

Recognition of Spectral Fingerprint using Direct Matching Algorithm

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Abstract

Most of the Biometric systems recognizing the identity of living person on the basis of physiological and behavioral characteristic. Biometric systems are well known for identification and verification. Use of Biometric system in fingerprint is secure and easy for image acquisition step in fingerprint recognition. Biometrics having physiological and behavioral characteristics. Such as Physiological are related to the shape of the body. It includes fingerprint, face, hand, eyes and the behavioral related to pattern of behavior of person including voice, signature, and keystroke dynamic. Before using the biometric system for verification or identification all users must be enrolled. Fingerprint recognition system is one of the most developed biometrics. Fingerprint recognition system is highly accurate and very reliable. Fingerprints give the unique identification of the person and due to the easy to access and faster method used in biometric system. Spectral fingerprint gives the translation, rotation invariant of fingerprint which increases the high speed. fingerprint verification code 2000 used as database.

Keywords: Biometric, Fingerprint, Minutiae, Local, Global And Very-Fine Level

I. INTRODUCTION

Fingerprint recognition system is one of the highest levels of distinctiveness and performance among other biometric characteristic [1]. Fingerprint is the feature pattern [3]. Each person having unique pattern on his fingertip. Fingerprint recognition system is having very high accuracy as compared to other biometric devices. Fingerprint recognition system requires small storage for biometric templates, reducing the size of the data base memory. Most of the fingerprint recognition system stores only the minutiae template in the database for further usage. Minutiae are Ridges ending or bifurcation on the fingerprints. They including their coordinate and direction are most distinctive feature to represent the fingerprint. Fingerprint recognition system grouped in to three domains such as Fingerprint Enrollment, Verification and Fingerprint Identification [5]. In biometric fingerprint templates is the name used to describe a stored file in a fingerprint scanning system. Fingerprint template is stored when a fingerprint is entered in to the system. Templates are used during the authentication process. In the simple word storing Biometric data, known as biometric templates [1]. Two types Minutiae one is termination and bifurcation. Termination is the immediate ending of ridge and bifurcation is the point where two branches derive shown in figure below

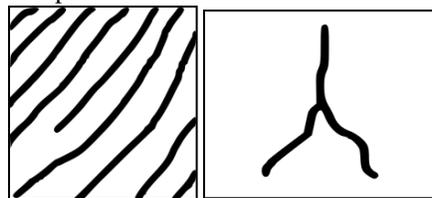


Fig. 1: Ridge Ending and Bifurcation

A. Comparison of Biometric Technology:

Table – 1
 Biometric Comparison

| Biometric technology | Accuracy | Cost | Device required | Social acceptability |
|----------------------|------------|--------|----------------------|----------------------|
| Iris recognition | High | High | Camera | Low |
| Retina Scan | High | High | Camera | Medium Low |
| Facial Recognition | Medium-low | Medium | Camera | Low |
| Voice Recognition | Medium | Medium | Microphone telephone | High |
| Hand Geometry | Medium-low | Low | Scanner | High |
| Fingerprint | High | Medium | Scanner | Medium |

| | | | | |
|-----------|-----|--------|-----------------------|------|
| Signature | Low | Medium | Optic pen touch panel | High |
|-----------|-----|--------|-----------------------|------|

1) **Fingerprint Feature:**

Fingerprint feature categorised in three types Global level, local level, very fine level.

Table – 2

Fingerprint Feature Characteristic

| Type | Specialty | Characteristics |
|-----------------|--------------------------------------------|----------------------------------------------------------------------------------|
| Global level | Have singular points called core and delta | -Robust to Low quality fingerprint -singular points not for accurate matching |
| Local level | Minutiae | High discriminative |
| Very-fine level | Have Finger sweat pores | Enhance particular or individuality |

2) **Global Level:**

In the global level has singular points called as core and delta points. This singular points useful for fingerprint classification but not for accurate matching [7]. This type of representation known as pattern which is characteristics of ridges and minutiae points.

3) **Local Level:**

At the local level has minutiae points [7]. Local level represents points within restricted region of the fingerprint, this kind of feature used for unique identification [6].

4) **Very Fine Level:**

At very fine level has finger sweat pores. The position of and the shape of pores is use to help identity a person [7]. Minutiae point is sometimes opening the skin or other surface.

B. Fingerprint Verification System:

Biometric system can work in either verification or identification mode.

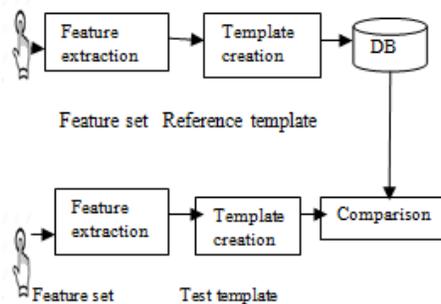


Fig. 2: Fingerprint Verification System

C. System Level Design for Fingerprint Recognition System:

A fingerprint recognition system includes fingerprint acquiring device minutiae extractor and minutiae matcher.

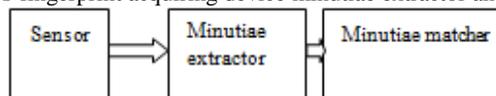


Fig. 3: Fingerprint Recognition System

II. VERIFICATION USING SPECTRAL MINUTIAE REPRESENTATION

Minutiae based fingerprint matching having drawbacks that limit their application as minutiae sets are unordered which require high time and fail to give speed. The spectral minutiae representation as projected during this paper overcomes the on top of drawbacks of the minutiae sets, thus broadening the applying of minutiae primarily based algorithms. Our methodology is impressed by the Fourier mellin remodel, which permits a illustration of pictures in an exceedingly manner that’s invariant to translation rotation and scaling .By representating minutiae as magnitude spectrum we tend to remodel a minutiae as into a feature vector that at identical time doesn’t want registrations to complete translation ,rotation and scaling.

A. Implementation:

In the above sections, introduced analytical expression for the spectral minutiae representations in order to obtain final output we use M=128 samples between $\lambda_1 = 0.1$ and $\lambda_n = 0.6$. In the angular direction β , we use N=256 samples uniformly distributed between $\beta = 0$ and $\beta = \pi$ and for $\sigma_L = 0.32$ and $\sigma_o = 3.87$.

III. SPECTRAL MINUTIAE MATCHING

The comparison of two minutiae spectra is done here it gives match or non match result. in this paper direct matching and Fourier melin matching is used.

A. Direct Matching:

Let $R(m, n)$ and $T(m, n)$ two sample minutiae spectra in polar-logarithmic domain got from reference and test fingerprint both are normalized to have zero mean unit energy. the correlation coefficient between R and T is defined as

$$C^{R,T}(i, j) = \frac{1}{MN} \sum_{m,n} R(m, n) T(m - i, n - j) \quad (15)$$

Where M, N are samples and $(m-i), (n-j)$ shifted samples

Now similarity score between R and T

$$S^{(R,T)} = \max_j \{C^{(R,T)}(0, j)\} \quad (16)$$

Where i in the vertical and j in the horizontal direction.

IV. RESULTS

We have used images of Fingerprint verification competition - 2000 for the verification process. Input image is shown in 1, The two processes are done on it . finding SML, SMO . The Results are calculated with by calculating FAR and FRR plot.

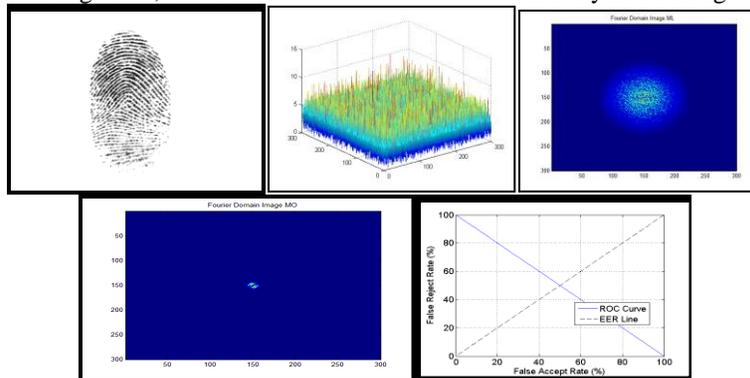


Fig. 4: (1) Input Image (2) Spectral Representation (3) SML (4) SMO (5) FAR Vs FRR

V. CONCLUSION

In this paper, we introduced the direct matching algorithm for verification of spectral minutiae . The basic fingerprint recognition system. By taking advantage of the spectral minutiae representations , we can speed up the recognition system by much more that speed than the traditional recognition system. The experimental results show that the spectral based recognition gives high speed than the minutiae based . Our future work will further more improve the spectral representations and we will move towards optimization of direct matching re-sizing process.

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