Person Identification Using Iris Recognition Suitable For Partial Occlusion of Iris Images

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Abstract— Segmentation of iris in the process of iris recognition is to locate the specific portion of the iris [15] that has to find the papillary boundary, limbic boundary of the iris. If iris has occlusion it is necessary to localize upper and lower eyelids. It is also needed to exclude any superimposed occlusions of eyelashes. All these steps are time consuming. Hence not spending more time in edge detection, the algorithm [11] proved improved accuracy by using some portion of iris. This is more applicable for partially occluded images. The proposed algorithm is also suitable to use for partially occluded images in which we have selected specific region of iris and proved good accuracy for MMU and our own database. Wavelet based features are created and Euclidian distance classifier is used in this process.

Keywords— Segmentation, *Localization, Feature extraction, Feature matching*

I. INTRODUCTION

Recently security systems take very stringent role in public and private sectors. To overcome the security problems more emphasis is given on biometric systems that are efficiently used. Iris as biometrics is considered as most accurate, reliable and efficient way to recognize and distinguish people. In paper [11] only the lower part of the encircled iris area and specific portion of iris is utilized for recognition. Using wavelet based texture features proved good performance with an accuracy of 99.31% for CASIA database. Biometrics features are unchangeable measurable biological features. These are used for verification and identification of individuals. The set of biological features are decided from physiological data and behavioral features. The physiological data is considered such as person's face, color of eye, iris patterns, fingerprints, vein structure, and pitch of voice, body smell or DNA. Behavioral data is considered as signature, typing speed, walking rhythm etc. Lot of research is going on in the development of these technologies.

An important organ from of human body is human eye. It is used for human vision as shown in Fig1. It contains iris, pupil, sclera and some other parts. The cornea from eye is transparent portion present inside the eye. From corea sun light is passed toward the lens. The lens helps light for the focusing on the retina. It is the internal part of eye. It is formed by the light sensitive curve that carries visual impulse to the optic nerve. The color of the iris, texture of the iris and patterns of the iris are unique. Excellent method for identification with incorrect match rate is as low as 1 in 10^{15} comparisons.

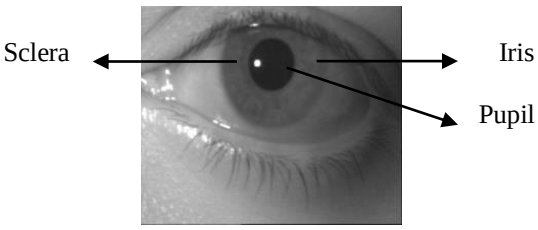


Fig. 1 Front view of human eye

In this paper related work and architecture is described in section two. Section three gives overall architecture of Iris Recognition System. Section four describes proposed work and five report our experiments, discusses the results and conclusions.

II. RELATED WORK

Pioneering work in the area of iris recognition is done by Daugman [1] [4] the first researcher with lot of efforts. An algorithm is based on iris codes from features using 2D Gabor Wavelets proves accuracy of more than 99.9%.The algorithm of Boles and Boashash [2] used zero crossing transformation of 1D Wavelet Transform at different resolution levels. But drawback is that it has very little information along concentric circle on the iris. It has comparatively lower accuracy. In paper [05] by Monro presented novel iris coding method. It is based on DCT coefficients. Those are obtained from normalized size of iris. Feature vectors are obtained from zero crossings of the differences between 1D coefficients. 1D coefficients are calculated in rectangular image patches. Advantage of this algorithm is its low computational cost. Also overlapping patches gave the best EER. Image patches

ate formed by bands of pixels along 45 degree lines from the iris images are selected. The weighted average under ¼ Hanning window is formed in the horizontal direction so as to reduce the resolution in the horizontal direction. To reduce effects of noise averaging across the width of the patches are done. Iris registration is made easier by using broad patches. The author uses CASIA Database. Similarly in the vertical direction eight pixels from each patch is taken and considered as 1D patch vector. This 1D patch vector is then windowed using a similar Hanning window. The differences between DCT coefficients of adjacent patches are calculated. Binary code is generated from zero crossings. The basis of their matching process is of 8 bit code. When FAR and FRR becomes equal actual figure if merit of the system EER is obtained. It is predicted by statistical modeling.

III. ARCHITECTURE OF IRIS RECOGNITION SYSTEM

The process of iris recognition is carried out through major steps as shown in Fig. 2. It consists of major steps such as eye image acquisition, Iris localization, feature extraction and matching.

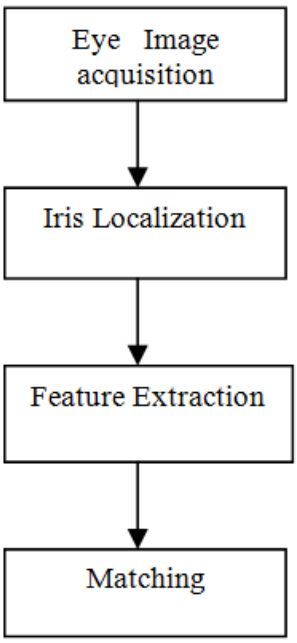


Fig. 2 Iris Recognition Process

High quality images are acquired with specified imaging set up. The imaging set up is developed according to the requirement of research. For moving images researchers have used more than one camera for acquiring eye images.

A. Iris localization

It consists of pupil detection and iris segmentation. Within the extraction block, may require previous processing to prepare data from which our representation is to be extracted.

For detection of pupil the iris image is converted into gray scale. This removes the effect of illumination. Pupil is the largest black area in the intensity image. Its edges can be detected from the binary image easily by using suitable threshold on the intensity image. Thus the first step to find or separate out the pupil is to apply histogram of input image. From which we get threshold value for pupil. Then it is applied for edge detection. Once edge of pupil is obtained then centre coordinates and radius can be easily found out. F.g.4 shows segmented iris of image 20L3 from left eye of person 3.

Fig.3 20L3.BMP Image

Fig.4 Segmented Iris

B. Iris Normalization

Normalization of the iris an important step in the pre processing of the iris Fig.5 as shown is normalized image by removing 4 pixels from upper region of the iris.

Fig. 5 Normalized Iris: Removing upper four pixels

IV. PROPOSED WORK

A. Iris image acquisition

Iris image acquisition set up and imaging frame work is as shown in Fig 6. Distance between camera and object is 20 cms approximately. Distance between camera and infrared source is about 8 cms. Iris Image Capture IR Sensitive CCD camera is used with onboard memory of 8MB. CPU used is Intel core, I7, windows 10 home,8GB RAM, DDR4,1TB hard disk. There are many other databases such as MMU and UBIRIS in which the iris images are partially as well as fully occluded. These images cannot be correctly recognized may reduce recognition accuracy. For such images it is needed to remove eyelashes from upper side, lower side and use various techniques to obtain required portion of iris. It is really very much time consuming which is not fair wherein we need to develop fast algorithm. In our proposed method instead of removing eyelashes we have tried to find good accuracy by removing four pixels from upper region of normalized iris. We have used MMU database and our own database.

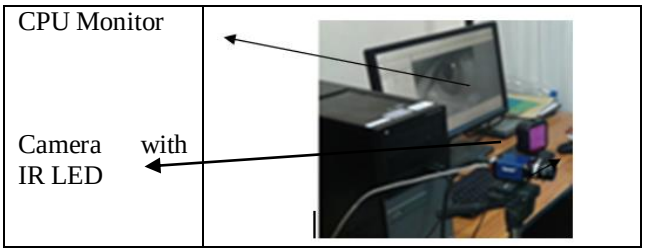
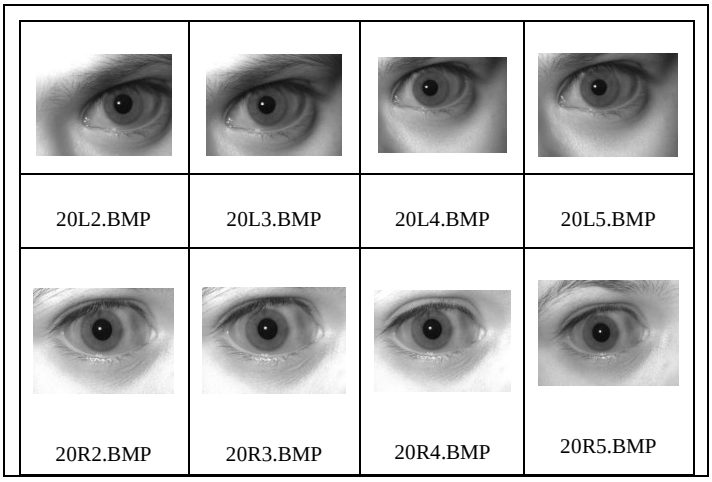


Fig. 6 Iris image acquisition set up

It consists of camera with IR LED source and CPU. The database is constructed with 485 images from 49 individuals. For 48 individuals, we have captured 05 images of right and

TABLE I



05 images from left eyes. For one individual, we have captured only 05 images of left eye and images are numbered as 1L1.bmp to 1L5.bmp. Similarly, right and left eye images of i^{th} person are numbered as iR1.bmp to iR5.bmp and iL1.bmp to iL5.bmp respectively. We have other noisy/non-cooperative database having 150 images captured from 30 individuals. We have captured 05 images of left eye from an individual. Thus total 635 images from 79 individuals. Table I. Sample images of from left eye and right eye of person 2, 3, 4 and 5 are shown. CVPR our database images can be made available by sending request at urkamble@sggs.ac.in or urkamble@yahoo.co.in.

B. Feature extraction using DWT and matching

Our IRIS database consists of image size 1024x768. Features are created using DWT and Euclidian Distance is metric used to compute similarity or match the value. For perfect match zero distance is shown and for any increase in distance mismatch is shown.

We have MMU2 iris database consists of 995 iris images. The iris images are collected using Panasonic BM-ET100US. These iris images are contributed by 100 volunteers with different age and nationality. They come from Asia, Middle East, Africa and Europe.

V. RESULTS AND CONCLUSIONS

In our experiments the images of iris from databases MMU and our own database are used. We have tried several experiments by removing four pixels from upper portion of normalized iris. We have determined accuracy rate from the ratio of number of correctly identified iris images to the total number of iris images in the test. We have proved accuracy that is approximately closer to Tissue [6] for our database CVPR and greater accuracy for MMU database as shown in TABLE II.

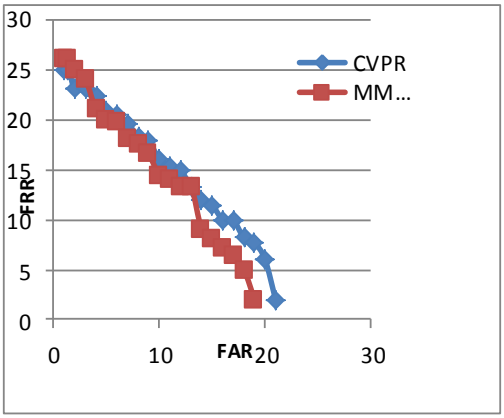


Fig. 7 Acceptance & Rejection Ratio

TABLE II

Algorithms	% FAR	%FRR	% Average Accuracy
Daugman[4]	0.010	0.090	99.90
Li Ma[5]	0.020	1.980	98
Avila[7]	0.030	2.080	97.89
Tissu[6]	1.840	8.790	89.37
Proposed CVPR_IRIS Database(DB1)	3.021	7.800	91.44
Proposed IRIS Database(DB1+ DB2) (Excluding four pixels from iris)	2.440	7.540	88.89
MMU2 Database (Excluding four pixels from iris)	3.867	6.128	89.77

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