VARIOUS WAVELET ALGORITHMS FOR IRIS RECOGNITION

R.Subha[1], Dr. M.Pushparani[2]

[1]*Research Scholar, Mother Teresa Women's University, Kodaikanal*

[2]*Professor and Head, Department of Computer Science,*

Mother Teresa Women's University, Kodaikanal (India)

ABSTRACT

Individual identification has become the need of modern day life. The recognition must be high-speed, automatic and infallible. Biometrics has emerged as a strong alternative to identify a person compared to the traditional ways. Also biometric identification can be made speedy, automatic and is already foolproof. Among other biometrics, Iris recognition has emerged as a strong way of identifying any person. Iris recognition is one of the newer biometric technologies used for personal identification. It is one of the most reliable and widely used biometric techniques available. In geAneral, a typical iris recognition method includes Localization, Normalization, and Matching using traditional and statistical methods. Each method has its own strengths and limitations. In this paper, we compare the recital of various wavelets for Iris recognition algorithm like complex wavelet transform, Gabor wavelet, and discrete wavelet transform.

Keywords: Iris Recognition, Complex Wavelets, Gabor Wavelets, Discrete Wavelet Transform

I. INTRODUCTION

Biometric is the science of recognizing a person based on physical or behavioral characteristics. The commonly used biometric features include speech, fingerprint, face, voice, hand geometry, signature, DNA, Palm, Iris and retinal identification future biometric identification vein pattern identification, Body odor identification, Ear shape identification, Body salinity (salt) identification. Out of all biometric system, Iris biometric is best suitable as it cannot be stolen or cannot be easily morphed by any person. The human iris is an annular part between the pupil and white sclera has an extraordinary structure.

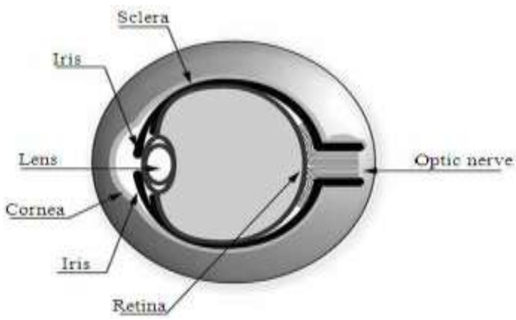

Fig 1: The Human Eye Structure

The iris begins to form in the third month of gestation and structures creating its pattern are largely complete by the eight months, although pigment accretion can continue in the first postnatal years. Its complex pattern can contain many distinctive features such arching ligaments, furrows, ridges, crypts, rings corona, and freckles. These visible characteristics, which are generally called the texture of the iris, are unique to each subject.

II. OVERVIEW OF THE IRIS RECOGNITION SYSTEM

Biometrics is automated method of identifying a person or verifying the identity of a person based on physiological or behavioral characteristic. Examples of physiological characteristics include hand or fingers images, facial characteristic and iris recognition. Behavioral Image processing techniques can be employed to extract the unique iris pattern from a digitized image of the eye and encode it into the biometric template, which can be stored in database.

The iris being a protected internal organ, whose random texture is most reliable and stable throughout life, can serve as a kind of living password that one need not to remember but always carries along. Every iris is distinct, even two irises of the same individual, and the irises of twins are different. Iris patterns are formed before birth and do not change over the course of a life time. This biometric template contains an objective mathematical representation of the unique information stored in the iris, and allows the comparisons made between templates. When a person wishes to be identified by an iris recognition system, their eye is first photographed and then template is created for their iris region. This template is then compared with the template stored in a database, until either a matching template is found and a subject is identified, or no match is found and subject remains unidentified.

III. VARIOUS WAVELETS TRANSFORM

3.1 Complex Wavelets

Complex Wavelets Transforms use complex valued filtering that decomposes the real/complex signals into real and imaginary parts in transform domain. The real and imaginary coefficients are used to compute amplitude and phase information, just the type of information needed to accurately describe the energy localization of oscillating functions. Here complex frequency B-spline wavelet is used for iris feature extraction.

3.1.1 Result

The iris templates are matched using different angles 210,240,280,320 and 350 Degrees and it is observed that as angles increases percentage of matching also increases the better match is observed at angle 350 which is 93.05%.Further by detecting eyelids and eyelashes the iris image is cropped and iris template is generated for matching purpose the results obtained is better than previous results the matching score is 95.30%.

3.2 Gabor Wavelet

The main idea of this method is that: firstly we construct two-dimensional Gabor filter, and we take it to filter these images, and after we get phase information, code it into 2048 bits, i.e. 256 bytes. In image processing, a Gabor filter, named after Dennis Gabor, is a linear filter used for edge detection. Frequency and orientation representations of Gabor filter are similar to those of human visual system, and it has been found to be particularly appropriate for texture representation and discrimination. In the spatial domain, a 2D Gabor filter is a Gaussian kernel function modulated by a sinusoidal plane wave. The Gabor filters are self-similar - all filters can be generated from one mother wavelet by dilation and rotation.

Its impulse response is defined by a harmonic function multiplied by a Gaussian function. Because of the multiplication-convolution property (Convolution theorem), the Fourier transform of a Gabor filter's impulse response is the convolution of the Fourier transform of the harmonic function and the Fourier transform of the Gaussian function. The filter has a real and an imaginary component representing orthogonal directions. The two components may be formed into a complex number or used individually.

Gabor filters are directly related to Gabor wavelets, since they can be designed for a number of dilations and rotations. However, in general, expansion is not applied for Gabor wavelets, since this requires computation of bi-orthogonal wavelets, which may be very time- consuming. Therefore, usually, a filter bank consisting of Gabor filters with various scales and rotations is created. The filters are convolved with the signal, resulting in a so-called Gabor space. This process is closely related to processes in the primary visual cortex. Jones and Palmer showed that the real part of the complex Gabor function is a good fit to the receptive field weight functions found in simple cells in a cat's striate cortex.

3.2.1 Result

We use the Daugman's methods to iris regions segmentation and use Gabor wavelet for feature extraction. At last, in the identification stage we calculate Hamming distance between a test image & a training image. The smallest distance among them is expressed, that test image belongs to this class. The recognition rate is 96.5%.

3.3 The Discrete Wavelet Transform

Computing wavelet coefficients at every possible scale is a fair amount of work, and it generates an awful lot of data. That is why we choose only a subset of scales and positions at which to make our calculations. It turns out, rather remarkably, that if we choose scales and positions based on powers of two so-called dyadic scales and positions then our analysis will be much more efficient and just as accurate.

3.3.1 Result

The technique developed here uses all the frequency resolution planes of Discrete Wavelet Transform (DWT). These frequency planes provide abundant texture information present in an iris at different resolutions. The accuracy is improved up to 98.98%. With proposed method FAR and FRR is reduced up to 0.0071% and 1.0439% respectively.

IV. CONCLUSION

In this paper, we compare the performance of various wavelets for Iris recognition like complex wavelet transform, Gabor wavelet, and discrete wavelet transform. Using complex wavelet, different coefficient vectors are calculated. Minimum distance classifier was used for final matching. The smaller the distance the more the images matched. It is observed that for the complex wavelets the results obtain are good than the simple wavelet because in complex wavelet we get both phase and angle also real and imaginary coefficients, so we can compare all these parameters for iris matching purpose.2D Gabor wavelets have the highest recognition rate. Because iris is rotator, and 2D Gabor wavelets have rotation invariance, it has the highest recognition rate. But 2D Gabor wavelets have high computational complexity, and need more time. Discrete wavelet transform used for iris signature formation gives better and reliable results.

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