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# REVIEW ON ENHANCING IRIS BASED SECURITY SYSTEM USING EDGE DETECTION MECHANISM

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## Abstract

In principle, the processing of personal data involving the use of a biometric system is considered by privacy experts to be only justified in places demanding a high level of security and strict identification procedures. Biometrics is the technology of identifying uniquely human subjects by means of measuring and analyzing one or more intrinsic behavioral or physical traits. These human body characteristics include fingerprints, voice patterns, eye retinas and irises, facial patterns and hand measurements. Biometric systems include applications making use of biometric technologies and which allow the identification automatically, verification or authentication of a natural person. In this research we have discussed Iris Recognition Technology using edge detection mechanism.

**Keyword**—Iris recognition, Biometrics, Edge detection, Signal System, Image, Image Segmentation, localization.

## I. Iris Recognition Technology

The iris-scan process begins with a photograph. A specialized camera, typically very close to the subject, not more than three feet, uses an infrared imager to illuminate the eye and capture a very high-resolution photograph. This process takes 1 to 2 seconds.

**Iris recognition** is an automated method of biometric identification that uses mathematical pattern-recognition techniques on video images of one or both of the irises of an individual's eyes, whose complex random patterns are unique, stable, and can be seen from some distance.

Not to be confused with other, less prevalent, ocular-based biometric technologies such as retina scanning, iris recognition uses video camera technology with subtle near infrared illumination to acquire images of the detail-rich, intricate structures of the iris which are visible externally. Digital templates encoded from these patterns by mathematical and statistical algorithms allow the identification of an individual or someone pretending to be that individual. Databases of enrolled templates are searched by matcher engines at speeds measured in the millions of templates per second per (single-core) CPU, and with remarkably low false match rates.

Several hundred millions of persons in several countries around the world have been enrolled in iris recognition systems, for convenience purposes such as passport-free automated border-crossings, and some national ID systems based on this technology are being deployed. A key advantage of iris recognition, besides its speed of matching and its extreme resistance to false matches, is the stability of the iris as an internal and protected, yet externally visible organ of the eye.

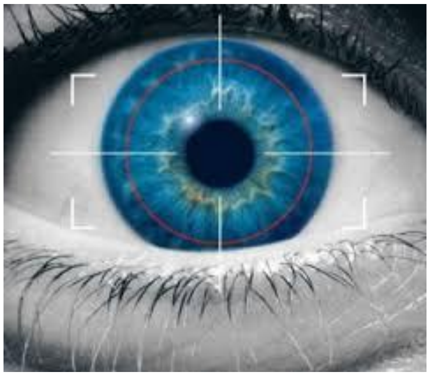

Fig 1: Human eye

**Iris as a powerful identifier**

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 78th power the entire human population of the earth is 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.

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.

Iris recognition is a biometric recognition technology that utilizes pattern recognition techniques on the basis of iris high quality images. Since in comparison with other features utilized in biometric systems, iris patterns are more stable and reliable, iris recognition is known as one of the most outstanding biometric technologies. Iris images could be taken from humans eyes free from such limitations as frontal image acquisition and special illumination circumstances. Daugman's and Wildes' systems are the two earliest and most famous iris recognition systems including all iris recognition stages.

In Daugman's algorithm, two circles which are not necessarily concentrated form the pattern. Each circle is defined by three parameters (x0, y0, r) in a way that (x0, y0) determines the center of a circle with the radius of r. An integro-differential operator is used to estimate the values of the three parameters for each circular boundary and the whole image is searched in relation to the increment of radius r. In Wildes' system, gradient based Hough transform has been used to localize two iris circular boundaries. This system consists of two stages. At first, a binary map is produced from image edges by a Gaussian filter. Then, the analysis is performed in a circular Hough space in order to estimate the three parameters (x0, y0, r) for a circle.
In segmentation step of the algorithm proposed in, a set of one-dimensional signals is extracted from iris image using the values of illumination intensity on a set of pupil centered circular contours which have been localized through use of edge detection techniques. In iris images are projected vertically and horizontally to estimate the center of the iris. Also, this method has been utilized for eyelash segmentation and lightening reflection removal in. The algorithm proposed in predicts the optimization of iris biometric system on a bigger set of data on the basis of Gaussian model obtained from a smaller set of data. Also, an iris recognition system has been proposed in which is used for frontal iris images and for an iris image which is not taken from frontal view.
When frontal iris image is not available for a particular individual, in this system the issue is considered through maximizing Hamming distance between the two mentioned images or through minimizing Daugman's integro- differential operator. Next, the image is transformed to a frontal image. An algorithm is presented to find eyelash and eyelids occlusions on iris in a completely close up image similar to Daugman's method in. In 3D environment, this algorithm searches for three parameters as with (x, y) in center and radius of z.

**Major characteristics of iris recognition**

- Iris is thin membrane on the interior of the eyeball.
- Iris pattern remains unchanged after the age of two and does not degrade overtime or with the environment.
- Iris patterns are extremely complex than other biometric patterns

**Typical iris system configuration for taking a picture**

- An iris recognition camera takes a black and white picture from 5 to 24 inches away.
- The camera uses non-invasive, near-infrared illumination that is barely visible and very safe.
- And this iris recognition cannot take place without the person permission

## II. Literature Review

The concept of using iris pattern for identification was first proposed by Ophthalmologist Frank Burch in 1936 (Iradian Technologies, 2003). During 1960, the first semi-automatic face recognition system was developed by Woodrow W. Bledsoe, which used the location of eyes, ears, nose and mouth on the photographs for recognition purposes. In the same year, the first model of acoustic speech production was creased by a Swedish Professor, Gunnar Fant. His invention is used in today's speaker recognition system (Woodward et al, 2003).

The first automated signature recognition system was developed by North American Aviation during 1965 (Mauceri, 1965). This technique was later, in 1969, used by Federal Bureau of Investigation (FBI) in their investigations to reduce man hours invested in the analysis of signatures. The year 1970 introduced face recognition towards authentication. Goldstein et al.(1971) used 21 specific markers such as hair color, lip thickness to automate the recognition process. The main disadvantage of such a system was that all these features were manually identified and computed.

During the same period, Dr.Joseph Perkell produced the first behavioral components of speech to identify a person (Woodwardet al, 2003). The first commercial hand geometry system was made available in 1974 for physical access control, time and attendance and personal identification. The success of this first biometric automated system motivated several funding agencies like FBI Fund, NIST for the development of scanners and feature extraction technology (Ratha and Bolle, 2004), which will finally lead to the development of a perfect human recognizer. This resulted in the first prototype of speaker recognition system in 1976, which was developed by Texas instruments and was tested by US Air Force and the MITRE Corporation. In 1996, the hand geometry was implemented successfully at the Olympic Games and the system implemented was able to handle the enrollment of over 65,000 people.

Drs. Leonard Flom and Aran Safir, in 1985, found out that no two irises are alike and their findings were awarded a patent during 1986.

Philip L. Worthington (2002) has proposed enhanced canny edge detection using curvature consistency. “Edges are often considered as primary image artifacts for extraction by low-level processing techniques, and the starting point for many computer vision techniques. As a result, reliable edge detection has long been a research goal. This author has described initial investigations into recovering reliable edges using curvature models. Canny’s edge detector has been enhanced by adjusting the gradient finding the zero crossings in those directions”.

The first statewide automated palm print database was deployed by the US in 2004. The Face Recognition Grand Challenge (FRGC) began in the same year to improve the identification problem. In 2005, Iris on the move was announced by Biometric Consortium Conference for enabling the collection of iris images from individuals walking through a portal.

## III. Image processing operations

The Image Processing Toolbox is a collection of functions that extend the capability of the MATLAB ® numeric computing environment. The toolbox supports a wide range of image processing operations, including:

1. Geometric operations
2. Neighborhood and block operations
3. Linear filtering and filter design
4. Transforms
5. Image analysis and enhancement
6. Binary image operations
7. Region of interest operations

Many of the toolbox functions are MATLAB M-files, series of MATLAB statements that implement specialized image processing algorithms. You can view the MATLAB code for these functions using the statement:

```
type function_name
```

You can extend the capabilities of the Image Processing Toolbox by writing your own M-files, or by using the toolbox in combination with with other toolboxes, such as the Signal Processing Toolbox and the Wavelet Toolbox.

## IV. Image processing MATLAB and the Image Processing Toolbox

The basic data structure in MATLAB is the array, an ordered set of real or complex elements. This object is naturally suited to the representation of images, real-valued, ordered sets of color or intensity data. (MATLAB does not support complex-valued images.)

MATLAB stores most images as two-dimensional arrays (i.e., matrices), in which each element of the matrix corresponds to a single pixel in the displayed image. (Pixel is derived from picture element and usually denotes a single dot on a computer display.) For example, an image composed of 200 rows and 300 columns of different colored dots would be stored in MATLAB as a 200-by-300 matrix. This convention makes working with images in MATLAB similar to working with any other type of matrix data, and makes the full power of MATLAB available for image processing applications. For example, you can

select a single pixel from an image matrix using normal matrix subscripting:
I(2,15)
This command returns the value of the pixel at row 2, column 15 of the image I.
There are many methods for edge detection, but most of them can be grouped into two categories, search-based and zero-crossing based. The search-based methods detect edges by first computing a measure of edge strength, usually a first-order derivative expression such as the gradient magnitude, and then searching for local directional maxima of the gradient magnitude using a computed estimate of the local orientation of the edge, usually the gradient direction. The zero-crossing based methods search for zero crossings in a second-order derivative expression computed from the image in order to find edges, usually the zero-crossings of the Laplacian or the zero-crossings of a non-linear differential expression. As a pre-processing step to edge detection, a smoothing stage, typically Gaussian smoothing, is almost always applied (see also noise reduction).
The edge detection methods that have been published mainly differ in the types of smoothing filters that are applied and the way the measures of edge strength are computed. As many edge detection methods rely on the computation of image gradients, they also differ in the types of filters used for computing gradient estimates in the x- and y-directions.

## V. Benefits

In addition to being used for security systems, authorities have found a number of other applications for iris recognition systems.
Iris-based identification & verification technology has gained acceptance within a number of different areas. Application of iris recognition technology could he limited only by imagination. The important applications are those following: ATM & iris recognition: within U.S many banks incorporated iris recognition technology into ATM for purpose of controlling access to one bank accounts. After enrolling once (a 30 second process), customer need only approach ATM, follow instruction to look at camera, & be recognized within 2-4 seconds. The benefits of such a system are that customer who chooses to use bank ATM with iris recognition would have a quicker, more secure transaction. Tracking Prisoner Movement: The exceptionally high levels of accuracy provided by iris recognition technology broadens its applicability within high risk, high-security installations. Iris scan has implemented their devices with great success within prisons within Pennsylvania & Florida. By this any prison transfer / release is authorized through biometric identification. Such devices greatly ease logistical & staffing problems. Applications of this type are well suited to iris recognition technology. First, being fairly large, iris recognition physical security devices are easily integrated into mountable, sturdy apparatuses needed / access control, The technology phenomenal accuracy could be relied upon to prevent unauthorized release / transfer & to identify repeat offenders re-entering prison under a different individuality. Computer login: The iris as a living password.

## VI. . Scope and Conclusion

Biometrics-based authentication clearly has advantages over these mechanisms, but there are also vulnerabilities that need to be addressed. No biometric trait can be applied universally, it may be a good choice for a given application, but unfeasible in another.
Significant progress has been made recently in the capabilities of biometric sensors, algorithms and procedures. Due to the availability of ever-increasing processing power at low cost, the accuracy of biometric systems has improved to a degree which in some scenarios may exceed the recognition accuracy of humans. In addition, sensors have decreased in size, allowing biometric applications to increasingly appear on mobile devices, which could outsource the processing-intensive parts of biometric recognition to the cloud. Scientific and technical challenges remain in achieving accuracy in recognition under uncontrolled illumination and environment conditions and in the recognition of moving objects.
Since biometrics rely on highly sensitive personal information, the handling of biometric information needs to be given special attention and protective measures need to be put in place to safeguard privacy and avoid compromise of biometric data.

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