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Wavelets Selection for Vein Pattern Extraction

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Abstract— Palm vein recognition is a new biometric system which can be applied as a method for access control by many organizations, but this has even further potential in the field of forensics. The Palm vein pattern are difficult to forge. Here, in the verge of developing an algorithm for vein pattern extraction for biometric system the first and foremost step is to obtain the palm image where the veins are visible for experimenting. And when the images obtained has varied intensities throughout the image then the image compression has to done to further proceed in the other pre- processing step in vein pattern extraction. The image compression process has been done here using Wavelet transform and the different wavelets are investigated on the obtained images and among all the wavelets the best wavelet has been found.

Keywords: Wavelet; Transform; Haar; Dmey; Bior

I. INTRODUCTION

Access control plays a very important part in an organization, the access can be granted based on the biological properties of an individual. Access control system provides the authentication to a system based on the biometric system used. Biometric system offers the promise of an easy, secure method to make highly secure identification and personal verification solutions of individuals ,and also guarantees that the means of identification cannot be stolen, lost. Biometric systems are increasingly in demand for access control and electronic transactions. Biometrics uses human physical and behavioural characteristics. The Biometrics has concerned more and more attention and becomes one of the most accepted and capable alternatives to the traditional password or PIN based authentication techniques. As compared to traditional identification techniques such as Personal Identification Numbers(PINs),passwords, the biometric techniques based on human physiological qualities can ensure higher security and more convenience for the consumer, hence the biometrics – based automated human recognition are now attractive more and become more popular in a huge range of inhabitant applications.

Many different types of biometric systems were adopted ,but each type has its merits and demerits .Finger print is a popular trait for recognition but it can be easily spoof using dummy fingerprint, sensitive to dirt, wet and age. Facial recognition is sensitive to the face expression and age. Voice recognition also depends upon the environmental condition and not secure for the recorded voice. Considering the challenges in the current recognition systems, now the development concerns have directed toward designing new generations of biometric recognition systems which depends on more robust features to enhance the tasks of human authentication and recognition.

A new method known as Vein pattern extraction for authentication is considered to be the new generation of biometric recognition system. Vein based biometric system can verify person's identity by recognizing the pattern of blood veins in his/her finger or palm regions. It has been shown that vein pattern is distinctive enough for human biometric identification, like fingerprints. Vein patterns are located inside the body. Therefore, veins provides a high level of accuracy due to the uniqueness and complexity of vein patterns of the finger or palm regions of the hand. Because the reason of uniqueness of vein patterns it is difficult to forge. Therefore, vein pattern extraction for authentication is a good candidate for biometric recognition system.

Many algorithms are proposed and implemented to recognize the veins from finger or palm regions of the images taken through Near Infrared Camera. The images taken using such cameras can be obtained from the online available databases, which are mainly created for the experiments or research purpose.

In this paper, the main process needed for the vein pattern extraction known as image compression is investigated with three different wavelets which are used for 2 Dimensional Discrete Wavelet Transform (2D-DWT) and the best suited wavelet among them are investigated.

II. DATASET

The dataset used in this work for obtaining the best suited co-efficient used for 2- Dimensional Discrete Wavelet Transform (2D-DWT) is the CIE Biometrics database. The database consists of palm images of 50 individuals with both right and left hand palm images. The each image has a resolution of 768 x 1024.

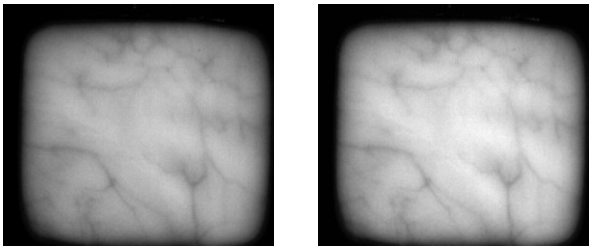
Since the images obtained from the database has a image resolution of 768 x 1024 and also suitable color model has been separated from the original image even the separated color component(V-Color Component) has the same image resolution as that of original image. With this image resolution the veins could not be extracted due to varied intensity on the image. So, image compression has to be done on the V-Color Component image obtained.

III. IMAGE COMPRESSION USING 2D-DISCRETE WAVELET TRANSFORM

Since, the image from the database is of varied intensity, image compression has to be done. The image compression method used to compress the image is 2D-DWT (2-Dimensional Discrete Wavelet Transform).The 2D-DWT is a multiresolution transform that gives time and frequency information. Wavelet decomposition depends on a single wave called the mother wavelet. High pass filter produces the detailed components of the image, while the low pass filter produce the coarse approximate of the image. The Palm vein image is decomposed using 2D-DWT.We compared the performance of the three different types of mother wavelet which are Haar, Bior, Dmey wavelets. Biorthogonal (Bior)wavelet has different orders within its family, the best order among them are selected. Among all the selected ones the best mother wavelet is obtained for 2D-DWT for image compression.

A. Haar Wavelet

Any discussion of wavelets begins with Haar wavelet, the first and simplest. Haar wavelet is discontinuous, and resembles a step function. After applying this Haar wavelet in 2D-DWT transform the image got compressed from 768 x 1024 to 384 x 512 and it is shown in figure 1b and also the intensity has increased in the compressed image i.e figure 1b.



(a) (b)

Fig 1. Haar DWT (a) Original Image (b) Compressed Image.

B. Bior Wavelet (Biorthogonal Wavelet)

A biorthogonal wavelet is a wavelet where the associated wavelet transform is invertible but not necessarily orthogonal. This wavelet has different order of wavelets within the given family .The orders are as follows bior 1.1,bior 1.3, bior 1.5,bior 2.2,bior 2.4 ,bior 2.6,bior 2.8,bior 3.1,bior 3.3,bior 3.5,bior 3.7,bior 3.9,bior 4.4,bior 5.5,bior 6.8.By applying all these orders of Bior wavelets in 2D-DWT is it observed that to all the orders the image resolution reduced from 768 x 1024 to 392 x 520 but intensity vice bior 6.8 was best among all other orders of Bior wavelet and it is shown in figure 2.

C. Dmey Wavelet (Dmeyer)

Dmey Wavelet is a orthogonal wavelets without FIR filter, but with scale function. These wavelets can be defined through the definition of the wavelet function and the scaling function. Applying this Dmey wavelet to the V-color images the image resolution reduced from 768 x 1024 to 434 x 562 and also intensity increased a bit to that of the V-color component image. The Dmey wavelet transform obtained is shown in figure 3.

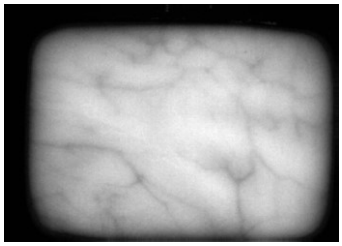


Fig 2. Bior 6.8 wavelet.

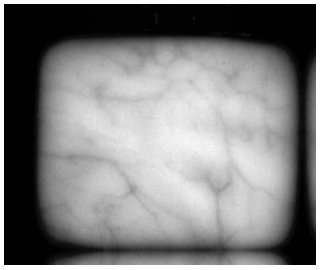


Fig 3. Dmey wavelet transform.

Comparing all the wavelets it can be observed that Haar wavelet has brighter image and image has got reduced much when compared to Bior and Dmey wavelet transform.

Using the Haar Wavelet in 2D-DWT is the best suited for vein extraction for images with varied intensity images obtained from the database.

IV. CONCLUSION

When images taken with Near infrared camera has varied intensity in them, which is not suitable for vein extraction in that case compression of the images has to be done. The compression of the images is done using discrete wavelet transform. Since,2D-DWT is a multi-resolution transform it has different wavelets which can be used .After applying three different wavelets the best among was finalised as Haar wavelet is best with 2D-DWT for vein pattern extraction.

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