

# A Review on Fingerprint Detection and Recognition Techniques

Yogita

Shri Shankaracharya group of Institution  
 Dept. of Information & Technology  
 Bhilai, Chhattisgarh, India  
 Yogita.verma14@gmail.com

Bhagwati Charan Patel

Shri Shankaracharya Group of Institution  
 Dept. of Information & Technology  
 Bhilai, Chhattisgarh, India  
 Bhagwaticharanpatel@gmail.com

## Abstract

Fingerprints are most extensively and effectively appropriate for the proof of identity in present days. Mostly because of their uniqueness among the people, public acceptance, originality, stability through life, and their least risk of invasion. Fingerprint technology, which is basically a biometric system, is utilized to identify an individual based on their physical qualities. Fingerprint matching is the trendiest biometric method appropriate to provide authentication. Fingerprint verification is one of the most trustable biometric security system in the world of computers. There are different qualities of fingerprints are available. Some of them are poor, medium, high and partial quality of fingerprints. This paper helps to provide a survey of various techniques of fingerprint matching.

**Keywords—** FingerPrint Recognition, FingerPrint Detection, Biometric, Identity, Authentication.

## I. INTRODUCTION

The most popular Biometric authentication of a person is fingerprint. It is most unique and permanent throughout the life of a person. There are mainly two types of biometric characteristics. They are

- Physiological characteristics- Physiological characteristics are one of the unique characteristics which are physically present in the human body. For example, face, fingerprint, iris, ear etc.
- Behavioral characteristics- Behavioral characteristics are completely related to the behavior of a person. For example, signature, voice etc.

The most important advantage of biometrics is that biometric classification is always carried by a person. So therefore is less chance of losing or forgetting it. Also, it is impossible to loose or steal biometric identity. Fingerprint technique is one of the most important biometric techniques used for identifying a person [1].

### A. Fingerprint

A pattern feature of fingerprint as shown in Fig. 1. It is impression of the furrows and friction ridges on all the parts of a finger and these furrows and friction ridges consisting good matching in every small local window.



Fig.1. fingerprint sample

Fingerprints are not only distinguished by their ridges and furrows but also are distinguished using a method called Minutia. Minutia are some abnormal points on the ridges which are as shown in Fig.2. [2]. among the different variety of minutia, two are mostly significant and widely used:

- Ridge bifurcation - a single ridge which divides into two ridges
- Ridge ending - the unexpected end of a ridge

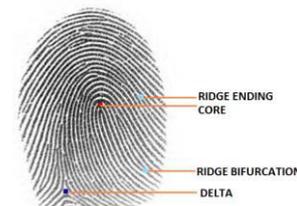


Fig.2. two important minutia features

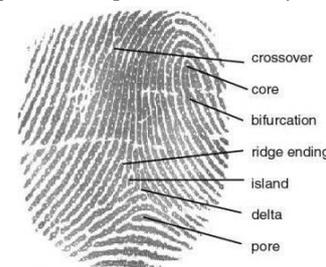


Fig.3. other important minutia features

## II. CLASSIFICATION OF FINGER PRINT PATTERNS

There are three types of fingerprint patterns.

### A. Arches

The specific pattern whose ridges route from one side to another side by lacking any type of rotation known as arches. Basically, noarch pattern allows the delta. If there is a delta point present, in the middle no recurring ridge point obtain.

Arches are specified into four types:

- Plain arches
- Ulnar arches
- Radial arches
- Tented arches



Fig.4. arches patterns

### B. Loops

Loops are nothing but the pattern whose ridges moves inwards to its origin is called loops. Ridges are basically a side of the reserves, imprint and ends in the where the ridges come in.

There are four types of loop are as follows [3].

- Plain loop
- Lateral Pocket loop
- Twinned loop
- A Central packet loop.



Fig.5. loop patterns

### C. Whorls

Whorls are the Patterns whose ridges generates a circular formation around a central point is known as whorls. Based on the pattern helps to comprises of two or more delta points in whorl pattern are also illustrate in following four groups:

- Plain whorls
- Central pocket loop whorls
- Accidental whorls
- Double pocket loop whorls.



Fig.6. whorls patterns

## III. LITERATURE SURVEY

Shuvra Chakraborty et al, presents a fingerprint matching system which uses eight directional Gabor filter bank, a popular method for enhancing poor quality image, to capture global and local information available in the fingerprints [4].

Alessandra A. Paulino et al, Identifying suspects based on impressions of fingers lifted from crime scenes (latent prints) is a routine procedure that is extremely important to forensics and law enforcement agencies. Latent are partial fingerprints that are usually smudgy, with small area and containing large distortion. Due to these characteristics, latent have a significantly smaller number of minutiae points compared to full (rolled or plain) fingerprints. The small number of minutiae and the noise characteristic of latent make it extremely difficult to automatically match latent to their mated full prints that are stored in law enforcement databases. Although a number of algorithms for matching full-to-full fingerprints have been published in the literature, they do not perform well on the latent-to full matching problem. Further, they often rely on features that are not easy to extract from poor quality latent. In this paper, we propose a new fingerprint matching algorithm which is especially designed for matching latent [5].

Rakesh Verma et al, Biometric recognition refers to the use of biological characteristics for identification and verification of individuals. Use of biometric is increasing nowadays because biometric characteristics are difficult to replicate and lifelong. Applications which require only the authorized persons to access the resources are information systems, National id systems, voter and driver registrations, documentations, military area and ATMs. Among all biometrics, fingerprints is the most widely used and accepted by the user as the acquisition of fingerprint image is minimally invasive and require little hardware [6].

Shehnaz M. et al, Fingerprint identification is very popular among the identification in biometric security systems. The identification process comprises of image enhancement, feature extraction and pattern classification. The adjustment of grey scale values improves the intensity values of the image. A region mask is generated which provides a stable sampling window to extract features [7].

Mouad.M.H.Ali at al, there are various types of applications for fingerprint recognition which is used for different purposes .fingerprint is one of the challenging pattern Recognition problem. The Fingerprint Recognition system is divided into four stages. First is Acquisition stage to capture the fingerprint image, the second is Pre-processing stage to enhancement, linearization, thinning fingerprint image [8].

C. C. Han et al applied four directions of Sobel operators to extract the feature points of ROI of palm print, and then applied a complex morphology operator to extract the features of palm print image [9].

Wei and Zhang et al. extracted the datum points and the line features from the palm print image. The datum points are defined as the points of palm print registration. Therefore, it detected the principle lines and their endpoints by using the

directional projection algorithm. Moreover, the authors have improved template algorithm to extract the ridges and wrinkles as straight lines [10].

**TABLE I.** Comparisons of various techniques and method used in present system

SN O	Name of Author	Method	Finding	Limitation	Accuracy
1	Shuvra Chakraborty et al [4]	Author presents a fingerprint matching system which uses eight directional Gabor filter bank	Author showed filter-bank approach has been tested on 800 images	Need to obtain features that are rotation independent and accurate detection.	77.125% accuracy
2	Alessandra A. Paulino et al [5]	Propose a new fingerprint matching algorithm which is especially designed for matching latents. The proposed algorithm uses a robust alignment algorithm	Author evaluate experimental results on two different latent databases (NIST SD27 and WVU latent databases)	Need to speed up latent matching.	Error Rate: 2.3% for latents with relatively large number of minutiae to as high as 22% for latents with the subjective quality “ugly”
3	Rakesh Verma et al. [6]	This paper presents the overview of different fingerprint recognition system.	The wavelet transformed based system reduces the cost and response time of fingerprint systems	Need to reduce noise from the dataset.	High Accuracy
4	Shehnaz M et. al [7]	Propose a fingerprint identification algorithm with improvised image enhancement method is introduced	Proposed method is robust in an environment less than 20% noises.	Need to reduce noise from the dataset.	80% accuracy
5	Mouad.M.H.Ali et al. [8]	Proposed work presented fingerprint identification and verification based on minutiae features. The work is done in sequence start from the first stage which is pre-processing which is used to remove unwanted data and increased the clarity of ridges of fingerprint image.	Result of FVC2002 is good comparing with FVC2000 in this work	Need to enhance and evaluate the performance of fingerprint recognition system	98.13 % accuracy
6	C. C. Han et al [9]	Region of interest algorithm	Extract the feature points of ROI of palm print, and then applied a complex morphology operator to extract the features of palm print image.	ROI selection is overhead	Decent accuracy 70-80%
7	Wei and Zhang et al. [10]	Extracted the datum points and the line features from the palm print image.	improved template algorithm to extract the ridges and wrinkles as straight lines	Scanning time is more	-

#### IV. RESULT AND DISCUSSION

Most of the journal paper was reviewed and some important papers were listed and compared shown in Table 1. We found that the average accuracy obtained by most of the literature is under 90%. The accuracy of fingerprint recognizer has to improve in future. Also some preprocessing technique can be used to reduce some noise and enhance the quality of processed images [11].

#### V. CONCLUSION

Fingerprints are most extensively and effectively appropriate for the proof of identity in present days. Mostly because of their uniqueness among the people, public acceptance, originality, stability through life, and their least risk of invasion. Fingerprint technology, which is basically a biometric system, is utilized to identify an individual based on their physical qualities. In this paper, variety of techniques used fingerprint enhancement and matching process have been surveyed. A brief overview of all the related fingerprint matching methods had been presented in this survey paper.

#### REFERENCES

- [1] Madhuri and RichaMishr, "Fingerprint Recognition using Robust Local Features", IJARSSE, Volume 2, Issue 6, June 2012, INDIA, pp. 441-447
- [2] Manisha edhu and Dr.Balkishan,Department, "Fingerprint Recognition Using Minutiae Extractor ", Applications (IJERA), Vol. 3, Issue 4, pp .2488-2497, Jul-Aug 2013, MaharshiDayanandUniversity , Rohtak, India pp. 2488-2497
- [3] Sangram Bana and Dr.Davinder Kaur, "Fingerprint Recognition using Image Segmentatio", IJAEST, Vol No. 5, IIT Roorkee, Roorkee pp. 12-23
- [4] S. Chakraborty, "An optimized fingerprint matcher," 2011 6th International Conference on Industrial and Information Systems, Kandy, 2011, pp. 181-185.
- [5] Paulino, A.A, Jianjiang Feng and Jain, A.K, "Latent Fingerprint Matching Using Descriptor-Based Hough Transform", Information Forensics and Security, IEEE Transactions on (Volume:8 , Issue: 1 ) Biometrics Compendium, IEEE Jan. 2013, pp. 31 – 45.
- [6] Rakesh Verma, "WAVELET BASED FINGERPRINT AUTHENTICATION SYSTEM: A REVIEW", Electrical and Electronics Engineering: An International Journal (ELELIJ) Vol 5, No 1, February 2016 pp. 61-72
- [7] Shehnaz M. and Naveen N., "A fingerprint identification algorithm: Combining image enhancement and chaos synchronisation classifier," 2015 International Conference on Control Communication & Computing India (ICCC), Trivandrum, 2015, pp. 491-494.
- [8] M. M. H. Ali, V. H. Mahale, P. Yannawar and A. T. Gaikwad, "Fingerprint Recognition for Person Identification and Verification Based on Minutiae Matching," 2016 IEEE 6th International Conference on Advanced Computing (IACC), Bhimavaram, 2016, pp. 332-339.
- [9] C. Han, H. Cheng, C.Lin and K. Fan, "personal authentication using palmprint features", PERGAMON pattern recognition, 2003, pp. 371-381
- [10] R. Wang, D. Ramos, J. Fierrez and R. P. Krish, "Automatic region segmentation for high-resolution palmprint recognition: Towards forensic scenarios," 2013 47th International Carnahan Conference on Security Technology (ICCST), Medellin, 2013, pp. 1-6.
- [11] B.C.Patel and G.R.Sinha "Medical Image Processing: concept and application", Printice Hall india, 2014.