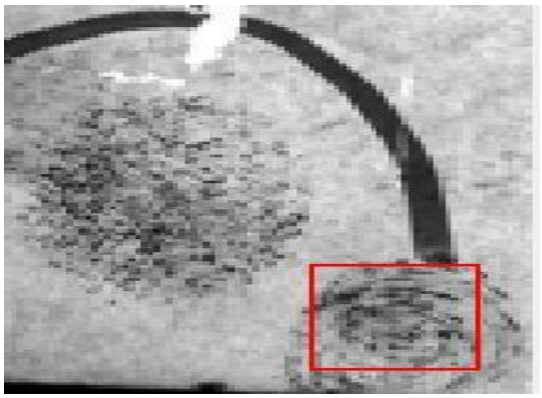
C. Template Matching Using with Latent to Latent Fingerprint Matching.



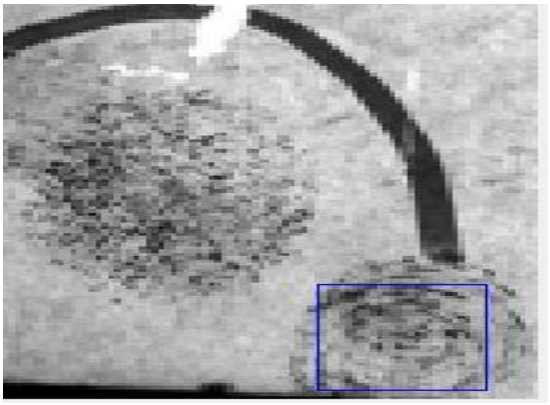
(a) Input Latent Image



(b) Input Template Latent Image



(c) Template Matching Using Phase Angle Method



(d) Template Matching Using Correlation Method

Fig 3: (A) Latent to Latent Fingerprint Matching. Image 1

(a) Input Latent Image

(b) Input Template Latent Image

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(c) Template Matching Using Phase Angle Method

(d) Template Matching Using Correlation Method

Fig 4: (B) Latent to Latent fingerprint Matching Image 2

TABLE II
Latent to Latent Fingerprint Matching Accuracy and compute Similarity

Database	Phase Angle Method (%)	Correlation (%)
A) Latent to Latent fingerprint Matching Image 1	14.90	100.0
B)Latent to Latent fingerprint Matching Image 2	33.27	100.0

V. CONCLUSION

This paper aim at experiment of latent fingerprint matching using correlation and phase angle method. From the study and analysis of Table after applying number of fingerprint images Rolled, Plain and latent are using NIST 27A Database. Came to the conclusion that Phase angle method improving matching accuracy for rolled, plain to latent fingerprint matching. We also reported two different latent fingerprint images and also compared the performance two difference methods improving matching accuracy and compute similarity for latent to latent fingerprint matching came to conclusion that phase angle less matching accuracy and correlation is more increasing improving matching accuracy and similarity.

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