BIOMETRIC IDENTIFICATION BY USING IRIS RECOGNITION

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Abstract—Iris recognition is a rapidly expanding method of biometric authendication that uses pattern-recognition techniques on images of irides to uniquely identify an individual. Algorithms produced by professor john daugman have proven to be increasingly accurate and realible after over 200 billion comparisons. The aim of this group project is to implement a working prototype of the techniques and methods used for iris recognition, and to test these methods on a database of irides provided by the Chinese academy of science'(CASIA), which consists of 756 images of irides from 108 individuals.

Keywords: iris recognition, biometric identification, pattern recognition, automatic segmentation.

INTRODUCTION

Security and the authendication of individuals is necessary for many different areas of our lives, with most people having to authendicate their identity on a daily basis; examples include ATMs, secure access to buildings, and international travel. Biometric identification provides a valid alternative to traditional authendication mechanisms such as ID cards and passwords, whilst overcoming many of the shortfalls of these methods; it is possible to identify an individual based on \who they are" rather than \what they possess" or \what they remember".iris recognition is a particular type of biometric system that can be used to reliably identify a person by analyzing the patterns found in the iris. The iris is so reliable as a form of identification identification because of the uniqueness of its pattern. Although there is a genetic inuence, particularly on the iris' colour, the iris develops through folding of the tissue membrane and then degeneration (to create the pupil opening) which results in a random and unique iris. In comparison to other visual recognition techniques, the iris has a great advantage in that there is huge variability of the pattern between individuals, meaning that large databases can be searched without sending any false matches. This means that iris can be used to identify individuals rather than just confirm their given identity; a property that would be useful in situation such as border control, where it might be important to not just show that an individual is not who they say they are but also to show exactly who they are. The objective of this project was to produce a working prototype program that functions as an iris recognition tool using the algorithms described by Professor John Daugman and other techniques in order to implement this in an accurate and useful way that is also user-friendly. Commercial iris recognition systems are available that implement similar algorithms to these; Iris is the focus of a relatively new means of biometric identification. The iris is called the living password because of its unique, random features. It is always with you and cannot be stolen or faked. The iris of each eye is absolutely unique. The probability that any two irises could be alike is one in 10 to 78^{th} power AC the entire human population of the earthis roughly 5.8 billion. So no two irises are alike in their details, even among identical twins. Even the left and right irises of a single person seem to be highly distinct. Every iris has a highly detailed and unique texture that remains stable over decades of life. Because of the texture, physiological nature and random Generation of

an iris artificial duplication is virtually impossible. The properties of the iris that enhance its suitability for use in high confidence identification system are those following.

1. Extremely data rich physical structure about 400 identifying features
2. Genetic independence no two eyes are the same.
3. Stability over time.
4. Its inherent isolation and protection from the external environment.
5. The impossibility of surgically modifying it without unacceptable risk to vision.
6. Its physiological response to light, which provides one of several natural tests against artifice.
7. The ease of registering its image at some distance forms a subject without physical contact. unobtrusively and perhaps inconspicuously
8. It intrinsic polar geometry which imparts a natural co-ordinate system and an origin of co-ordinates
9. The high levels of randomness in it pattern inter subject variability spanning 244 degrees of freedom - and an entropy of 32 bits square million of iris tissue.

LITERATURE SURVEY

In 1997 Richard P. Wildes presented the paper “Iris recognition: An emerging biometric technology” in which he introduced the polar to rectangular method. The same method was used by John Daugmann in 2004.

In 2004 R. W. Ives and D. M. Etter implemented iris recognition using histogram analysis. The pre-processing methods were not implemented and further processing of database was required.

In 2010 H.A. Hashish and M. A. Mohamed verified the uniqueness of iris.

In 2004 R. W. Ives, A. J. Guidry and D. M. Etter used histogram analysis for iris recognition.

In 2008 R. W. Ives, R. P. Broussard, L. R. Kennell, R. N. Rakvic and D. M. Etter implemented iris recognition using Ridge Energy Direction (RED) algorithm.

Ryan N.Rakvie, Hau Ngo, Randy P. Broussard, Robert W. Ives used the same algorithm for comparing an FPGA to a cell for an image processing application. In the same year R. N. Rakvic, Bradley J. Ulis, R. P. Broussard and R. W. Ives used the RED algorithm for template generation with parallel logic.

In 2009 R. N. Rakvic, Bradley J. Ulis, Randy P. Broussard, R. W. Ives and Nell Steiner used RED algorithm for paralleling iris recognition. In 2009 R. N. Rakvic, Hau Ngo, R. P. Broussard, R. W. Ives used the RED algorithm for Image processing application. Bradley J. Ulis, R. P. Broussard, R. N. Rakvic, R. W. Ives, Neil Steiner, Hau Ngo used the algorithm for hardware based segmentation in iris recognition and authentication system.

In 2010 G. Annapoorani, R. Krishnamoorthi, P. Gifty Jeya, S. Pethiammal gave a method for accurate and fast segmentation method.

WHY IRIS RECOGNITION

- High degree of Randomness
- No two Iris are alike – no two humans have same iris even one just have different iris in both eyes.
- Stable in a persons life.
- Doesn't vary with changes.
- Easy to capture.
- Do not depend upon genetic material.
- No contact with sensing device.

Basically there are Two Types of Biometric Features

i) Physical like (biological) figure prints, facial characteristics, hand shape and iris recognition.
ii) Behavioral biometric like voice recognition, signature recognition. Among these two methods physical biometric has more secure & accurate than the behavioral method.

It can be shown by the following tree diagram:-

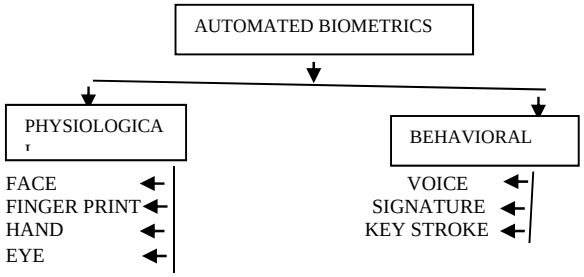

Fig.1.1.1: Classification of Biometrics

The biometric features are highly unique, stable, and easy to captured & secure one. The iris is commonly recognized as one of the most reliable biometric measures. It has a random morphogenesis & no genetic penetrance. In 1987, Flom & Safir studied the problem & concluded that iris morphology remains stable throughout human life & also estimated the probability of the existence of two similar irises on distinct persons at 1 in 10^{72}. This prove the uniqueness of iris information he iris information can be captured without any physical contact with the sensing devices which is required for sensing devices which is required for recognition of finger print hand shape, handwritten signature. Iris recognition has high accuracy reliable & confidential. It has ability to handle very large a population at high speed unique is one of the most important salient features of iris systems.

Characteristics of Biometric Features

- ***Universality:*** Every person should have the characteristic. People who are mute or without a fingerprint will need to be accommodated in some way.
- ***Uniqueness:*** Generally, no two people have identical characteristics. However, id entical twins are hard to distinguish.
- ***Permanence:*** The characteristics should not vary with time. A person's face, for example, may change with age.
- ***Collectibility:*** The characteristics must be easily collectible and measurable.
- ***Performance:*** The method must deliver accurate results under varied environmental circumstances.
- ***Acceptability:*** The general public must accept the sample collection routines. Nonintrusive methods are more acceptable.
- ***Circumvention:*** The technology should be difficult to deceive.

Biological Description:

The iris is protected internal organ of the eye, located behind the cornea and the aqueous humour, but in front of the lens. The human iris begins to from during the third month of gestation. The structure is complete by the eight month of gestation, but pigmentation continues into the first year after birth. It is stable, reliable and is unrelated to health or the environment. The iris grows from the ciliary body and its colour is given by the amount of pigment and by the density of the iris tissue that means from blue to black. The most important function of the iris is controlling the size of the pupil. Illumination, which enters the pupil and falls on the retina of the eye, is controlled by muscles in the iris. They regulate the size of the pupil and this is what permits the iris to control the amount of light entering the pupil. The change in the size results from from involuntary reflexes and is not under conscious control. The tissue of the iris is soft and loosely woven and it is called as STROMA.

The word IRIS dates from classical times (a rainbow). The iris is a Protective internal organ of the eye. It is easily visible from yards away as a colored disk, behind the clear protective window of the cornea, surrounded by the white tissue of the eye. It is the only internal organ of the body normally visible externally. It is a thin diaphragm stretching across the anterior portion of the eye and supported by lens. This support gives it the shape of a truncated cone in three dimensions. At its base the eye is attached to the eye's ciliary body. At the opposite end it opens into a pupil. The cornea and the aqueous humor in front of the iris protect it from scratches and dirt, the iris is installed in its own casing.

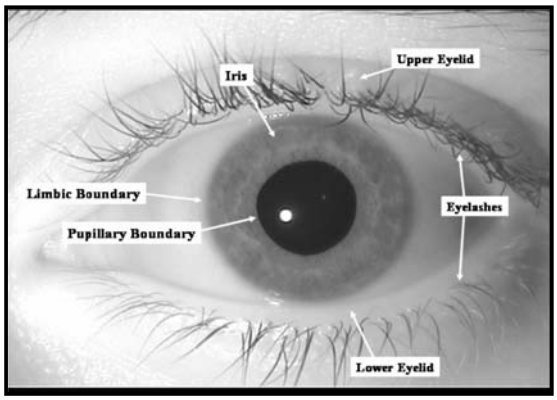

Figure 1.1.2.a: Diagram of eye.

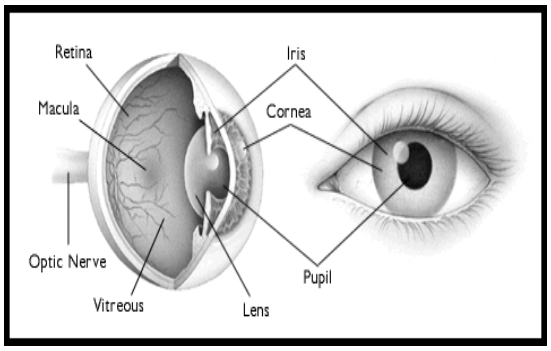

Figure 1.1.2.b: Comparison of internal and external human eye.

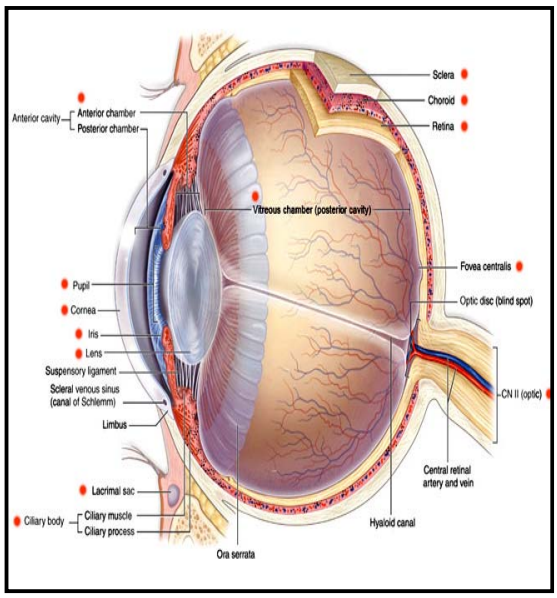

Figure 1.1.2.c: Detail diagram of eye.

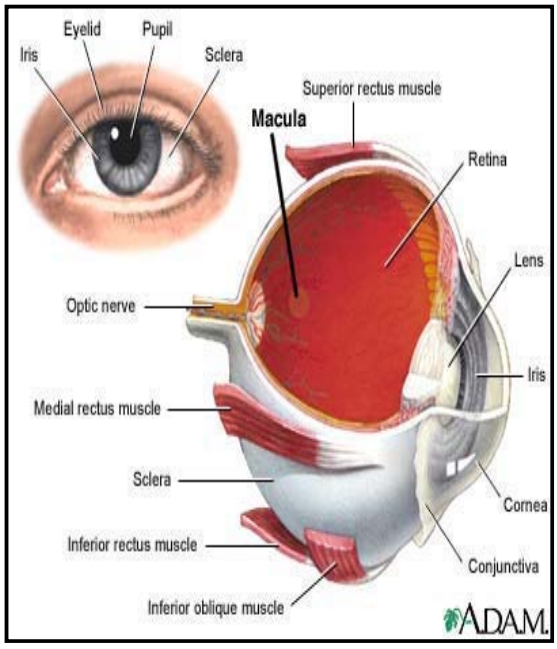

Figure 1.1.2.d: Section of eye.

The iris is composed of several layers. Its posterior surface consists of heavily pigmented epithelial cells that make it light tight (i.e., impenetrable by light). Anterior to this layer are two cooperative muscles for controlling the pupil. Next is the stromal layer, consisting of collagenous connective tissue in arch-like processes. Coursing through this layer are radially arranged corkscrew like blood vessels. The most anterior layer is the anterior border layer, differing from the stroma in being more densely packed, especially with individual pigment cells called chromataphores. The visual appearance of the iris is a direct result of its multilayered structure. The anterior surface of the iris is seen to be divided into a central pupillary zone and a surrounding cilliary zone. The border of these two areas is termed the collarette; it appears as a zigzag circumferential ridge resulting as the anterior border layer ends abruptly near the pupil. The cilliary zone contains many interlacing ridges resulting from stromal support. Contractile lines here can vary with the state of the pupil.

Last, iris color results from the differential absorption of light impinging on the pigmented cells in the anterior border layer. When there is little pigmentation in the anterior border layer, light reflects back from the posterior epithelium and is scattered as it passes through the stroma to yield a blue appearance. Progressive levels of anterior pigmentation lead to darker colored irises.

Due to epigenetic nature of iris patterns each and every individual has a unique iris compared to other biometrics features. Even the two eyes of an individual contain completely independent iris patterns, and identical twins posses uncorrelated iris patterns.

RELEVANCE

As the iris is unique, stable, universal, circumvention and acceptable hence we have used it as compare to other bio-metric features. For iris recognition RED algorithm is used. The same algorithm was used by R. W. Ives, R. P. Broussard, L. R. Kennell, R. N. Rakvic and D. M. Etter in 2008 as well as for parallel iris recognition and image processing applications. The rubber sheet model was also used by John Daugmann for polar to rectangular conversion in 2004.

PROJECT UNDERTAKEN

We are going to use iris recognition due to its various characteristics as stated in section 1.1.2 for this the image is downloaded and applied to

the pre-processing stage. Segmentation is carried out and the features are extracted from the iris image using RED algorithm. These templates are match using hamming distance and if the template is matched the person can further access the secured system.

Objectives:

- Captured the image.
- Carried out pre-processing stages.
- After pre-processing segmentation process is carried out i.e. separate the pupil from the image.
- Extraction the feature from iris using RED algorithm.
- Template are created and matched with the stored one using Hamming distance.
- If the template is match than the person can further access the authenticated system for this Xbee technology is used.

APPLICATION

Iris-based identification and verification technology has gained acceptance in a number of different areas. Application of iris recognition technology can be limited only by imagination. The important applications are those following:

- **ATM's and Iris Recognition:** In U.S many banks incorporated iris recognition technology into ATM's for the purpose of controlling access to one's bank accounts. After enrolling once (a "30 second" process), the customer need only approach the ATM, follow the instruction to look at the camera, and be recognized within 2-4 seconds. The benefits of such a system are that the customer who chooses to use bank's ATM with iris recognition will have a quicker, more secure transaction.
- **Tracking Prisoner Movement:** The exceptionally high levels of accuracy provided by iris recognition technology broadens its applicability in high risk, high-security installations. Iris scan has implemented their devices with great success in prisons in Pennsylvania and Florida. By this any prison transfer or release is authorized through biometric identification. Such devices greatly ease logistical and staffing problems.
- **Computer login:** The iris as a living password.
- **National Border Controls:** The iris as a living password.
- Telephone call charging without cash, card or PIN numbers.
- Ticket less air travel.
- Premises access control (home, office, laboratory etc.)
- Driving licenses and other personal certificates.
- Entitlements and benefits authentication.
- Forensics, birth certificates, tracking missing or wanted person.
- Credit-card authentication.
- Automobile ignition and unlocking; anti-theft devices.
  Anti-terrorism (e.g.:- suspect screening at airports)
- Secure financial transaction (e-commerce, banking)

CONCLUSION AND FUTURE WORK

In this work a new neural network method is presented for iris identification. A template is achieved using Image processing techniques. Classification is mainly done by LAMSTAR neural network. Structure of this network makes it a good candidate for classifying. The software code for image processing and the network has been written in MATLAB R2014a taking into account image processing toolbox and the fact that it is very user friendly in image processing application After reprocessing step all template matrix are saved and in the next step they are loaded as input to classifier. Overall result suggests that normalized LAMSTAR increase efficiency and convergence time. The next step for increasing efficiency is considering rotational inconsistency. Also it seems that having a matrix with 480 columns is not reasonable so reducing its size can be helpful especially for reducing memory that is needed for running for database with more image. In comparison with other methods the performance of Normalized LAMSTAR seems to be better and convergence time is pretty much faster than method based on other network such as Back Propagation. Also stability and not being sensitive to initialization are other positive points of using LAMSTAR. Ability to dealing with incomplete and fuzzy input data sets make LAMSTAR neural network an effective candidate for problems such as Iris classification purpose.

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