ISSN : 2394-2975 (Online)
ISSN : 2394-6814 (Print)

Biometric Iris Identification using Gauss Laplace and Gabor Filter

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Abstract
The recognition of an individual human by means of their physical characteristics is termed to be biometric identification. Iris recognition is the one of the most reliable unique biometric identification. Our iris contains very perceptive features and provides the error free authentication of persons. Biometric identification system is a deprecatory demand in a variety of applications. Even though there are some techniques have clampdown in identifying individual meticulously and effortlessly. In our scheme, a strategy that seize domestic and universal attribute of the iris, using a bank of Gabor filters is initiated. Our experimental results demonstrate that Gauss Laplace filter is applied to the CASIA iris image to decrease the sensitivity of noise and it is used for edge detection. The outcome of our paper is to get optimal segmented iris image to produce more flawless data.

Keywords
Biometric, CASIA, Gausslaplace, Gabor filter.

I. Introduction

Iris Recognition is the action of recollection of a individual by study the undirected sketch of the iris.[1]The automated technique of iris recollection is relatively young, existing in permit only since 1994. Iris is the muscle within the eye which modulates the size of the pupil, managing the amount of the melatonin pigment within the muscle.[4]

In our report, we possess segmentation and normalization on the eye image of 320 x280 dimensions is acquired from CASIA database[6]. In segmentation process, it is used for localizing the iris and pupil regions is done by circular Hough transform. Using Hough transform for localizing the eyelids and thresholding for detecting eyelashes.[2,3] At normalization technique, the segmented iris image is converted into rectangular form using Daugmans rubber sheet model. After detecting, it is easy to map the inner and outer boundaries of the iris to a rectangular block in a stable size.[1] Encryption features of the iris is achieved so that the 2D normalized template divided into a series of 1D signals. To perform iris recognition by convolving we normalized the iris region with the Gabor filters then it is phase quantised to obtain the output. we have used hamming distance for matching to calculate the bit differences between two template. In present method, for producing optimal segmented iris Gauss laplace filter is used to gain more accurate and gives the best results for stable authentication.[2]

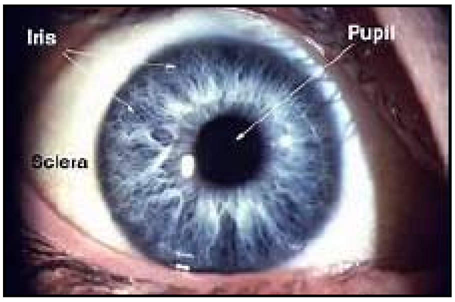

Fig.1: Eye image

II. Characteristics

Its feature are: 1. singing 2.walking 3.tone of voice etc., for chemical traits, we also uses the DNA , bloodglucose and also the body odour. The fig.1 shows the coloured ring around the pupil of the eye is termed to be Iris. The right eye differs from left eye. The twins usually have different iris texture[1].The Iris patterns are eminently composite than other biometric patterns.

III. Features

The attribute : 1.Enduring 2.Idiosyncratic 3.Being collectible 4. Efficacy 5.High reliability 6.Being commensurate 7.General acceptance etc. Daughman presented the first iris system-matic representation whose invention are highly utilized by the Iradian company. [1] An iris recollecting system includes the following steps: step1:Segmentation step2:Normalization step3:Encryption step4:Feature extraction and Matching.

IV. Segmentation

Iris segmentation automatically detects the Pupilllary and limbic boundries of an iris in a given image,The fig.2 shows that the code comprise automatic segmentation system that is assembled on Hough transform, and is able to delimit the circular iris and pupil region, materialised eyelids ,eyelashes and reflection [6]. The extracted iris recollection was then normalized into a rectangular block with sustained dimension. Atlast, from 1D-log was quantized from gabor filter by four levels to unique pattern of the iris into a bit-wise biometric template[1].

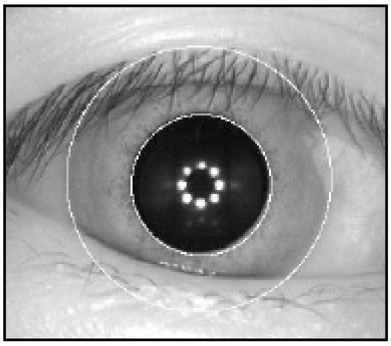

Fig 2.Segmented image

V. Hough Transform

Hough transform is designed to detect lines. The Hough transform is an algorithm for detecting the geometrical shapes in images. [2,3] The fig.3 demonstrates the flow of complete process of iris identification. This algorithm uses a long pro-cessing time.[9]

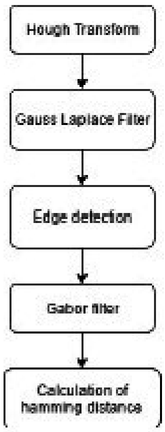

Fig. 3 : Flow of Process of Iris identification

VI. Normalization

Normalization brings or returns something to a normal condition or state. This is based on the transforming iris into polar coordinates, known as unwrapping process. Pupil and limbus boundary(non-concentric contours) these two con-ditions leads/ to different choices of reference point for transforming an iris into polar coordinates. In the radical directions, the fig.4 shows the texture is normalized from the inner to outer boundary. The pixel is about 60 and the angular resolution is also fixed to a 0.8degree over the 360 degree, which produces 450 pixels in the angular directions. Normalization refers for iris image are highly affected by their distance and angular position with respect to the camera[1].

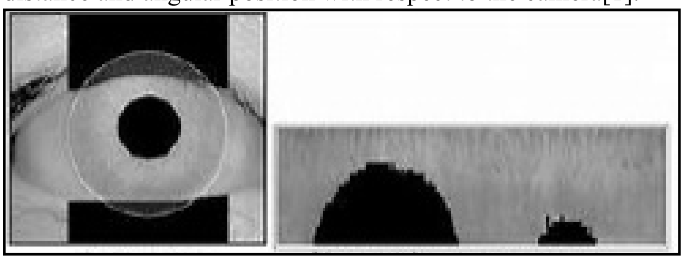

Fig 4. a)iris region b)normalization iris region
Normalised Image

VII. Daugman's Cartesian To Polar Transform

In fig.5 shows the Daughman's rubber sheet model which transforms a localized iris texture from Cartesian to polar coordinates[5]. In our proposed approach, is capable of compensating the unwanted variations due to distance of eye and its position with respect to the camera translation . This model is defined as

$x(p,q)=(1-p)*x_{p\theta} + p * x_{i\theta}$ $y(p, q) = (1 - p) * y_{p\theta} + p * y_{i\theta}$

where,

$x_{p\theta} = x_{po\theta} + r_p * \cos\theta$

$y_{p\theta} = y_{po\theta} + r_p * \sin\theta$

$x_{i\theta} = x_{io\theta} + r_i * \cos\theta$

$y_{i\theta} = y_{io\theta} + r_i * \sin\theta$

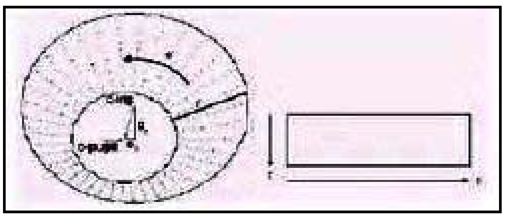

Fig 5.Daugman rubber sheet model image

VIII. Edge Detection

Edge detection technique is a fundamental tool particularly in areas of feature detection and feature extraction. It works according to the image segmentation and data extraction .In the areas of computer processing and image processing edge detection is used[7]. It is used in imprisoning events and changes in the view of the world. During the general premise of an image in formating model, it is likely to correspond to interruption in depth, interruption in surface orientation, differs in material properties and variations in scene illumination. The canny is ploted as optimal edge detector. In this, the grayscale image is taken as input and it shows the position of tracked intensity discontinuities as output. In this method vigorous and fragile, the two different thresholds are detected[9]. Thresholding is a technique used for detecting eyelashes. If the intensity value is less than than the threshold value then the point belongs to eyelashes. There are two types of eyelashes. Separable eyelashes are detected by gabor filter. Multiple eyelashes are detected by calculating the intensity variance. If the variance is less than the threshold, the centre is taken as the point in the eyelash.

IX. Gauss Laplace Filter

Gauss laplace filter is a 2Disotropic for the appraisal images second spatial derivative. It culminates the rapid intensity change areas and is used for edge detection. When it is applied to an image by laplacian filter it decrease the sensitivity towards noise.[2] the Fig 6 6.1 shows the sharpening of image when gauss laplace filter is applied.

$$G(x,y) = G(x) * G(y) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\frac{x^2}{2\sigma^2}} * \frac{1}{\sqrt{2\pi\sigma^2}} e^{\frac{y^2}{2\sigma^2}}$$

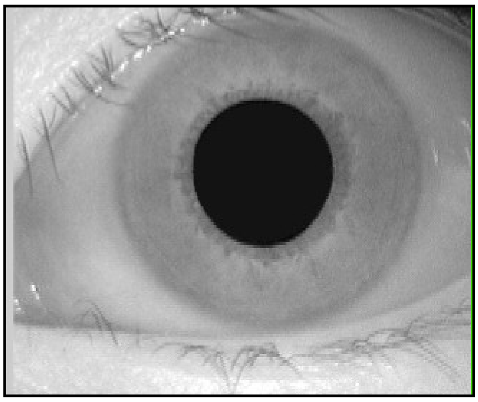

Fig. 6 : Before Gauss Laplace filter

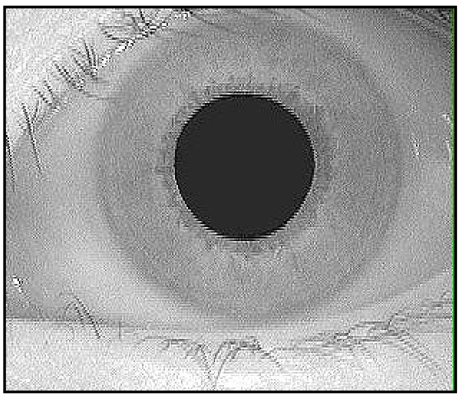

Fig. 6.1 : After Gauss Laplace filter

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X. Gabor Filter

Gabor filters are band pass filters in the image processing for element removal, appearance study, and stereo imbalance approximation. It has great application in computer account for the extraction of features especially in the analysis of texture[8]. Gabor filter is implemented modulation sine / cosine wave to obtain real and imaginary part [2] (even symmetric, odd symmetric) that shows in fig.7

$$\mathbf{G}_{(s,t)}(\rho,\theta) = \exp\left(-\tfrac{1}{2}\left(\frac{\rho-\rho_s}{\sigma_\rho}\right)^2\right)\exp\left(-\frac{1}{2}\left(\frac{\theta-\theta_{(s,t)}}{\sigma_\theta}\right)^2\right) \quad (1)$$

$$\text{with} \begin{cases} \rho_s = \log_2(n) - s \\ \theta_{(s,t)} = \begin{cases} \frac{\pi}{n_t}t & \text{if s is odd} \\ \frac{\pi}{n_t}(t+\frac{1}{2}) & \text{if s is even} \end{cases} \\ (\sigma_\rho, \sigma_\theta) = 0.996\left(\sqrt{\frac{2}{3}}, \frac{1}{\sqrt{2}}\frac{\pi}{n_t}\right) \end{cases}$$

where (ρ, θ) are the log-polar coordinates (in $\log_2$ scale, indicating the filters are organized in octave scales);

Gabor Filter Formula

In fig.8,Quantization filtering results (4 levels) get two bits of data so that each point in the normalized iris template eye corresponding two-bit template that the signature of the iris.

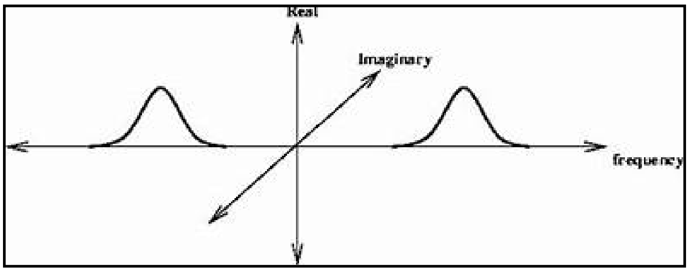

Fig. 7 : Gabor Filter image of real imaginary part

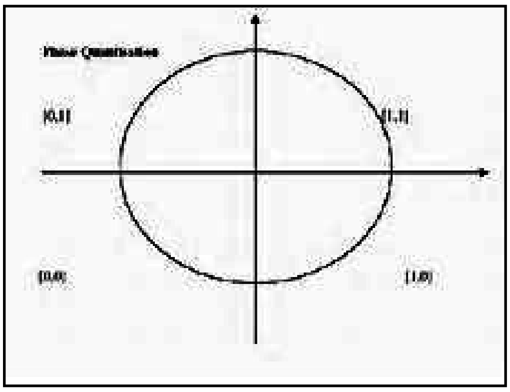

Fig. 8 : Phase Quantisation image

XI. Feature Extraction

Feature extraction contains the most significant information quality, to provide for accurate recognition. From that, the iris code will be generated and make the comparisons between that two templates. The fig.9 shows the template is initiated for encoding process that corresponding matching metric, it gives the resemblance measure between two iris templates.

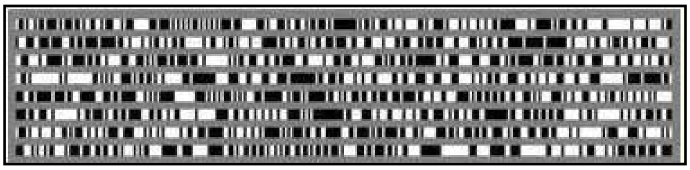

Fig. 9 : Iris template image

XII. Matching

In matching, hamming distance gives the bitwise comparison for accurate recognition. The calculation of the Hamming distance is analysed with bits that are generated from the actual iris region. It gives a rate of how frequent bits are the same. In between two bit patterns[1]they are derived from the same iris, the Hamming distance is correlated with the close distance of 0.0 intervals .The essence of an iris is used for Hamming distance.

$$HD = \frac{1/N \sum_{j=1}^{N} X_j(XOR)Y_j(AND)Xn'_j(AND)Yn'_j}{N - \sum_{k=1}^{N} Xn_k(OR)Yn_k}$$

Hamming distance formula

XII. Results

Biometric iris identification rapidly developing authentication method. It uses the pattern recognition on CASIA iris image to recognize an individual for accurate authentication.
The table1 clearly demonstrate the various existing approaches for iris detection and their accuracy rates[2].In this paper, Hough transform and canny edge detection has been used to segment the iris figures.

Table 1 : Techniques

Algorithm	Author	Year	Accuracy
Phase based image matching	Miyazawa et al.	2008	DSP technology
Hierarchical phase based matching	Durai and Karnan	2010	Fourier transform
Daugman's rubber sheet model Canny edge detection	Verma et al.	2012	Pattern recognition
K-means algorithm	Jayachandra and Reddy	2013	K-means
Haar wavelet transform	Yao et al.	2014	Euclidean distance
Proposed approach (Gauss laplace and gabor filter)	Gopikrishnan et al.	2018	Hamming distance

After that, the features has been subtracted from figures and the gabor gauss laplace filters are applied to that iris image. Then, the phase modulator has been used to encode the iris and save them as a iris template in a separate database file for iris recognition. The hamming distance has been calculated in the encoded images to retrieve the iris related information to get flawless data.
From the above discussion, it has been clearly demonstrate that the approach adapted in this study yields more accurate results and retrieve the faster pace information that are far better than that of existing techniques.

XIV. Conclusion

In this paper, the implementation of proposed approach is computationally efficient and insensitive to illumination and noise. The usage of gauss laplace algorithm for optimal segmentation of iris image and localizing the pupil retrieved iris image form the CASIA database. This clearly predicts that the proposed iris recognition system exhibits the greater performance and gives the more accurate data for the identification of individual person. The outcome has a been shown that the proposed approach has quicker time of execution compared to that of other existing algorithms.

Our future work will focus on

1. By implementing, the various algorithms and using different segmentation tools for minimization of time taken for identification and minimization of space required for storing the template data.
2. By implementing, the different neural networks applications using various trained algorithms for finding the effective optimal solution.

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