CHAPTER 1:INTRODUCTION

Fingerprints are a result of an anatomical manifestation of a pattern of ridges and furrows of the epidemic layer at the anterior aspect of the fingertips. This pattern is determined during the fetal development, and is believed to provide a unique signature for every individual and for each finger. Therefore, fingerprints constitute one of the most reliable biometrics identification schemes, and are universally accepted as a legitimate proof of identity. Accordingly, fingerprints provide major evidence for forensic investigations and in criminal science. Additionally, they are used in contemporary security systems for access control

Fingerprint are one of the main type of analysis for the identification of the suspect in a criminal case the traditional methods of the identification of the fingerprints include the spotting of the fingerprints in the scene of crime the fingerprint are most favourably found in objects, articles furniture,glass,bottles,doors,windows ect these fingerprints are developed predominantly by using the fingerprint powders like black powder white fingerprint powder e ct and then lifting the developed fingerprints by using lifting tapes then the unique features of the developed fingerprints are studied and they are compared with other available fingerprint for the identification of the culprit, but many of the cases are left unsolved as there are no clear visible fingerprints are present which makes the case unsolved and the investigation officers cannot further do the proceeding for finding the culprit pr they may need to identify other minor evidences from the crime scene sometimes the fingerprint evidences are found as smudged in some objects due to factors like less pressure of application of the finger,due to the surface in which the fingerprint is present or else if the fingerprint which is developed may not have clear fingerprint ridges which may cause problems in the future investigation of the crime .

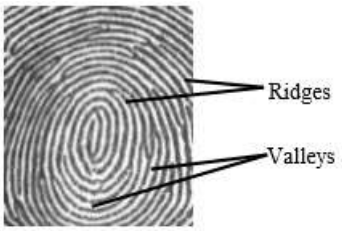

Figure 1 :Image of ridges and valleys in a fingerprint

There are ridges and valleys in fingerprint which should be seen clearly so that identification of by fingerprint can be done .In this case a more reliable and functional type of system is required for obtaining clear and proper fingerprint so that the comparison and the examination of the fingerprint can be made easier. In the modern era technology has a very big role and also the role of computer technology has grown and now many of the forensic identification systems and database are linked with the networks nationally or internationally which contains huge data regarding the collected fingerprints the system compares and matches the input fingerprint image with the database provided in the system and provides matching but for this task the imputed fingerprint should be of good quality and there should be well defined differentiation between the ridges of the fingerprint also if the collected fingerprint doesn't have clarity it would lead to wrong assumptions in the case .

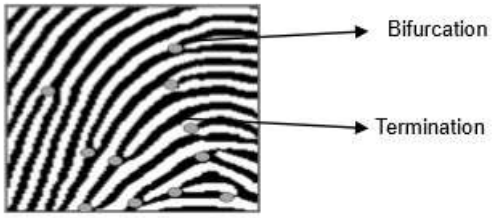

Figure 2:Dot representation of minutiae

Now for the enhancement and for more precision of the fingerprint collected from the crime scene and for uploading more accurate fingerprints to the databases like the AFIS(Automated Fingerprint Identification System) and other fingerprint data storages which make it easy to compare the imputed fingerprint and the fingerprints in the storage the key minutiae points in the fingerprints are evaluated and enhanced by using different software's so the digital computer acts an aid in the fingerprint development system different

algorithms are used for editing and enhancement of the fingerprint this technique also helps in cases if the fingerprint evidences are in the areas where the powder and lifting process cannot be applicable the fingerprint in these areas are exposed by UV another florescent lights and then the fingerprint are photographed and then they are enhanced using image enhancement software to get the clear image of the ridges in the fingerprint. Several commercial AFIS systems are currently available; however, those that provide enhancement, classification, and matching of fingerprints use proprietary source code and do not allow any customization. In addition, those that provide increased accuracy are amongst the most expensive.

Personal identification based on biometrics is nowadays an emerging research subject. Several physiological and behavioural human characteristics have been suggested in the last decades as discriminating features to be used in personal recognition. Among them, fingerprint is the most widely used technique due to its high discriminating power.There are different open source and closed source applications and software which are available in the internet which are based on the graphical and command based extraction of features of the inserted fingerprint image or scanned fingerprint these software's uses command lines implemented to graphical interface for the segmentation and for enhancement of the image and processes more clear output the software also helps in the reduction of noise from the image and to reduce the problems inn the fingerprint like breaking of the ridges due to cuts or injuries or due to old age of fingerprints

The software's which can be used for the enhancement and for editing the fingerprint are DMIT,MATLAB and Scilab ect these are based on programming language like python and java.

INTRODUCTION ON SCILAB

Image Processing and Analysis are fields of Computer Science whose objective is to enhance digital images and extract information from them . This allows automatic or semi-automatic identification, classification or characterization of objects and patterns. Some interesting applications are biometry systems (e.g. fingerprint and iris recognition), satellite and

microscope image analysis, diagnosis from medical images, and more. Another example is special effect filtering, usually found in image manipulation software such as the GIMPor Photoshop. A remarkable characteristic of this field is its overwhelming complexity. Many image processing techniques are based on sophisticated mathematical and computational concepts, such as the Fourier Transform. All this is combined with deep biological, psychological and probabilistic principles underlying the way animals identify and recognize objects. This makes implementation a challenging (frequently tedious) task , specially with traditional languages such as C or Fortran. Many programmers also embed an interpreter in their final application, to reuse the large amount of functionality available in these environments without having to rewrite it all. Following this trend, the inherent complexity of scientific applications called for specific scripting technologies. Among them is the popular(and rather expensive)Matlab,very widely used in science, engineering, and the industry. Fortunately there are free software alternatives such as Octave,numerical Python,and Scilab the one we will be talking about in this paper. Features common to all these numerical prototyping environments are convenient matrix manipulation enforced by a suitable language, as well as tools for scientific visualization, debugging, and a great amount of easy-to-use libraries. They may be used interactively or programmed from a separate file (the 'script' or 'macro'). In particular, they enable development of Image Processing applications with much less burden to the programmer. Hence, these tools have in fact been the standard prototyping solutions in the field. Scilab is a free software created at INRIA–France for prototyping and numerical processing. It is much like Matlab, and already has a rich set of functionalities. Currently in version 5.4, Scilab have been widely used in Unix-like systems. It has been adopted in many Universities and companies around the world. Given its features to assist numerical programming, as we just said, it has tremendous potential to be used for image processing, both educationally and as a prototyping languageto develop and test solutions. As far as we know, currently neither Octave or Python match the richness and plain simplicity of scilab functionality for scientific computing and engineering.

CHAPER 2:LITRATURE REVIEW

1. Akinyokun Oluwole Charles Department of Computer Science Federal University of Technology, Akure, Nigeria ,Olabode Olatubosun,2004 Department of Computer Science Federal University of Technology, Akure, Nigeria, : Fingerprint has remained a very vital index for human recognition. In the field of security, series of Automatic Fingerprint Identification Systems (AFIS) have been developed. One of the indices for evaluating the contributions of these systems to the enforcement of security is the degree with which they appropriately verify or identify input fingerprints. This degree is generally determined by the quality of the fingerprint images and the efficiency of the algorithm. In this paper, some of the sub-models of an existing mathematical algorithm for the fingerprint image enhancement were modified to obtain new and improved versions. The new versions consist of different mathematical models for fingerprint image segmentation, normalization, ridge orientation estimation, ridge frequency estimation, Gabor filtering, binarization and thinning. The implementation was carried out in an environment characterized by Window Vista Home Basic operating system as platform and Matrix Laboratory (MatLab) as frontend engine. Synthetic images as well as real fingerprints obtained from the FVC2004 fingerprint database DB3 set A were used to test the adequacy of the modified sub-models and the resulting algorithm. The results show that the modified sub-models perform well with significant improvement over the original versions. The results also show the necessity of each level of the enhancement.

2. A Study on Fingerprint Image Enhancement Techniques M. Saravanan1, Dr. D. Bennet Research Scholar, Bharathiar University, Coimbatore, Tamilnadu, India Professor, Department of Computer Applns, Narayanaguru College of Engineering, Manjalumoodu, Tamilnadu, India,2003 : Fingerprints have ridges and valleys on the surface of the finger. Segments on the top skin layer are the ridges and the bottom skin layers are valleys. Minutia points are designed by ridges. The fingerprint is identified uniquely by the pattern of the

ridges and minutiae points. There are 5 categories of patterns available in a fingerprint: arch, tented arch, left loop, right loop and whorl. Sensor captures several images of finger under different Illumination conditions that include different wavelengths, different illumination orientations, and different polarization conditions. The output contains information about both the surface and subsurface features of the skin. The finger print image used for matching must be of good quality and it must be without of any type of noise. Reduce the amount of noise in finger print image gives more accurate results. Reducing noise in finger print image is not an easy process. Because of this the fingerprint image gives inopportune minutiae results. Therefore the fingerprints must be improved to mine the minutiae and get entire features of the fingerprints. There have been different image enhancement technique approaches and filters were developed to enhancement the fingerprint images. There are three main techniques of enhancement. Pixel wise Enhancement Techniques, Contextual Filter Enhancement Techniques and Multi Resolution Enhancement Techniques. This paper focuses on these various Fingerprint Enhancement Techniques

3. Segmentation of Fingerprint Image Based on Gradient Magnitude and Coherence by Saparudin1 and Ghazali Sulong Faculty of Computer Science, Sriwijaya University, South Sumatera, Indonesia Faculty of Computing, University Technology Malaysia, Johor Bahru, Malaysia: Fingerprint image segmentation is an important pre-processing step in automatic fingerprint recognition system. A well-designed fingerprint segmentation technique can improve the accuracy in collecting clear fingerprint area and mark noise areas. The traditional grey variance segmentation method is widely and easily used, but it can hardly segment fingerprints with low contrast of high noise. To overcome the low image contrast, combining two-block feature; mean of gradient magnitude and coherence, where the fingerprint image is segmented into background, foreground or noisy regions, has been done. Except for the noisy regions in the foreground, there are still such noises existed in the background whose coherences are low, and are mistakenly assigned as foreground. A novel segmentation method based on combination local mean of grey-scale and local variance of gradient magnitude is presented in this paper. The proposed extraction begins with normalization of the fingerprint. Then, it is followed by foreground region separation from the background. Finally, the gradient coherence approach is used to detect the noise regions

existed in the foreground. Experimental results on NIST-Database14 fingerprint images indicate that the proposed method gives the impressive results.

4. Classification of fingerprint images with the aid of morphological operation and AGNN classifier Subba Reddy Borraa,, G. Jagadeeswar Reddyb, E. Sreenivasa Reddy Department of Computer Science and Engineering, JNTUH, Hyderabad , India Narayana Engineering College, Nellore, AP ,: In The uniqueness, public recognition, firmness, and their least jeopardy of fingerprints made an extensively and proficiently utilized personal authentication metrics. Fingerprint technology is a biometric method that is used to recognize persons on the basis of their physical traits. These physical forms comprise of ridges and valleys prevailing on the surface of fingertips. Fingerprint images are direction-oriented pattern fashioned using ridges and valleys. The reputation of the fingerprint image regulates the durability of a fingerprint authentication scheme. For enhancing the restrictions of prevailing fingerprint image augmentation approaches we have proposed an effectual method to pact with various fingerprint images. The proposed methodology alienated into three modules. Primarily, the fingerprint image is endangered to denoising procedure where Wave atom transform is used. Once this procedure is accomplished the image augmentation is achieved for improving the classification rate. The morphological operation is used inourproposed technique in order to augment the image.The morphological operators such as dilation and area opening are used here for improvement. Finally the ordering of fingerprint image is done. Adaptive Genetic Neural Network (AGNN) is used for classification of images efficiently.The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University

5. Fingerprint image: pre- and post-processing by M. Usman Akram*, Anam Tariq and Shoab A.Khan Department of Computer Engineering College of Electrical and Mechanical Engineering National University of Science and Technology (NUST) Rawalpindi, Pakistan: Automatic Fingerprint Identification Systems (AFIS) are widely used for personal identification due to uniqueness of fingerprints. Minutiae based fingerprint matching techniques are normally used for fingerprint matching. Fingerprint matching results and their

accuracy depends on presence of valid minutiae. In this paper, we present a new technique for fingerprint image post-processing. This post-processing is used to eliminate a large number of false extracted minutiae from skeletonised fingerprint images. We propose a windowing post-processing method that takes into account the neighbourhood of each minutia within defined window and check for minutia validation and invalidation. We also present a complete pre-processing system including new segmentation technique that is required to extract region of interest (ROI) accurately from a fingerprint image. The results are confirmed by visual inspections of validated minutiae of the FVC2004 reference fingerprint image database. Experimental results obtained by the proposed approach show efficient reduction of false minutiae

6. Pre-Processing Image Alogorithm for Fingerprint Recognition And Its Implementation on DSP TMS320C6416 by Farah Dhib1 , Mohsen Machhout and Aguili Taoufik Department of Electrical Engineering, National School of the Studies of Engineer of Tunis, Tunis,Tunisia : Fingerprint recognition technology is becoming increasingly popular and widely used for many applications that require a high level of security. We can meet several types of sensors integrated in the fingerprint recognition system as well as several types of image processing algorithm in order to ensure reliable and fast authentication of people. Embedded systems have a wide variety and the choice of a well designed processor is one of the most important factors that directly affect the overall performance of the system. This paper introduces a preliminary treatment to the image in order to improve the quality, and then present a hardware implementation

7. Fingerprint Image Enhancement And It‟s Feature Extraction For Recognition, Pankaj Bhowmik, Kishore Bhowmik, Mohammad Nurul Azam, Mohammed Wahiduzzaman Rony,2002 : Fingerprint recognition is one of the most popular and successful methods used for person identification, which takes advantage of the fact that the fingerprint has some unique characteristics called minutiae; which are points where a curve track finishes, intersect with other track or branches off. A critical step in studying the statistics of fingerprint minutiae is to reliably extract minutiae from the fingerprint images. However, fingerprint images are rarely of perfect quality. They may be degraded and corrupted due to

variations in skin and impression conditions. Thus, image enhancement techniques are employed prior to minutiae extraction to obtain a more reliable estimation of minutiae locations. The goal of this paper is to represent a complete process of fingerprint feature extraction for minutiae matching

8. Fingerprint Image Enhancement with easy to use algorithms ,Thomas Klir Technische Universities ¨at Darmstadt: This paper looks at measures to enhance image quality with the intention of improving recognition rates of finger recognition systems. There are thus different algorithms when compared to each other. The methods cover sharpness enhancement in general; wavelet sharpness, photocopy filters, EAW filters, DoG filters and Cartoon filters. The FVC2000 Db1a is used as reference dataset. The scores for the comparison are based on the NFIQ quality scores. The approach of the paper is to use a few single algorithms of the GIMP program and evaluate which one improves the reference database the most. GIMP is open-source software so everybody can use it to improve fingerprint images without having advanced programming skills

CHAPTER 3:AIM AND OBJECTIVE

AIM:

To process and enhance image of low quality fingerprint for getting clear ridge fingerprint by using image enhancing softwares and different image processing techniques

OBJECTIVE

- Collection of a partially dull fingerprint
- Enhancing the fingerprint using Scilab computation software
- Compare the changes in the fingerprint before and after the enhancement process.
- Thus verifying the quality of assessment of the software

CHAPTER 4:MATERIALS AND METHODOLOGY

MATERIALS REQUIRED

- A Fingerprint which is partially dull
- A Camera
- A laptop or a computer
- Scilab computation software

Figure 3:Photograph of the low quality fingerprint

METHODOLOGY

1. A fingerprint of a person is collected from right index finger which is not having clear ridges and other properties and cannot be analysed or compared until image enhancement and clearing of the unwanted noise in the fingerprint is done
2. The photograph of the fingerprint is taken using a camera and then copied to a computer or a laptop
3. Download the Scilab computation software from www.scilab.com
4. Insert the image to Scilab by using the insert code

5. Then the computation, noise reduction and other enhancement techniques are done are done on the inserted image to get maximum clear image in which the ridges of the fingerprint can be distinguished and the pattern of the fingerprint are identified
6. After each process the changes in the image are noted down

FUNCTIONS AND FILTERS APPLIED ON SCILAB

Scilab is a image and graphical computation and analysis software which can enhance and increase the clarity of 2D and 3D images and can also be used in the identification and comparison of the fingerprint and enhance quality of image by using mathematical and algorithm functions.

The basic functions that Scilab can do to enhance the image resolution of the fingerprint are

Filters: Gaussian blurring, median, Laplacian, artistic effects, de-noising by min-max curvature flow.

1. Edge detection: Sobel, Fourier derivatives, Canny.
2. Geometric transforms: rotation, zoom, shearing, and general affine.
3. Image segmentation: watersheds, adaptive thresholding.
4. Mathematical morphology: dilation, erosion, thinning, etc., using state-of-theart Euclidean algorithms for circular structuring elements.
5. Shape analysis: perimeter, border tracking, state-of-the-art fast skeletonization with multiscale runing,curvature,state-of-the-art Euclidean distance transforms (including fast distance transforms up to a given distance), fractal dimension.
6. Enhancement: histogram equalization, contrast manipulation.
7. Other operators: Hough transform, noise generation, image display, interferometry operations (e.g. phase unwrapping), etc.

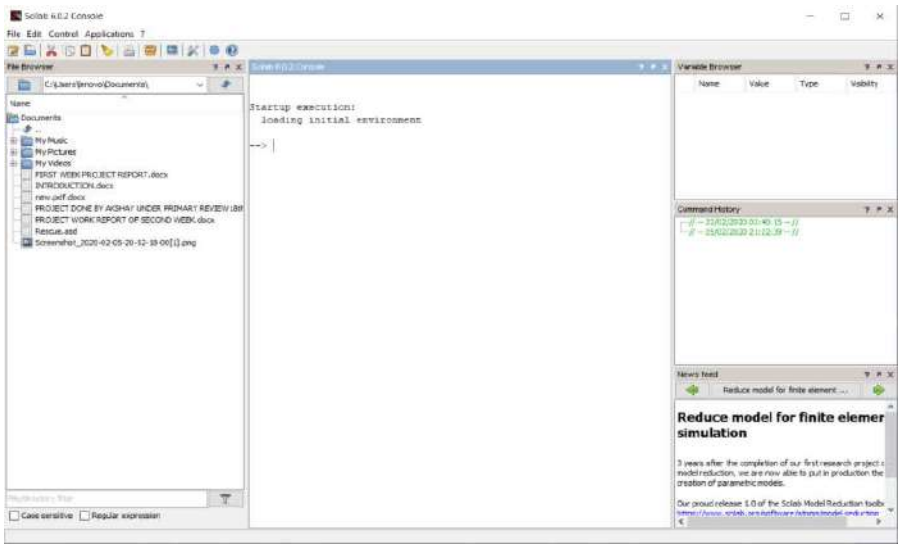

Figure 4:.Scilab version 6.02 console homepage

THE FOLLOWING PROCESS ARE APPLIED ON THE PROVIDED FINGERPRINT FOR THE ENHANCEMENT OF SMUDGED FINGERPRINT

A fingerprint is made up of a set of locally parallel lines forming a unique pattern for each individual. We can distinguish streaks (which are the lines in contact with a surface) and valleys (these are the spaces between two streaks).

Each fingerprint has two types of singular points: the global singular points and the local singular points. The global singular points are the center (the points of convergence of the striations) and the deltas (the points of divergence of the streaks) . The local singular points are called minutiae main When capturing a fingerprint image, several factors affect image quality such as:

- Scars in the finger, age of the person.
- Parasitic substances (water, grease, dirt, etc.)
- Capture environment: temperature (dilation, compression), humidity termination and bifurcations).

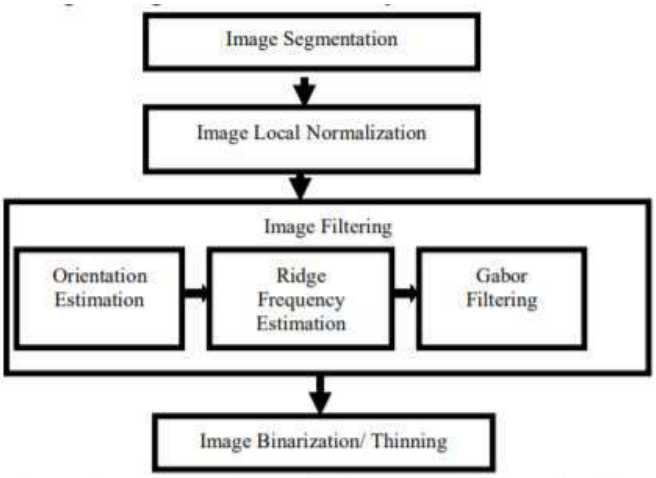

Figure 5:Schematic representation of the concept of image enhancement using software algorithm

PRE-PROCESSING FUNCTIONS FOR FINGERPRINT RECOGNITION

To guarantee the reliability of the recognition, a pre-processing is important to eliminate the effect of these parasitic elements on the impression image. After this step, the image becomes clear and ready for the next step.

Fingerprint recognition algorithms use several filtering methods in order to locate the useful points for each fingerprint. The most used filter is that of Gabor given its proven performance in this type of treatment.

However, in order to have reliable results, the input image of the filter must be as clear as possible, for this reason we propose a series of mathematical and morphological operations to improve the appearance of the image before pass to the filtering step

1.GREY-SCALE TRANSFORMATION

The acquired image is of the RGB format which needs more processing power,memory and time to process so the image is converted to a greyscale image The image becomes smaller because each pixel will be represented on 8 bits (from 0 to 255 grey levels) instead of 24 bits for the colour image. Normally, the intensity value of fingerprint images is greatly varied from one print to another over time of capturing. As a result, there are prints whose intensity values concentrated in the upper-range of grey leve ls, for instance 128 – 255, which indicates bright images or over-exposure. On the contrary, there are fingerprints whose grey-levels ranging from 0 – 128 or lower-range, which indicates dark images or underexposure. The uneven or irregular distribution of light intensities may affect the statistical information of the image such as mean and variance of grey-levels, and therefore normalization is needed. This normalization process aims at reducing variation in grey-level values along ridges and valleys without changing the clarity of their structures. Therefore, the input fingerprint image is standardized to a desired mean and variance.

2.NORMALIZATION

It is the feature used to change the range of pixel density poor visibility of the ridges of the fingerprint and the key minutiae points can be made more distinct and clear and also makes the missing in the image like faded ridges, discontinuous ridge, no clear differentiation between the furrows and ridges and also normalization increases the clarity of the pattern of the fingerprints. Normalization is used to standardize the intensity values in an image by adjusting the range of grey level values, the structure of the image does not change, and the variation in grey levels is standardized. Normalisation is performed to remove the effect of noise and gray-level background which are the consequence of difference in finger pressure. Normalisation is used to standardise the intensity values in an image by adjusting the range of gray-level values so that it lies within a desired range of values. It is a pixel wise operation which does not change the clarity of the ridge and valley structures. It basically

changes the range of pixel intensity values . The Normalization method proposed in consists of three steps: Firstly, global mean value of fingerprint image is determined. Secondly, global variance value of fingerprint image is computed. Finally, new intensity values are calculated The pixel density of the image is increased Normalization algorithm can be used to address the problem of uneven background in digital fingerprint images. A background normalization algorithm is adaptively adjust the pixel intensity based on an approximation of the background of a document image. Weiner Filtering method restores the image even in the presence of blur as well as noise. It uses a pixel wise adaptive method for noise reduction

3.SEGMENTATION

The segmentation makes it possible to eliminate the edges of the image as well as the too noisy zones. Segmentation is done to extract fingerprint image from background. In the extraction, the processing of the surrounding background in fingerprint image is not necessary and consumes more processing time in all stages. Cutting or cropping out the region that contains the fingerprint feature minimises the number of operations on the fingerprint image. A simple thresholding technique proves to be useless because of the streaked nature of the fingerprint area. The presence of noise in a fingerprint image requires more dynamic techniques for effective fingerprint segmentation. A good segmentation method should exhibit the following characteristics

- It should be insensitive to image contrast.
- It should detect smudged or noisy regions.
- Segmentation results should be independent of whether the input image is an enhanced image or a raw image.
- The segmentation results should be independent of image quality.
- Hence, a new boundary values and modified gradient-based method for fingerprint segment

1. Divide the input image into non-overlapping blocks

2 .Use histogram equalisation to enhance the contrast between background and foreground.

3.Use a 3x3 median filter to reduce the noise in background of the image

4. Compute the gradients and clarity level at each pixel which is the center of the block.

5 Compute the mean values of Mx and and My for x and y components of the gradient .

4.GABOUR FILTERING AND FREQUENCY ESTIMATION

The configurations of parallel ridges and valleys with well defined frequency and orientation in a fingerprint image provide useful information which helps in removing undesired noise. The sinusoidal-shaped waves of ridges and valleys vary slowly in a local constant orientation. Therefore, a band-pass filter that is tuned to the corresponding frequency and orientation can efficiently remove the undesired noise and preserve the true ridge and valley structures. Gabor filters have both frequency-selective and orientation-selective properties and have optimal joint resolution in both spatial and frequency domains . Therefore, it is appropriate to use Gabor filters as band-pass filters to remove the noise and preserve true ridge/valley structures. The Gabor filter is applied to the fingerprint image by spatially convolving the image with the filter

Frequency estimation In a local neighbourhood where no minutiae and singular points appear, the gray levels along ridges and valleys can be modeled as a sinusoidal-shaped wave along a direction normal to the local ridge orientation. Therefore, local ridge frequency is another intrinsic property of a fingerprint image in addition to the orientation image that is used in the construction of the Gabor filter. The frequency image represents the local frequency of the ridges in a fingerprint

5. BINARISATION

Image binarisation converts an image of up to 256 gray levels to a black and white image. The simplest way to use image binarisation is to choose a threshold value, and classify all

pixels with values above this threshold as white, and all other pixels as black. The problem is how to select the correct threshold. In many cases, finding one threshold compatible to the entire image is very difficult, and in many cases even impossible. Therefore, adaptive image binarisation is needed where an optimal threshold is chosen for each image area. There are also other methods available for image binarisation. A multi-scale algorithm based on a statistical test of homogeneity decides if a region belongs to the background or not. At each iteration, the image is smoothed with a nonlinear filter to remove the noise. Stable regions in scale space are used as a model to automatically find a threshold from the intensity histogram . Grey level image into a binary image and in a binary image each pixel value is either 0 or 1(255). Most minutiae extraction algorithms operate on binary images where there are only two levels of interest: the black pixels that represent ridges, and the white pixels that represent valleys. This improves the contrast between the ridges and valleys in a fingerprint image, and consequently facilitates the extraction of minutiae. We have implemented adaptive binarisation .

6.HISTOGRAM EQULIZATION THINNING OF IMAGE

This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast without affecting the global contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values. It is reasonably visible that after performing DFT and histogram equalization fingerprint image quality has increased. By using two stage cascading enhancements process showing much better result.

The final image enhancement step typically performed prior to minutiae extraction is thinning. Thinning is a morphological operation that successively erodes away the foreground pixels until they are one pixel wide. This skeleton image is then used in the minutiae extraction . Thinning is normally only applied to binary images, and produces another binary image as output. The skeletonisation method is guaranteed to produce a connected skeleton . A number of methods have been proposed for correct thinning of a fingerprint image.

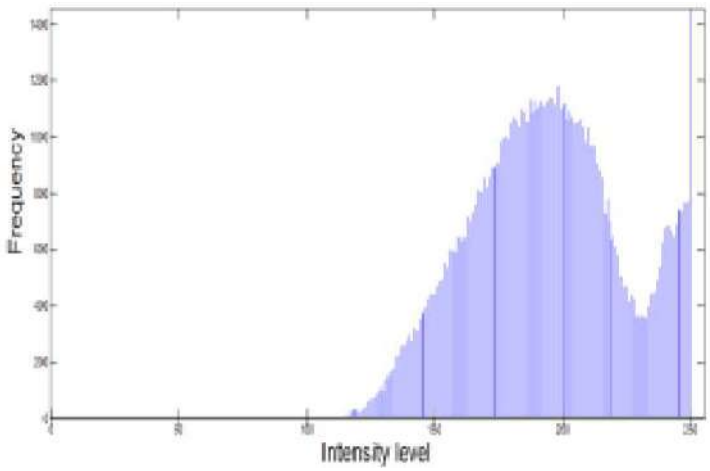

Figure 6: Histogram equivalence of original fingerprint image

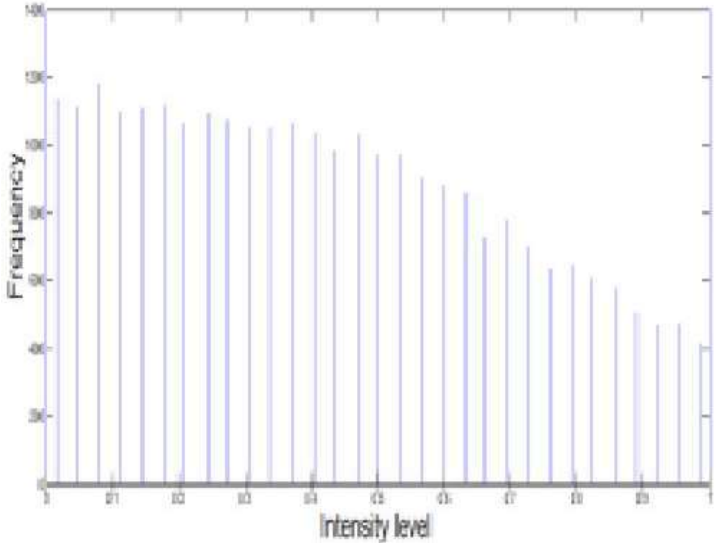

Figure 7: Histogram equivalence of filtered fingerprint image

7.ORIENTATION FIELD ESTIMATION

The orientation image represents an intrinsic property of the fingerprint images and defines invariant coordinates for ridges and valleys in a local neighbourhood. By viewing a fingerprint image as an oriented texture, a number of methods have been proposed to estimate the orientation field of fingerprint images .The orientation field of a fingerprint image defines the local orientation of the ridges contained in the fingerprint. The orientation estimation is a fundamental step in the enhancement process as the subsequent Gabor filtering stage relies on the local orientation in order to effectively enhance the fingerprint image. Fine orientation field estimation is very vital for fingerprint recognition

CHAPTER 5:OBSERVATIONS

Table 5.1 Comparison of original image and image after editing.

ORGINAL IMAGE OF FINGERPRINT	COMPUTATION AND ENHANCEMENT PROCESS DONE ON THE IMAGE	RESULTANT ENHANCED IMAGE
	GREYSCALE TRANSFORMATION	
	NORMALIZATION	
	SEGMENTATION	

	GABOUR FILTERING AND FREQUENCY ESTIMATION	
	BINARISATION	
	HISTOGRAM EQULIZATION AND THINNING OF IMAGE	
	ORIENTATION FIELD ESTIMATION	

Table 5.2:Type of Enhancement applied and change observed in the image

TYPE OF ENHANCEMENT APPLIED	CHANGES OBSERVED IN THE IMAGE
GREYSCALE TRANSFORMATION	The RGB Format is converted to greyscale imaging, ridges are slightly visible but the image is full of noise.
NORMALIZATION	By normalization the pixel density and clarity of image has increased a bit and greying and noise is removed
SEGMENTATION	After segmentation the ridges and the fingerprint are separated from the background and has darker shade
GABOUR FILTERING AND FREQUENCY ESTIMATION	Only some of the ridges and valleys orientation frequency was made proper by frequency estimation .the filtering process increased the contrast
BINARISATION	By doing binirisation the pixel quality of the image increased
HISTOGRAM EQULIZATION AND THINNING OF IMAGE	After histogram equalization the noise in the image has reduced and the filtering has made

CHAPTER 6:RESULT AND CONCLUSIONS

RESULT

The fingerprint image which is not having clear ridges and minutea is computed using Scilab software and the following features of the fingerprint could be enhanced:

1. The greyness in the image could be reduced by greyscale mapping and thus could reduce the noise
2. By using normalization the density of the image and pixel rate of the image could be increased
3. Segmentation of the fingerprint image distinguish between the outline and the inline fingerprint ridges and provided more density to the image.
4. Gabour filter changed visibility of the minutiae points
5. some of the features including the false minutiae and ridge dilation could not be identified .

Figure 8:Enhanced image of fingerprint

CONCLUSION

The study concludes that fingerprint image of the damp fingerprint was enhanced using Scilab and some of the distinct features of the fingerprints could be clearly viewed by enhancing techniques but some feature could not be identified by this method more sophisticated identification software's are required for the detailed enhancement of the fingerprint. The study could help in the identification and enhancing of the fingerprints by using programming softwares and algorithm.

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