



PHAGWARA (DISTT. KAPURTHALA), PUNJAB

**FINGERPRINT MATCHING ALGORITHM  
USING  
ADVANCED PRE-PROCESSING TECHNIQUES**

A  
Dissertation submitted by

**SarbjitKaur  
(11300942)**

to

**Department computer  
science and engineering**

In partial fulfilment of the Requirement for the  
Award of the Degree of

**Master of Technology in computer  
Science and engineering**

**Under the guidance  
of  
Mrs.Urvashi Garg(16983)**

**(May, 2015)**

School of: Computer Science and Engineering

DISSERTATION TOPIC APPROVAL PERFORMA

Name of the student : Sarbjit Kaur Registration No : 11300942  
 Batch : 2013-2015 Roll No : RK2306A17  
 Session : 2014-2015 Parent Section : K2306

Details of Supervisor:

Name : Urvashi Garg Designation : Assistant Professor  
 UID : 16983 Qualification : M.Tech  
 Research Exp. : 4 year

Specialization Area: Database (pick from list of provided specialization areas by DAA)

Proposed Topics:-

1. Finger print matching with advance pre processing technique.
2. Algorithm for cluster formation.
3. Palmprint recognition algorithm.

*Urvashi 16983*  
 Signature of supervisor

PAC Remarks:

*Topic 1 is approved*  
*Publication is expected*

*[Signature]*

APPROVAL OF PAC CHAIRMAN

Signature: *[Signature]*

Date:

\*Supervision should finally encircle one topic out of three proposed topics and put up for an approval before Project Approval Committee (PAC).

\*Original copy of this format after PAC approval will be retained by the student and must be attached in the Project/Dissertation final report.

\*One copy to be submitted to supervisor.

# Abstract

Fingerprint matching algorithm is popular by its uniqueness. Fingerprint is unique to all even in twins. In previous decade mostly people use signature for security purpose. But they are now shifting to fingerprint after using signature to enhance the security. We can match the fingerprint by two steps. The first step is pre-processing technique which helps to remove noise & blur from an image. Second step is post-processing technique which helps to match the fingerprint. A lot of algorithm & techniques have been developed for pre-processing & post processing. But it was observed that in pervious papers pre-processing technique cannot remove noise properly. Also if fingerprint is not in right direction then it may create a problem during post processing technique. In this paper we have tried to develop a new technique for pre-processing to remove noise properly & develop an algorithm for post processing for match fingerprint aligned in any direction.

Keywords: fingerprint recognition, fingerprint uniqueness, thinning process

## CERTIFICATE

This is to certify that Sarbjit kaur has completed M tech dissertation titled fingerprint matching algorithm using advanced pre processing technique under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of the dissertation has ever been submitted for any other degree or diploma.

The dissertation is fit for submission and partial fulfilment of the conditions for the award of M tech computer science and Engg.

Date

Signature of advisor

Name

## **Acknowledgement**

I am highly thankful to my mentor Urvashi Garg who give me proper guidance for my dissertation. With her inspiration & suggestion I am being able to do this research. Under her supervision I am going to do “fingerprint matching with advanced pre processing technique. It would really hard to make this dissertation without her supervision. I would really express my deeper thankful to her. She play major role for my dissertation. She always inspired us to do something better.

I also like thankful to my H.O.D. who provided me with the facilities being required. Under the guidance of my HOD. Now I am able to do my best.

# DECLARATION

I hereby declare that the dissertation entitled, SARBJIT KAUR submitted for the M.Tech Degree is entirely my original work and all ideas and references have been duly acknowledged. It does not contain any work for the award of any other degree or diploma.

Date: \_\_\_\_\_

**Investigator**

**Regn. No. \_\_\_\_\_**

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# Chapter 1

## Introduction

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Fingerprint identification is the most popular & old way to identify the person. Signature is used for security but as the time grows people are moving to fingerprint to enhance the security. Over the last decade this technique basically used to identify the criminals. Mostly this technique is used in CID department. Because they are identify the criminals by their fingerprints. Now a day's fingerprints are used in ID cards. It can also be used to keep the records for example in libraries we can keep the record of student's entrance & exit. Fingerprint is a valid proof of any person's identity. Because it is unique to every person. In traditional way, when any person, who is illiterate, is using fingerprint as a identification. On that days fingerprint is taken on paper with ink but now in these days fingerprint is taken by any sensor. This sensor captures the fingerprint & put it in the database

When we take an image there is more noise & blur in the image. Because an image is consist of noise & blur. This may create problem while matching with another image therefore it has to be removed before matching. This can be removed with the help of pre-processing technique. In pre- processing technique we apply many techniques which help to remove the noise from an image. Pre-processing technique is main part of fingerprint matching. So if pre-processing is good then we can match the fingerprint properly. Many algorithms have been proposed for fingerprint matching but less work is done on pre-processing technique.

While taking a fingerprint image with the sensor in some cases our finger is tilt or we can say moved. Then we apply good technique so that it captures the movement of fingerprint & auto adjusts it. This will help us take a good fingerprint & matching will be properly.

Fingerprint matching technique is very old technique. In the fingerprint matching technique firstly define the pre-processing technique. In which fingerprint image is pre-processed. Then we match the fingerprint. With the help of pre-processing technique we can remove the blur or noise from a

fingerprint image. When we take an image there is more noise in the image. This can be removed with the help of pre-processing technique. In post processing method we can match the image. In this way image is matched. Pre-processing technique is the main part of fingerprint. So if pre-processing is good then we can match the fingerprint properly. Till today pre-processing technique is not good. Many algorithms are made for fingerprint matching but less work is done on pre-processing technique. In this paper I am going to improve the pre-processing technique by combining of pre-processing techniques. In this way we can improve the pre-processing technique so that fingerprints are matched properly because fingerprint matching technique is the best way to identify criminals or any other person. So there is a need to improve it.

I have read many papers on fingerprint matching technique. In these papers pre-processing techniques are also given. In pre-processing technique we remove the noise & blur from an image so that quality of image is increased & fingerprints are matched properly. Fingerprint matching technique basically used to identify the criminals. Mostly this technique is used in CID department. Because they are identify the criminals by their fingerprint. Fingerprint is different from one another even differ in twins. If fingerprint technique is good then we can identify the criminals. These fingerprint technique not only used to identify the criminals but also it can be used to identify a person. Like in these days fingerprint is used in ID cards & any other cards. It can also be used to keep the records like in libraries we can keep the record of student's entrance & exit. Fingerprint is valid proof of any person's identity. Fingerprint can also be used for attendance & leave. Some days before adhaar cards are made based on fingerprint which is used as voter card, license or any identification. In traditional any person, who is illiterate, is using fingerprint as a identification. On that days fingerprint is taken on paper with ink. First of all finger is dip in ink, then placed it on paper. In this way fingerprint is taken. But now in these days fingerprint is taken by any sensor. This sensor captures the fingerprint & put it in the database. Then again take another image & match it. The scope of my study is to improve the quality of the image.

# 1.1 Fingerprint images

Fingerprint identification is the most popular & old way to identify the person. Over the past year this technique is specially used to identify the criminals. Fingerprint is unique. It is different from one person to another even this is different in twins. This is not changed throughout whole life. If one finger is damaged then we can use another finger. Many scanners are used to capture fingerprint. These scanners capture the ridges, bifurcation, dot, end ridges in a finger. Now in these days we can capture the fingerprint with mobile phones.

## **Types of fingerprint:**

Fingerprint is of three types

### **Whorl:**

This is circular around the point of finger.



PLAIN WHORL

Figure 1.1.1 Whorl

### **Loop:**

This is ridges enter from one side of fingerprint, from a curve then exit from same side.



Figure 1..1.2 loop

### **Arch**

Ridges enter from one side of finger rise in the centre forming an arch & then exit from another side.

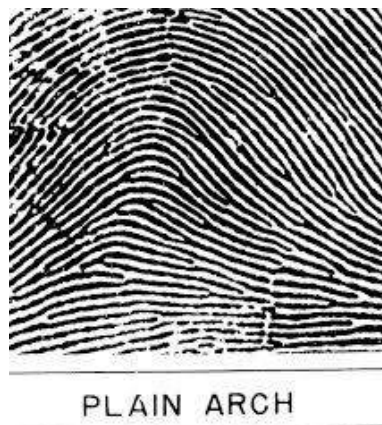


Figure 1.1.3 arch

Fingerprint matching technique is very old technique. In the fingerprint matching technique firstly define the pre-processing technique. In which fingerprint image is pre-processed. Then we match the fingerprint. With the help of pre-processing technique we can remove the blur or noise from a fingerprint image. When we take an image there is more noise in the image. This can be removed with the help of pre-processing technique. In post processing method we can match the image. In this way image is matched. Pre-processing technique is the main part of fingerprint. So if pre-processing is good then we can match the fingerprint properly. Till today pre-processing technique is not good. Many algorithms are made for fingerprint matching but less work is

done on pre-processing technique. In this paper I am going to improve the pre-processing technique by combining of pre-processing techniques. In this way we can improve the pre-processing technique so that fingerprints are matched properly Because fingerprint matching technique the only a best way to identify criminals or any other person. So there is a need to improve it.

## 1.2 Further divication of fingerprints



Figure 1.2.1 fingerprint lines

Fingerprint is again mainly divided into some parts.

### **Crossover**

First is crossover. It is the point from which two lines of fingerprints are cross each other.

### **Bifurcation**

Second is bifurcation in which fingerprint line is next divide into two lines.

### **End ridges**

Third point is end ridges in which fingerprint line is finish before join with other fingerprint line.



## Island

Forth line is island in which fingerprint in the shape of triangle.

## Delta

Delta is the point in which fingerprint line is independent from other lines.

## Pore

Pore is the point which is little in round shape but it is half in circle.

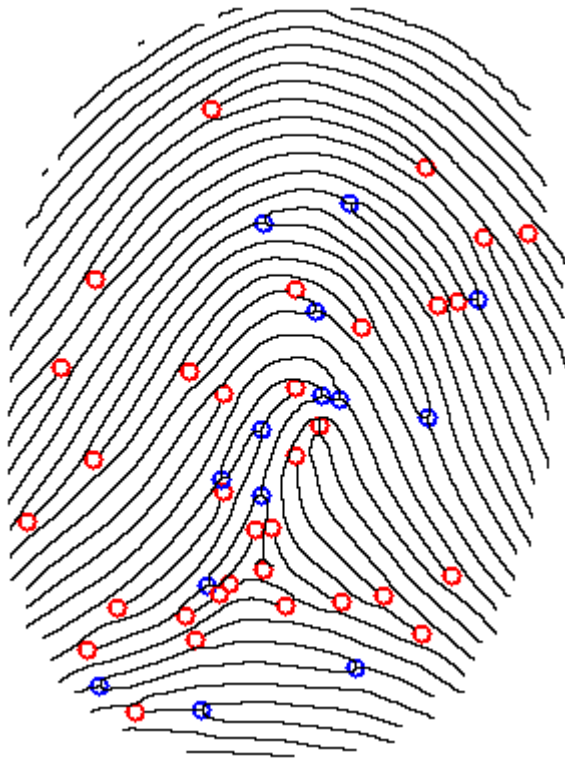


Figure 1.2.2 minutiae extraction

Minutiae extraction is a method through which we can match the fingerprint image. With the help of this method some points are extract which are bifurcation and ridges. These two points are extracting from an image.

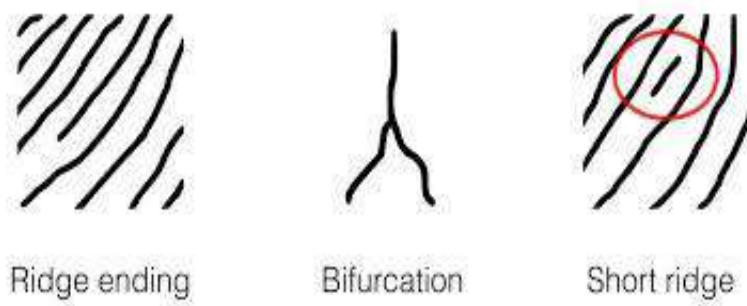


Figure 1.2.3 Ridges, bifurcations & short ridges

In the minutiae method we draw a circle around the ridges & bifurcation. In this way we can match or compare two images with ridges & bifurcation. This is very popular technique to compare or match the fingerprints. Many other types of fingerprints are like

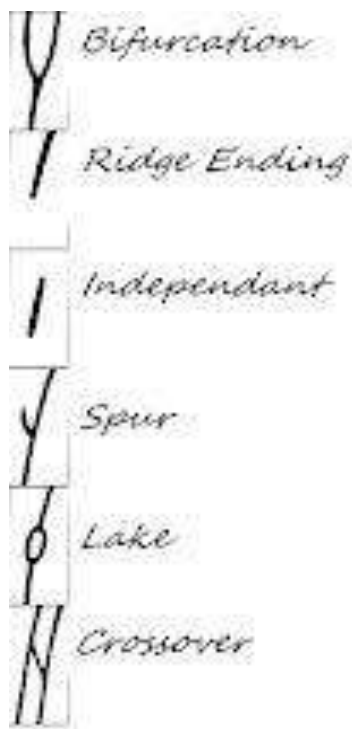


Figure 1.2.4 Fingerprint lines

## **Independent**

Independent line is also available in our fingerprint. This line doesn't attach with any other line.

## **Spur**

Spur is like a big line then a short line is attached.

## **Lake**

Lake is like a zero or whole is available in a line.

## **Crossover**

Crossovers are lines that cross each other.

## **Bifurcation**

This is a point at which two lines are attached. This point initialization point for two lines like

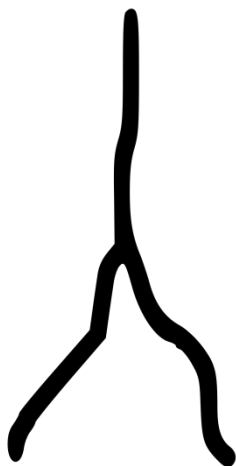


Figure 1.2.5 bifurcation

## End ridge

It is a single line that is not attach with any other line. Independent in nature. like



Figure 1.2.6 end ridge

These are some independent lines of fingerprint image. From these lines fingerprint are recognized. Fingerprint lines are different from one person to another. These lines are same but their position is different in every person. So that's why every person has unique fingerprint even difference in twins.



Figure 1.2.7 Noisy images

These are the noisy images which are not able for perfect matching so I apply some technique so that I can increase the quality of the images. So that we can take a good quality images like

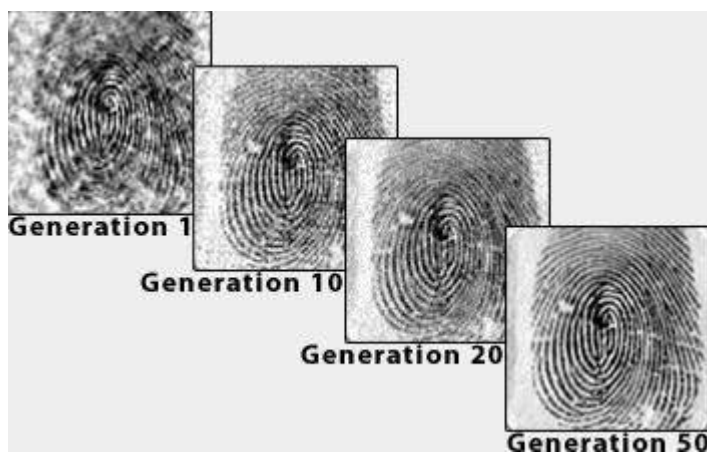


Figure 1.2.8 Step by step improved image

In this diagram we define a generation of fingerprint. First take a row image.

In second generation remove most of noise.

Then apply another technique in which mostly noise is removed.

In the next generation we receive a noise free image. This is our final image.

Now it is ready for matching.

In this way image is matched properly. Like these generation I want to improve my fingerprint image Because till today pre-processing technique is not good. So I want to improve the pre-processing technique. After pre-processing technique the quality of image is improved. In this way matching is successfully done.

While taking fingerprint image, if finger is moved, then with the help of technique it auto adjust an image. Then apply pr-processing technique. & at last image can be matched.

## Chapter 2

# Terminology

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Many times we see that if a person has a cut on his finger then we cannot take fingerprint properly. Then major problem is occur when if that person is criminal or not. So I give more attention to this project. To do this we take an image and make many cuts on that fingerprint image's copy. Then try to match these images. It is successfully done.



Figure 2.1 Step by step improved image

In this diagram we define a generation of fingerprint.

### **G1\_1**

In generation 1 first take a row image. In second generation remove most of noise.

### **G1\_2**

In generation 2 then apply another technique in which mostly noise is removed.

## **G1\_3**

In the next generation we receive a noise free image.

## **G1\_4**

In this generation this is our final image. Now it is ready for matching. In this way image is matched properly.

Like these generation I want to improve my fingerprint image. Because till today pre-processing technique is not good. So I want to improve the pre-processing technique. After pre-processing technique the quality of image is improved. In this way matching is successfully done.

While taking fingerprint image, if finger is moved, then with the help of technique it auto adjust an image. Then apply pr-processing technique. & at last image can be matched.



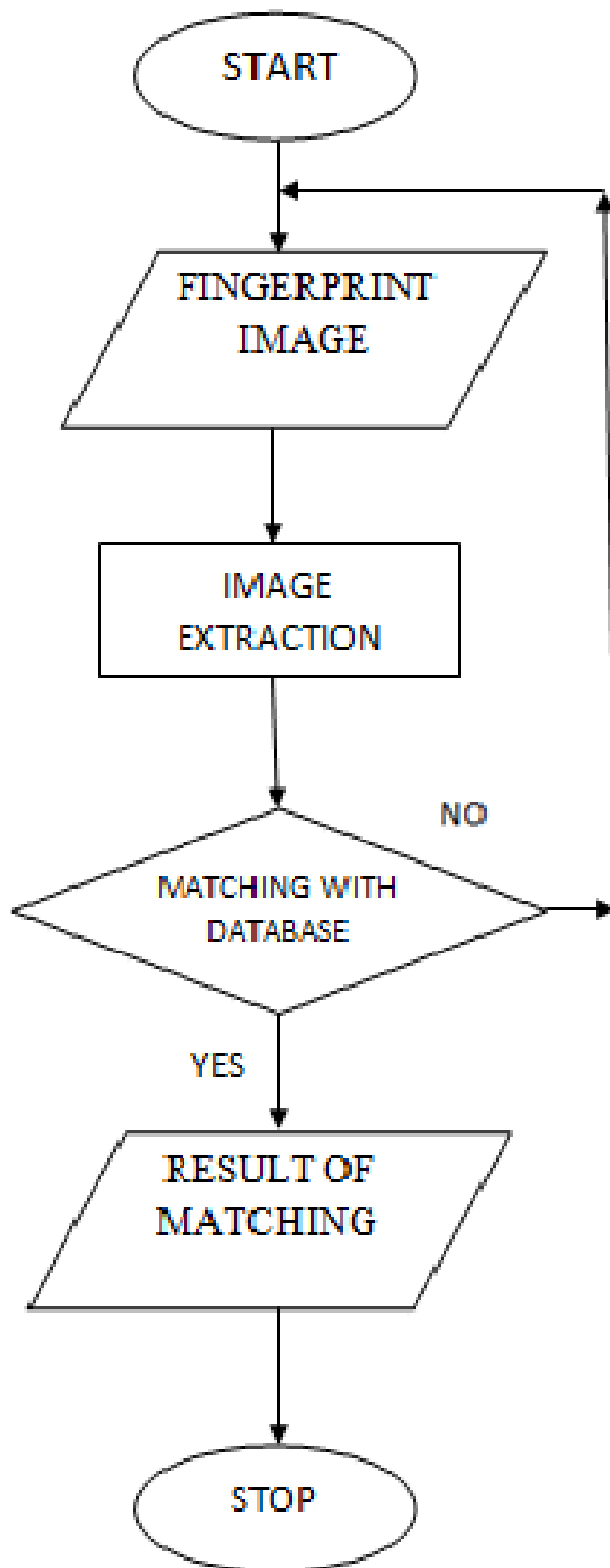


Figure 2.2 Fingerprint matching

In this way we can match the fingerprint images. Firstly take fingerprint & then extract the image. Then match the fingerprint with database. If matched then result shows fingerprint is matched. If no then again matching process is start.

In this we can match the fingerprint with accurate way. As shown in this diagram first of all we take an image from the database. Then apply techniques on it. In second step we can take another image from database if database have a image. Then apply again techniques on it. After taking two images we are going to match the fingerprint images.

## Chapter 3

### Literature survey

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**Chih-jen lee ; Dept. Of electr. Eng.,nat.Taiwan univ.,Taipei , Taiwan ; sheng-De wang** IEEE [1] works on A Gabor filter-based approach for fingerprint recognition . Gabor filter is used for edge detection. It is also used in texture representation & discrimination. In this paper image is taken & then Gabor filter is applied on this & fingerprints matching take place. But It doesn't remove the noise from an image.

**Byoung-ho cho ; Dept of comput. Eng. , kyoungpook nat. univ. , teagu , south korea ; jeung-Seop kim ; jae hyung bae ;In-Gu bae** IEEE [2] works on Core-based fingerprint in which image is classified. It is an algorithm in which the core points of fingerprint image is detected. False core points may cause the noise in the image. Author tries to remove the false core points & increase the accuracy up to 92.3%. But accuracy is not increased because of image incomplete or there is any damage then this algorithm is not helpful.

**Virginia Espinosa Dur-6 polytechnic university of Catalonia** IEEE [3] works on Minutiae detection for fingerprint image. In this paper, a very good algorithm is proposed for detect the bifurcation & ridge end points. This technique is so good for detection but it doesn't help to remove the noise & blur from an image.

**Sato. , N,NTT Microsystems integration labs,NTT corp., kanagawa,Japan ; Machida Katsuyuki ; Morimura,H, Shigemstu, S** IEEE [4] works on fingerprint sensor immune to various finger surface conditions that concentrate on the sensor machine in which author capture ridges & valise accurately. The purpose of MEMS (micro electro mechanical system) to make the structure pixel arrayed on sensor surface & this process stacks the cavity structure on CMOS.

**Selvraj H.; Dept of ECE , univ. Of Nevada , Las vegas,NV,USA,Arivajhagan ,S ; Ganesan ,L** IEEE [5] works on fingerprint verification in which author uses wavelet transformation . Wavelet

transformation helps to deny the noise & blur from an image. In this way performance as well as accuracy is increased. It uses Image compression. This algorithm increase the accuracy this algorithm is not completely removing the noise.

**Jain,A.K.,Dept. Of comput. Sci.& eng.,Michigan state univ.;** **yei chen ; demirkus,M** IEEE [6] works on Pores & ridges in which high resolution fingerprint matching using level 3 features proposed an algorithm in which author defines three levels of fingerprint matching .1.pattern 2. Minutiae 3. Pore & ridges. In this paper author increase the resolution of a scanner that is up to 500 ppi . So that image can be taken accurately. But there is no work on pre-processing technique.

**Mar Win; Dept of software technol.,Univ. Of Comput. Studies,Yangon Myanmar;** **sein M.M.** IEEE[7] works on Texture feature based fingerprint recognition for low quality image in which while taking fingerprint image it is of low quality because of fabric background. Author combine two algorithm wavelet transformation & Gabor filter. By using this it increase the quality of an image. In this centre point of an image is detected & core point becomes a centre point. In this way accuracy is increased. It doesn't remove noise properly. It is focusing on detection not on extraction.

**Zin Mar Win Univ. of Comput. Studies, Yangon, Myanmar Sein M.M.** IEEE [8] works on Fingerprint recognition system for low quality images proposed an algorithm proposed an algorithm in which author use the Gabor filter. This algorithm is not widely used because it handles only low quality images.

**L. Ravi Kumar<sup>1</sup>, S. Sai Kumar<sup>2</sup>, J. Rajendra Prasad<sup>3</sup>, B. V. Subba Rao<sup>4</sup>, P. Ravi Prakash<sup>5</sup>** [9] works on Fingerprint Minutia Match Using Bifurcation Technique in which the minutiae extraction points are explained. This technique is only used for detection. Only bifurcation is detected by using this technique. So it cannot remove the noise properly.

**Swapnil G. Patil 1, Mayank Bhatt 2** [10] works on a Survey on Latent Fingerprint Matching Techniques in which pre-processing technique is used. By which quality of an image is increased. Ridge detection, edge detection, ROI, feature orientation & minutiae points are calculated in this paper. But they are not helpful to increase the quality.

**Urvashi Chaudhary, Shruti Bhardwaj, Himani Sabharwal** [11] works on Fingerprint Recognition in which orientation features are used, from sample fingerprint images using orientation feature & local directional pattern. In this SVM classifier is used for better result using FAR & GAR. In this we calculate the value of FAR & GAR. But main deficiency of this algorithm is its pre-processing technique.

**K. Phalgunarao, m.charan kumar, International Journal of Computer Science and Mobile Computing** [12] work on fingerprint matching in which a quick & efficient technique of fingerprint recognition using a set of texture statistical based feature. The three arithmetic features which are extracted from fingerprint images. 1. Entropy coefficient, which is computed from intensity of histogram of an image. 2. A relationship coefficient, computed by correlation between navel image & filtered image. 3. An energy coefficient, which is computed by first subjecting the image to 5-level wavelet decomposition & computing the proportion energy of the approximation coefficient obtained by 5-Level. Result shows fingerprint can be used for personal verification. In this paper there is a use of three different colours. But if we combine it then shape can be changed.

**Devendra Singh Kaushal, Yunus Khan & Dr. Sunita Varma** [13], in this works on A Novel Approach of Finger Print Recognition Using (Ridge) Minutia Method and Multilayer Neural Network Classifier in which 80 extraction points of a fingerprint image. Multilayer neural network is also classified in this paper. Two level are explained in this paper first is low level design & second is high level design. In low level design the definition of image loading, pre-processing technique, image recognition & database management is given. But in high level these terms are explained. In pre-processing technique first of all apply normalization then edge detection then ridge detection, thinning & minutiae extraction. But if image is incomplete or there is any cut or any other problem then this algorithm is not helpful.

**N. Nagaraju Research Scholar, PACE Institute of Technology & Sciences Ongole** [14] works on A responsive Fingerprint Matching system for a scalable functional agent proposed to classify the fingerprint image. Firstly author classifies the image into three major parts like whorl, arch & loop. Then image is classified into tentative areas like bifurcation, ridge end, delta etc

## **Chapter 4**

### **Scope of the study**

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I have read many papers on fingerprint matching technique. In these papers pre-processing techniques are also given. In pre-processing technique we remove the noise & blur from an image so that quality of image is increased & fingerprints are matched properly. Fingerprint matching technique basically used to identify the criminals. Mostly this technique is used in CID department. Because they identify the criminals by their fingerprint. Fingerprint is different from one another even differ in twins. If fingerprint technique is good then we can identify the criminals. These fingerprint technique not only used to identify the criminals but also it can be used to identify a person. Like in these days fingerprint is used in ID cards & any other cards. It can also be used to keep the records like in libraries we can keep the record of student's entrance & exit. Fingerprint is valid proof of any person's identity. Fingerprint can also be used for attendance & leave. Some days before adhaar cards are made based on fingerprint which is used as voter card, license or any identification. In traditional any person, who is illiterate, is using fingerprint as a identification. On that days fingerprint is taken on paper with ink. First of all finger is dip in ink, then placed it on paper. In this way fingerprint is taken. But now in these days fingerprint is taken by any sensor. This sensor captures the fingerprint & put it in the database. Then again take another image & match it. The scope of my study is to improve the quality of the image. Like



Figure 4.1 Noisy & improved fingerprint image

The first image is noisy image in which more noise is existing. This is the image in which is directly taken from any sensor machine. As you seen this image is not clear. Then if we done matching process on it then it doesn't say that this is perfect match or not. To remove this kind of disturbance, we have done pre processing technique on noisy image. With the help of pre processing technique maximum noise is removed. Then we can match the image very clearly. As we know fingerprint is more important identification proof of any person.

Fingerprint is used in all fields like if we consider education field then in colleges, schools and other institute attendance and leave and any other procedure are used fingerprints. In other important document like identity cards , voter cards fingerprints are used.

## Chapter 5

### Objectives of the study

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The main objective of my study is to achieve the goals like best quality fingerprint image. In previous fingerprint image is come with noise & blur. I want to improve the image. Remove the noise & blur from an image. This is happening only with help of pre-processing technique. In the pre-processing technique we can enhance an image. Firstly we take a row image with fully noisy & blurred. Then we remove noise & blur from it

#### 5.1 Improved quality

In traditional days fingerprint is more important to identify someone. But the technique by which we take the fingerprint is not good. Till today fingerprint technique is not good. So my main objectives of this research are to obtain good quality image. Because fingerprint is only a technique by which we can identify the real person. This is the main evidence by which we can catch the criminals. So in my research i want to improve the quality of an image.



Figure 5.1 improved image

This the improved image from noisy image. First image is noisy image but second image improved image with the help of our algorithm



## 5.2 Increase performance

I also improve the performance. Because while taking a fingerprint image with the sensor in some cases our finger is tilt or we can say moved. Then we apply good technique so that it captures the movement of fingerprint & auto adjusts it. This will help us take a good fingerprint & then automatically fingerprints are good & perfect matching is done.



Figure 5.2 tilt image

This is a image which moved from its place. Our algorithm can take this type of image auto adjust the image in that manner in which it can be matched. So with the help of our algorithm we can match fingerprint properly even if it is little tilt. Because if image is tilt, then we cannot match the fingerprint properly. So we have to auto adjust the image so that image will match proper and give us a good output.

# Chapter 6

## Present work

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In this paper pre-processing technique is going to be improved. Because till today pre-processing technique is not good. There is no much work is done on this technique. This technique is very useful because while taking fingerprint more disturbances are come with fingerprint. It is very important to remove this disturbance for perfect matching. In our research many techniques are used with loop and filters to remove noise from an image.

### 6.1 Problem formulation

While taking fingerprint image there is a more noise & blur in the image. We are going to improve the quality of the images by applying pre-processing technique. By applying pre-processing technique we mean firstly remove the noise & blur from an image & improve the quality of an image. Then apply post processing technique to match the images. A fine fingerprint can identify the person. Fingerprint is unique for every person. Even they are twins but fingerprint is different from one person to another. In my research i am going to improve the fingerprint. Fingerprint matching can be perfect if its pre-processing technique is good. In my research i am going to improve the pre-processing technique. I also increase the performance because while we take the fingerprint image it can be moved.

### 6.2 Objectives

The main objective of my study is to achieve the goals like best quality fingerprint image. In previous fingerprint image is come with noise & blur. I want to improve the image. Remove the noise & blur from an image. This is happening only with help of pre-processing technique. In the pre-processing technique we can enhance an image. Firstly we take a row image with fully noisy & blurred. Then we remove noise & blur from it

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good. Till today fingerprint technique is not good. So my main objectives of this research are to obtain good quality image. Because fingerprint is only a technique by which we can identify the real person. This is the main evidence by which we can catch the criminals. So in my research i want to improve the quality of an image.

I also improve the performance. Because while taking a fingerprint image with the sensor in some cases our finger is tilt or we can say moved. Then we apply good technique so that it captures the movement of fingerprint & auto adjusts it. This will help us take a good fingerprint & then automatically fingerprints are good & perfect matching is done

## 6.3 Steps to match fingerprint images

There are many steps for matching fingerprint images. Basically two steps are considered. First is pre-processing technique and second is post processing technique. These steps are explained as follows:

### 6.3.1 Pre processing technique

To remove noise and blur from an image, Pre processing technique is used. So while taking fingerprint there is more noise and blur in the image. Some persons have also cut in their fingerprint. While taking fingerprint there is a chance that image can be tilt or moved. So there is a need to remove these kind of noise from fingerprint and auto adjust it. To do this pre-processing technique is used. In the previous papers many techniques are used. All processes of the research that we are going to apply. In the first step we take the input. We can take the fingerprint image with scanner or any other sensor machine. Then after that we convert this image into black & white image. Then we apply binarize technique on it. Then we take a histogram of this image. By applying histogram means histogram tells us the graphical representation of an image. Then we apply thinning technique. This thinning technique tells us the actual representation of a fingerprint image. Like where the ridges & bifurcations are located. Then apply melting technique. Melting technique is where the black area is more in

an image we expand that area. Then apply whitening technique. With the help of this technique we clean the melted area. Apply white colour on that area. With the help of this technique we can improve the pre-processing technique. Last of all we apply the kelm filter. This filter helps to remove noise. After applying all upper techniques if some noise is left so we apply kelm filter. It also helps when take the fingerprint & fingerprint is moved. It captures the movement of the fingerprint. Mostly these techniques are used in previous papers.

### 6.3.2 Post Processing Techniques

Post processing technique is a technique in which we match the fingerprint image. First of all we take an image from database. Then apply pre-processing on the image. After getting an output image we have to take another image from database. Then apply pre-processing technique on that image. Then limit is provided. This limit tells that at how much limit images can be matched. After that we can match images. If image is not matched then take another image from database.

# Chapter 7

## Methodology

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In the research methodology. All processes of the research that we are going to apply. In the first step we take the input. We can take the fingerprint image with scanner or any other sensor machine. Then after that we convert this image into black & white image. Then we apply binarize technique on it. Then we take a histogram of this image. By applying histogram means histogram tells us the graphical representation of an image. Then we apply thinning technique. This thinning technique tells us the actual representation of a fingerprint image. Like where the ridges & bifurcations are located. With the help of this technique we can improve the pre-processing technique. In this Gabor filter and median filter is used to remove the extra portion from an image. We also use loop for auto adjust the image.

### 7.1 Proposed Technique

Many experiments are done on the fingerprint images but still there is a lack of much improvement in pre-processing technique. In this paper, try to improve the pre-processing technique by combining of techniques with filter and loop.

Filter is used to remove the noise and bits from an image or it is used to identify the edges of fingerprint image. Loop is basically used to auto adjust the image so that is while taking fingerprint image if fingerprint is little tilt then it will auto adjust it. Second technique is post processing technique through which we can match the fingerprint images. In matching process limit is apply. It is user defined. So that user can give limit according to the need. These are as follow:

## 7.1.1 Pre Processing Techniques

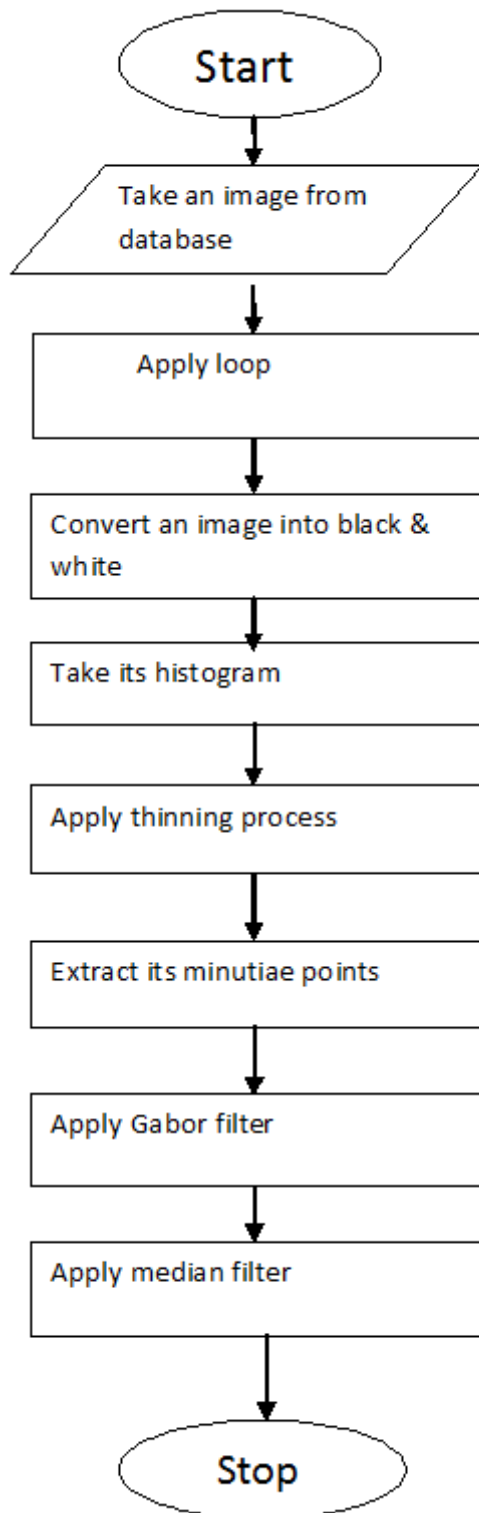


Figure 7.1.1 pre processing technique

In this flow chart we describe the research methodology. All processes of the research that we are going to apply.

## **Input image**

In the first step we take the input. We can take the fingerprint image with scanner or any other sensor machine. In today's life we can take fingerprint with the help of mobile phones because there is a function of some mobiles that their password to open is fingerprint.

## **binarize**

Then after that we convert this image into black & white image. We have to convert it because we cannot measure the proper value with RGB. So that's why we have to convert it into black and white

## **Apply loop**

Then apply loop so that if image is not in right direction it will auto adjust it. Because while taking fingerprint there is a chance that fingerprint is little tilt so in this case loop will auto adjust the image.

## **Histogram**

Then we take a histogram of this image. By applying histogram means histogram tells us the graphical representation of an image.

## **Thinning process**

Then apply thinning process which tells us the outer representation of an image. This is also a important process through which we can tell the outer representation of any image.

## **Minutiae extraction**

Then applies minutiae method. This method tells us the location of bifurcation & ridges. Through this technique we can identify the location of end ridges and bifurcation.

## 7.1.2 Post processing technique

Post processing technique is a technique in which we match the image. First of all we take an image from database. Then apply pre-processing on the image. After getting an output image we have to take another image from database. Then apply pre-processing technique on that image. After that we can match images. If image is not matched then take another image from database. In the post processing technique limit is also apply. It is user defined. So that user can apply limit according to the need. With the help of this technique we can match the fingerprint image.

### **Input image**

In the first step we take the input. We can take the fingerprint image with scanner or any other sensor machine. In today's life we can take fingerprint with the help of mobile phones because there is a function of some mobiles that their password to open is fingerprint.

### **Pre processing technique**

To remove noise and blur from an image, Pre processing technique is used. So while taking fingerprint there is more noise and blur in the image. Some persons have also cut in their fingerprint. while taking fingerprint there is a chance that image can be tilt or moved. So there is a need to remove these kind of noise from fingerprint and autoadjust it. To do this pre-processing technique is used. In the previous papers many techniques are used.

### **Another input image**

In this we have to take another image from database if there is no image in the database then the process is stopped but if there is a fingerprint in the database then takes that image.

### **Output image**

We can take the output image. Store that image.



## **Apply limit**

Then we apply the limit on matching. Normally limit is 90%. But in this algorithm limit is user defined. User can put the limit according to the need. Limit is used to define that at what level images can be matched. So in this limit is user defined.

## **Matching**

This is main motive of the image that how we can match the fingerprint images so that matching is perfect. In this step matching can be done

## **Conclusion**

Post processing technique is a technique in which we match the image. In this diagram First of all we take an image from database. Then apply pre-processing on the image. After getting an output image we have to take another image from database. Then apply pre-processing technique on that image. Then apply limit. By applying limit it is meant that at how much percentage images are matched. In this paper limit is user defined it means that its user's choice that how much limit is provided. After that we can match images. If image is not matched then take another image from database.

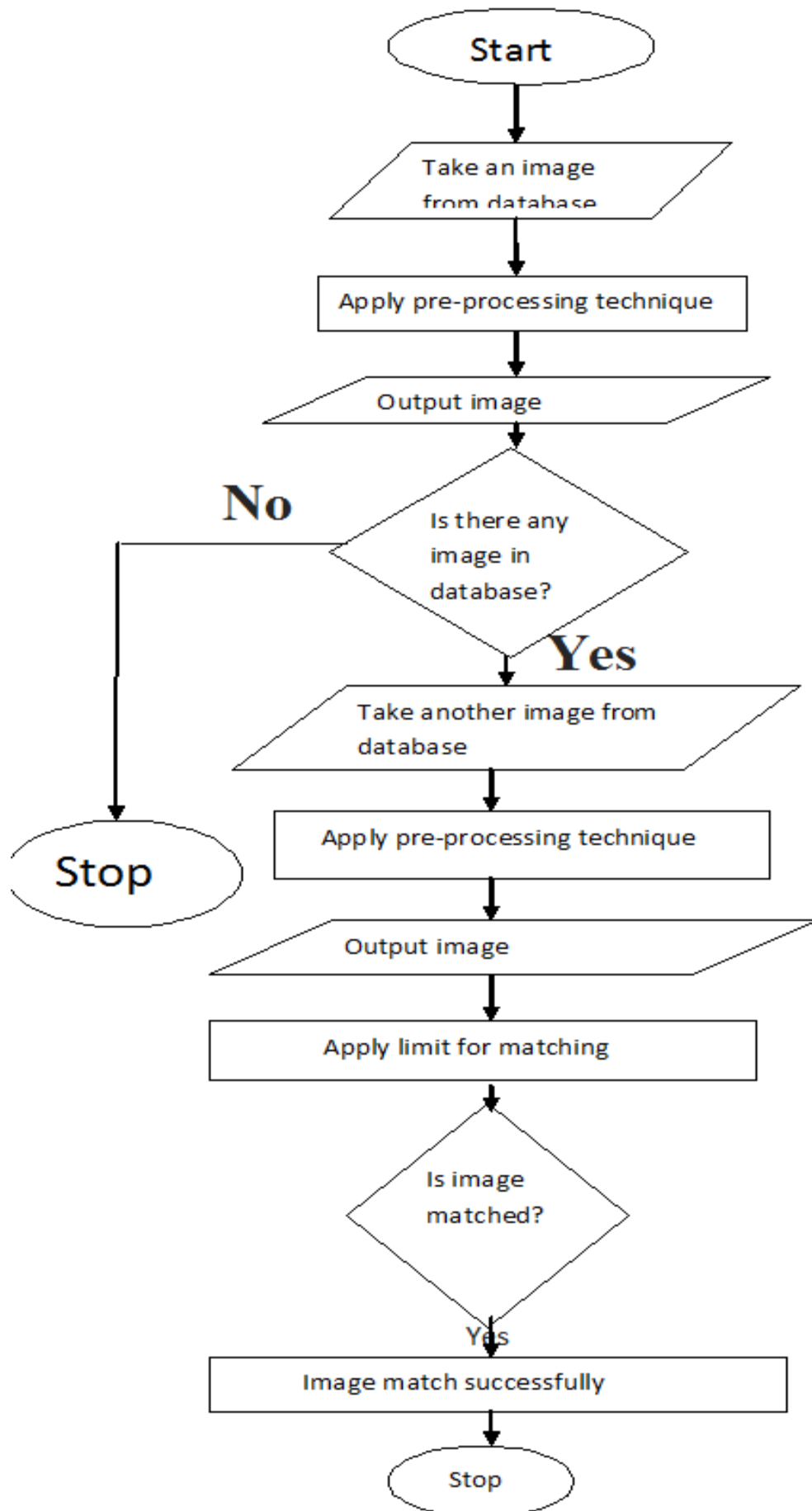


Figure 7.1.2 post processing technique

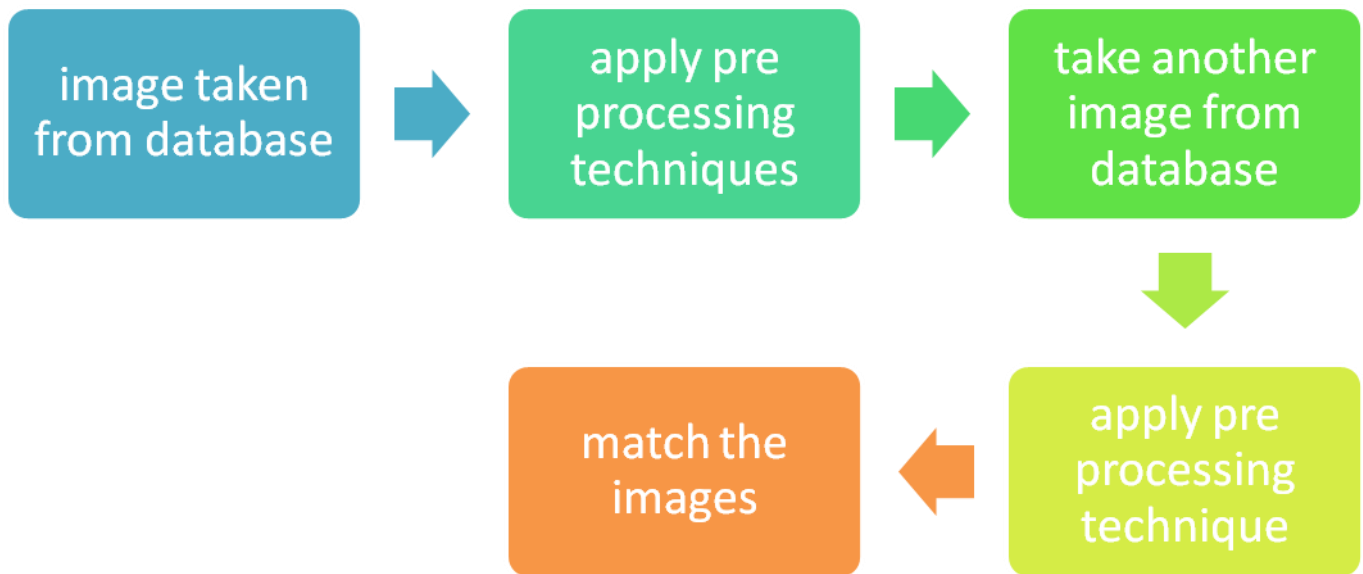


Figure 7.1.3 process of methodology

This is the whole process to match the fingerprint images in this image first of all we take an image from database where we store the images. Then we apply pre processing technique to remove noise and blur from an image, Pre processing technique is used. So while taking fingerprint there is more noise and blur in the image. Some persons have also cut in their fingerprint. While taking fingerprint there is a chance that image can be tilt or moved. So there is a need to remove this kind of noise from fingerprint and auto adjusts it. To do this pre-processing technique is used. In the previous papers many techniques are used. Then take another image from database. Then apply whole pre processing technique on that image. After this we can match the fingerprint images.

## Chapter 8 Result

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In previous ones there is more noise and blur in the fingerprint image. With the help of our algorithm we try to remove the blur and noise from an image. The input image is

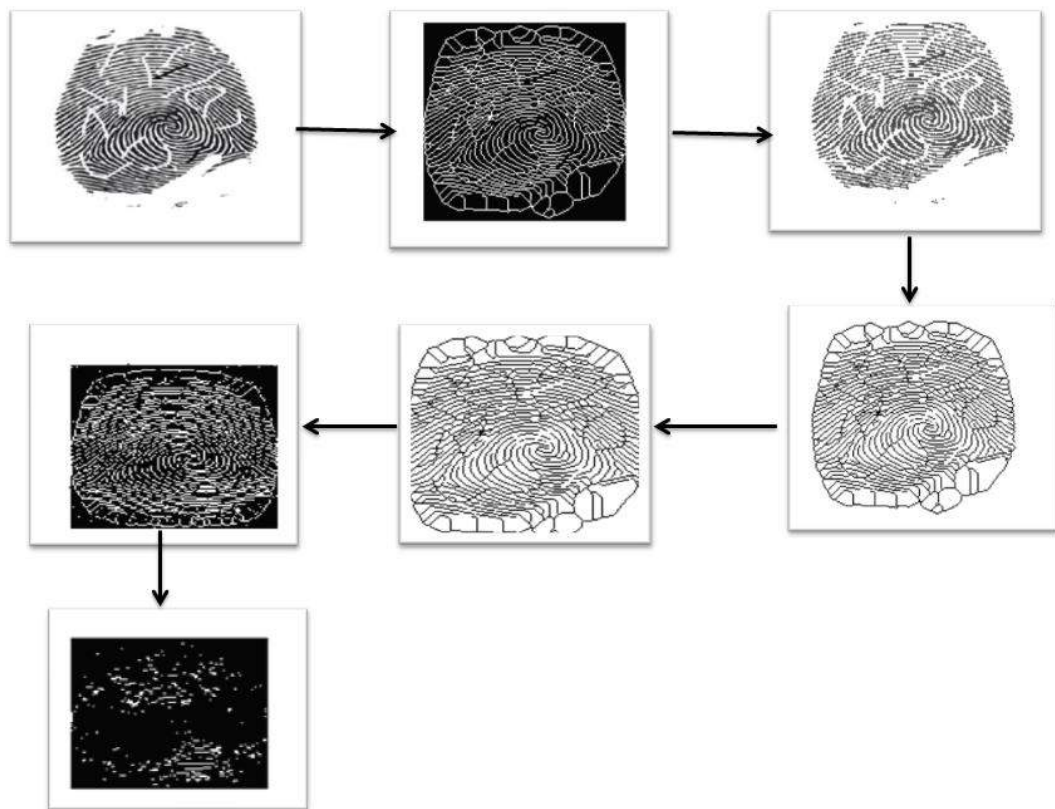


Figure 8.1 result

In this first of all we take an image from database. Then convert into RGB. After that apply Gabor filter it helps to remove bits from an image. Then apply take its histogram. By histogram mean graphical representation of an image. Then we apply thinning process. It helps to take outer image. After that we apply minutiae extraction. It extracts the points from an image. Points are

bifurcation & ridges. Then apply median filter. By using it first of all add noise in the image & then remove all noise from an image. In this way image is pre processed. Then apply post processing technique. In this technique matching limit is asked from user. After enter matching limit images are matched.

## Input image



Figure 8.2 input image

In this first of all we take an image from database. Then convert into RGB.

## Gabor filter



Figure 8.3 apply Gabor filter

After that apply Gabor filter it helps to remove bits from an image

## Histogram



Figure 8.4 histogram

Then apply take its histogram. By histogram mean graphical representation of an image

## Thinning process



Figure 8.5 thinning

Then we apply thinning process. It helps to take outer image.

## Minutiae extraction



Figure 8.6 minutiae extraction

After that we apply minutiae extraction. It extracts the points from an image. Points are bifurcation & ridges.

## Median filter



Figure 8.7 put noise

Then apply median filter. By using it first of all add noise in the image



Figure 8.8 remove noise

Then remove all noise from an image.

In this way we can remove the noise from an image and match the image properly. We apply many techniques with filter and loop so that we remove the disturbance and noise from an image properly and make the image very clearly. These are the techniques which are applied in pre processing techniques. We can match the image in post processing technique. We have developed a algorithm in which we describe the pre processing technique. In this algorithm we explained the process of pre processing technique and post processing technique.

## Main application pseudo code

```
BEGIN

SELECT AN IMAGE FROM DATABASE

APPLY PRE PROCESSING TECHNIQUE

IF (DATABASE CONTAINS AN IMAGE)

TAKE ANOTHER IMAGE FROM DATABASE

APPLY PRE PROCESSING TECHNIQUE

APPLY MATCHING LIMIT

IF(MATCHING_PER > MATCHING_LIMIT)

    DISP('IMAGE MATCHED SUCESSFULLY')

ELSE

    DISP('IMAGE MISMATCHED')

END
```



# PSUEDO CODE FOR PRE PROCESSING TECHNIQUE

SELECT AN IMAGE FROM DATABASE

{

CONVERT RGB TO GREY

APPLY LOOP TO AUTO ADJUST AN IMAGE

TAKE HISTOGRAM

APPLY THINNING PROCESS

EXTRACT ITS POINT THROUGH MINUTIAE METHOD

APPLY GABOR FILTER

APPLY MEDIAN FILTER

TAKE ANOTHER IMAGE FROM DATABASE

REPEAT STEP 1 TO 7

## Chapter 9

# Experimental work

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In our experiment first of all we have to take an image from database. We take an image in which is being damaged. We do many cuts on fingerprint image using paint. We also erase some area from fingerprint. But with the help of our algorithm we can match the fingerprint although there may be a cut or damaged.



Figure 9.1



figure 9.2

Noisy images

While experimental setup many images are used but main concentration is on these two techniques. Many experiments are done with help of these images. First of all take an image from database and take a copy of this image. After that copy of image is open in paint and makes the changes like apply many cuts and erase some area. Then apply the algorithm

## Input image



Figure 9.3 image taken from database

This is the original image which we download from internet. Now we are going to put noise or disturbance on this image. Like



Figure 9.4 create a disturbance

This is a noisy image. We erase some area of this image and put many cut on this image. Then it will become very noisy image. Then our algorithm pic this image and do successful matching.

We take another image which is download from internet and do many experiment on it.like



Figure 9.5 images taken from database

This is the another image that we taken from internet



Figure 9.6 noisy image

This is the image in which we put many noise to do many experiments on it. We simply apply cut on it and erase some area of an image. We took these two

images for experimental setup. Firstly we create much noise on these images and after that we remove this noise from an image with help of our algorithm.

# Chapter 10

## Data analysis and interpretation

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For, Fingerprint matching algorithm, we have taken data from internet. We collect all images from internet. After getting data we start our all experiment on that data. Otherwise firstly take an image with sensor machine .like in this image.

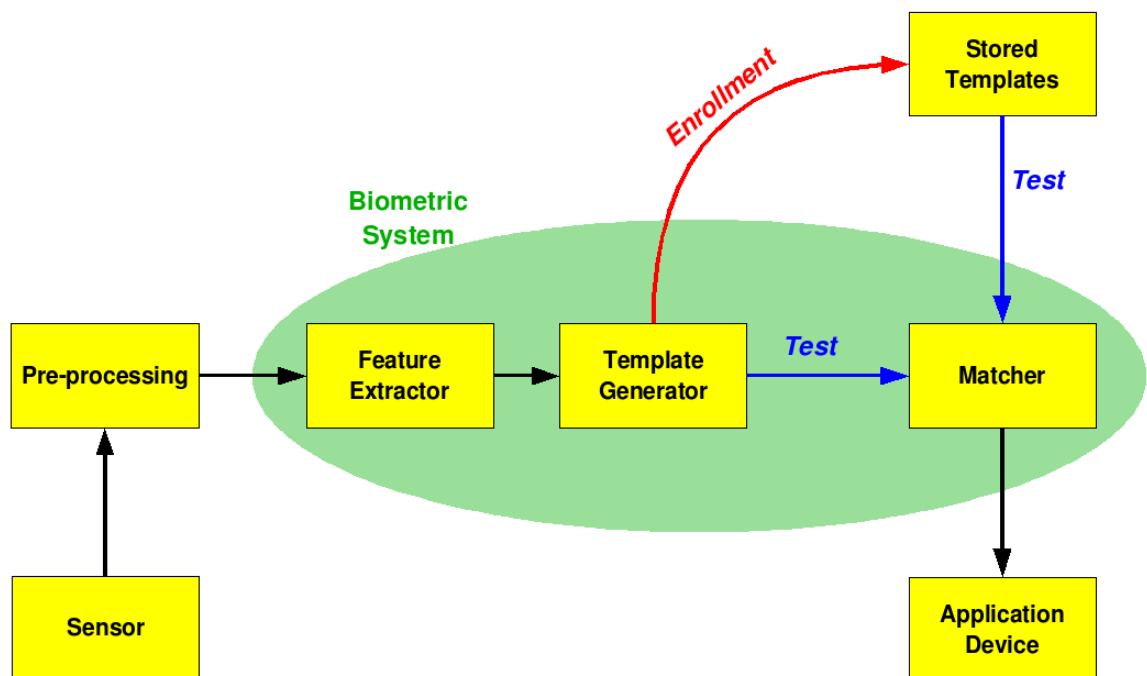


Figure 10.1 data interpret

In this image first of all we take an image with sensor machine. Then apply pre-processing technique. With the help of pre processing technique we can remove the noise, blur and disturbance from an image. Then with the help of feature

extraction we can take features of an image. This can be done with the help of minutiae extraction. This technique helps us to extract the points like bifurcation and end ridges.



Figure 10.2 minutiae based

In this image we calculate the minutiae points like bifurcation and end ridges. Then template is generated which can be stored at stored template with enrolment. Or we can test the image and send for matcher. Then we can store the final image at application device. In this way we can store the images. We can use these images for matching when we needed.

# Chapter 11

## Performance evaluation

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With the help of our algorithm we can increase the performance. Because while taking fingerprint there is chance that finger can be little tilt. So that's why we use loop for auto adjusts the image.



Figure 11.1 tilt image

In this way while we take an image from any sensor machine then it can be tilt. So with the help of our algorithm we can auto adjust the image. In this way we can increase the performance of fingerprint images in the case of any criminals we have to take an image from glass, car, door and any other things that are available at that moment. So the fingerprint images at that time not in right position. So there is a need for that algorithm which helps to auto adjust it and make it in appropriate position. So our algorithm helps to remove this kind of problem and match the fingerprint image properly. In this way we can increase the performance with the help of our algorithm.



Because while taking a fingerprint image with the sensor in some cases our finger is tilt or we can say moved. Then we apply good technique so that it captures the movement of fingerprint & auto adjusts it. This will help us take a good fingerprint & then automatically fingerprints are good & perfect matching is done.

## Chapter 12

# Conclusions

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While taking fingerprint image there is a more noise & blur in the image. We are going to improve the quality of the images by applying advance pre-processing technique. Till today pre-processing technique is not good. So we are going to improve the quality of fingerprint image. By applying advance pre-processing technique we mean firstly remove the noise & blur from an image & improve the quality of an image. Then apply post processing technique to match the images. While taking fingerprint image there is a more noise & blur in the image. We are going to improve the quality of the images by applying pre-processing technique. By applying pre-processing technique we mean firstly remove the noise & blur from an image & improve the quality of an image. Then apply post processing technique to match the images. A fine fingerprint can identify the person. Fingerprint is unique for every person. Even they are twins but fingerprint is different from one person to another. In my research i am going to improve the fingerprint. Fingerprint matching can be perfect if its pre-processing technique is good. In my research i am going to improve the pre-processing technique. I also increase the performance because while we take the fingerprint image it can be moved.

## **Chapter 13**

### **Future work**

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In this research we try to improve the pre processing technique to improve the quality of the image. Pre processing technique is more important technique which helps to remove the noise and blur from an image so that we can match the fingerprint fingerprints properly. We use some techniques with filters and loop.

More work can be done the pre processing techniques. We can give more concentrate on fingerprint image because if pre processing technique is not good then we cannot match the fingerprint properly. So more work will be done on pre processing technique.

# Chapter 14

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