

Iris Recognition

Shirke Swati D.
ME-Computer-I
CAY's Siddhant COE,
Sudumbare,Pune

Shirke Suvarna D.
ME-Computer-I
D.Y.Patil COE, Aakurdi,
Pune

Gupta Deepak
Assistant Prof. ME Computer
CAY's Siddhant COE
Sudumbare,Pune

ABSTRACT

Algorithms developed for recognizing persons by their iris patterns have now been tested in many field and laboratory trials, producing no false matches in several million comparison tests [3]. We present an efficient Iris Code classifier, built from phase features which use Gabor wavelets bandwidths [1]. The final iris classifier consists of a weighted contribution of weak classifiers. Based on the Levenshtein distance between phase vectors of the respective iris images [4]. Our experiments show that the Levenshtein distance has better discrimination in comparing Iris Codes than the Hamming distance [1] IRIS Recognition is used of Identification, Authentication, and Scanning .IRIS Is a Muscle which is placed in between Pupil and Sclera[2].

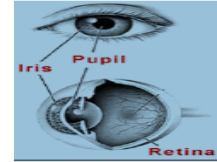
Keywords

IRIS Recognition; biometrics; levenstein distance, gaborwavelet.

1. INTRODUCTION

“ Biometric is a Greek Word Bio means “Life” and metrics means “Measurement”. Biometric systems are becoming popular methods for personal identification. Each biometric technology has its set of advantages – and disadvantages – based on their usability and security. The human iris, located between the pupil and the sclera, has a complex pattern determined by the chaotic morphogenetic processes during embryonic development. The iris pattern is unique to each person and to each eye, and is essentially stable during an entire lifespan. Furthermore, an iris image is typically captured using anon-contact imaging device, of great importance in practical applications. These reasons make iris recognition a robust technique for personal identification. The first automatic iris recognition system was developed by Daugman. He applied Gabor filters to the iris image for extracting phase features, known as the Iris Code. use an 1D wavelet transform at various resolution levels of concentric circles on the iris image. They characterize the texture of the iris with a zero-crossing representation. employ a bank of spatial filters, with kernels that are suitable for iris recognition to represent the local texture features of the iris.

The only work in literature that makes use of boosting for iris recognition is. Instead of Gabor phasors, ordinal measures are used for iris representation. There are however too many parameters that need tuning when using ordinal measures, and to construct and optimal classifier is a difficult problem. The authors suggest the use of similarity oriented boosting instead of AdaBoost. Ordinal measures are difficult to boost, thus oriented boosting must be driven by a similarity rule because of the large amount of features. It should be noted that all these algorithms work with grey level images, and color information is not used since the most important information for recognition is the texture variation of the iris, which is the same in both grey and color images.

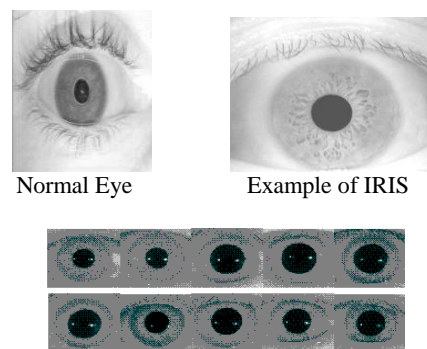


“Figure-1” Iris Recognition

Iris is a muscle within the eye size of the Pupil, Controlling the amount of light that Enters the eye. it is the colored Portion of the eye. The iris is the most unique identifier on the human body. In recent years, iris recognition has become the major recognition technology since it is the most reliable form of biometrics. Iris patterns are unique and stable, even over a long period of time. Furthermore, iris canning and recognition systems are very user-friendly. During recognition the scanned iris is on a smart card.

Biometric identification utilizes physiological and behavioral characteristics to authenticate a person’s identity. Some common physical characteristics that may be Iris recognition is the Process of recognizing a person by analyzing that random pattern of automated method of iris recognition is relatively young. The used for identification include fingerprints, palm prints, hand geometry, retinal patterns and iris patterns. Behavioral characteristics include signature, voice pattern and keystroke dynamics. A biometric system works by capturing and storing the biometric information and then comparing the scanned biometric with what is stored in the repository.

The “Fig-2” below demonstrates .



10 Different images of IRIS

“Figure-2”

2. IRIS RECOGNITION PROCESS CONSISTS STAGES

A. Image acquisition:

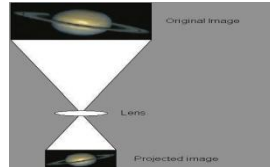
The image acquisition is done by a monochrome CCD-camera covering the iris radius with at least 70 photosites(=pixels)The camera is situated normally

situated between half a meter to one meter from the subject.



“Figure-3” Image Acquisition

The CCD-cameras (Charge Coupled Device) job is to take the image from the optical system and convert it into electronic data.



“Figure-4” The CCD-camera

B. - Iris Recognition Process

Process of capturing an iris into a biometric template is made up of 3 steps:

- 1) The Capturing the image
- 2) Defining the location of the iris
- 3) optimizing the image
- 4) Storing and comparing the image

i. Capturing the image

The iris has many features that can be used to distinguish one iris from another. One of the “primary visible characteristic is the trabecular meshwork, a tissue which gives the appearance of dividing the iris in a radial fashion” that is permanently formed by the eighth month of gestation. During the development of the iris, there is no genetic influence on it, a process known as “chaotic morphogenesis” that occurs during the seventh month of gestation, which means that even identical twins have differing irises. The iris has in excess of “266 degrees of freedom” i.e. the number of variations in the iris that allow One iris to be distinguished from another. The fact that the iris is protected behind the eyelid, cornea and aqueous humors means that, unlike other biometrics such as fingerprints, the likelihood of damage and/or abrasion is minimal. The iris is also

(ii) defining the Location of the Iris and

Optimizing the Image-

Once the camera has located the eye, the iris recognition system then identifies the image that has the best focus and clarity of the iris. The image is then analyzed to identify the outer boundary of the iris where it meets the white sclera of the eye, the pupillary boundary and the centre of the pupil. This results in the precise location of the circular iris. The iris recognition system then identifies the areas of the iris image that are suitable for feature extraction and analysis. This involves removing areas that are covered by the eyelids, any deep shadows and reflective areas. The following diagram shows the optimization of the image.

(iii) Storing and Comparing the Image-

E-Once the image has been captured, “an algorithm uses 2-D Gabor wavelets to filter and map segments of the iris into hundreds of vectors (known here as phases)”.the 2-D

Gabor phasor is simply the “what” and “where” of the image. Even after applying the algorithms to the iris image there are still 173 degrees of freedom to identify the iris. These algorithms also take into account the changes that can occur with an iris, for example the pupil’s expansion and contraction in response to light will stretch and skew the iris. This information is used to produce what is known as the Iris Code, which is a 512-byte record. This record is then stored in a database for future comparison. When a comparison is required the same process is followed but instead of storing the record it is compared to all the Iris Code records stored in the database. The comparison also doesn’t actually compare the image of the iris but rather compares the hexadecimal value produced after the algorithms have been applied. In order to compare the stored Iris Code record with an image just scanned, a calculation of the Leventine Distance is required. The Leventine Distance is a measure of the variation between the Iris Code record for the current iris and the Iris Code records stored in the database. Each of the 2048 bits is compared against each other, i.e. bit 1 from the current Iris Code and bit 1 from the stored Iris Code record are compared, then bit 2 and so on. Any bits that don’t match are assigned a value of one and bits that do match a value of zero.

3. IRIS RECOGNITION TECHNIQUES USED

A. Iris Localization

Both the inner boundary and the outer boundary of a typical iris can be taken as circles. But the two circles are usually not co-centric. Compared with the other part of the eye, the iris is more difficult to detect because of the low contrast between the two sides of the boundary. We detect the outer boundary by maximizing changes of the perimeter-normalized along the circle. The technique is found to be efficient and effective.



“Figure-5” IRIS Localization

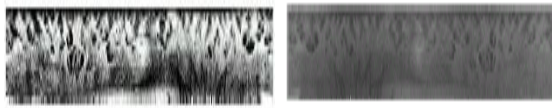
B. Iris Normalization-

The size of the pupil may change due to the variation of the illumination and the associated elastic deformations in the iris texture may interface with the results of pattern matching. For the purpose of accurate texture analysis, it is necessary to compensate this deformation. Since both the inner and outer boundaries of the iris have been detected, it is easy to map the iris ring to a rectangular block of texture of a fixed size.

C. Image Enhancement-

The original image has low contrast and may have non-uniform illumination caused by the position of the light source. These may impair the result of the texture analysis. We enhance the iris image reduce the effect of non-uniform illumination The enhancement consist of Sharpening the picture with a sharpening mass Reducing the effect of non-

uniform illumination with local histogram equalization. It is necessary to enhance the image to be able to extract the iris patterns later.



(a) Texture image (b) Texture image

“Figure-6” Image Enhancement.

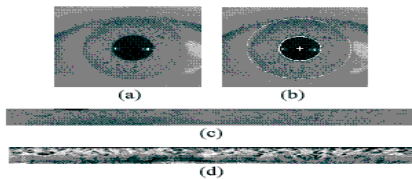
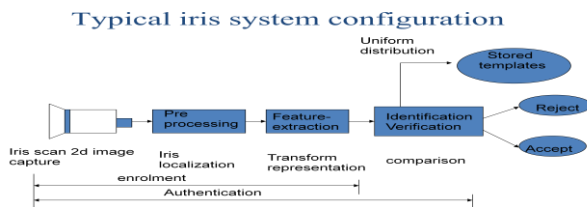


Figure-7” Iris Preprocessing

- Iris preprocessing:
 - (a)Original eye
 - (b) Iris Localization
 - (C) Iris Normalization
 - (d) Iris Enhancement

4. TYPICAL IRIS SYSTEM CONFIGURATION



“Figure-8” Iris System Configuration.

5. CREATING AN IRIS CODE

The picture of eye first is processed by software that localizes the inner and outer boundaries of the iris. And it is encoded by image-processing technologies. To construct the iris code, 2D Gabor filters are used. The iris code has a length of 256 bytes (2048 bits). A very important aspect of the iris coding is to achieve commensurability among the iris codes. This is done by mapping all irises into a representation having universal format and constant length, regardless of the apparent amount of iris detail. An important property of the iris recognition system, is that there are independent variation in iris detail, both within a given iris and as well across the human population. There have been identified about 250 degrees of freedom in the iris, and the iris code is very close to a maximum entropy code ($P_{state} = 1/\#states$). The difference between iris codes are measured in by the Levensting Distance (LD).

6. APPLICATIONS

National border controls: The iris as a living passport, **Computer login:** the iris as a living password, **Cell phone and other wireless-device-based authentication,** Secure access to bank accounts at cash machines, **Ticketless travel;** authentication of rights to services, premises access control(home,office,laboratory,etc), **Driving licenses;** other personal certificates, Entitlements and benefits authorization, **Forensics;** birth certificates; tracing missing or wanted persons, credit-card authentication, Automobile ignition and unlocking; anti-theft devices

7. LEVENSHTTEIN DISTANCE

In information theory and computer science, the **Levenshtein distance** is a metric for measuring the amount of difference between two sequences (i.e. an edit distance). The term **edit distance** is often used to refer specifically to Levenshtein distance.

The Levenshtein distance between two strings is defined as the minimum number of edits needed to transform one string into the other, with the allowable edit operations being insertion, deletion, or substitution of a single character. It is named after Vladimir Levenshtein, who considered this distance in 1965

Example

For example, the Levenshtein distance between "kitten" and "sitting" is 3, since the following three edits change one into the other, and there is no way to do it with fewer than three edits:

1. kitten → sitten (substitution of 's' for 'k')
2. sitten → sittin (substitution of 'i' for 'e')
3. sittin → sitting (insertion of 'g' at the end).

8. GABOR WAVELET

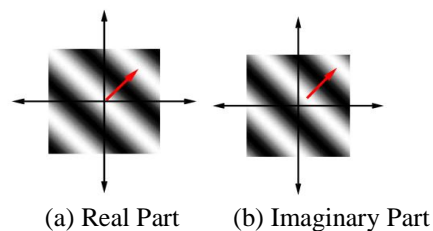
To understand the concept of Gabor filtering, we must start with Gabor wavelets. Gabor wavelets are formed from two components, a complex sinusoidal carrier and a Gaussian envelope.

$$g(x, y) = s(x, y)wr(x, y)$$

The complex carrier takes the form:

$$s(x, y) = e^{j(2_{-}(u0x+v0y)+P)}$$

We can visualize the real and imaginary parts of this function separately as shown in this figure-



“ Figure-9 “gabore wavelet

A. IRIS ADVANTAGES :

The iris of the eye has been described as the ideal part of the human body for biometric identification for several reasons:[1]It is an internal organ that is well protected against damage and wear by a highly transparent and sensitive membrane (the cornea). This distinguishes it from fingerprints, which can be difficult to recognize after years of certain types of manual labor.[2]The iris is mostly flat, and its geometric configuration is only controlled by two

complementary muscles (the sphincter papillae and dilator papillae) that control the diameter of the pupil. This makes the iris shape far more predictable than, for instance, that of the face.[3]The iris has a fine texture that—like fingerprints—is determined randomly during embryonic gestation. Like the fingerprint, it is very hard (if not impossible) to prove that the iris is unique. However, there are so many factors that go into the formation of these textures (the iris and fingerprint) that the chance of false matches for either is extremely low. Even genetically identical individuals have completely independent iris textures.[4]An iris scan is similar to taking a photograph and can be performed from about 10 cm to a few meters away. There is no need for the person being identified to touch any equipment that has recently been touched by a stranger, thereby eliminating an objection that has been raised in some cultures against fingerprint scanners, where a finger has to touch a surface, or retinal

B. IRIS DISADVANTAGES:

[1]Generally, we use infrared rays to scan the iris of a person. Now consider a case that a person is going in and out of the premises every day. Now he is in a situation that more amounts of IR rays fall in his eye if he works on the premises for a long period. There are possibilities that his eye may get damaged due to the passage of infrared rays and some optical diseases may affect him. This is the main disadvantage of iris technology.[2]. Another disadvantage can be explained considering the two types of death. When people is dead by his brain and within the period of the somatic death, if he is sent into scan, both iris and the fingerprints of him matches and he is automatically accessed. It is obvious that machines can't identify human physiology.

9. CONCLUSION

- A. We have discuss novel iris recognition technique that minimizes false identification rates. The iris is the most unique, data rich physical structure on the human body, and is, with its 250 degrees of freedom, considered to be one of the most robust ways to identify humans.
- B. The properties of the iris that enhance its suitability for use in automatic identification includes:

- Natural protection from external environment
- Impossibility of surgically modifying without the risk of vision.
- Ease of registering image at some distance

10. REFERENCES

- [1]. Ioan Climent, Juan Diego Blanco, Roberto A Hexcel (Approximate String matching for Iris recognition by means of boosted Gabor Wavelet" *IEEE Trans on Systems, 2010 23rd SIBGRAP*
- [2] J. L. Wayman, A. K. Jain, D. Maltoni, and D. M. (Eds.), *Biometric Systems*. Springer-Verlag, 2005, isbn 978-1-85233-596-0.46
- [3]. J. G. Daugman, "High confidence visual recognition of persons by a test of statistical independence," *IEEE Trans on Pattern Analysis and Machine Intelligence*, vol. 15, no. 11, pp. 1148–1161, 1993.
- [4]. "New methods in iris recognition," *IEEE Trans on Systems, Man and Cybernetics, part B: Cybernetics*, vol. 37,
- [5]. R. P. Wildes, "Iris recognition: An emerging biometric technology," *Proc of the IEEE*, vol. 85, no. 9, pp. 1348–1363, Sep. 1997.
- [6]. W. W. Boles and B. Boashash, "A human identification technique using images of the iris and wavelet transform," *IEEE Trans on Signal Processing*, vol. 46, no. 4, pp. 1185–1188, Apr. 1998.
- [7] L. Ma, Y. Wang, and T. Tan, "Iris recognition using circular symmetric filters," in *Int Conf on Pattern Recognition (ICPR'02)*, vol. 2, 2002, pp. 414–417.
- [8]. L. Ma, T. Tan, Y. Wang, and D. Zhang, "Efficient iris recognition by characterizing key local variations," *IEEE Trans on Image Processing*, vol. 13, no. 6, pp. 739–750, Jun. 2004.