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Disarticulation of Hand Vein using Digital Image Processing for Biometric Recognition

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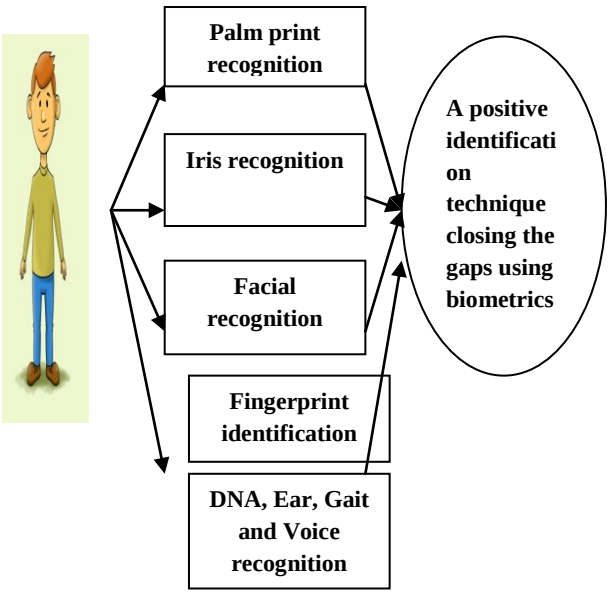
Abstract: ***In our day to day life e-mail, internet resources and even, internet of things has become a part of life. This leads to increasing necessity of security concern. Vein recognition technology is secure because, the authentication data exists inside the body and is therefore difficult to forge. This paper presents an analysis of hand vein pattern recognition algorithms, techniques and methodologies. The theoretical foundation, difficulties of hand vein recognition, the threshold segmentation method and thinning method of hand vein image are studied along with a new threshold segmentation method and an improved conditional thinning method. The method of hand vein image feature extraction based on end points and crossing points is done. The results and comparison with alternative methods show that our method achieved exceptional performance in segmenting the dorsal hand vein. It has laid a good foundation for the latter part of the vein recognition [4]. The problem addressed is solved using MATLAB 2009 of version 7.9.0.***

Keywords: **Hand vein recognition, Threshold segmentation, Feature extraction.**

I. INTRODUCTION

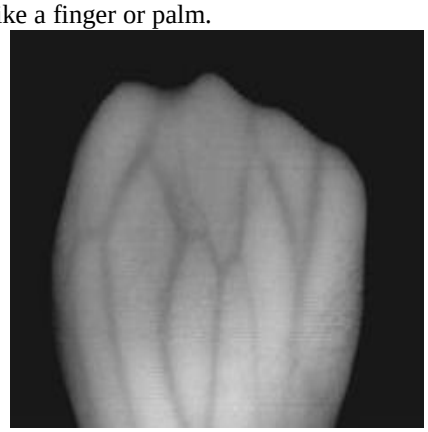
'Privacy is the ability to lead one's life free of intrusions, to remain anonymous and to control access to their personal information', a well said saying by Mr.Anil.K.Jain in biometric systems. Automated measurement of physiological and behavioral characteristics are used as authenticate identity is known as biometrics. The physiological characteristics would be the physical human traits like fingerprints, hand shape, eyes, face and veins. All has its own pros and cons.



The biometric technologies follow a step-by-step process: capture a raw biometric sample using a system to extract the sample's features. And the extraction is done with the help of various matlab operations.

HAND VEIN AUTHENTICATION

Hand vein authentication uses the vascular patterns of an individual's back of a hand as personal identification data. The hand vein is less susceptible to a change in skin color, unlike a finger or palm.



An image of dorsal hand vein

The vascular pattern used in this authentication technology refers to the image of vessels within the body that can be seen as a random mesh at the surface of the body[1]. Since everyone has vessels, vascular pattern authentication can be applied to almost all people. If vascular patterns were compared to the features used in other biometric authentication technologies, such as the face, iris, fingerprint, voice, and so on, the only difference would be whether or not the feature is at the surface of the body.

ARCHITECTURE OF THE PROPOSED SYSTEM

Image acquisition in image processing can be broadly defined as the action of retrieving an image.

Image segmentation is the process of partitioning a digital image into many segments. The aim of segmentation is to simplify and/or change the representation of an image. The result of image segmentation is a set of segments that collectively cover the whole image extracted from the image. Each one of the pixel in a region is similar with respect to some characteristic or computed property [6]. The segmented image is sent into feature extraction block. The work flow of the model is as follows

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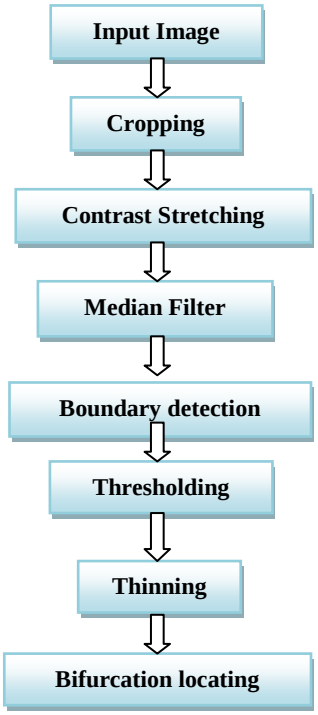


Flow of Work

II. METHODOLOGY

PRE-PROCESSING TECHNIQUES

A. Input Image Acquisition

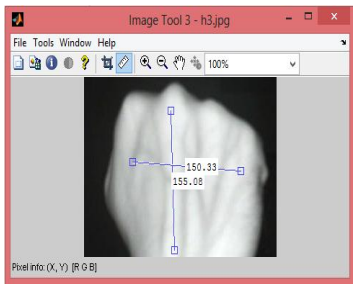
Depending on the image acquisition model, images is classified into various types as light intensity (visual) images, range or depth images, magnetic resonance images, thermal images and so on. Light intensity images represent the variation of light intensity on the scene and are used in the biometric systems [7].

B. Region of the Image-Identification

It is the image cropping technique. The size of the transformation matrix will dictate the transformation type. A rectangle ROI is specified by its top-left corner and its size. If you specify one ROI, it must be a *4-element* vector of format [r,c,h,w]T .

Distance Measurement

For computational simplicity and efficiency, this block uses algebraic distance. The algebraic distance for a pair of points,[xa,ya]T on image *a*, and [xb,yb]T on image *b* , according to transformation .

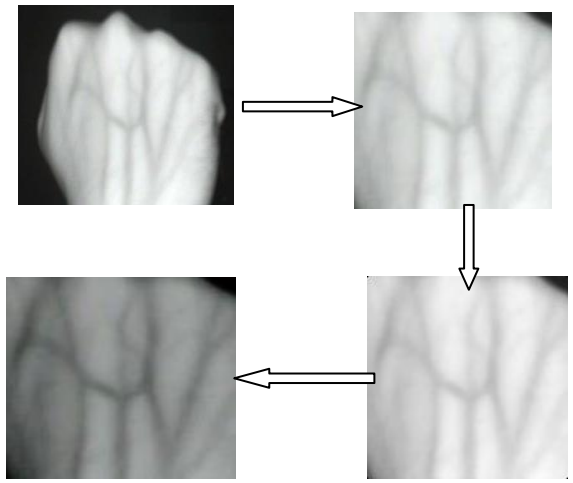


Distance measurement

C. Contrast Stretching

Contrast-stretching transformations increase the contrast between the darks and the lights[1]. This transformation keeps everything at relatively similar intensities and merely stretched the histogram to fill the image's intensity domain.

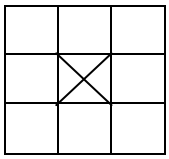
Original image **Cropped Image**



Contrast Image **Median filter Image**

D. Median Filter

The Median Filter block replaces the central value of an *M-by-N* neighborhood with its median value. If the neighborhood has a center element, the block places the median value there, as illustrated in the following figure.



Median Filter

Median Filter is then applied to smooth the contrasted image. Noises on the thresholded image are removed by again applying Median Filter.

SEGMENTATION

The goal of segmentation is typically to locate certain objects of interest which may be depicted in the image. Segmentation is the process of partitioning an image into non-intersecting regions[3] such that each region is homogeneous and the union of no two adjacent regions is homogeneous.

Four popular segmentation approaches are: threshold techniques, edge based methods, region-based techniques, and connectivity-preserving relaxation methods.

A.Thresholding

The image recognitions go through the same process. Following with image extraction and image standardization, the image will go on with the vein image threshold disposal. For vein image, our experiment indicated that good segmentation effects can't be got by Single threshold (fixed threshold, total mean, total OSTU

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and so on) and multi-thresholds segmentation methods (local mean, local OSTU). But the segmentation effect has been improved from the single threshold to multi-thresholds.

So we proposed a completely new method to segment the vein image, we call it the threshold image method. That is to increase the number of the thresholds to the number of the image pixels. It is also to say that if we get a threshold image in the same size as the original image, we can segment the original image by the threshold image.

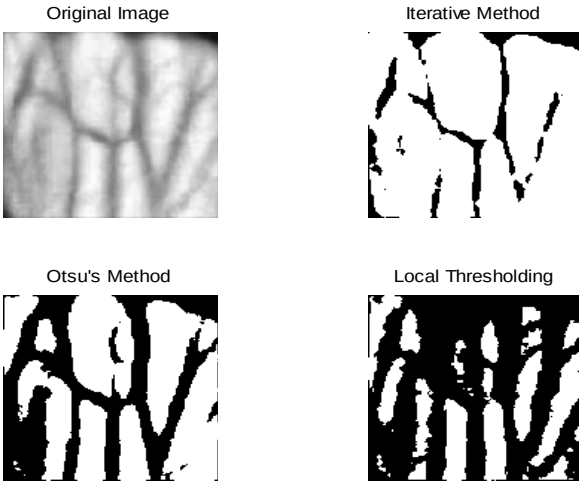
On comparing the fore-and-aft effect of segmentation. The effect is comparatively ideal. Median filtering method can eliminate burrs and make the borderline smooth. In addition, because the result of the new threshold dispose algorithm inducts massive noises, these noises are wiped off.

B.IMAGE THINNING

Thinning of the vein image is done by combination method of general conditional thinning and templates. Get rid of the special un-single pixel point after the general conditional thinning.

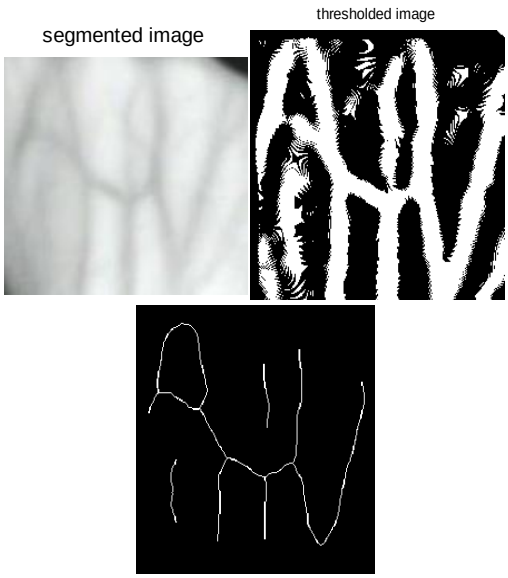
1.Conditional thinning algorithm

Mark the target point 1, the background 0. The target point in whose 8-neighborhood there is at least one background point is defined as boundary point[5]. All points marked are eliminated after all of boundary points have been checked out. Repeat it for every point of the image till all of the pixel point can't be deleted. The advantage of the conditional thinning algorithm is that the connected points of lines, the turning points of the polyline and the T type breakouts can be coherent with the original image.



2. The improved thinning algorithm

The algorithm improvement is on the base of the conditional thinning. On the conditional thinning image, the template algorithm is added to get rid of the un-single pixel point.

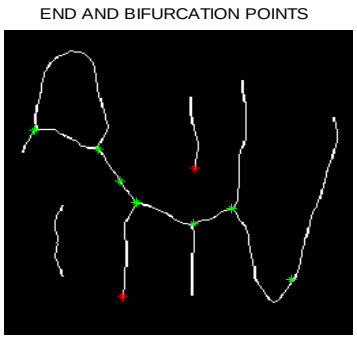


Thresholded Image **Thinning of Image**

C. Bifurcations and Spurious Bifurcations

Hand vein patterns contained two main features, ending and bifurcation. The endings are the end points of a thinned line and the bifurcation is the junction point of three lines.

The spurious fixed points is said to be stable; thus, there will be a basin of attraction and for such initial conditions, the numerical method produces incorrect asymptotic behavior [2]. Moreover, since such numerical solutions are often smooth, they may not be recognized at first sight as spurious.



III.RESULTS AND DISCUSSIONS

In this paper image de-noising and enhancement is performed by Histogram Equalization techniques. The results of median filter and various filters are compared in terms of SNR (Signal to Noise Ratio) of de-noised image to get better image. We have done this for nearly 3 types of images. Vein patterns are extracted and shown in bi-level representation i.e, in 0‟s and 1‟s in the output window as featured image

A throw performance and feature testing approach would be designed and applied to evaluate the performance of the simulated hand vein recognition algorithm to detect the errors and to recover them.

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Seen from the experiment result of algorithm within the small scope, the technical criteria of this experiment prototyping system may meet a very high response. The experiment result is very exciting.

Further our project extends to the matching process through the matching algorithm by calculating the distances with the help of end bifurcation points by referring the best techniques for simpler and easy calculations.

IV.CONCLUSION

Our main objective is to enhance the input image and section the vein present in the dorsal hand without noise. It is noticeable that even though all of the proposed techniques are developed to solve the same image processing task, many totally different methodologies and algorithms have been developed. The results obtained are applicable, and can be implemented in a mobile device smart phone having frontal camera. The performance gain achieved from the additional training samples is quite significant while the sample size is still small, but the redundant information accumulates rapidly as the training sample size increases.

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