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Fingerprint Reconstruction and Matching from Minutiae to Image

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Abstract-: ***On the surface of human fingertips, FINGERPRINTS are ridge and valley patterns present. The set of minutia points is widely used in fingerprint matching and fingerprint representation. To reconstruct the original fingerprint image from which minutiae were extracted, it was believed that the minutiae set do not contain sufficient information. To reconstruct fingerprint images from their minutiae representations, however, recent studies have shown that it is indeed possible. The need for securing fingerprint templates, improving the template interoperability, and improving fingerprint synthesis, Reconstruction techniques demonstrate. The matching performances obtained from original fingerprint images and reconstructed fingerprint images there is there is a large gap between the matching performance fingerprint images. To improve the fingerprint reconstruction, the prior knowledge about fingerprint ridge structures is encoded in terms of orientation patch and continuous phase patch dictionaries. While the continuous phase patch dictionary is used to reconstruct the ridge pattern, the orientation patch dictionary issued to reconstruct the orientation field from minutiae. Experimental results on three public domain databases demonstrate that the proposed reconstruction algorithm out the state-of-the-art reconstruction algorithms in terms of both:1) spurious minutiae 2) matching performance.***

Keywords: Fingerprint reconstruction, AM-FM model, Minutiae set, and Ridge

I. INTRODUCTION

The purported individuality of fingerprints is characterized by three levels of features. Global features, such as pattern type, ridge orientation and frequency fields, and singular points, are called level-1 features [1]. Level-2 features mainly refer to minutia points in a local region; edge ending and ridge bifurcations are the two the majority famous types of minutiae. Level 3 features include all dimensional attribute at a very fine scale, such as width, shape, bend and edge contour of ridges, pores, just beginning ridges, as well as other permanent details. Among these three types of features, the place of minutia points (called minutiae) is regarded as the most distinguishing feature and is most commonly used in fingerprint identical systems.

The purpose of interoperability of matching algorithms, an international standard ISO/IEC 19794-2 has been proposed for minutiae template symbol. To evaluate fingerprint matching algorithms uses this standard minutiae template format, FVC-on Going, a well-known web-based automatic assessment stage for fingerprint recognition algorithms [1], has set up a standard. However, it has been established that it is indeed probable to rebuild the fingerprint image from the minutiae; It was believed that it is not possible to reconstruct a fingerprint image given its extract minutiae set. The reconstruct image can be matched to the original fingerprint image with reasonable high accuracy. There is still a room for development in the accuracies, particularly for type-II attack. To create the reconstruct fingerprint be similar to the unique fingerprint, the aim of fingerprint reconstruction from a given minutiae set. A successful reconstruction technique demonstrates the need for secure fingerprint templates. Such a technique would also be useful in improving the corresponding presentation with ISO templates as well as addressing the issue of template interoperability. It also could be used to improve synthetic fingerprint reconstruction and reinstate latent fingerprint images. obtainable reconstruction algorithms basically consist of two main steps: i) orientation field reconstruction and ii) ridge pattern reconstruction. The orientation fields, which follow the ridge flow, can be reconstructed from minutiae and/or singular points.

II. LITERATURE REVIEW

In 2010, A. K. Jain, "Data clustering: 50 years beyond k-means,"2010.Requires Orientaion field andpattern. Different fingerprint recognition systems store minutiae-based fingerprint templates differently. This paper proposes a scheme to reconstruct a full fingerprint image from the minutiae points based on the amplitude and frequency modulated (AM-FM) fingerprint model. The scheme starts with generating a binary ridge pattern which has a similar ridge flow to that of the original fingerprint [2].

In 2011 E. Liu, H. Zhao, L. Pang, K. Cao, J. Liang, and J. Tian, "Method for fingerprint orientation field reconstruction from minutia template". In the proposed work the algorithm is used for the fingerprint reconstruction ,only the partial skeleton is obtain. A baseline algorithm for fingerprint verification in FVC. They describes an improved version of the MCC fingerprint matching approach. An in-depth error analysis allowed us to point out the weakest points of the original MCC and to design: i) a more effective minutiae pair selection and ii) a more distortion-tolerant relaxation. The parameters of the new version have been turned over a new larger dataset and the final algorithm has been evaluated on FVC-onGoing. The results show that MCC compares favorably with some of the most accurate commercial algorithms published in FVC-onGoing. MCC: A baseline algorithm for fingerprint verification [1].

In 2013 J. Feng, J. Zhou, and A. K. Jain, "Orientation field estimation for latent fingerprint enhancement," IEEE Trans. Pattern Anal. In this, Stream lines and line integral convolution is used.but for type -1 attack only Partial fingerprint is reconstructed. Orientation Field Estimation for Latent Fingerprint Enhancement [3].

In 2014 K. Cao, E. Liu, and A. K. Jain, "Segmentation and enhancement of latent fingerprints: A coarse to fine ridge structure dictionary," IEEE Trans. Pattern Anal. Mach. Intell., In this,AM FM model algorithm is used ,but Spurious minutiae and blocking effect appear in reconstructed fingerprint. Fingerprint Image Reconstruction from Standard Templates. This work proposes a novel approach to reconstruct fingerprint images from standard templates and investigates to what extent the reconstructed images are similar to the original ones. The efficacy of the reconstruction technique has been assessed by estimating the success chances of a masquerade attack against nine different fingerprint recognition algorithms [4].

- **Comparison of Fingerprint reconstruction algorithm -:**

Existing reconstruction algorithms essentially consist of two main steps: i) orientation field reconstruction and ii) ridge pattern reconstruction. The orientation field, which determines the ridge flow, can be reconstructed from minutiae and/or singular points.
In existing work, the orientation field was reconstructed from the singular points (core and delta) using the zeropole model. However, the orientation field in fingerprints cannot simply be accounted for by singular points only.
In one more existing work, a set of minutiae triplets was proposed to reconstruct orientation field in triangles without using remarkable points. The algorithm proposed by Feng and Jain predict an orientation value for each block by using the adjacent minutia in each of the eight sectors.
In a variant of the zeropole model with additional degrees of freedom to fit the model to the minutiae directions. However, the orientation field reconstructed based on zero-pole model cannot be guaranteed when the singular points are not available.
In the Existing Fingerprint reconstruction technique Number of algorithm are used. Here,comparison of some fingerprint reconstruction algorithm are

Algorithms	**Orientation Field Reconstruction**	**Ridge Pattern Reconstruction**	**Performance Evaluation**	**Comments**
Hill(4)	Zero-pole model (5)	Partial Skeleton reconstruction.	Type-I attack. Identification rate.	Only partial Skeleton is obtain.
Cappeli(7)	Modified zer-pole model	Line integral convolution	Gaber filtering	Many fake Minutiae is Obtain
Feng and Jain	Nearest minutiae in eight sector	AM-FM model	Type –I attack.Identification rate on NIST SD4 by verifinger SDK 4.2	Blocking effect apper in reconstructed fingerprint
Ross etal	Minutiae triplets	Streamlines and line integral convolution	Identification Rate on NIST SD4	Only partial fingerprint is reconstructed.
Li and Cot	Nearest Minutiae in eight sector	AM-FM model	Type-II attack.Verifinger SDK 6.3	Ridge frequency and ridge flow may change the continuous fingerprint.
Proposed algorithm.	Orientation patch dictionary.	Continious phase patch dictionary	Type-I attack ,Identification rate on NIST by verifinger SDK .	Requires lerning orientation field and ridge pattern.

Table1-: comparison of Fingerprint reconstruction algorithm in existing techniques.

III. PROPOSED APPROACH

We propose to reconstruct fingerprint patches using continuous phase patch dictionary and minutiae belonging to these patches; these patches are optimally selected to form a fingerprint image. The spurious minutiae, which are detected in the phase of the reconstructed fingerprint image but not included in the input minutiae template, are then removed using the global AF-FM model. The proposed reconstruction algorithm has been evaluated on three different public domain databases.

The goal of fingerprint reconstruction is to reconstruct a gray-scale fingerprint image based on an input. In this paper, a dictionary-based fingerprint reconstruction method is proposed. Two kinds of dictionaries are learnt off-line as prior knowledge: 1) orientation patch dictionary and 2) continuous phase patch dictionary. For an input fingerprint minutiae set, the orientation patch dictionary is used to reconstruct the orientation field from the minutiae set, while the continuous phase dictionary is used to reconstruct the ridge pattern. In addition, the spurious minutiae introduced in the reconstructed fingerprint are removed using the global AM-FM model.

- **Advantages of proposed system**

Given the prior knowledge of orientation pattern (*i.e.*, orientation patch dictionary), the orientation field reconstructed from the proposed algorithm is better than the method proposed in existing; the singular points obtained from the proposed algorithm are very close to the original ones.

Experimental results demonstrate that the proposed algorithm performs better than two state of- the-art reconstruction algorithms.

Use of prior knowledge of orientation pattern, *i.e.*, orientation patch dictionary, which provides better orientation field reconstruction, especially around singular points. Instead of generating a continuous phase and then adding spiral phase to the continuous phase globally, this procedure is able to better preserve the ridge structure. Use of local ridge frequency around minutiae

IV. SYSTEM ARCHITECTURE

In the Proposed System Algorithm for Fingerprint Reconstruction the System Flow uses Continious Field Dictionary and the Orientation Phase Dictionary. To fulfill the patches in the Input Image (From which the Minutiae was extracted) . Input Minutiae set is reconstructed by preprocessing minutiae set.In the Proposed System Algorithm for Fingerprint Reconstruction the System Flow uses Continious Field Dictionary and the Orientation Phase Dictionary.To fulfill the patches in the Input Image. Input Minutiae set is reconstructed by preprocessing minutiae set.

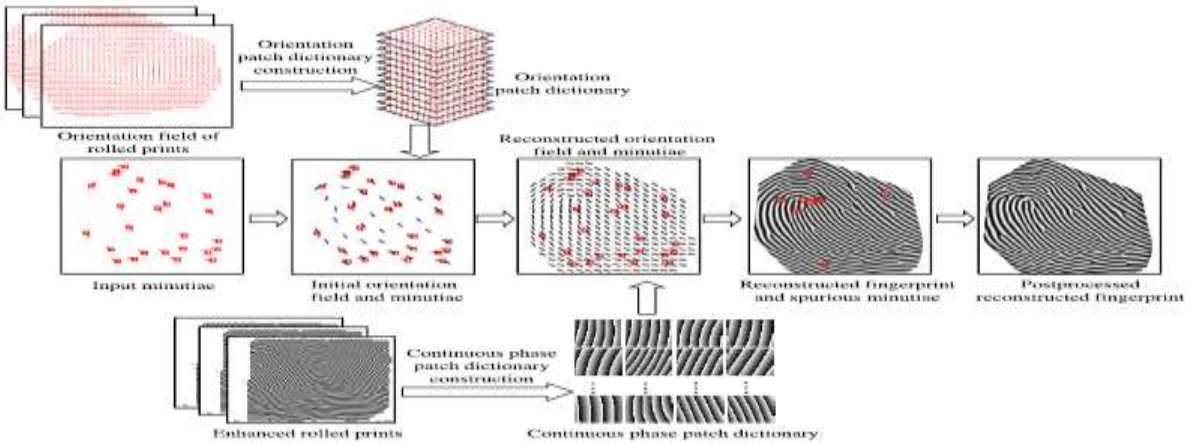

Fig 1-: System Architecture

V. EXPERIMENTAL ANALYSIS

We compare the proposed method with a)algorithm result by Li and Cot b)algorithm result byFeng c) algorithm result by Jain d)algorithm result by E.liuandK.Kau(2013) e)algorithm result by K.cau and A.K.Jain.

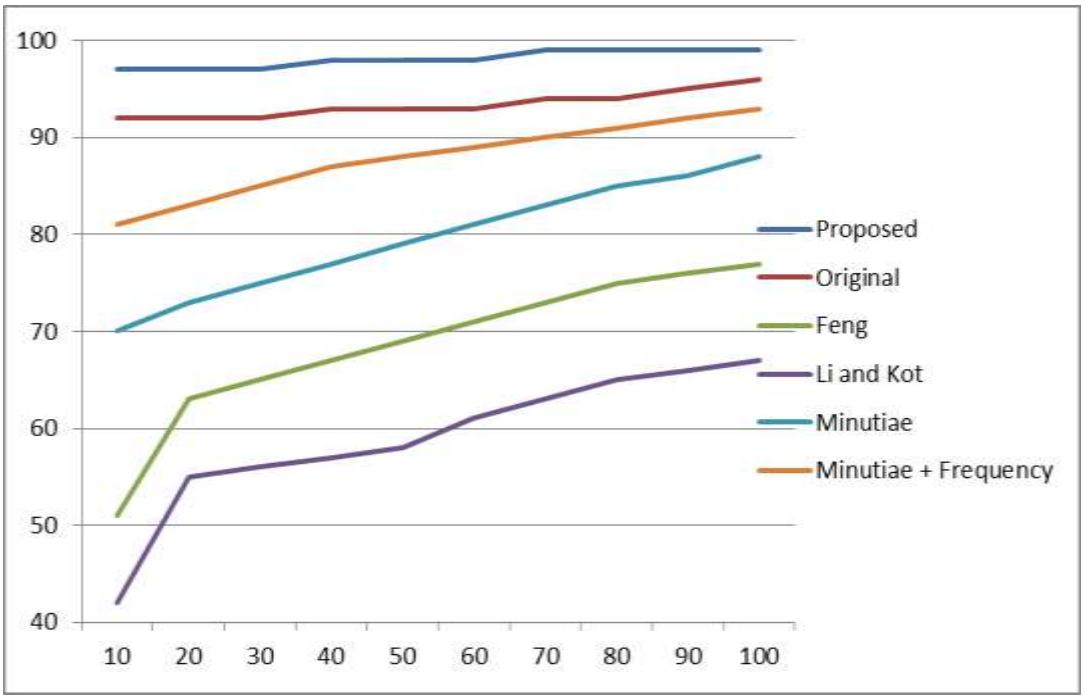

Figure 2-: Comparison Graph

CONCLUSION

The goal of fingerprint reconstruction is to reproduce the original fingerprint image from an input minutiae set. We propose to extend our work as follows-

- To demonstrate the need for securing minutiae template
- To improve the interoperability of fingerprint templates generated by different combinations of sensors and algorithms
- To improve fingerprint synthesis.

In this paper, we propose a reconstruction algorithm that utilizes prior knowledge of fingerprint ridge structure to improve the reconstructed fingerprint image.

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