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Finger Vein Recognition Using Euclidean Minimum Distance Classifier

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ABSTRACT: Vein pattern is the network of blood vessels beneath a person's skin. This vein pattern can be used to authenticate the identity of an individual. In the ubiquitous network society, where individuals can easily access their information anytime and anywhere, people are also faced with the risk that others can easily access the same information anytime and anywhere. Because of this risk, personal identification technology, which can distinguish between registered legitimate users and imposters, is now generating interest. Currently, passwords, Personal Identification cards are used for personal identification. However, cards can be stolen, and passwords and numbers can be guessed or forgotten. To solve these problems, biometric authentication technology, which identifies people by their unique biological information, is attracting attention. Finger vein recognition is that it is not affected by dryness or roughness of skin or by physical injury on surface of the hand but sometimes the temperature and humidity can affect the quality of the captured image. MATLAB software has been used for the proposed work.

KEYWORDS:- Finger Vein Biometric Pattern Recognition, Adaptive Threshold, KFCM Algorithm Euclidean Minimum Distance Classifier, Template matching

I. INTRODUCTION

The biometric sample is acquired from candidate user. The prominent features are extracted from the sample and it is then compared with all the samples stored in the database. The finger prints have been detected by using the enrollment system the biometric sample have been taken and the templates of the finger prints has been extracted and it is named as template extraction. The extracted templates (finger prints) have been stored in template storage database. The template comparisons process takes place by comparing from the extracted biometric samples from the system access and then finally the result has been produced as identity verified (matched) or not verified (not matched).

Image Processing

Image preprocessing is the important step to remove unnecessary information and noises from the input image. This step will improve the image quality. Image enhancement is among the Simplest and most engaging areas of digital image processing. Basically, the idea behind enhancement techniques is to bring out detail that is obscured, or simply to highlight certain features of interest in an image such as changing brightness and contrast etc. Images have a huge share in this era of information. In biometrics, image

processing is required for identifying an individual whose biometric image is stored in the database previously. Faces, fingerprints, irises, etc., are image-based biometrics, which require image processing and pattern recognition techniques. Requirement of Image Processing in Biometrics The image of user's biometric is fed into the biometric system. The system is programmed to manipulate the image using equations, and then store the results of the computation for each pixel. To selectively enhance certain fine features in the data and to remove certain noise, the digital data is subjected to various image processing operations. With increasing use of Information Technology in the field of banking, science, medication, etc., there is an immense need to protect the systems and data from unauthorized users. Biometrics is used for authenticating and authorizing a person. Though these terms are often coupled; they mean different.

II. RELATED WORK

Authentication (Identification)

This process tries to find out answer of question, "Are you the same who you are claiming to be?", or, "Do I know you?" This is one-to-many matching and comparison of a person's biometrics with the whole database.

Verification

This is the one-to-one process of matching where live sample entered by the candidate is compared with a previously stored template in the database. If both are matching with more than 70% agreeable similarity, then the verification is successful.

Authorization

It is the process of assigning access rights to the authenticated or verified users. It tries to find out the answer for the question, "Are you eligible to have certain rights to access this resource?" The conventional methods of information system security used ID cards, passwords, Personal Identification Numbers (PINs), etc. They come with the following disadvantages as follows. In such cases, the security of the system is threatened. When the systems need high level of reliable protection, biometrics comes to help by binding the identity more oriented to individual.

Image Restoration

Image restoration is the operation of taking a corrupt/noisy image and estimating the clean, original image. Corruption may come in many forms such as motion blur, noise and camera miss-focus. Image restoration is performed by reversing the process that blurred the image and such is performed by imaging a point source and use the point source image, which is called the Point Spread Function (PSF) to restore the image information lost to the blurring process. Image restoration is different from image enhancement in that the latter is designed to emphasize features of the image that make the image more pleasing to the observer, but not necessarily to produce realistic data from a scientific point of view.

Image Enhancement

The aim of image enhancement is to improve the interpretability or perception of information in images for human viewers, or to provide 'better' input for other automated image processing techniques. Frequency domain methods, which operate on the Fourier transform of an image. Laplacian method is also used for the enhancement of edges in microscopic images. It performs the local enhancement of the brightness levels of pixels. The frequency domain approaches for image enhancement operate on the Fourier transform. In frequency domain, the image enhancement is easy and straightforward.

Feature Extraction

Feature extraction involves reducing the number of resources required to describe a large set of data. When performing analysis of complex data one of the major problems stems from the number of variables involved. Analysis with a large number of variables generally requires a large amount of memory and computation power, also it may cause a

classification algorithm to overcome training samples and generalize poorly to new samples. Feature extraction is a general term for methods of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy.

The objective of this project is to present a novel finger vein indexing and retrieval scheme based on unsupervised clustering. To this extent the investigated three different clustering schemes namely K-means, K-medoids and Self Organizing Maps (SOM).

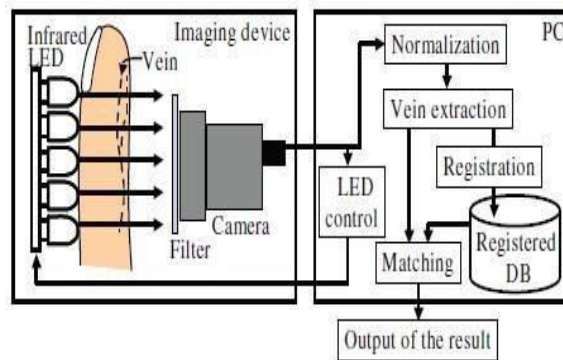


Fig.1 Capturing Device

Capturing Image

Finger vein biometric system use infrared light to capture blood vessels. However the position of infrared light source affects the quality of images. Moreover the image acquisition device should be small and cheap and it should provide high resolution images. In captured image the vein appeared as grey patterns as seen in figure

Normalization

In this phase, I try to search the ROI (Region of Interest) of the finger image by set top_pos, bottom_pos, left_pos, and right_pos. In order to speed up the process time for later stage and get better vein result, I reduce the ROI image size to 240 x 180 and placed the ROI in the center of the new image as seen in the below image.

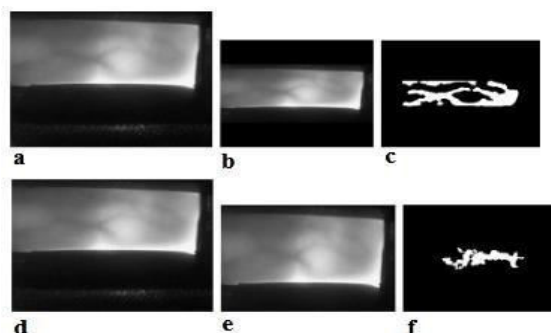


Fig.2 (a) Original image - 320x240. (b) Normalized image - 240x180. (c) Vein extracted from b. (d) Normalized image 320x175. (e) Vein extracted from d. (f) region of interest

Vein Extraction

Since I already have a better image quality, I can segment the image and get the vein information in it. For the vein image, I can't get a good segmentation using single or multi threshold (e.g.: fixed threshold, total mean, total OTSU, local mean, local OTSU). So I proposed the local adaptive threshold [3] to obtain the new threshold image in the same size as the original image and then Segment each pixel in the original image with the related pixel in the threshold image.

Adaptive Threshold

The detail of the process is as follows. Actually the concept of the adaptive threshold is the same as the smoothing algorithm. First, I define $N \times N$ window size and copy the boundary pixel of the original image as much as $(N \div 2 - 1)$ to the top, left, right and bottom. Then I do the convolution on the original image $f(x, y)$ based on the window size to calculate the mean gray value and copy the value to the threshold image $T(x, y)$. In the whole process of calculating the threshold image, the gray value of the original image didn't changed, because they were only read out. Because the whole threshold image is regarded as the threshold of the original one, then I compare them pixel by pixel.

Matching Data

For the matching phase, we adopted improved template matching method from [1] and [2] and then set our mis-match ratio threshold (R_m threshold) to 0.11. If Matching First, we carry our database on self-matching and use 0.11 as a threshold value. It is to say that the 5 images for every hand match with each other. This is to judge the rate of refusing identifying, as known as False Reject Rate (FRR). From the review, it is understood that the fingerprint recognition technique is a dominant technology in the biometric market. In relation to the research study, the review study also reveals the fact that even though several success stories are published with relation to complete finger vein recognition, a perfect partial fingerprint recognition system is not yet eminent and still requires careful examination in terms of accuracy, speed, memory utilization and cost. The main complaint against the use of level 3 features (pores) is its need for high quality and high resolution images along with improvement in terms of accuracy. But, now, due to the advancement of high speed hardware and sophisticated software, this complexity has been reduced to a great extent. To improve the accuracy of the partial finger vein systems, the research work proposes the use of multiple non-minutiae based features, combined with level 3 pore features. The methodology used in the proposed work is presented in the proposed system.

III. PROPOSED METHODOLOGY

The major criterion to consider in case for detecting the finger vein is the finger vein pattern has been recognized. In proposed work, it requires only slow training speed and the problem like over fitting and under fitting can be solved. Several existing methods have been reviewed for Finger veins recognition. One of the very important solutions for the security issues is the human behavioral and physiological features in biometrics. However, the existing biometric systems are not suitable in very high security and are highly complex in terms of time or space or both. Thus a biometric authentication based on finger- vein recognition system is proposed. In the proposed approach, instead of using the whole Finger veins image at a time, dominant LBP (Local binary pattern) features have been extracted such as the major lines. This approach helps in increasing the performance and accuracy of the system and the finger vein pattern has been recognized.

A lot of work has to be done with the feature extraction algorithms as well as the matching algorithms. Initially the data in the form of images are collected and preprocessing is carried out. The noise such as unwanted data can be removed during this process. The input image has been given and the finger vein region has been detected and enhanced image has been produced from the detected region. The local binary pattern technique has been used for feature specification. Minutiae points have been extracted. This is done by using adaptive histogram equalization. The matching finger vein sample has been recognized by using the Euclidian distance. The aim of working on the Finger veins recognition system is to develop a system with increased performance and accuracy.

IV. THE EXPERIMENTAL RESULTS



Fig.3 Image Acquisition

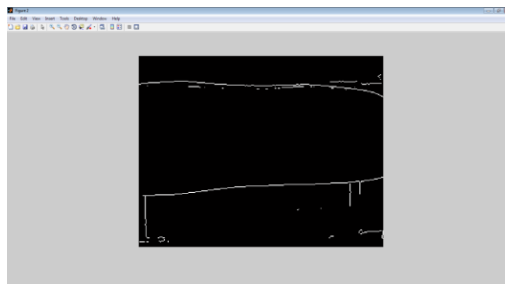


Fig.4 Test and Training Image Processing

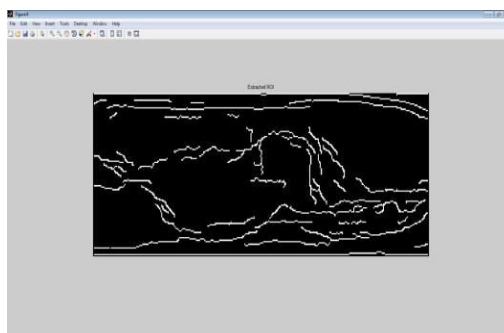


Fig.5 ROI Extraction

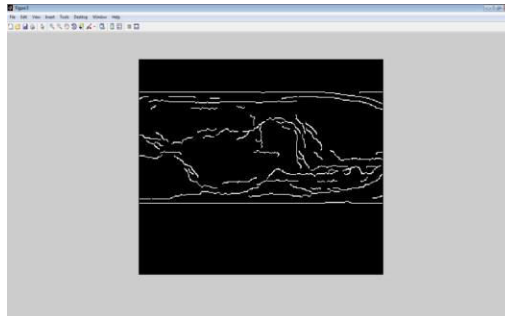


Fig.6 Local Binary Pattern Technique

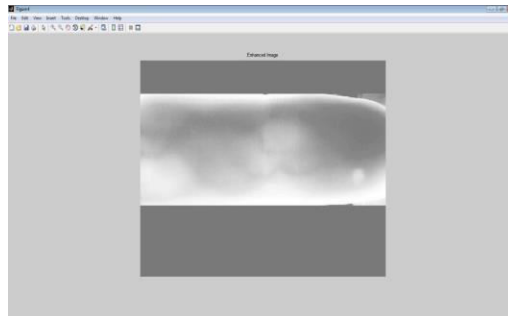


Fig.7 Extract Minutiae Points

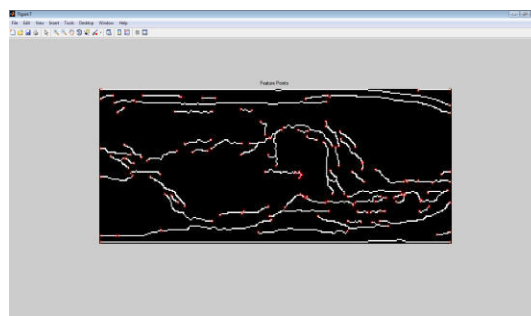


Fig.8 Curve Analysis Over the Minutiae Point Information

Result

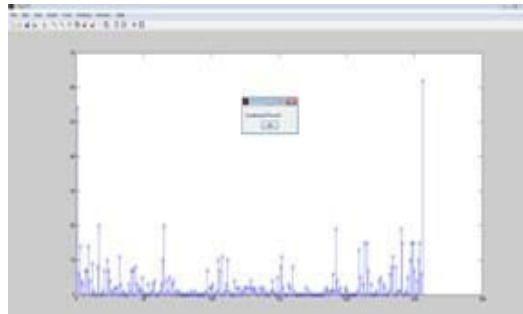


Fig.9 Authorized

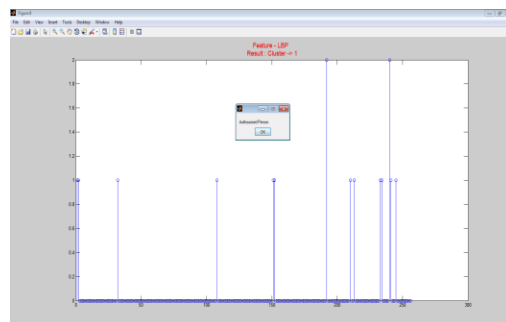


Fig.10 Unauthorized

As an important part of finger vein recognition finger vein network has a profound impact on matching and identification subsequently. Current imagesegmentation methods have made greatachievements in numerous fields but are not always adept at dealing with finger vein images.To verify the effectiveness of the proposed system, the algorithm was tested using the test images of a custom finger veinimage database. The database includes five images each of 100 individuals finger veins. Each image is 320*240.the traditional segmentation algorithms and their improved algorithms to segment the vein image were used. Many of the algorithms are used in the segmentation part of the vein image. Butthey aren't ideal. The wiener filter algorithmwas used in it gives better performance than other algorithms. Segmentation was done for all the images in our database using KFCM algorithm. Moreover the KFCM algorithm to conduct the initialization, which is able tosolve the problem that the active contourbased methods are susceptible to initial contours .For recognition part the lpb featureextraction and Euclidean minimum distance classifier was used.it can return thematching finger-vein sample and recognize the person by using Euclidean minimum distance classifier.it performs that the curve details has matched with training data and shows the match with highest similarity as the recognized sample and the Euclidean distance was classified. The result shows that it will find the person id and correlate the person recognition.

V. CONCLUSION AND FUTURESCOPE

The use of biometric system has been increasing more and more now a day. In this work, the defect named as finger vein is identified which occurred due to enhancement of image. Previous methods used were not able to discriminate about the recognition. The fault remains unnoticed in the system for more times which cause serious hazards to the biometric systems. This work proposes sparse reconstruction method combined with Lbp image for defect detection. So it is very efficient and time saving approach for testing the biometric system. These models are able to producegood generalization performance and learnthousands of times faster than networks trained dataset. In this phase, the detailed study on finger



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vein detection in biometric system is done by studying the various types of algorithms used. The need for detection of finger vein in biometric and its applications has also been studied. A suitable dataset has been downloaded for the proposed finger vein detection model that contains all the required factors. The data is collected and then pre-processed to make it suitable for implementing the next phase for identifying the finger vein approach. Grip-type technology embeds personal authentication in the natural motion of opening a door, ensuring the highest security without forcing the user to learn complicated new procedures. This technology will be applicable to home, office or car doors and will usher in a future without keys that nevertheless allows one to protect personal property with the utmost security.

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