

# A Review on Detection and Analysis of Fingerprint

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## ABSTRACT

Fingerprint analysis is the most essential part of human identification or human recognition. At present too many biometric techniques are presented for fingerprint identification and fingerprint recognition. We know that, a fingerprint contains a lot of key point like Y shape, delta, ridge ending, ridge starting, minutiae's pattern and etc. All points are apodictic of unique for any human fingerprint. The aim of this paper is to review numerous recently work on fingerprint recognition system. Fingerprint detection is a very important topic to identify the correct person's finger print and can make everything secure. The main idea of this research paper is to find out the 100% correct fingerprint details from any document (in image format). In this research paper we will get that how to identify the details of fingerprint from image.

**Keywords:** Feature extraction, Feature Matching, Fingerprint, Minutiae, SIFT

## I. INTRODUCTION

Fingerprint detection is an interesting and important topic for research in modern Science. We will get many kinds of fingerprints. So it is very difficult to identify the proper details of a particular fingerprint without any tool. For those kinds of situations, we should have a Fingerprint Recognizer tool, which will help you to find out the details of fingerprints. We can use this to recognize different kind of objects also, which will be very helpful.

Along of assorted fingerprint identification techniques, within the past few decades, human-beings are hooked in to varied technologies like captured photos, scanned signatures, bar code systems, verification Id & so on. Also, biometrics is one amongst the applications in Image process that refers to technologies that used physiological or behavioural characteristics of human body for the user authentication. The biometric identification system supported 2 modes: entry and Recognition. Within the entry mode, the biometric

information is acquired from the detector and keep in an exceedingly database together with the person's identity for the recognition. Within the recognition mode, the biometric information is re-acquired from the detector and compared to the keep information to see the user identity.

The uniqueness of fingerprints is something staying unchanged throughout the complete life. For instance, such features as the face shape, manner of walking could change over time however fingerprints won't. However, the fingerprint itself will give a picture of a bad quality as a result of the state of the skin, unhealthy impression, dirty surface of the finger, etc. That is why; the ways for image improvement should be implemented to induce a lot of correct results.

The fingertip surface is a combination of the many of ridges and plenty of valleys. Just in case of the ridge that declare as black lines and therefore the valleys declare, as white lines are show in Fig.1. The minutiae

points are the points wherever the ridge structure changes like bifurcation and finish point.

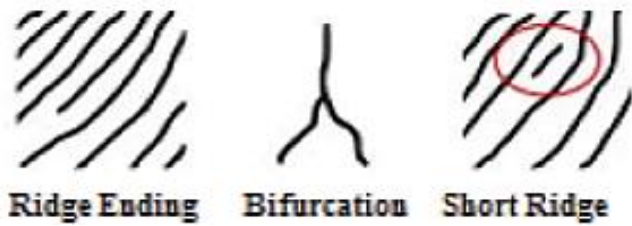


Figure 1. Graphical of ridge and valleys Ridge Ending, Bifurcation and short Ridge

## II. FINGERPRINT

Fingerprints are graphical patterns of ridges and valleys on the surface of fingertips, the ridge ending and ridge bifurcation is termed minutiae as shown in Fig.2. There are several ways supported minutiae-based fingerprint representations were projected. Every one contains a unique fingerprint from the other person. The fingerprint identification is predicated on 2 basic assumptions: - invariance and Singularity Invariance: means that the Fingerprint characteristics don't change along the life.

Singularity: means the fingerprint is exclusive and no 2 persons have constant pattern of fingerprint.

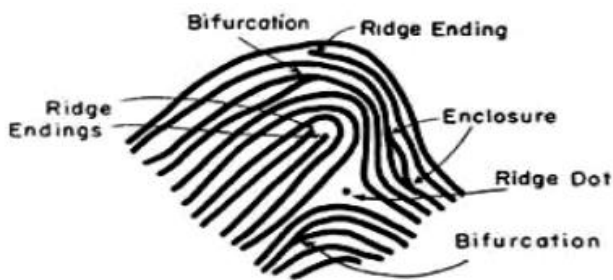


Figure 2. Different ridge features on Fingerprint image

TABLE I  
SHOWS THE TERMS AND DEFINITIONS OF FINGERPRINT STRUCTURE

No	Term	Definition
1	Termination	The location where a ridge comes to an end.
2	Bifurcation	The location where a ridge divides into two separate ridges.
3	Binarization	a process to transform the image from 256 levels to two levels(0,1)refers to (black and white) respectively
4	Thinning	The process of reducing the width of each ridge to one pixel.
5	Termination Angle	Considered as angle between the direction of the ridge and the horizontal.
6	Bifurcation Angle	This Considered as the angle between the direction of the valley ending between the bifurcations and the horizontal.
7	Matching Score	It is the measure of similarity between the input and template data
8	False Non Matching Ratio	The system fails to detect a match between input and template in database.

There are various methods, through which we can detect and analyse the fingerprints. Following are some techniques given for fingerprint analysis:

- A. MINUTIAE BASED ANALYSIS
- B. POINT FEATURE ANALYSIS
- C. SIFT ANALYSIS

#### A. Minutiae Based Analysis

Fingerprint identification contains a great utility in forensic science and aids criminal investigations etc. Most of the automated fingerprint recognition systems are based on local ridge features called minutiae. Hence it's very important to mark these minutiae accurately and reject the false ones.

In case of a fingerprint identification system, the captured fingerprint image has to be matched against the stored fingerprint templates of each user within the database. This involves a lot of computation and search overhead and thus we need a fingerprint classification system that will help us to severely restrict the size of the templates database. To accomplish this, we have a tendency to extract the minutiae features and match against the incoming fingerprint. The template size of minutiae-based fingerprint illustration is little and most of the fingerprint identification systems are based on minutiae.

#### B. Point Feature Analysis

Feature extraction a kind of dimensionality reduction that efficiently represents interesting elements of an image as a compact feature vector. This approach is helpful when image sizes are large and a reduced feature representation is needed to quickly complete tasks such as image matching and retrieval.

Feature extraction is an attribute reduction process. Feature extraction actually transforms the attributes. Point Feature extraction can also be used to enhance the speed and effectiveness of supervised learning.

Feature extraction methods helps with the problems by reducing the dimensions without much loss of the total information. It also helps to make sense of the features and its importance.

#### C. SIFT Analysis

Scale Invariant Feature transform (SIFT) was originally developed for the final purpose object recognition. SIFT detects stable feature points in a picture and performs matching based on the descriptor representing every feature point. The features are selected to be invariant to scale and rotation and they provide robust matching across a substantial range of affine distortion, addition of noise and partial change in the lighting.

### III. LITERATURE SURVEY

This paper presents the work done by other researcher related to fingerprint detection and analysis. Descriptions regarding all reference papers are summarized below:

Mouad .M.H.Ali et al. [1] proposed an approach to identify the fingerprint using SIFT technique. This paper proposes a system to extract the fingerprint from the image. As part of the proposed system, using point feature extraction and SIFT technique they have built a tool which can identify the fingerprint from a high quality image.

Kuntal Barua et al. [2] proposed an approach to identify the fingerprint using Feature Matching technique. This paper proposes a system to extract the fingerprint from the image. As part of the proposed system, using point feature extraction and feature matching technique they have built a tool which can identify the fingerprint from a high quality image.

Chandra Prakash Singh et al. [3] proposed an approach to identify the fingerprint using Level 3 Feature Matching and SIFT technique. This paper proposes a system to extract the fingerprint from the image. As part of the proposed system, using point feature extraction and SIFT technique they have built a tool which can identify the fingerprint from a high quality image.

Dibyendu Nath et al. [4] proposed an approach to identify the fingerprint using Pattern-based (or Image-based) Matching technique. This paper proposes a system to extract the fingerprint from the image. As part of the proposed system, using template matching technique they have built a tool which can identify the fingerprint from a high quality image.

Sharad Pratap Singh et al. [5] proposed an approach to identify the fingerprint using SIFT technique. This paper proposes a system to extract the fingerprint from the image. As part of the proposed system, using point feature matching and SIFT technique they have built a tool which can identify the fingerprint from a high quality image.

Priyanka Rani et al. [6] proposed an approach to identify the fingerprint using Template Matching technique. This paper proposes a system to extract the fingerprint from the image. As part of the proposed system, using point template matching technique they have built a tool which can identify the fingerprint from a high resolution image. But it is very difficult to match two different quality and different size images. So it is also a very slow process to identify the fingerprint.

Umesh Singh Tomar et al. [7] proposed an approach to identify the fingerprint using Minutiae’s Analysis technique. This paper proposes a system to extract the fingerprint from the image. As part of the proposed system, using point feature matching and Minutiae’s Analysis technique they have built a tool which can identify the fingerprint from a high quality image.

This table provides the information regarding different methods used by different authors to detect the fingerprint with the result.

TABLE II  
REVIEW ON VARIOUS TECHNIQUES USED FOR  
DETECTION AND ANALYSIS OF FINGERPRINT

Sl. No.	Author	Year	Method Used	Result
1	Mouad . M.H.Ali, Vivek H. Mahale, Pravin Yannawar, A. T. Gaikwad	2016	SIFT	They got the good result with SIFT technique, but it is very slow to identify the fingerprint and if image is not clear then it can't identify the fingerprint
2	Kuntal Barua, Samayita Bhattacharya, Dr. Kalyani Mali	2011	Feature Matching	This method can extract feature points from the fingerprint and display the extracted different feature points.
3	Chandra Prakash Singh , Susheel Jain , Anurag Jain	2014	Level 3 Feature Extraction, SIFT	They found the more secure and good result with these techniques, but it is very slow to identify the fingerprint and if image is not clear then it can't identify the fingerprint.

4	Dibyendu Nath , Saurav Ray, Sumit Kumar Ghosh	2010	Pattern-based (or Image-based) Matching	They have used templates for matching the fingerprint patterns. But still it won't work with a little bit blurred (unclear) fingerprint.
5	Sharad Pratap Singh ; Sahanz Ayub ; J. P. Saini	2016	SIFT	They have presented a method for detecting appearance of fingerprint contain in low-resolution. The method is based on matching the SIFT descriptors, plus several heuristics. But still it is slow to detect the fingerprint.
6	Priyanka Rani, Pinki Sharma	2014	Template Matching	They have matched the fingerprint using Template Matching technique with dataset fingerprint template. But it is very difficult to match two different

				quality and different size images. So it is also a very slow process to identify the fingerprint.
7	Umesh Singh Tomar, Abhinav Vidwans	2017	Minutiae's Analysis	They have concluded that in this method the fingerprint detection is very fast and more accurate for more trusty and safety system.

#### IV. CONCLUSION

Detecting the fingerprint accurately is the major topic in the field of digital security system. This review paper gives a survey of fingerprint detection and analysis by using image processing techniques. Different authors proposed different algorithm to detect the fingerprint. The computational time is also saved by different algorithm. Authors used Pattern-based Matching, Minutiae's Analysis, Feature Extraction, Template Matching, SIFT method to give the high accuracy. These methods also save the computational time. From the methods the fingerprints are accurately detected and identify by less time consuming.

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