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RESEARCH ARTICLE

Iris Recognition Technique, The Finger Print of the Eye: Anatomical, Opthomological and Forensic Perspective

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Abstract

It is a newer method of biometric authentication that uses specific pattern recognition techniques based on high-resolution images of the iris of an individual's eyes.Iris scanning system is considered to be the best biometric performer because it has very low false reject rates and also faster identification facilities.The technique is gaining importance amidst modern threats of Terrorism, High security needs in order to ensure safety of people around the world .Even lesser developed nations do not want to compromise on security issues .

Introduction

The advantage with the iris isthat iris is so unique that no two irises are alike, even among identical twins, in the entire human population. In practice, identifying the iris and converting it to mathematical code, the probability that two irises will produce the same mathematical code is approximately one in ten to the 78th power. The iris itself has 400 unique characteristics termed as Degree of freedom which are analyzed and then used for identification of individuals. Despite this only 260 such characteristics or degree of freedom are being used in the identification system. The iris has in excess of "260 degrees of freedom", i.e. the number of variations in the iris that allow one iris to be distinguished from another.

These Special characteristics include filaments, crypts (darkened areas on the iris), rings, and freckles etc.Iris systems have a very low False Accept Rate (FAR) compared to other biometric tests; the False Reject Rate (FRR) of these systems can be rather high. Iris recognition analyzes Unique and highlyspecific features like rings, furrows, and freckles existing in the colored tissue surrounding the pupil. Innovative and modern 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.

This biometric template contains an objective mathematical representation of the unique information stored in the iris, and allows comparisons to be made between templates.

The fact that the iris is protected behind the eyelid, cornea and aqueous humour means that, unlike other biometrics such as fingerprints, the likelihood of damage and/or abrasion is minimal. The iris is also not subject to the effects of aging which means it remains in a stable form.

Embryological and Anatomical Perspective

The iris begins to develop in the Third month of gestation and the structures creating its pattern are largely complete by the eighth month.[1]During the development of the iris, there is no genetic influence on it, a process knownas "chaotic morphogenesis" that occurs during the seventh month of gestation, which means thateven identical twins have differing irises.

Further development leads to formation of complex pattern that contain many distinctive features such as arching ligaments, furrows, ridges, crypts, rings, corona, freckles, and azigzag collarette.

Anatomically the iris extends over the anterior surface of the lens from the anterior border of the ciliary body. The word iris means a rainbow. It was initially recognized as a structure with variegated appearance ·Anatomically , the iris is part of the uveal, or middle, coat of the eye. It is a thin diaphragm stretching across the anterior portion of the eye and supported by the lens.

This support gives it the shape of a truncated cone in three dimensions. At its base, the iris is attached to the eye's cilliary body. At the opposite end, it opens into the pupil, typically slightly to the nasal side and below center. The cornea lies in front of the iris and provides a transparent protective covering.

It consists of 5 layers, from anterior to posterior namely:

1. A layer of fibroblasts and melanocytes
2. The avascular anterior stromal lamella
3. A vascular layer of loose connective tissue forming the bulk of the iris
4. The posterior membrane, containing the circular sphincter pupillae and radial dilator pupillae muscles
5. A double layer of pigmented epithelium.

Features of Iris making it suitable for identification

Unlike other biometrics such as fingerprints and face, the distinct aspect of iris comes from randomly distributed features. This leads to its high reliability for personal identification, and at the same time, the difficulty in effectively representing such details in an image.

Iris patterns are assuming importance especially in developed world as an effective alternative approach to reliable visual recognition of persons when imaging can be done at distances of less than a meter, and especially when there is a need to search very large databases without incurring any false matches despite a huge number of possibilities.

The iris has the great mathematical advantage that its patterns are highly variable and the variability among different persons is huge and enormous.

Another point which is highly favourable is that it is as internal (yet externally visible) organ of the eye, the iris is well protected from the environment and stable over time.

On studying the Iris pattern of the eye in many subjects, Ophthalmologists and anatomists [2]havenoted that the detailed pattern of an iris, even the leftand right iris of a single person, seems to be highlydistinctive.The source of evidence is developmental biology[3, 4] It has been observed that while the general structureof the iris is genetically determined, the particulars of itsminutiae are critically dependent on circumstances (e.g., theinitial conditions in the embryonic precursor to the iris).Therefore, they are highly unlikely to be replicated via thenatural course of events.

Rarely, the developmental processgoes the wrong way, yielding only a rudimentary iris (aniridia) ora marked displacement (corectopia) or shape distortion (colobloma) of the pupil [5, 6]

There is also a case of stability with age. Certainparts of the iris (e.g., the vasculature) are largely in place atbirth, whereas others (e.g., the musculature) mature aroundtwo years of age. Of particular significance forthe purposes of recognition is the fact that pigmentationpatterning continues until adolescence, [7] Also,the average pupil size (for an individual) increases slightlyuntil adolescence . Following adolescence, the healthy iris varies little for the rest of a person's life, althoughslight depigmentation and shrinking of the average papillary opening are standard with advanced age Variousdiseases of the eye can drastically alter the appearance ofthe iris [It also appears that intensive exposure tocertain environmental contaminants (e.g., metals) can alteriris pigmentation [8,9]. However,these conditions arerare.

Claims that the iris changes with more general statesof health (iridology) have been discredited [10].

Studies have proven that the iris ishighly distinctive and, following childhood, typically stable

Iris scans analyse the features in the coloured tissue surrounding the pupil which has more than 200 points that can be used for comparison, including rings, furrows and freckles. Iris recognition technology combines computer vision, pattern recognition, statistical inference, and optics. Its purpose is real-time, high confidence recognition of a person's identity by mathematical analysis of the random patterns that are visible within the iris of an eye from some distance.

Because the iris is a protected internal organ whose random texture is stable throughout life, that one need not remember but can always present. The randomness of iris patterns has very high dimensionality; recognition decisions are made with confidence levels high enough to support rapid and reliable exhaustive searches through national-sized databases.

Iris Recognition Process

This process comprises of capturing an iris into a biometric template is made up of 3 steps:
1. Capturing the image
2. Defining the location of the iris and optimizing the image
3. Storing and comparing the image.

The identification system involves two stages: active and passive.
Basically the whole thing is a four step process.

The Process

First a person stands almost at a distance of one and three feet away while the wide angle camera can focus and calculate the position of the user's eye.
A second camera then zooms into the eye and captures a black and white image.After the iris system has one's iris in focus, it overlays a circular grid (zone of analyis) on the image of the iris and identifies where areas of light and dark fall. The purpose of overlaying the grid is so that the iris system can recognize a pattern within the iris and to generate 'points' within the pattern into an 'eyeprint'.
Finally, the captured image or 'eyeprint' is checked against a previously stored 'reference template' in the database.
The time it takes for a iris system to identify your iris is approximately two seconds.
In general a template iris pattern code contains 256 and 512 bytes of data.

Advantages and Disadvantages:

- **Time Saving Technique:** The time it takes for a iris system to identify iris is in seconds and not minutes , approximately two seconds. In general a template iris pattern code contains 256 and 512 bytes of data. Up to 100,000 records a second can be scanned using a standard personal computer.

- **Highly specific technique:** Because of huge variation the mismatch rate is less than one in 100,000. Since the iris is a very unique part of the body and also different for identical twins the method is efficient for crime control activities and also identification.Hence it has proven to be superior to finger prints in identification. It uses both **visible and near-infrared light** to take a clear, high-contrast picture of a person's iris. With near-infrared light, a person's pupil is very black, making it easy for the computer to isolate the pupil and iris Iris scanners are becoming more common in high-security applications because people's eyes are so unique. Iris recognition is being considered in areas where there is a need for large throughput andqueuing. For example border clearance, ticketless air travel, transportation and airport security.

- They also allow **more than 200 points of reference for comparison, as opposed to 60 or 70 points in fingerprints.**

- The iris is a **visible but protected structure, and it does not usually change over time**, making it **ideal for biometric identification.**

- Most of the time, people's **eyes also remain unchanged after eye surgery,** and blind people can use iris scanners as long as their eyes have irises.

- Eyeglasses and contact lenses typically do not interfere or cause inaccurate readings.

- This technology not only offers **convenience**, but also promises **greater safety and security.** Top airport security officials have recently recognized iris identifiers as an important tool for increasing airport security and for improving upon current immigration practices.

- Major applications of this technology across the globe include: unmanned passenger travel (frequent flier programmes); aviation security, controlling access to restricted areas at airports; database access and computer login; access to physical infrastructure

- **Screening and Identification of criminals, suspects, people with suspected background** in restricted areas(nuclear installations, Biochemical laboratories, defence installations, airports , can be done more efficiently and people trying to gain entrance to these places by putting false identities can be caught.

Disadvantages are:

- Although being a very efficient but it is a very expensive method to implement especially in developing countries. Needs enough funding from private sectors and government.
- Subjects who are blind or have cataracts can also pose a challenge to irisrecognition, as there is difficulty in reading the iris.
- The technology requires high skilled user and operator.
- Although there is minimal intrusiveness with iris recognition, there is still the need for cooperationfrom subjects to enrol in the system and undergo subsequent authentication scans.Enrolling a non-cooperative subject would prove very difficult
- Normal day-to-day problems such as system failures, power failures, network problems, and softwareproblems can all contribute to rendering a biometric system unusable.
- The technology also has health hazards and is intrusive in nature.

Conclusion

Inspite of the fact that the problems mention the iris scanning system is considered to be the best biometric performer on the market as it has very low false reject rates and also faster identification facilities. The technique is gaining importance amidst modern threats of Terrorism, High security needs in order to ensure safety of people around the world .Even lesser developed nations do not want to compromise on security issues . In developed World Computer engineers are also predicting that e-commerce will use the technology for legal tender purposes i.e the tender will be a combination of digital certificates and an image of the person's iris.

Thus overall the significance and awareness of Iris Recognition technology is growing and some nations have already placed this technique at place at various important sites like vital offices, vital installations, nuclear facilities, biochemical labs, high security prisons , aviation security and controlling access to restricted areas at airports; database access and computer login; premises access control; hospital settings including mother-infant pairing in maternity wards; "watch list" screening at border crossings; and it is under consideration for biometrically enabled National Identity Cards.

Having only become automated and available within the last decade, the iris recognition concept and industry are still relatively new. Through the determination and commitment of the iris industry and government evaluations, growth and progress will continue.

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