Iris Based Attendance System

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Abstract: In this paper we are going to discuss the automatic attendance system on the basis of iris recognition. This system will automatically identify the person and will mark their attendance while he enters in the describe area viz. school, college, company, departments, etc. The system architecture along with the algorithm is described in the paper. With the help of this system we can improve the attendance record reliability and also from the misuse of person in the different fields. Also this system is reduces the time to take or mark the attendance while comparing with the traditional method. The image of iris is captured by the high pixel camera and gets saved in the database as the reference iris image. After saving the iris image the system will direct take the iris image and extract the features of that image and match with the reference iris image with the help of Euclidean distance. If it is matched, the person is identified and then attendance will mark in the system. The attendance records that use this technology is difficult to replicate by others. This is the main advantages of the proposed system. That is why it can be use in the different area where the uniqueness and secret is maintained.

Key Words: Iris recognition, Euclidean distance, Uniquess, Reliability etc.

INTRODUCTION:

Biometric authentication is the process of verifying the individual person based on the bio medical characteristics such as Palm, Hand Gesture, Signature, Voice, Face, Retina, Iris, Thumb impression etc. Amongst all this method the most recently not only discussed but also have more security, is the Iris Recognition Technology. This system is more secure because of different features present in this system such as the structure of the iris, pupil ring, freckles, colour of the iris, stripes, filaments, crypts (Darkened area of the iris) collagenous fibers, of human being or person, will remain same throughout the life. Also each person is having unique shape iris pattern which cannot be match with anyone. Even the two eyes of single person do not have the same iris pattern.
The chances of same iris patterns are so rarely and it can be consider as 1×10^{78} which is so rare. As it uses the human body part, so it have one more advantage that it cannot be lost or stolen, and no need to remember the word or no. like the pin and password. Due to this feature the iris is more widely and uniquely used. Even the two identical twins do not have the same iris pattern. Iris is that part of the eye which is protected from the external damage from the different parts of the eye. The eye anatomy will show the details of the eye structure and the different parts of the eye.

MATERIAL: MATLAB Software.

EYE ANATOMY:

The human eye is the organ of vision which transmits the picture through the visual paths into the brain. The structure of the eye is very complex in nature. The part which we are interested is the inner part of the eye, which is of different colour called as the iris, which is surrounded by the portion called as the sclera which is generally white in colour. The iris is highly protected part of the eye and which is composed of tissue. Iris is the toughest tissue within the. The pigmented tissues are generally tough in nature. The iris is a resilient tissue.

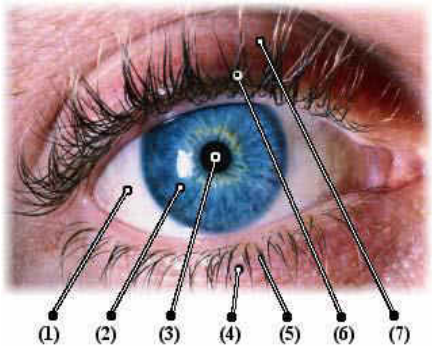


Fig.1. Human eye,

Where, 1) Sclera, 2) Iris, 3) Pupil, 5) & 6) Eyelashes and 4) & 7) Eyelids.

Macroscopic Appearance:

1) Ciliary Zone: It presents series of redial streaks due to underlying radial blood vessels.

2) Pupillary Zone: It is relatively smooth and flat in nature.

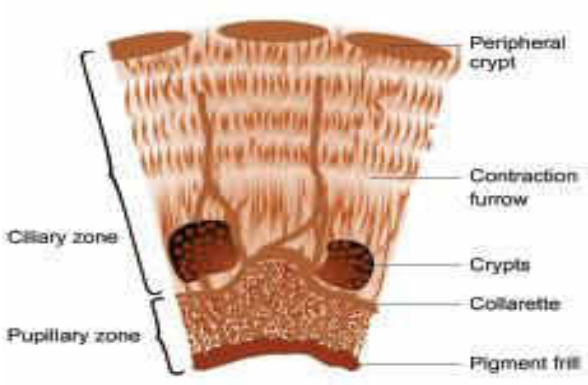
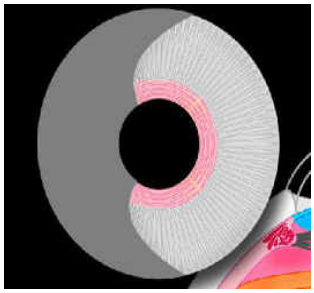


Fig.2 Macroscopic Appearance

The iris consists of pupil border. The sphincter mechanism of pupil border is function due to smooth muscle with a great constricting and dilating capacity. The stroma connects to a sphincter muscle (sphincter papillae) of the eye. It contracts the pupil in a circular motion, and a set of dilators muscle (dilator pupillae) which pull the iris radially to enlarge the pupil, pulling it in folds.



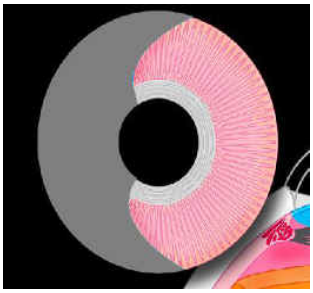


Fig.3 Sphincter papillae muscle Fig.3 Dilator pupillae muscle

Pupil dilation mechanism occurs in three concentric areas which are given below.

- The central part is highly mobile dilatable and constructible.
- The paracentral thickened area lies at two third from the iris base.
- The iris base is immobile.

The iris gets developed from the age of one year and after development of iris it will remain same or unchanged throughout the life time with its unique feature. Formation of unique iris pattern is a random process and it is not related with any genetic factor. Only one characteristic is dependent on the genetics that is pigmentation of the iris, which will determine the colour of the iris. Iris is covered by the upper and lower eyelid and eyelashes, and at the centre there exist a dark circle called as the pupil. This pupil will controls the amount of light that are passes

into the eye and further it passes to the brain for further processing. Some researcher gained to find the value of the diameter of iris which is approximately considering that up to 10 to 12mm. Further it is very difficult to determine the value of the diameter of the pupil. But still it is consider that it ranges from 2 to 5 mm in length by the some researchers. Though the iris is inner organ but it is externally visible and get protected from the environment and damage by the layer called as the cornea.

LITERATURE REVIEW:

At the beginning the first the idea of iris is developed by the ophthalmologist Frank Burch in 1936. Then it appears in the James Bond films in 1980. It is the fiction at that time but after many researchers was try to develop it and finally the fiction comes in true in the 1987. Aram Safir & Leonard Flom patented the idea for the iris, and he asked the John Dougman to create the actual algorithm for that, and he created the algorithm successfully. The John Dougman patented the iris recognition system in the 1994 with its grateful work in the field of image processing of biometric topic. All the improvements are done by the John Dougman over Aram Safir & Leonard Flom approach. Dougman: Image acquisition use near infrared illumination. For iris localization he uses integro differential operator for detecting the iris boundary for searching the parameters. In iris normalization process he converts the extracted iris image into the polar coordinates system. Feature encoding is done by the 2D wavelet demodulation, and finally he matches the images with the help of measuring the hamming distance.

Again the Wilds work on the same technology i.e. on iris technology with the following methods he changes as compare to the Dougman's method. He uses low light level camera for image acquisition. He uses the Hough Transform to detect the circle in the localization method. He extracted the feature with the help of Laplacian of Gaussian filter. And finally matched the image with base image i.e. reference image.

SYSTEM ARCHITECTURE:

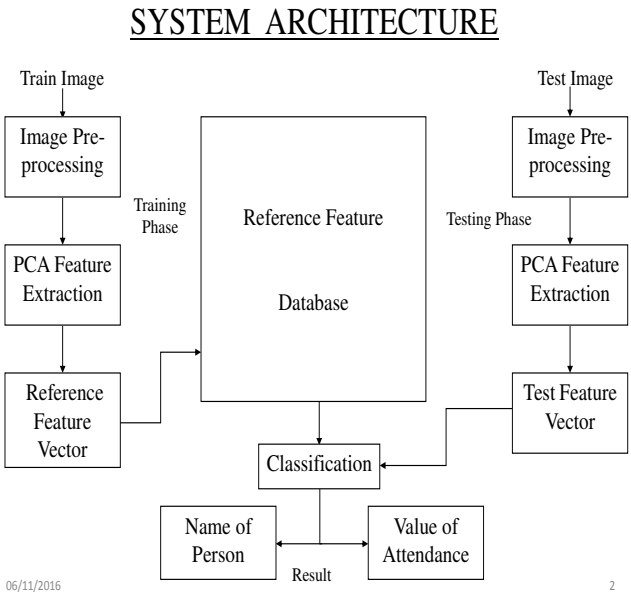


Fig.4 System Architecture

IRIS RECOGNITION:

Image processing techniques can be employed to extract the unique iris pattern from a digitized image of the eye, and encode it into a biometric template, which can be stored in a database. The iris is a thin circular diaphragm, which lies between the cornea and the lens of the human eye. The function of the iris is to control the amount of light entering through the pupil, and this is done by the sphincter and the dilator muscles, which adjust the size of the pupil. It is also positive that the iris from the first year of age maintains its complex structure unchanged throughout its lifetime.

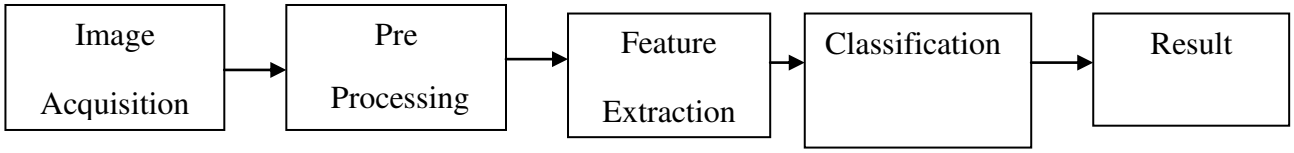


Fig5. Overview of recognition system

Image Acquisition: The Camera is mounted at a distance from the entrance to capture the frontal images of the students. But in our system we are considering the iris image as the database for iris,

Iris Pre-processing: In this section the iris texture is detected and transformed into a rectangular block. In this iris pre-processing system the following process is carried out.

1. **Image Adjusting**: When we get image from the scanner or camera the size of that iris image is so large. So there is need to reduce the iris image size. Image adjusting is done with the help of interpolation. This interpolation technique is mostly used the task such as zooming, rotating, shrinking and geometric correction.
2. **Image Smoothening**: When we get image from the scanner or camera and perform the image transform task that time some noise will get introduced in the iris image. To remove this noise we are introducing the image smoothening. Convolution is used to perform the image smoothening. Also the median filter which is more effective than the convolution for removing the noise from the iris images.

Principal Component Analysis (PCA): It is also called as the Hotelling Transform Karhunen-Loeve Transform. PCA is the technique that has been used for image recognition and compression. It can be used for prediction, redundancy removal, feature extraction, data compression etc. Basically PCA allows us to identify the principle direction in which data varies.

Feature Extraction: In the iris recognition system the feature extraction is done using PCA. In this process a 2-D iris image can be represented as a 1-D vector by concatenating each row (or column) into a long vector. We are having 20 iris images of variable size so these all are reshaped to fixed size 512 X 512.

1. Vector representation of images

In our case we have 20 iris images and each having total number of 262144 pixels. These 2-D images are arranged to form a 1-D vector 'T' having columns equal to number of images, 20 in our case.

2. Mean Vector

To calculate mean *m* of each image, we have to read image column wise and it is calculated as

$$m = \frac{1}{20}\sum_{k=1}^{20} T_K$$

After this we get mean vector *m* whose columns are mean of each image. Where, 20 are the total number of images.

3. Forming Centred Images

To obtain deviation of each image from mean image we have to subtract mean of each image from itself. So as to form centred images. Suppose T is the data matrix so we have to subtract *m(i)* from T(i). Where, *i* is the image number.

$$temp = \sum_{i=1}^{20} T(i) - m(i)$$

T(i) represents first i^{th} column i.e. each image. *temp* contains difference image.

4. Calculating Covariance matrix

Mathematically covariance matrix is obtained by multiplying difference image and its transpose. But if we consider image size 512 X 512 then obtained covariance matrix has size 262144 X 262144, which is computationally complex. To reduce complexity we are obtaining eigenvectors of

$$C_{x1} = temp' \times temp$$

Which is much smaller matrix of size 512 X 512? Here dimensionality is much reduced. We can call C_{x1} surrogate of original covariance matrix C_x

$$C_x = \text{temp} \times \text{temp}'$$

If we multiply C_{x1} by original data matrix T, resulting into the actual eigenvectors of C_x.

If C_x is real and symmetric then finding ortho-normal eigenvectors is possible. Suppose e_i and V_i ,i=1,2,…n, are eigen values and eigenvectors of C_x arranged in descending order. Let D be a matrix whose rows formed from eigenvectors of C_x. Suppose if we use D as transformation matrix to map x's into vector y's as below

$$y = D(T - m)$$

Mean of the *y* vectors resulting from this transformation is zero. We can calculate covariance matrix of the y's in terms of D and C_x as follows

$$C_y = DC_xD^T$$

Thus C_y is the diagonal matrix whose elements along the main diagonal are the eigen values of C_x. After all these steps we are getting eigenvectors for C_{x1} of size 150X 150. If we multiply it by difference images i.e. *temp* then we get original eigenvector of size 262144 X 150.

PERFORMANCE ANALYSIS:

Performance analysis can be done with help of following.

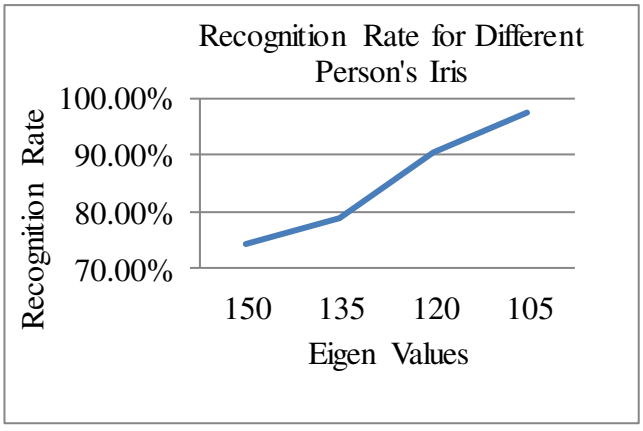
For performance analysis we vary of Eigen values. For Iris recognition Eigen values considered as 150, 135, 120 and 105. Recognition Rate gives us how many test samples are matched among given data samples, and calculated as

$$\text{Recognition Rate} = \frac{\text{Number of correctly recognized test images}}{\text{Total number of test images}} \text{ X } 100$$

No.	Person	Eigen Values	Recognition Rate
1	Person1	150	97.67%
2	Person2	135	90.70%
3	Person3	120	79.07%
4	Person4	105	74.42%

Table.1 Recognition Rate of Different Person's Iris

Following graph shows that as we go on increasing Eigen values then recognition rate increases accordingly. And we get maximum recognition rate for all Eigen values.



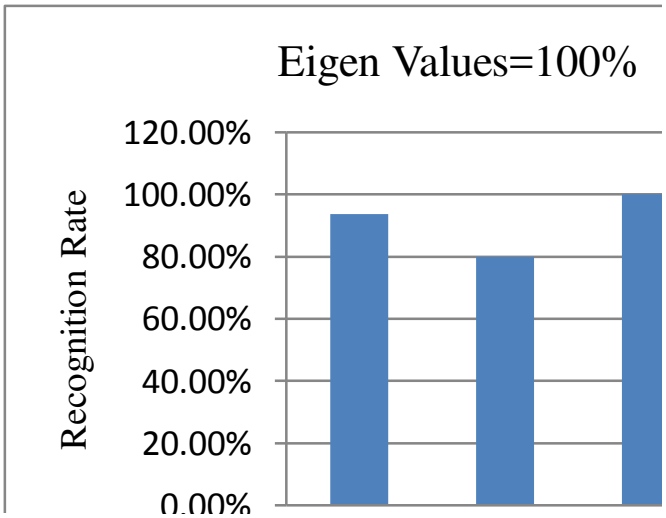
Graph.1 Recognition rate Vs Eigen values for Different Person's Iris

After testing our system for different person data I have gone for performance of system for individual person. In that system is tested by considering only particular iris image of each person for example to calculate recognition rate for person1 we calculate PCA parameter for only person1 images stored in train database.

No.	Person	Recognition Rate
1	Person 1	93.75%
2	Person 2	80%
3	Person 3	100%
4	Person 4	100%

Table.2 Recognition Rate of Individual Person's Iris with Eigen Values= 100% (All)

We note here that for Person 3 and Person 4 we get 100 % result when all eigen values are considered. But for Person 2 Iris it is only 80 % because there are less samples in training database.



Graph.2 Recognition rate Vs Eigen values (100 %) for individual Person

MERITS:

1. Uniqueness of iris patterns hence improved accuracy.
2. Highly protected, internal organ of the eye
3. Stability: Persistence of iris patterns.
4. Non-invasive: Relatively easy to be acquired.
5. Speed: Smaller template size so large databases can be easily stored and checked.
6. Cannot be easily forged or modified
7. Concerns / Possible improvements
8. High cost of implementation
9. Person has to be "physically" present.

ADVANTAGES:

1. It reduces the time to mark the attendance in the largest firm.
2. It use in the defense of ministry to avoid the illegal persons entry in the specified area.
3. It also uses in the commercial purpose such as ADHAR.

DISADVANTAGES:

1. It is having high cost of scanning camera.

2. Though it is not possible for making fake iris but in future it can create problem.

APPLICATIONS:

1. Authentication Applications
2. Identification Applications
3. Application by Technologies
4. Commercial Product

CONCLUSION:

This dissertation proposes Iris Recognition system based on evaluation of PCA Parameter. For pattern classification simple Euclidean distance is used which works better than other methods. Proposed system is compared with existing system and has better recognition rate. The algorithm proposed was successfully made to recognize front side of iris image. We obtained PCA parameter i.e. Eigen values and Eigen vector which found to be enough to differentiate between iris of different people. Proposed system used to detect iris image of individual and its stored iris image. By varying Eigen values we are able to reduce dimensionality and processing time required to execute system. We get maximum recognition rate for all Eigen value, which is 97.67%. Recognition rate decreases as we tend to reduce Eigen values.

REFERENCE:

1. L. G. Shapiro, G. C. Stockman : Computer Vision, Prentice-Hall. (2001).
2. Y. Zhu, T. Tan, Y. Wang : Biometric Personal Identification Based on Iris Paterns, ICPR, pp. 805-808. (2000).
3. J. Dougman : How Iris Recognition Works, IEEE Transactions on Circuits and Systems for Video Tech, number 14, pp. 21-30. (2004).
4. J. Dougman : Wavelet Demodulant Codes, Statistical Independence, and Pattern Recognition, Proc. 2 IMA-IP, pp. 244-260. (2000).
5. Gabor filter in Wikipedia: http://en.wikipedia.org/wiki/Gabor_filter (last visit: March 1 2009).
6. L-1 Identity Solutions and their iris biometric technology: http://www.l1id.com/pages/118-iris (last visit: March 1 2009).
7. CASIA V1.0 – used iris database: http://www.cbsr.ia.ac.cn/IrisDatabase.htm (last visit: March 1 2009).
8. J. Dougman : The importance of being random: statistical principles of iris recognition, Pattern recognition, no.36, pp.279- 291. (2003).
9. K. Nixon, V. Aimale, and R. Rowe, "Spoof detection schemes," Handbook of biometrics, pp. 403–423, 2008.
10. R.P. Wildes, "Iris recognition: an emerging biometric technology," Proceedings of the IEEE, vol. 85, no. 9, pp. 1348–1363, 1997.
11. U.C. von Seelen,: "Countermeasures against iris spoofing with contact lenses," in Biometric Consortium Conference BC2005, 2005.
12. Report on Identity Verification. Bakk. Medien-Inf. Tilo Burghardt, University of Bristol, November 2002.
13. Biometric Authentication. First International Conference, ICBA 2004, Hong Kong, China, July 15-17, 2004, Proceedings Series: Lecture Notes in Computer Science, Vol. 3072 Zhang, David; Jain, Anil K. (Eds.) 2004, XVII, 800.
14. K. Miyazawa, K. Ito, T. Aoki, K. Kobayashi, H. Nakajima. A Phase-Based Iris Recognition Algorithm. ICB 2006, LNCS 3832, Springer-Verlag Berlin Heidelberg, 2005, 356–365.
15. E. Wolf. Anatomy of the Eye and Orbit. 7th Edition, H.K. Lewis & Co. LTD, 1976.
16. J. Daugman. Biometric Personal Identification System Based on Iris Analysis. U.S. Patent No. 5,291,560 issued March 1, 1994.