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MULTI-MODAL BIO-METRIC AUTHENTICATION USING GABOR AND CANNY FILTERING METHOD

Dhanashri Lamane
Department of electronics and telecommunication Shree L. R. Tiwari college of engineering Mira Road, Thane Email: dhanashri.lamane@gmail.com
Ameya Naik
Department of electronics and telecommunication K.J.Somaiya college of engineering Vidyavihar,Mumbai
Email: ameyanaik@somaiya.edu

Abstract—Every human has unique biological features, which can be used for the person authentication. More than one biological feature can be used for authentication to achieve a higher degree of security. The proposed system uses fingerprint and iris biometric features for authentication purpose with Gabor and Canny filtering method. Gabor filters are linear filters applied in multiple directions to compensate for orientation effect. The proposed system uses Gabor filter with eight direction rotation. The canny filter is the multilevel algorithm that detects a wide range of edges with a low error rate in iris images. Fingerprint and iris both, when combined give the higher degree of security. The proposed system achieved 96% accuracy with 100 samples tested. Also, authentication approval error rate was almost zero, thus proposed system can be used in banks, secure government documents and military operations etc.

Keywords—Multi-modal security, Iris detection, Canny and Gabor filter, Fingerprint

I. INTRODUCTION

A system of biometric identification refers to recognition of the personal characteristics. The fundamentally biometric sys-tem has two broad domains, including the unimodal biometric system and multimodal biometric system. In the unimodal sys-tem, there is a disadvantage of its lack of non-universality and unacceptable error ratio. To overcome these difficult problems of the unimodal system, multimodal is the best system for his two or three level of identification and for the check.Well-blended multimodal systems which also several advantages in comparison with no biometrics and unimodal systems. The human fingerprints and the iris have a model of unique texture and can be used to identify the person. Experimental result calculates parameters of performance as false acceptance rate (FAR); the rate of forgery-rejection (FRR), true acceptance rate (TAR), rate of true rejection (TRR). The result of the test is pointed out in EER (Error Equal Rate), what is very important for the authentication. Correspondence of fingerprint filter based various algorithms uses the Gabor filter to get the various features. Examples are Minutiae Based Matching and Pattern Based Matching. The algorithm based on a filter of fingerprints in the field of Gabor to capture the local and complete details in fingerprints in the form of a compact finger of fixed length. This is capable of accomplishing a check which is only marginal element, the best results of algorithms based on minutiae. The quick transformations of Fourier (FFT) and the filters of Gabor improve the picture. The combination of the filtration of Gabor and of the filtration in frequency domain to improve the fingerprints. With eight different rotations the Gabor filter, the characteristics of fingerprint are extracted and combined. Human iris has a very unique motive; therefore we can use it for a high security By detecting the center of the pupil and of the iris precisely and by locating the iris and the pupil layer region, the score of constant matchmaking can be achieved.

In the process of authentication, the detection of the pupils is the most crucial stage. In the iris the sclera veins are used as biometric feature. The sclera veins are unique feature and change by every person. The internal edge of the eye is not a normal circle, which can create a problem of definite recognition. The identification of the pupil is a better method to admit the eye and to augment the precision of recognition.

In this paper, system uses Gabor filter and SVM classifier for fingerprint recognition. The Gabor filter gives the filtration with eight rotations. The canny filter, MSER algorithm and SURF classifier used for iris recognition. Fingerprint and iris combined gives the high accuracy.

II. LITERATURE REVIEW

Biometric authentication provides more accuracy than any other type of authentication. Fingerprint is the biometric parameter which does not change with time. Biometrics Authentication system has two types, unimodal and multimodal.It can be performed with different biometrc features[1].Biometric authentication can be done using fingerprint and iris features, using KNN type of classifer and hybrid wavelate transform[2]. Finger knuckle print pattern can also be used as a biometrc feature and can be recognize using Kekre's Wavelate transform[3].Minute based fingerprint matching technique is one of matching technique among various types of techniques and algorithm[4].To overcome the disadvantages in minute based feature extraction, Gabor filter bank can be used for fingerprint feature extraction[5]. Combination of FFT and Gabor filter can be used to enhance the fingerprint[6].For detection of iris features pupil detection, pupil area detection and center of pupil detection is important for this purpose 1D Gabor filter can be used.[7]. Different algorithms are used for iris recognition[8]. Sclera veins can be used for iris

recognition, to detect sclera veins canny filter can be used[9].

III METHODOLOGY

1. The figure (a) shows the block diagram of multimodal authentication system . The algorithm shows the flow of block diagram.

A. Algorithm

The proposed system has the algorithm as follows:
1. To read the Input fingerprint image.
2. To convert the RGB input fingerprint image to grayscale image.

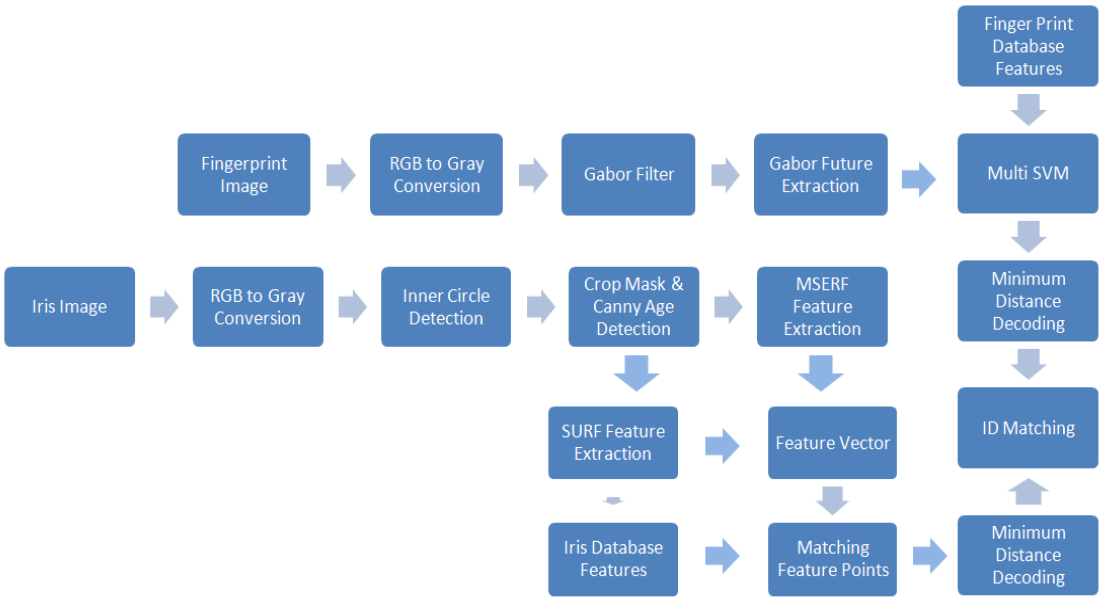
2. To extract the image features using Gabor filter bank.
3. To save the Gabor filter bank output.
4. To call multiSVM.
5. To match the database image features with input image features.

6. To read the iris input image.
7. To convert input iris image to grayscale image.
8. Inner and outer circle drawing.
9. To get the threshold for image.
10. To perform the crop mask determination.
11. To perform the Canny edge detection.
12. To extract the input image features using MSER.
13. To extract the database image features using SURF classifier.

14. To match the input image with database images using feature points.

15. Decision making.

MULTIMODAL BIOMETRIC AUTHENTICATION SYSTEM MODEL



Figure(a):Block Diagram of Proposed System

a)Fingerprint detection

A fingerprint is the outer layer of finger screen. It con-tains interleaved edges and the gap between them is called as valleys.These edges and valleys pattern can be used as biometric feature.Every human has a unique fingerprint pat-tern. Fingerprints are entirely formed in about seven months of development of the foetus. The general characteristics of

fingerprintprint appear when the skin of the fingertip begins differentiating the flux of fluids amniotic fluid around the foetus and its position in the change of the uterus in the course of the process of differentiation. So, cells on the fingertips grow in a microenvironment are different finger by finger and person by person.

Steps for Fingerprint Recognition are as follows:
1. RGB to GRAY image conversion

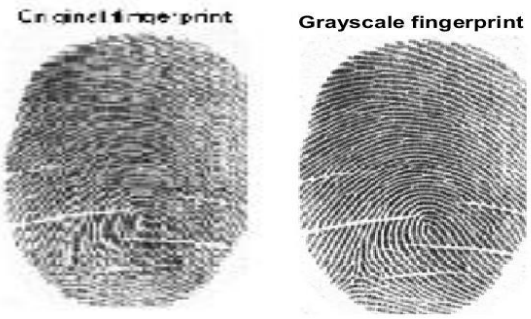


Figure: (b)

For easy processing, the RGB image is converted into grayscale. The resulting grayscale image is retained luminance by eliminating saturation information and hue. Grayscale image is 8-bit image Number equations consecutively.

2. Gabor Filter Bank

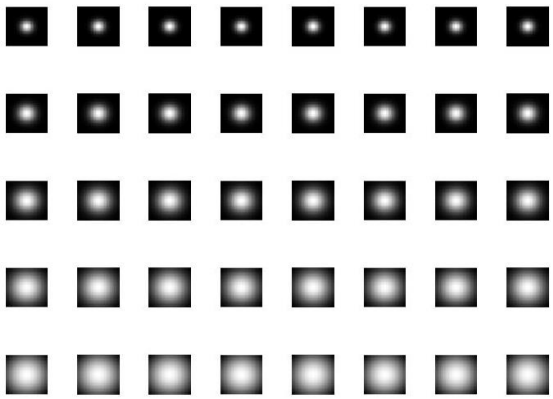


Figure: (c)

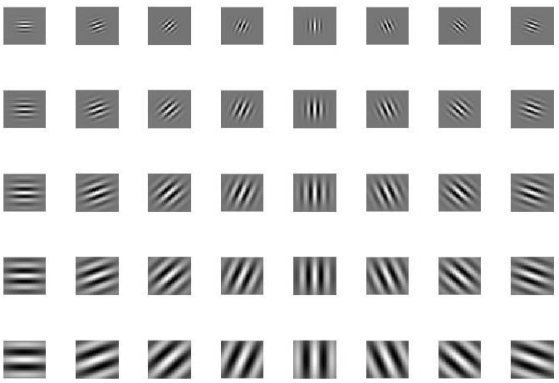


Figure: (d)

Gabor filter is a linear filter whose response is defined by Gaussian multiplication function. Multiplication character (complexity theorem), Fourier Conversion of the gauze filter's impetus response is the transformation of the Fourier Trans-formation of Harmonic Function And Fourier Transformation of the Gaussian Function Dennis's name Gabor is given to the Gabor filter. It is used in image processing to detect the edge of the object. Gabor filter can be used for various rotations and dilations. The proposed system uses Gabor filter bank for eight rotations. It is similar to the human visual system. It analysed for frequency components present in a direction in the region of interest. The local domain has 2D Gabor filter is Gaussian kernel function in spatial domain modulated by a sinusoidal plain wave. The feature vectors are normalized to zero mean and unit variance.figure(c) and (d) shows magnitudes of gabor filter and real parts of gabor filters respectively. Following equation represents the gabour filter

$$G(x,y) = \exp\left\{-\frac{1}{2\left[\frac{x^2}{dx^2}+\frac{y^2}{dy^2}\right]}\right\}\cos(2\pi\, fx)$$

3. SVM classifier

Support Vector Machine (SVM) is a technology of classification of characteristics. It can divide the space of functionality In two main classes, by an optimum hyperplane, so that the generalization error is minimized. One Optimum hyper-plan is represented by the largest margin of separation of both

classes. A small subset of the feature vectors lie precisely on the margin are the support vectors. Whereas training feature vectors lie outside the margin. The SVM classification process consists of two steps: training and testing. The fingerprint input to SVM consists of positive and negative samples. In training phase, the training vectors belonging two different classes are separated by training algorithm. The algorithm looks for optimum hyper-plan in such a way that the distance between the vectors of support is maximized. The decision is based on The distance of the data of hyper-plan Before reading the input image. The database feature vectors are classified using SVM classifier according to the one Vs all relation.Since th0e input fingerprint image feature vector compared with database fingerprint image vectors.

B.Iris Recognition

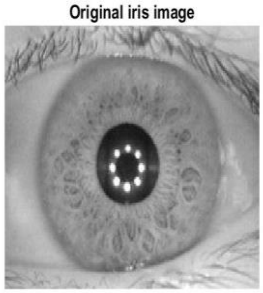
Iris has some advantages, as it can be used for identification

a. Iris pattern does not change with age

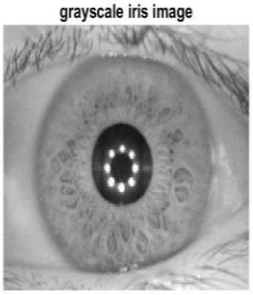
b.Eyes are protected with eyelids by outside environment

c.simple to impement

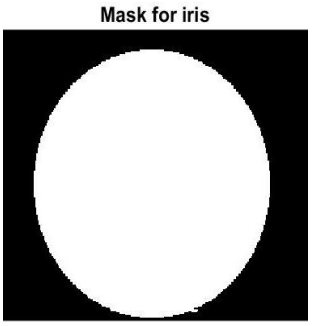
d.speed of matching is very fast



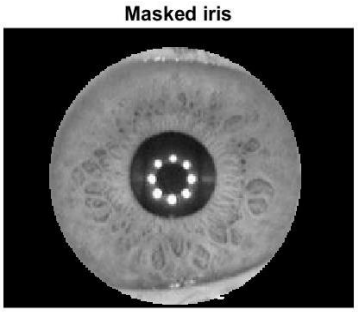
Figure(e)



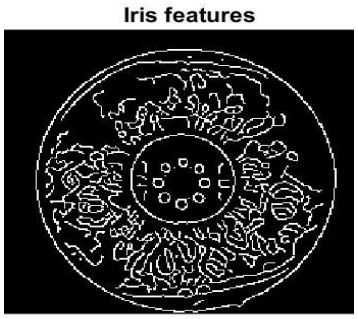
Figure(f)



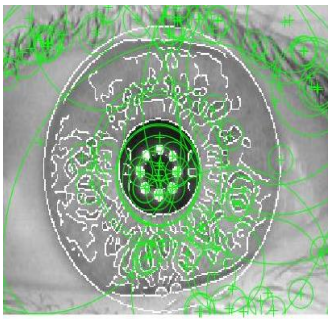
Figure(g)



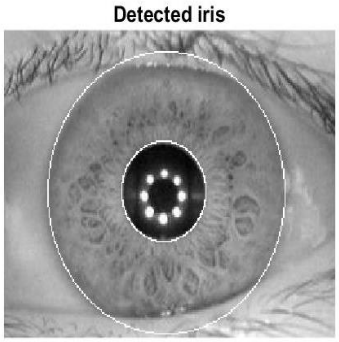
Figure(h)



Figure(i)



Figure(j)



Figure(k)

Steps in Iris recognition

1.Convert input iris image to gray scale image. Figure (e) and (f) shows the original iris image and gray scale iris image respectively.

2. Iris segmentation and localization

System uses MATLAB for mplementation which provides function to search the centre coordinates of pupil and iris along with their radius. Once iris has been detected the pupil centre coordinates are found by searching 10*10 neighbourhood around the iris centre and varying the radius until the maximum is found.Figure(k)shows the detected iris image.

3.Iris masking

In this blank image is created ,the dimentions of which are exactly same as that of input iris image.The dimensions can be varied manually. The dimensions are depends on selected iris image of database.Then by using the cropmask function the pupil size array of zero is placed on masked iris image output and then inverted to get the holes in the area of pupil.Then the empty iris mask and iris gray scale image is multiplied to get the masked iris which is shown in figure (g) and (h).

3.Canny Edge Filter

Figure(i) shows iris features got as a canny fiter output. Canny edge filter for segmentation purpoe.This provies the map of pupil. To increase the speed further inner and outer circle detection algorithm is used.Circle detection provides advantages like, good speed and recognition performance, capable to define partially occluded circles, needs very small amount of memory,simple and efficient

4.Feature extraction using MSERF

Maximally Stable Extreme Regions(MSER) is a blob detection method in digital image processing. This technique is used to find relation between two image elements from different view points.It returns object, regions containing information about the features detected in 2D grayscale image.The objects uses MSER algorithm to find out regions.Figure(j) shows MSER iris features.

5. SURF Classifier

Propoed system uses the Speeded Up Robust Feature(SURF). This is is a local feature detector and descriptor. SURF can be used for image registrationand object recognition or 3D reconstruction as well as classification. SURF is robust against different image transfigurations. To detect the interest points, SURF uses the integer approximation of MSER algorithm output. SURF algorithmprocessed in tree main steps: interest point detection, local neighbourhood description and matching. The Surf function returns the input iris image features which futher compared by database image features.

IV RESULTS

The proposed system uses the fingerprint and iris images for authentication purpose. The spoofing of two biometric features is very difficult, so it achieves very high accuracy rate. The Gabor filter is used for feature extraction for eight rotations. This minimizes the error due

to misplacing of a finger on the fingerprint sensor. The SVM classifier accuracy is higher than the other classifiers, helps to achieve high security. The Canny edge detector and MSER algorithm are used to extract the iris features. SURF classifier is used which is speed up the type of classifier. Combination of all gives high security, up to 96%. Further by increasing number of biometric features and different types of classifiers, accuracy can be increased.

$$FAR = \frac{\text{Total no. of imposter fingerprints accepted genuine}}{\text{Total no. of forgery tests performed}}$$

$$FRR = \frac{\text{Total no. of genuine fingerprints rejected as importer}}{\text{Total no. of genuine matching tests performed}}$$

$$TAR = \frac{\text{Total no. of genuine fingerprints accepted}}{\text{Total no. of genuine matching tests performed}}$$

$$TRR = \frac{\text{Total no. imposter fingerprints rejected}}{\text{Total no. of forgery tests performed}}$$

	FAR	FRR	TAR	TRR
Fingerprint	1.000	1.818	98.182	99.000
Iris	3.571	1.923	98.077	96.429
Fusion	0.036	0.035	96.294	95.464

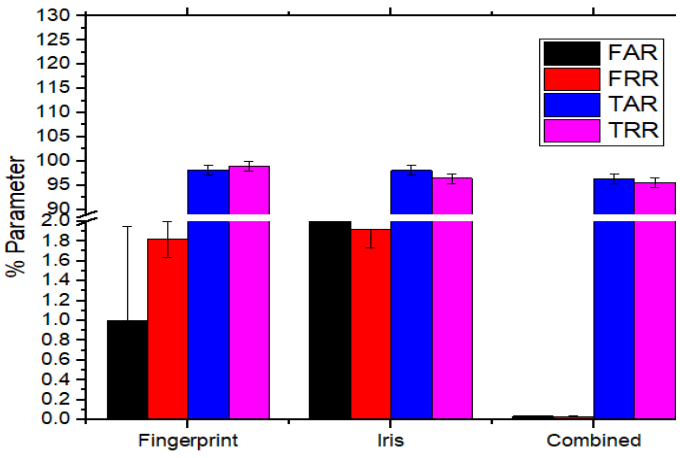


Figure:Bargraph for different parameter for biometric authentication

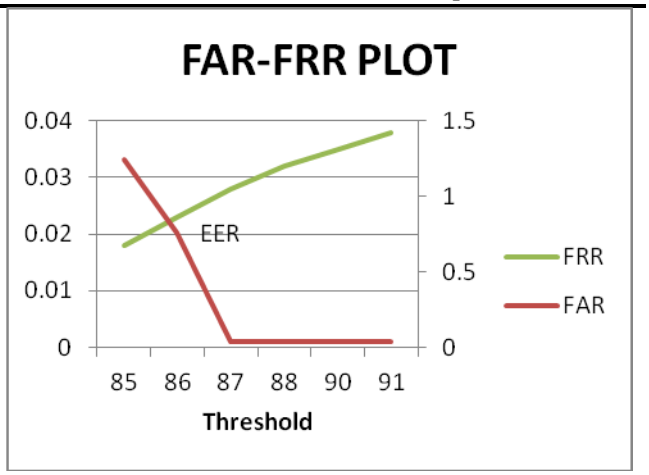


Figure: FAR-FRR graph

Equal error rate (EER) is a biometric security system algorithm used to predetermines the threshold values for its false acceptance rateand its false rejection rate. When the rates are equal, the common value is referred to as the equal error rate. The value indicates that the proportion of false acceptances is equal to the proportion of false rejections. The lower the equal error rate value, the higher the accuracy of the biometric system.

V. CONCLUSION

In this paper , system uses the fingerprint and iris images for authentication purpose. The spoofing of two biometric features is very difficult, so it achieves very high accuracy rate. The Gabor filter is used for feature extraction for eight rotations. This minimizes the error due to misplacing of a finger on the fingerprint sensor. The SVM classifier accuracy is higher than the other classifiers, helps to achieve high security. The Canny edge detector and MSER algorithm are used to extract the iris features. SURF classifier is used which is speed up the type of classifier. Combination of all gives high security, up to 96%. Further by increasing number of biometric features and different types of classifiers, accuracy can be increased.The use of different algorithms can help recognition of fingerprint and iris features with corrupt images, or scanning in no uniform light, wearing the cosmetics, in physical injury,etc.

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