Mobile Security using Iris Recognition

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ABSTRACT
Biometric recognition system is the most demandable in working area. Among the biometrics, iris is the most suitable and accurate system. Recently Iris recognition system is used in Aadhar card system and many areas for person identification.The iris recognition system is given in three steps: Image Preprocessing, Feature Extraction and Template Matching.We have studied the various Iris Recognition algorithms. This paper reviews some feature extraction methods of iris recognition.The image preprocessing and feature extraction are the essential steps for accurate accuracy. The available databases will be useful to implement the application for identification or verification of a person. Mobile users need security on their smartphones with the help of biometric technique.

Keywords
Iris Recognition, Image Preprocessing, Feature Extraction, Template Matching.

1. INTRODUCTION
Biometric identification is an technology which gains more attention in recent years. Many researchers have done the work with this technique. Daugman proposed first working methodology of iris biometrics. Iris Recognition is one of the most reliable technique as compared to other biometrics such as fingerprint, hand geometry, face, hand thermogram,retina, voice and signature etc. Iris recognition is most useful identification technique in various areas such as civilized societies and many organizations. A person's two eye iris has different iris pattern, two identical twins also has different in iris patterns and it remains same in whole of the life.We have studied existing research methods of Iris Recognition Technology.In this paper,we have discussed various types of iris recognition algorithms. Currently mobile device is the essential part for each people in the world. It is a platform to share the information which requires secure authentication. Mobile users need security on their smartphones that can protect them from the risks of lost and stolen devices, as well as other security. Iris recognition system is given in three steps such as Image preprocessing, Feature extraction and Template matching [1][2][3][4][5][6].

Image Preprocessing

Basically it is necessary to do the preprocessing for an analysis of an eye image. Initially an image of the eye must be acquired by digital camera. It is required to convert the image in digital form. The acquired image always contains not only the useful parts but irrelevant parts i.e. eyelid, pupil. Iris image preprocessing is divided into three steps such as Iris localization, Iris normalization and Image enhancement. Iris localization detects the inner and outer boundaries of iris. Eyelids and eyelashes that may cover the iris region are detected and removed.Compared with the other part of the eye, the pupil is much darker. We detect the inner boundary between the pupil and the iris. The outer boundary of the iris is more difficult to detect because of the low contrast between the two sides of the boundary. It is necessary to convert iris image from cartesian to polar coordinates for normalization. The normalized iris image is a rectangle image with angular resolution and radial resolution.The iris image has low contrast and non-uniform illumination because of the position of the light source. All these factors can be compensated by the image enhancement algorithms [7][8][9].

2. FEATURE EXTRACTION
Feature plays an important role in the field of image processing. Feature extraction methods are applied to get features that is useful in classifying and recognition of images. Feature extraction methods are helpful in various image processing applications.The various feature extraction methods are given as following[10][11][12][13].

A. Gabor Filter
Gabor filter is the most useful algorithm for feature extraction.There are various kinds of Gabor filters. Gabor filters instinct response by a harmonic function. Each pattern is demodulated to extract its phase information using 2D Gabor Wavelet. The phase information is quantized into four quadrants in the complex plane. Each pixel is demodulated into two bits code in the template. It is necessary to extract the phase information because it provides the significant information within the image. It is independent on imaging contrast and illumination. A Gabor filter is constructed by modulating a sine or cosine wave with a Gaussian. Modulation of the sine wave with Gaussian provides localization in space, though with loss of localization in frequency. Decomposition of a signal is accomplished using a quadratic pair of Gabor filters. A real part is specified by a cosine and an imaginary part is specified by a sine modulated by a Gaussian. The real filters are known as the even symmetric and imaginary filters are known as odd symmetric components.

B. Wavelet Transform
In Wavelet transform method, it decomposes the iris region into components with different resolutions. The wavelets are the small waves of varying frequency and limited duration. Wavelet transformation is better than the fourier transformation. In Fourier, the frequency remains same with the time.The commonly used methods for wavelets are Biorthogonal, Daubechies, Haar and Mexican Hat wavelet.The main advantage of wavelet transform method is that it has both space resolution and frequency resolution.The features are localized in both space and frequency domains with varying window sizes.A bank of wavelet filters is applied to the normalized iris region. Each filter is tuned for each resolution with each wavelet defined by scaling functions. The output of the filters is encoded to generate a biometric template.

C. Key Local Variations

Key local variations are used to represent the characteristics of the iris. The normalized iris image is decomposed into a set of 1D intensity signals.Dyadic wavelet transform is applied to each signal.Local extrema of the wavelet transform results correspond to sharp intensity variations of the original signal. The local maximum and minimum points are encoded into a feature vector. The feature vector is converted to a binary template with the same size as the normalized iris image[14].

D. Hilbert Transform

Hilbert transform is used to extract significant information from iris texture. Analytic image is constructed by the original image and its Hilbert transform. It can be used to analyze the iris texture.Emergent frequency and instantaneous phase is computed from the analytic image. Emergent frequency is formed by three different dominant frequencies of the analytic image. Instantaneous phase is the arctangent function of the real and imaginary parts of the analytic image. Feature vector is encoded by thresholding the emergent frequency and the instantaneous phase.The advantage of this approach is computationally effective.The filtering is performed in the fourier domain using pure real filters.

E. Discrete Cosine Transform

In this method feature are extracted by the difference of discrete cosine transform (DCT) coefficients of rectangular patches. The normalized image is divided into diagonal 8x12 patches. The average over width is windowed using a Hanning window to reduce the effects of noise.A similar Hanning window and DCT is applied to the patch along its length. The differences between the DCT coefficients of adjacent patches are obtained. A binary template is generated from the zero crossings of the differences between the DCT coefficients.This coding method has low complexity and good interclass separation. It is superior to other approaches in terms of both speed and accuracy[15].

F. Cumulative Sums Change Analysis Method

Normalized iris image is used for feature extraction.Overall feature extraction processing of cumulative sums change analysis method is given as :To calculate the cumulative sum the normalized image is divided into number of cell regions where each cell region contains 3 rows and 10 columns. Average of the gray values is used a representative for calculation of a basic cell region. Grouping of cell regions is done horizontally and vertically.The experimental results gives better results when grouping is done by five cell region. Finally calculate the cumulative sum for every cell region group which generates the iris feature code[16][17][18].

3. TEMPLATE MATCHING

The matching metric will give a measure of similarity between two iris templates. It gives a range of values when comparing templates from the same iris, and another range of values when comparing templates from different irises.Finally the person id identify by using templates. The various algorithms of template matching are Hamming Distance method, Weighted Euclidean Distance, Normalized Correlation, Nearest feature line and Support Vector Machine.

Hamming distance method is used to measure dissimilarity between two binary templates. The fractional hamming distance is sum of the exclusive-OR between two templates over the total number of bits. Hamming distance is suitable for comparisons of millions of template in large database.Weighted Euclidean Distance method is calculated using Pythagorean theorem to calculate the distance between two points. An iris template is compared with all templates in the database. The two templates are matched if the Weighted Euclidean Distance is minimum. Normalized Correlation is defined as the normalized similarity of corresponding points in the iris region. Normalized correlation method is not computationally effective because images are used for comparisons. The nearest feature line distance is used in the classification stage. Support Vector Machine is used for pattern matching to verify a person's identity based on the iris code.

4. CONCLUSION

We surveyed the various iris recognition techniques. Available iris recognition algorithms for feature extraction and template matching are studied in this paper. The performance of each algorithm affects the accuracy of the system. This survey is useful to the researchers for the implementation of image processing applications. Currently the biometric techniques are used for mobile security. Iris recognition will give a powerful way to protect each mobile device that is both secure and convenient.

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