

## Finger Print Recognition Techniques: A Review

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### ABSTRACT

*Fingerprint recognition is one of the most eminent methods in Biometrics, and it is mainly used biometric solution for authentication on computerized systems. Images are often corrupted by random variations like intensity, illumination, or have poor contrast and they cannot be used directly. Filtering is a technique to transform pixel intensity values to reveal certain image characteristics like enhancement, smoothing, template matching etc. This paper illustrates various image filtering techniques. We Finger print recognition is one of the most eminent methods in Biometrics, and it is mainly used biometric solution for authentication on computerized systems. Images are often corrupted by random variations like intensity, illumination, or have poor contrast and focused on spatial filtering techniques like Mean and Order-Statistics filters and various types under these filters which are used in fingerprint recognition. Fingerprint recognition is being widely applied in the personal identification for the purpose of high degree of security by matching processes between two human fingerprints. Many different techniques have been proposed to have a satisfactory fingerprint identification. Gabor filter based matching to capture both local and global details in a fingerprint as a compact fixed-length Fingerprintcode.*

***Keywords: Filtering, Ridge, Valley, Terminations, Bifurcations***

### I. INTRODUCTION

Fingerprints being the oldest and easily available trait of biometrics, offers an infallible means of personal identification. Even features such as persons gait, face or signature may change with passage of time and may be fabricated or imitated. However a fingerprint is completely unique to an individual and stayed unchanged for lifetime. Therefore, fingerprint authentication is one of the most researched and matured field of biometric authentication. Fingerprints provide an outstanding source of entropy which makes them an excellent candidate for security applications. Users cannot pass their fingerprint characteristics to others as easily as they do with their cards or passwords [1]. A fingerprint image consists of a pattern of the valleys & ridges on human fingertips. Ridges are dark whereas valleys are bright. Ridges and valleys often run in parallel; sometimes they bifurcate and sometimes they terminate. According to Galton, a fingerprint is constituted by a set of ridge lines which often run parallel, sometimes terminates and sometimes intersects. The discontinuities, such as an end point or a bifurcation are known as minutiae, which may divide and almost immediately reunite, enclosing a small circular or elliptical space or sometimes the independent beginning or ending of ridges.

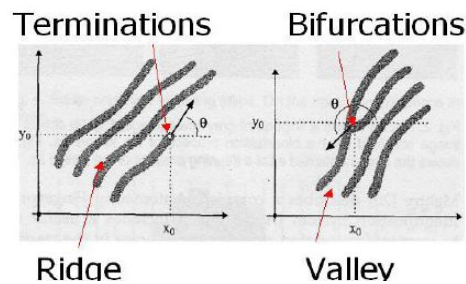


Fig. 1.



Fig.2. Fingerprint Image

Fingerprint authentication techniques are based on three methods: minutiae-based, correlation –based and hybrid. In minutiae-based techniques two sets of minutiae points taken from two fingerprints are aligned and then total number of matched minutiae are counted [2]. Accuracy and performance of minutiae-based techniques, however depends on the accurate detection of minutiae points as well as the use of sophisticated matching techniques to compare two minutiae fields that undergo non-rigid transformations. In the correlation-based approach, global patterns of ridges and furrows are compared to determine whether two fingerprints are aligned. Performance of correlation-based techniques is affected by non-linear distortions and noise present in the image. These days office/corporate environment security is a major threat faced by every individual when away from home or at the home. When it comes to security systems, it is one of the primary concerns in this busy competitive world, where human cannot find ways to provide security to his confidential belongings manually. Instead, He finds an alternative solution which provides better, reliable and atomized security. This is an era where everything is connected through network, where anyone can get hold of information from anywhere around the world. Thus chances of one's info being hacked are a serious issue. Due to these risks it's very important to have some kind of personal identification to access one's own info. Now a day's personal identification is becoming an important issue all around. Among mainstream personal identification methods we mostly see password and identification cards techniques. But it is easy to hack password now and identification cards may get lost, thus making these methods quite unreliable. There are certain situations which are very annoying like when a person locks himself out of his house or office or he leaves his key inside or sometimes when a thief just breaks the lock and steals everything. These kinds of situations always trouble people who use manual door lock with keys. Although in some places people use smart cards, there might arise a situation when someone loses the card or keeps the card inside. Then in other scenarios there are caretakers for locking houses or offices and keeping the keys safe. But then again there are times when a person in charge of the keys might not be available or has gone to some emergency routine, which can cause unwanted delay for people who need

the key straightaway. These are some of the hassles that people might face when using keys or smart cards. That is when our system, fingerprint based lock system comes into play. Our design is implemented to provide better securities as users don't need to remember passwords and don't need any sort of keys or cards that often get lost. If someone's fingerprint is authorized in the system he would not face any sort of delays to enter a room. Fingerprint recognition is one of the most secure systems because a fingerprint of one person never matches with the others. Therefore unauthorized access can be restricted by designing a lock that stores the fingerprints of one or more authorized users and unlock the system when a match is found. Bio-metrics authorization proves to be one of the best traits because the skin on our palms and soles exhibits a flow like pattern of ridges on each fingertip which is unique and immutable. This makes fingerprint a unique identification for everyone. The popularity and reliability on fingerprint scanner can be easily guessed from its use in recent hand-held devices like mobile phones and laptops.

## **II. LITERATURE REVIEW**

Sirisha et al [1] This paper illustrates various image filtering techniques. We focused on spatial filtering techniques like Mean and Order-Statistics filters and various types under these filters which are used in fingerprint recognition.

Chavan et al [2.] The paper presents fingerprint authentication system using filter bank based matching algorithm. The algorithm uses Gabor filter bank to extract features of fingerprints. Image with feature vectors of database Two sets of databases FVC2000 and DBIT are used for evaluating the performance and efficiency of the algorithm. The experimental results show that the average efficiency of the algorithm is 82.95% and 89.68% for FVC2000 and DBIT fingerprint databases respectively.

Garg et al [3] This paper illustrates Fingerprint recognition is the most popular methods used for identification with higher degree of success. The fingerprint has unique characteristics called minutiae, which are points where a curve track finishes, intersect or branches off. In this work a method for Fingerprint recognition is considered using a combination of Fast Fourier Transform (FFT) and Gabor Filters for enhancing the image. The proposed method involves combination of Gabor filter and Frequency domain filtering for enhancing the fingerprint. With eight different orientations of Gabor filter, features of the fingerprint extracting are combined. In Frequency domain filtering, the fingerprint image is subdivided into 32\*32 small frames. Features are extracted from these frames in frequency domain. [4] Raj kumar et al: This paper is a survey on directional filter, which describes the splitting of the input image into eight parts and reconstruction in to a single image after image enhancement.

## **COMPARISON TABLE**

Comparative analysis technologies used are Filtering bank ,matching algorithm ,Gabor filter based enhancement etc.

FAR is False acceptance rate.

VR is velay and ridge

FRR is False Recognition Rate.

Author	Techniques Used	FAR, FRR & VR	Data Base Used
Lin Hong et al. (1997)	Alignment based elastic matching algorithm	FRR=15%	MSU: contain 10 images per finger from 70 individuals. Total 700 images size: 640×480
Lin Hong et al. (2000)	Filtering bank based matching	FAR=1.92% FRR=10.006%	MSU DBI, consists of a total of 2672 Images
Afsar et al. (2004)	Gabor filter based Enhancement and CN concept for Minutiae Extraction	FAR=1% FRR=7%	FVC 2000 800 fingerprints from 110 different Fingers
Kaur et al. (2008)	Histogram Equalization and FFT for enhancement and CN Concept for Minutiae Extraction	VR=75%	N/A
Saleh et al. (2011)	Minutiae based matching, FFT For enhancement	FAR=0.171% FRR=0.166%	FVC2000
Chaudhar y et al. (2012)	Filtering based matching and Gabor Filter	FAR=0.350% FRR=21.49%	DB1_B, DB2_B, DB3_B, DB4_B, PNG, VeriFinger_Sample DB
Gopi et al. (2012)	Gabor Filter And Frequency Domain Filtering	Recognition rate= 95%	FVC 2002
Liu et al. (2012)	Gabor filter based Enhancement and CN concept for Minutiae Extraction	FAR=0.085% FRR=1.4% VR=99.75%	2000 fingerprint images of 200 individuals at 500dpi size: 256×360
Virk et al. (2012)	Histogram Equalization for Enhancement & CN Concept for Minutiae Extraction	FAR=0.06% FRR= 6.9%	FVC2000
Dahmal (2013)	Filtering based matching and Gabor Filter	FAR=0.0% FRR= 6.333%	SmallDB, NewDB, FingDB. SmallDB contains 4 different new DB is a small database containing the 14 images. The FingDB contains fingerprint images of 21 persons

### III. CONCLUSION

Fingerprint Recognition is one of the well known and reliable Biometrics Authentication Techniques. We have presented an enhancement algorithm for fingerprint recognition using a bank of filtering that utilizes both the frequency and orientation information available in a fingerprint. Gabor filters are used to extract features from the template and input images by eight different directions with a short fixed length. Hence, the process of extracting in many oriented components from a finger print image is an expensive process because it entails filtering of the image by a bank of Gabor filters in many directions. The separating of two dimensional of complex Gabor filter 2D into two one dimensional 1D filters on the x and y axes is an efficient method to reduce the time of image filtering process. The filtering is based on fingerprint matching by computing the Euclidean distance between the template Fingerprint and the input Fingerprint (Finger Codes).

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