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Fingerprint Recognition

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Abstract: Fingerprint recognition is one of the method to identify between two or more persons. This method is commonly applicable in many industries, The technology provide higher security than traditional methods such as signature, pins, smart cards etc. With the help of features which are extracted from human fingerprints the input image is analyzed and compared with database to find authorized person. Oriented images are also recognized with the help of different algorithms such as DWT with Gabor filter, haar wavelet transform. By using these algorithms here we recognized different oriented images such as 0°,45°,90°,etc.
Keywords: Fingerprint, DWT, gabor, haar wavelet, Euclidean distance

I. INTRODUCTION

Biometric Identification System is a technology that uses different characteristics of person for recognition purpose such as fingerprint , palm ,retina etc. There are number of traditional methods are available for identification such as password, smart cards ,tokens but it has some disadvantages such as it is difficult to remember password, carry the token or smart card . it may be lost or it can be used by unauthorized persons .Instead of that biometric system is secure than traditional methods. Out of that here we use fingerprint than retina or palm because to extract feature from fingerprint is easy and cheaper as compared to palm or retina. it is easy to detect core point. Fingerprint is unique for every one even in twins. Fingerprint contains ridges and valleys. Fingerprint contain different features such as global or local that mean minutiae (ridge ending ,ridge bifurcations etc.)Here we work on oriented images (such as 0°,45°,90°,etc).With the help of DWT and haar wavelet we can extract features for different orientation. Extracted features are compared with database for identification.

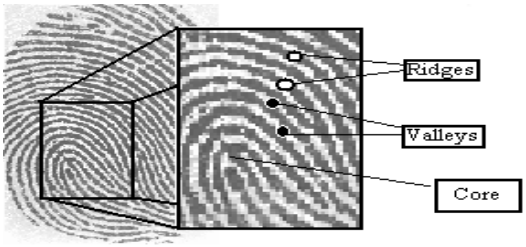


Fig. Fingerprint with core, valleys, ridges

Here we work on different orientation with two algorithms to extract features and compare with database with the help of Euclidean distance. The results of algorithms are compare to detect which one is best. This is done with the help of haar wavelet and DWT.

II. RELATED WORKS

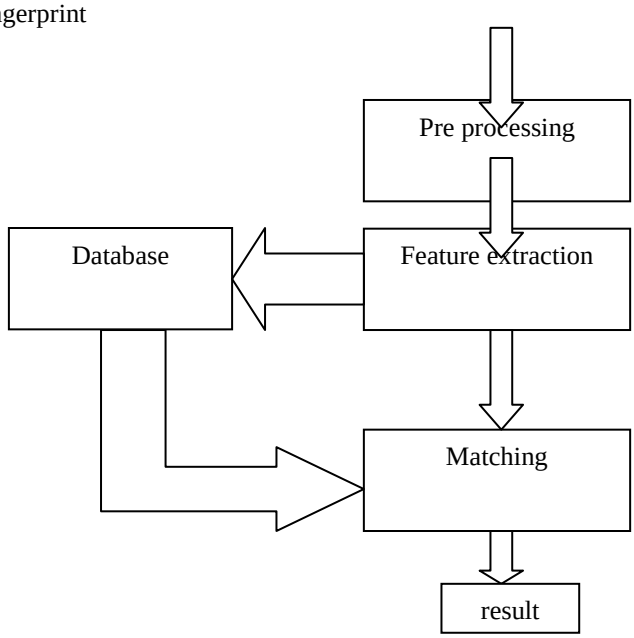
A lot of work has been done to identify fingerprint for low quality images as well as dark images . Input image may be rotated in different angle or original so we have to identify this image with the help of different algorithm. Biometric steps contain some basic steps such as pre processing, feature extraction, matching with database. We can use DWT, haar wavelet, FFT or Gabor filter or combination of them for verification of fingerprint image. Where the DWT is proposed to identify dark images or inked images.

III. PROPOSED APPROACH

In biometric system a variety of algorithms are available to find authorized person. In this paper we analyze the an image with Discrete Wavelet Transform .We take the fingerprint images of persons with

different orientation .We can analyze dark images or poor quality images also. We use texture analysis using wavelet transform to overcome problems with dark images etc.

Fingerprint



A. Pre processing

Input image contain noise. So image enhancement is necessary to reduce noise & to get original image .Sometimes fingerprint may contains cuts ,dry, wet, dirt so image enhancement is the first step to get clear image. To obtain Region of Interest(ROI) by applying segmentation on grey scale image.

B. Feature extraction

To determine features from the raw signal by the use of digital processing techniques .If image size is large and reduced feature extraction is required then this approach is used .This feature extraction is used for image matching, object detection, texture classification for quick response.

Algorithm for texture analysis and feature extraction with DWT:

1. Obtain grey level image from the scanner. Or inked image scan and convert into grey scale.
2. Apply a 2 level discrete wavelet transform decomposition on grey scale image
3. For each level wavelet transform decompose the given image into three directional components, i.e., horizontal, diagonal and vertical detail sub bands in the direction of 0, 45 and 135 respectively apart from the smooth sub band. For the second level LL sub-image.
   Now compute the following three features.

i. Standard deviation: This is the deviation of the image which gives a measure of the amount of detail in that sub band.

ii. Kurtosis: It measures the peaked ness or flatness of the distribution and is given by

$$k = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{x_i - \mu}{\sigma}\right)^4$$

σ is standard deviation where μ is the sample mean of the *N* pixels within the image and

iii. Skewness: Skewness is a measure of the asymmetry of the data around the sample mean

A distribution that is skewed to the left(the tail of the distribution is heavier on the right)will have a negative skewness. A distribution that is skewed (the tail of the distribution is heavier on the left), will have a positive skewness.

4. Now these three features for original image are computed.. so length of the feature vector is (3*10) + original image = 93.

Haar Wavelet Transform:

Basically haar wavelet rescaled square-shaped functions which relate to a wavelet family. Haar wavelet is simplest wavelet. There is a disadvantage of the Haar wavelet is that it is not continuous, so it is not differentiable. Actually this property provide an advantage for the analysis of signals with sudden transitions, such as monitoring of tool failure in machines Wavelet transform gives image as addition of wavelets on different resolution levels. wavelet transform gives high temporal localization for high frequencies while attempts good frequency resolution for low frequencies. So wavelet transform is a good method to extract local features of the image . wavelet transform contains on many layer function decomposition. by applying wavelet transform a signal representing many wavelet coefficients which define the characteristics of signal, the corresponding sub images have larger energies in wavelet transform so mostly wavelet transform is used in signal processing, texture recognition, pattern recognition. vital information is transformed into compressed image without much loss of information. It is a based on many layer function decomposition. After applying wavelet transform, a signal can be described by. If the image has distinct features with some frequency and direction, the corresponding sub images have larger energies in wavelet transform. So wavelet transform is widely used in pattern recognition and texture recognition. Haar wavelet is also known as Db1. Haar wavelet is useful in feature extraction from fingerprint. This transform is easy and applicable for non-linear intensity images.

C) Matching:

This is the last step of proposed system that is matching .In this process calculated features are compared with database .If it crosses the threshold level it mean that the person is authorized and for that purpose here we uses Euclidean distance. It will verify the test image with the database images using following equation.

If N is the number of features in feature set *f*, *fj* (*x*) is the *j*th texture feature of the test sample X and *fj* (*k*) is the *j*th texture feature of *k*th texture class in the database, then the Euclidean and Canberra distance metrics are described as below:

Euclidean

$$d_E(k) = \sqrt{\sum_{j=1}^{N} \left[f_j(x) - f_j(k) \right]^2}$$

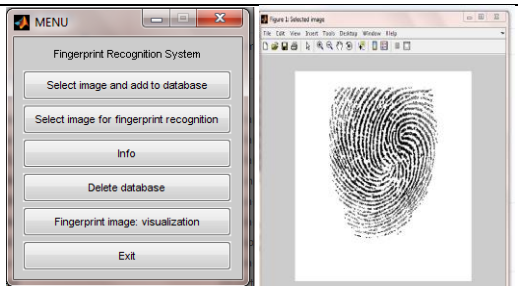
Canberra

$$d_{Can}(k) = \sum_{j=1}^{N} \frac{\left| f_j(k) - f_j(x) \right|}{\left| f_j(k) \right| + \left| f_j(x) \right|}$$

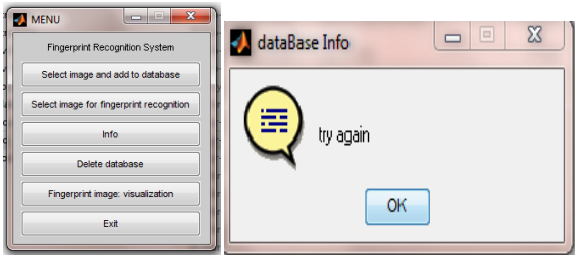
In Canberra distance metric, before finding the distance between the two images the individual feature components are normalized

IV. EXPERIMENTAL RESULTS

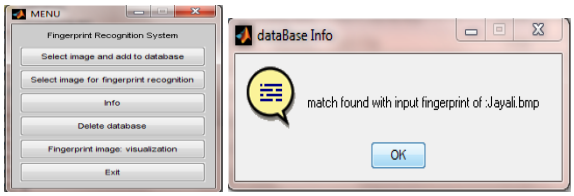
This approach is very simple and it contains input images of different persons with orientations. With the help of DWT algorithms features are extracted and minutia are find for various images. Then extracted features are compared with database by using Euclidean distance. It will recognize the authorized person. The results are shown below:



a) Select image and add to database



b) Invalid person



c) Match found with input fingerprint

V. CONCLUSION

It is found that performance of system increased and it is more effective when we increases the number of images. For each feature average value is calculated and compared with database to find authorized person. Matching process is done with Euclidean distance and Canberra. If extracted feature matched with database then person is authorized otherwise invalid.

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