

## Noisy Iris Recognition & Its Importance

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### Abstract

In today's sensitive environment, there are so many biometric technologies including iris recognition are available for person authentication and are coming of age due to the need to address sensitive security concerns in the 21<sup>st</sup> century. But, the single biometrics technique is not adequate for person identity recognition due to both insufficiently accurate and user-acceptable for universal application. When capturing an iris image under unconstrained conditions and without user cooperation, the image quality can be highly degraded by poor focus, off-angle view, motion blur, specular reflection (SR), and other artifacts. The noisy iris images increase the intra-individual variations, thus markedly degrading recognition accuracy. To overcome these problems, there are various iris recognition algorithms for noisy iris images. This paper is organized as follows. Part 1 discusses introduction & the technology of iris recognition; Part 2 and Part 3 discusses the application areas; and advantages of iris recognition for personal authentication; Part 4 discusses the importance of noisy iris recognition

*Key words* : Biometric technologies, noisy iris recognition

### 1. Introduction

Person authentication has always been an attractive goal in computer vision. It involves confirming / accepting proof of identity given by a credible person who has evidence on the said identity. Authentication systems based on human characteristics such as face, finger, iris, voice are known as Biometric

Systems. Biometrics includes fingerprints, facial features, retina, iris, voice, gait, fingerprint, palm-prints, handwritten signatures and hand geometry. Among the various traits, Iris recognition has attracted a lot of attention because it has various advantageous factors like greater speed, simplicity and accuracy compared to other biometric traits.

Iris recognition is a method of identifying

people based on unique patterns within the ring-shaped region surrounding the pupil of the eye. It is used to identify individuals by photographing the iris of their eye. The iris usually has a brown, blue, gray, or greenish color, with complex patterns that are visible upon close inspection. Iris recognition technology has become popular in security applications because of its ease of use, accuracy, and safety. Its most common use is controlling access to high-security areas.

In Iris recognition technology, the identification process is carried out by gathering

one or more detailed images of the eye with a sophisticated, high-resolution digital camera. It is capable of recording this image from as much as 16 inches (40.64 centimeters) away, so no physical contact is necessary. After fetching the image from digital camera; specialized computer software will be used to compare the subject's iris pattern with images stored in a database. The software can compare millions of images per second with a level of precision comparable to conventional fingerprinting or digital finger scanning and confirm someone's identity or authentication within a few seconds [Figure 1].

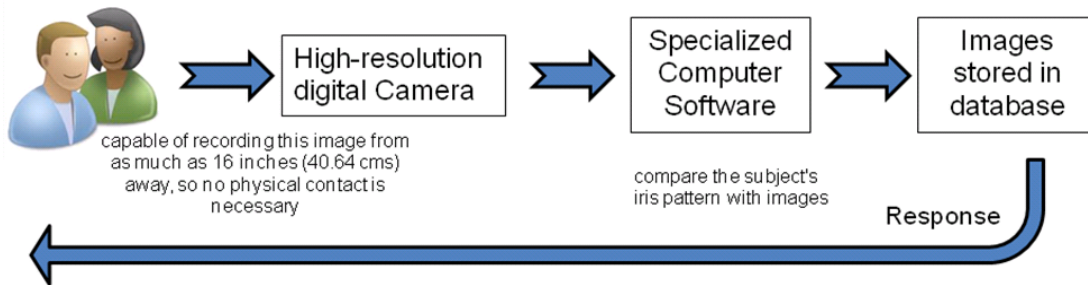


Figure 1. Identification Process of Iris Recognition Technology

Iris is distinct for every person, even the twins have different iris patterns and it remains same for whole of the life. Thus this technology is now considered as providing positive identification of an individual without contact and at very high confidence levels. The word Iris is most likely derived from the Latin word for rainbow. It appears that the term was first applied in the sixteenth century, making reference to this multicoloured portion of the eye<sup>10</sup>.

The iris itself extends out in front of the lens, forming a circular array, with a variable

opening in the center, otherwise known as the pupil<sup>3</sup>. The pupil is not located exactly in the center of the iris, but rather slightly nasally and inferiorly<sup>1</sup>. The visual appearance of the iris is directly related to its multi-layered construction. The iris has been found to be incredibly unique from person to person, in both color and structure. In fact, it has been discovered by both ophthalmologists and anatomists, examining large numbers of eyes, that even the left and right eye of an individual exhibit differences in their iris pattern. Also, the patterns appear to vary little after childhood. Developmental biology further suggests that, while the general

structure of the iris is genetically determined, the particular aspects of its details are dependent upon circumstance, like the conditions in the embryonic precursor to the iris. Developmental biology also supports the lack of variance through life idea, noting that the iris is most fully developed and grows little after childhood. However, once out of the teenage years, it is likely a person's iris variations will likely remain the same for the rest of their life. Thus there is enormous interest in utilizing iris variation in a biometric system.

## 2. Application Areas:

- *AADHAR*, India's UID project uses Iris scan along with fingerprints to uniquely identify people and allocate a Unique Identification Number.
- *United Arab Emirates IrisGuard's* : Homeland Security Border Control has been operating an expellee tracking system in the United Arab Emirates (UAE) since 2001, when the UAE launched a national border-crossing security initiative. Today, all of the UAE's land, air and sea ports of entry are equipped with systems. All foreign nationals who possess a visa to enter the UAE are processed through iris cameras installed at all primary and auxiliary immigration inspection points. To date, the system has apprehended over 330,000 persons re-entering the UAE with fraudulent travel documents.
- Iris is one of three biometric identification technologies internationally standardized by ICAO for use in future passports (the other two are fingerprint and face recognition).
- Police forces across America plan to start using BI2 Technologies' mobile MORIS (Mobile Offender Recognition and Information System) in 2012. New York City Police Department was the first, installed in Manhattan fall of 2010<sup>6</sup>.
- Iris recognition technology has been implemented by BioID Technologies SA in Pakistan for UNHCR repatriation project to control aid distribution for Afghan refugees. Refugees are repatriated by UNHCR in cooperation with Government of Pakistan, and they are paid for their travel. To make sure people do not get paid more than once, their irises are scanned, and the system will detect the refugees on next attempt. The database has more than 1.3 million iris code templates and around 4000 registrations per day. The one-to-many iris comparison takes place within 1.5 seconds against 1.3 million iris codes.
- At Schiphol Airport, Netherlands, iris recognition has permitted passport-free immigration since 2001.
- Canadian Air Transport Security Authority's Restricted Area Identity Card (RAIC) program is the world's first dual-biometric program deployed around major Canadian airports for staff and aircrews to access the restricted areas using separate channels from passengers<sup>2,7</sup>.
- In a number of US and Canadian airports, as part of the NEXUS program that facilitates entry into the US and Canada for pre-approved, low-risk travelers.
- In several Canadian airports, as part of the CANPASS Air program that facilitates entry into Canada for pre-approved, low-

risk air travelers.

- UK's IRIS — Iris Recognition Immigration System, which started operating in 2004 but which was closed to new registrations in 2011 and which is being phased out in 2012<sup>5,9</sup>
- Google uses iris scanners to control access to their datacentres.
- In 2010, Leon, Mexico, deployed iris scanners in scan public spaces, where they can identify up to fifty people at once<sup>8</sup>.
- On May 10, 2011, Hoyos Group demonstrated a device called EyeLock using iris-recognition as an alternative to passwords to log people in to password-protected Web sites and applications, like Facebook or eBay<sup>4</sup>.
- However, some hotels have experimented with using iris recognition technology in place of a room key.
- The potential exists for iris recognition technology to replace most current forms of physical access-based identification. This would include anything requiring a password, personal identification number (PIN), or key; such as electronic transactions, building access, or automobile ignition. And unlike those physical methods of identification, an iris cannot be stolen. Iris recognition technology addresses the problems of both password management and fraud.

### *3. Advantages of Iris Recognition for Personal Authentication :*

Iris recognition, like facial recognition, is most often used for security-related applications.

- Iris recognition technology is currently used at physical access points demanding high security, such as airports, government buildings, and research laboratories.
- The technology has also been used to prevent unauthorized access of personal computers and mobile devices.
- A small, portable iris-scanning device is available for consumer use, bypassing the need for cumbersome password entry.
- Iris recognition applications are also available for the iPhones and other smartphones.
- Glasses or contact lenses do not interfere with the operation of iris recognition technology. Very few surgical procedures involve altering the iris, in which case re-enrollment in the database would be necessary.
- Blind people, as long as they have an iris present to scan, can likewise be identified with iris recognition technology.
- This is because no two irises are alike- not between identical twins, or even between the left and right eye of the same person. Irises are also stable; unlike other identifying characteristics that can change with age, the pattern of one's iris is fully formed by ten months of age and remains the same for the duration of their lifetime. Iris recognition technology is also accurate because it uses more than 240 points of reference in an iris pattern as a basis for a match. By comparison, fingerprints use about 60.
- 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.

- The iris is mostly flat, and its geometric configuration is only controlled by two complementary muscles (the sphincter pupillae and dilator pupillae) that control the diameter of the pupil. This makes the iris shape far more predictable than, for instance, that of the face.
- 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.

An iris scan is similar for 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 scanning, where the eye must be brought very close to an eyepiece (like looking into a microscope).

#### 4. Noisy Iris Recognition & its importance:

An analytical look at the preceding section reveals various unfolded challenges. On

these, major challenges of iris recognition systems are related to *Iris Template Security* and *Iris Recognition Performance*. As biometric is an integral part of human body, loss of one's biometric corresponds to loss of his/her identity. Therefore, security of biometric templates is one of the most important concerns in any biometric authentication system.

In **Noisy Iris Recognition Image datasets**, an iris image under unconstrained conditions and without user cooperation, the image quality can be highly degraded by low illumination, off-angle view, angle rotation, motion blurring, occlusion by eyelids, occlusion by eyelashes, noises by glasses, occlusion, specular reflection (SR), and other artifacts [Figure 2].

Due to these situations, the noisy iris images increase the intra-individual variations; and these variations clearly show their impact on recognition accuracy. The key points related to **importance of Noisy Iris Recognition** are as follows:

- Noisy Iris Recognition works in less constrained environments where iris images are captured at-a-distance and on-the-move, iris segmentation becomes much more difficult due to the effects of significant variation of eye position and size, eyebrows, eyelashes, glasses and contact lenses, and hair, together with illumination changes and varying focus condition.
- It significantly decreases the error rates of iris recognition.
- Efficiently deal with non infra-red images and non uniform illumination.

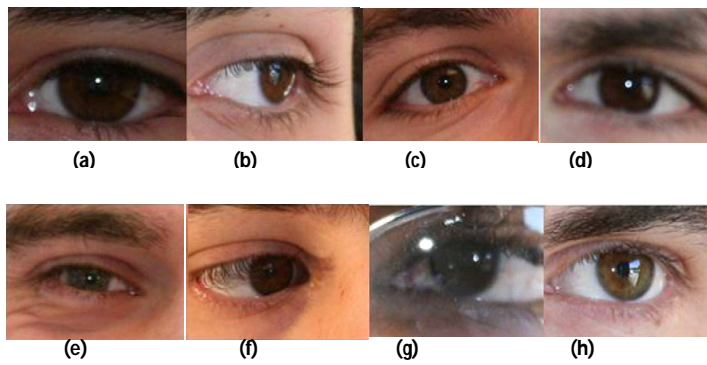


Figure 2 – The Noisy Iris Images (NICE.II training dataset)

- (a) Low illumination.
- (b) Off-angle.(c) Rotation.
- (d) Blurring.
- (e) Occlusion by eyelids.
- (f) Occlusion by eyelashes.
- (g) Noises by glasses.
- (h) Occlusion by ghost region.

## 5. Conclusion

Noisy Iris Recognition technology provides a practically & significantly feasible technique for overcoming the performance and user acceptability obstacles to the widespread adoption of biometric systems. Much research effort around the world is being applied for expanding the accuracy and capabilities of this biometric domain, with a consequent broadening of its application in the near future. This paper introduces noisy iris recognition & its importance. The noisy iris recognition system is potentially useful in remote video surveillance, health informatics and criminal identity verification.

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