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Effect of Aging on Human Iris and Examine Their Authentication in Bio Metrics

Namrata[1], Manju Sharma[2]

M.Tech. Scholar,
[1]Computer Science & Engineering, Panipat Institute of Engineering, Panipat, Haryana, India

[2]Assistant Professor, Computer Science & Engineering, Panipat Institute of Engineering, Panipat, Haryana, India

Abstract: ***If we talk about the means of total security than we finished with none but if we talk about satisfactory security with minimum chances to failure than biometrics based security systems seems to be meaningful in this context. Though there is no doubt as far as the reliability of these security systems is concerned but efficiency more or less depended upon the simplicity of the system. In the field of biometric security, human iris detection based security system gaining too much acceptances due to its minimum tolerance to the failure of the system but there is an emerging threat to this system which apart from the system lies within the iris of the subject. As the age of the subject increases or due to any natural or manmade, accidental or through the influence of any disease the shape of iris gets defected and ultimately resist the system to recognise through comparison. Here in this research paper, the effect of aging on human iris and its impact over the efficiency of the iris recognition based security system is being discussed. The case studies and personal interviews has been conducted of the users of this system to find out minimum possibilities of failure and through simulation in dot net language, results has been shown.***

Keywords: biometrics, human iris, efficiency, aging, simulation, dot net, disease.

1. Introduction

Insuring total security of any premises remain top priority of every individual or commercial entity and for this there are plethora of products which already in use and which are going to make their debut in the field of customized securities. Biometrics based securities are one of the leading means of authenticated security which is not much economic but act as a good option for industrial and risk assured securities. In the field of biometrics based security, iris pattern recognition based security system emerges as the most secure and preferred industrial security system due to its reliability but there is a lacuna in the iris based security as a minute change can leads to rejection.

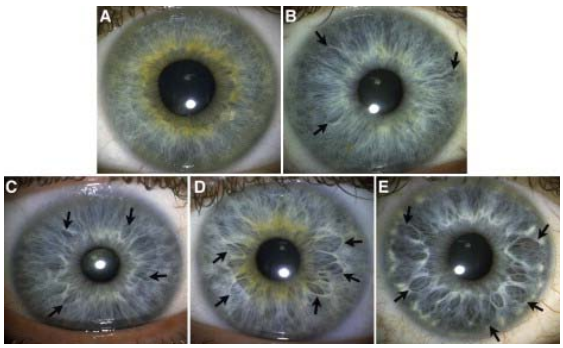

Figure 1: some patterns of human iris.

The iris recognition based biometric security technology is accurate, reliable, easy to use, easy to manage, non-intrusive, difficult to forge and, despite what people may understand, is actually quite a sophisticated system once initial enrolment has taken place. However, in the system the co-operation of the subject is mandatory along with specific hardware and software to operate and administrators need to ensure they have a fall back plan should the resources required to operate the system failure, which is inevitable and the major risk in every computer oriented system, for example power. Iris recognition technology does provide a good method of authentication to replace the current methods of passwords, token cards or

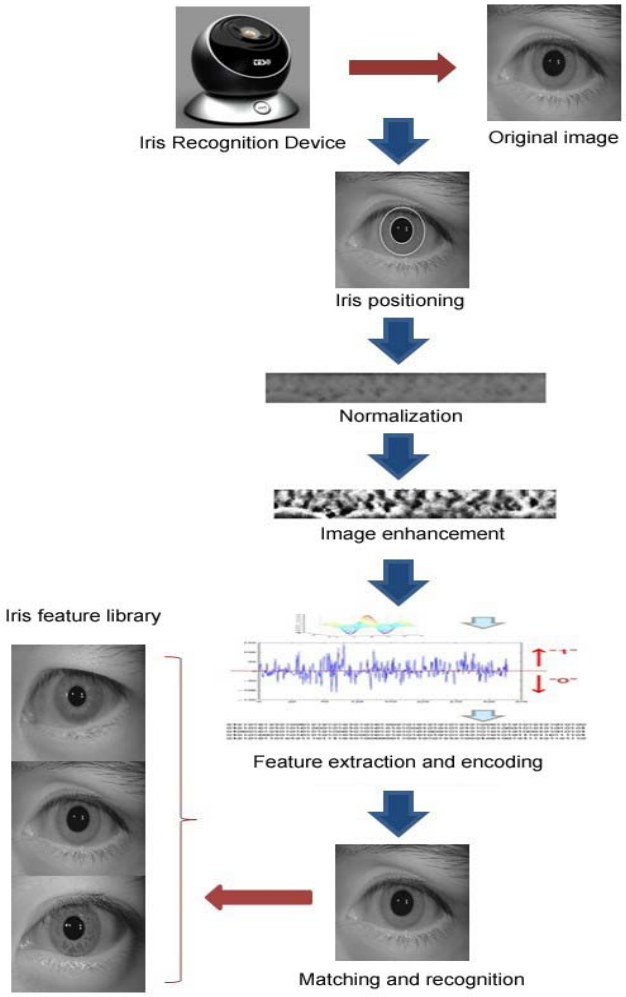

Figure 2: Flow chart displaying method of iris based security system.

PINs and if used in conjunction with something the user knows in a two-factor authentication system then the authentication becomes nearly impossible to forge.

2. Literature Review and History

First of all in the mid 1980s two ophthalmologists, **Drs Leonard Flom** and **Aran Safir**, discovered that every individual's iris is totally different from its pattern, even in twins, thus making them a good biometric parameter to fix identity. This belief was based on their clinical experience where they observed the distinctive features of irises including the "many collagenous fibres, contraction furrows, coronas, crypts, colour, serpentine vasculature, striations, freckles, rifts and pits". After researching and documenting the potential use of irises as a means of identifying people they were awarded a patent in 1987. They then approached **Dr John Daugman**, a Harvard mathematician, in 1989 to assist with creating the mathematical algorithms required for digitally encoding an image of an iris to allow comparison with a real time image. By 1994 the algorithms had been developed and patented and are now used as "the basis for all iris recognition systems and products"3 currently being developed and sold. These processes are owned by Iridian Technologies who develop products and license the processes to other companies.

3. Principal

There are almost 200 conjunctions points present in human iris which form the base of identification which also includes rings, rectangles, triangles, furrows, freckles, etc shapes inside the iris. The system firstly locate the inner and outer boundaries of human iris in an high definition image of whole eye and then excludes other parts of eye from the iris which finally get normalized using rubber sheet model to compensate for pupil dilation to finally approach the bit pattern encoding the information needed to compare two iris images. To study the impact of aging in iris recognition based system we are using **Harcascade.Xml** software to compare two images of iris and the difference occurred in iris morphology with reference to aging.

4. Methodology

As far as the simulation is concerned, to detect any changes in the pattern of iris or verify the present picture of iris with the subject **Harcascade.Xml** software is used as a tool along with dot-net in the front end coding.

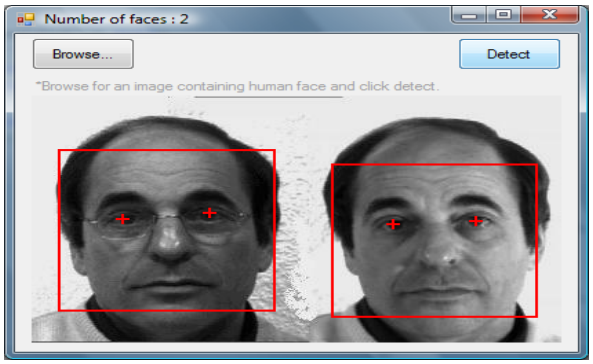

Figure 3: Harcascade.Xml window for iris recognition

For the purpose of ground level situation analysis, the survey questionnaire based approach has been utilized to find out difficulties in recognition system in the form of selective bunch of questions and statistical analysis.

Hardware specification:

Processor	32 BIT, Pentium – IV
Ram	1 GB
Hard Disk	40 GB
Monitor	SVGA Monitor (800 * 600RESOLUTIONS)
Clock Speed	266 MHz

Software Specification

Operating System	: Windows 2000/XP,7,8,8.1.
Front End	: ASP.NET
Back End	

5. Databases

Two publicly available iris databases are used to investigate the effect of aging on iris recognition with a time lapse of two years and four years.

1. ND-Iris-Template-Aging-2008–2010 Database: The images in the ND-Iris-Template-Aging-2008–2010 database are acquired using the LG 4000 iris sensor during spring 2008, spring 2009, and spring 2010. This allows to conduct two different one year template aging studies, i.e., for the year 2008–2009 and 2009–2010, and one two year template aging study for 2008–2010. The number of subjects in the study is 88, 157, and 40 for 2008–2009, 2009–2010, and 2008–2010 sessions respectively.
2. ND-TimeLapseIris-2012 Database: The ND-TimeLapseIris-2012 database contains images acquired with the LG2200 iris camera located in the same studio throughout all the acquisitions. A total of 6797 images are collected from 23 subjects (46 irises) in between 2004 to 2008. The age of these subjects ranges from 22 to 56 years where 16 subjects are male and 7 are female.

To find out reasons behind the changes occurred in the pattern of iris, case studies from recognized research centres, medical colleges and forensic labs has been referred and after scrutinizing the data we get an appropriate observations which are discussed in under title of observation and result.

6. Observation

Iris as a biometric identifier is earlier assumed to be non dynamic in terms of its internal structure as the age of the subject increases. However, some researchers have observed that as aging takes place, the genuine match score distribution shifts towards the impostor score distribution and the performance of iris recognition reduces.

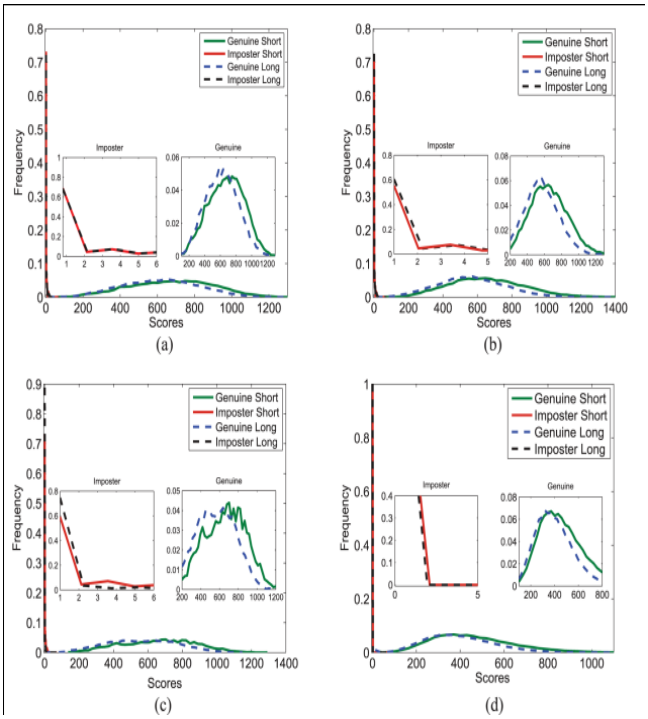

Figure 4: graphical representation of observation.

The experiments are performed on the two publicly available iris aging databases namely, ND-Iris-Template-Aging-2008–2010 and ND-TimeLapseIris-2012 using a commercial matcher, Harcascade.Xml.

The observations are-

1) The rejection happens primarily due to the presence of other covariates such as blur, noise, occlusion, and pupil dilation.
2) This claim is substantiated with quality score comparison of the gallery and probe pairs.
3) Effect of aging remains sufficiently remarkable in the iris detection system because of the bulging, defect in size, shape, thickness of iris.
4) The aging effect remarkably seen on the individuals which have enrolled in iris recognition based security system more than 5 years back and there after they get interact with the problem of sever rejection.

7. Result

We observed that, contrary to common belief, iris recognition accuracy does degrade as the age increases. The reason for this is not understood. The underlying reasons behind the rejection as obvious to casual visual inspection as the signs of aging that we are used to seeing in face images. Therefore, future research which is currently going on in recognized laboratories will focus on why rejection occurs as age increases.

For example, the average pupil dilation of an eye decreases over a person's lifespan. Larger differences in pupil dilation between two images of the same iris increase the rate of rejection. However, while it is possible that changes in dilation contribute to template aging, our analyses suggest that this is not the main factor.

8. Conclusion

Recent research results continue the already going on debate over that whether aging affects iris templates or not. While some researchers support that aging affects the performance and rate of rejection, others are of the opinion that it does not have any significant measurable effect.

With the help of publicly available iris template aging databases, this paper shows that the reduced performance of iris recognition caused by mainly because of aging and secondly because of noise and differences in the quality of gallery and probe pairs.

It is our assertion that effect of aging over iris is an important research problem which requires a longitudinal study; similar to face biometrics where significant age duration is to be studied.

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