A Panacea To ATM Challenges Using Iris Authentication

Igwe Agu Felix, Eneh I I

Abstract- This paper exposes how iris authentication can be used as a biometric identification in ATM machine, data were collected with the aid of camera, this was achieved by allowing only those NIR wavelength from narrow –band illuminator back into the iris camera. Measurements were taken with the aid of a camera, the data gotten are stored and saved in a database , if the a customer comes, data will be collected with the aid of camera to ascertain whether the person is the rightful owner or not. The data gotten from the customer will be matched with the ones stored in database, if it matches, access is granted to the customer, but if it does not access will be denied.

Keywords: Database, ATM, Electromagnetic Spectrum NIR spectrum and iris camera

I. INTRODUCTION

Iris authentication is an automated method of biometric identification that uses mathematical pattern-recognition techniques on video images of the insides of an individual's eyes, whose complex random patterns are unique and can be seen from some distance.Not to be confused with other, less prevalent, ocular-based technologies, retina scanning and eye printing, iris recognition uses camera technology with subtle infrared illumination to acquire images of the detail-rich, intricate structures of the iris externally visible at the front of the eye. 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. Many 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, protected, yet externally visible organ of the eye.

A History

Although John Daugman developed and patented the first actual algorithms to perform iris recognition, published the first papers about it and gave the first live demonstrations, the concept behind this invention has a much longer history and today it benefits from many other active scientific contributors. In fact, the markings of the iris are so distinctive that it has been proposed to use photographs as a means of identification, instead of fingerprints [1].

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Just as every human being has different fingerprints, so does the minute architecture of the iris exhibit variations in every subject examined. [Its features] represent a series of variable factors whose conceivable permutations and combinations are almost infinite [2]. Iris could serve as a human identifier, but they had no actual algorithm or implementation to perform it and so their patent remained conjecture [3]. The roots of this stretch back even further in 1892 the Frenchman A. Bertillon had documented nuances in "Tableau de l'iris humain". Divination of all sorts of things based on iris patterns goes back to ancient Egypt, to Chaldea in Babylonia, and to ancient Greece, as documented in stone inscriptions, painted ceramic artefacts, and the writings of Hippocrates. (Iris divination persists today, as "iridology.")The core theoretical idea in Daugman's algorithms is that the *failure* of a test of statistical independence can be a very strong basis for pattern recognition, if there is sufficiently high entropy (enough degrees-of-freedom of random variation) among samples from different classes. He patented this basis for iris recognition and its underlying Computer Vision algorithms for image processing, feature extraction, and matching, and published them in a paper. These algorithms became widely licensed through a series of companies: IriScan (a start-up founded by Flom, Safir, and Daugman), Iridian, Sarnoff, Sensar, LG-Iris, Panasonic, Oki, BI2, IrisGuard, Unisys, Sagem, Enschede, Securimetrics and L-1, now owned by French company Morpho. With various improvements over the years, these algorithms remain today the basis of all significant public deployments of iris recognition, and they are consistently top performers in NIST tests (implementations submitted by L-1, MorphoTrust and Morpho, for whom Daugman serves as Chief Scientist for Iris Recognition). But research on many aspects of this technology and on alternative methods has exploded, and today there is a rapidly growing academic literature on optics, photonics, sensors, biology, genetics, ergonomics, interfaces, decision theory, coding, compression, protocol, security, mathematical and hardware aspects of this technology. Most flagship deployments of these algorithms have been at airports, in lieu of passport presentation, and for security screening using watch-lists. In the early years of this century, major deployments began at Amsterdam's Schiphol Airport and at ten UK airport terminals allowing frequent travellers to present their iris instead of their passport, in a programme called *IRIS: Iris Recognition Immigration System.* Similar systems exist along the US / Canadian border, and many others. In the United Arab Emirates, all 32 air, land, and seaports deploy these algorithms to screen all persons entering the UAE requiring a visa. Because a large watch-list compiled among GCC States is exhaustively searched each time, the number of iris cross-comparison has climbed to 62 trillion in 10 years. But by far the most breathtaking deployment began operation in 2011 in India, whose Government is enrolling the iris

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patterns (and other biometrics) of all 1.2 billion citizens for the Aadhaar scheme for entitlements distribution, run by the Universal Identification Authority of India (UIDAI). This programme enrolls about one million persons every day, across 36,000 stations operated by 83 agencies. The number of persons enrolled exceeded 530 million. Its purpose is to issue each citizen a biometrically provable unique entitlement number by which benefits may be claimed, and social inclusion enhanced; thus the slogan of UIDAI is: "To give the poor an identity."

B Visible wavelength (VW) vs near infrared (NIR) imaging

All publicly deployed iris recognition systems acquire images of an iris in the near infrared wavelength band (NIR: 700–900 nm) of the electromagnetic spectrum. The majority of persons worldwide have "dark brown eyes", the dominant phenotype of the human population, revealing less visible texture in the VW band but appearing richly structured, like the cratered surface of the moon, in the NIR band. [4] Using the NIR spectrum also enables the blocking of corneal specula reflections from a bright ambient environment, by allowing only those NIR wavelengths from the narrow-band illuminator back into the iris camera.

Iris melanin, also known as chromophore, mainly consists of two distinct heterogeneous macromolecules, called eumelanin (brown–black) and pheomelanin (yellow–reddish), whose absorbance at longer wavelengths in the NIR spectrum is negligible. At shorter wavelengths within the VW spectrum, however, these chromophores are excited and can yield rich patterns., provides a comparison between these two imaging modalities[5]. An alternative feature extraction method to encode VW iris images was also introduced, which may offer an alternative approach for multi-modal biometric systems.

C Operating principle

An iris-recognition algorithm can identify up to 200 identification points including rings, furrows and freckles within the iris. First the system has to localize the inner and outer boundaries of the iris (pupil and limbus) in an image of an eye. Further subroutines detect and exclude eyelids, eyelashes, and specular reflections that often occlude parts of the iris. The set of pixels containing only the iris, normalized by a rubber-sheet model to compensate for pupil dilation or constriction, is then analyzed to extract a bit pattern encoding the information needed to compare two iris images. In the case of Daugman's algorithms, a Gabor wavelet transform is used. The result is a set of complex numbers that carry local amplitude and phase information about the iris pattern. In Daugman's algorithms, most amplitude information is discarded, and the 2048 bits representing an iris pattern consist of phase information .[6] Discarding the amplitude information ensures that the template remains largely unaffected by changes in illumination or camera gain (contrast), and contributes to the long-term usability of the biometric template. For identification (one-to-many template matching) or verification (one-to-one template matching), a template created by imaging an iris is compared to stored template(s) in a database. If the Hamming distance is below the decision threshold, a positive identification has effectively been made because of the statistical extreme improbability that two different persons could agree by chance ("collide") in so many bits, given the high entropy of iris templates.

D Advantages

The iris of the eye has been described as the ideal part of the human body for biometric identification for several reasons:
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 pup illae) 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 to 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).

The commercially deployed iris-recognition algorithm, John Daugman's IrisCode, has an unprecedented false match rate (better than 10^{-11} if a Hamming distance threshold of 0.26 is used, meaning that up to 26% of the bits in two IrisCodes are allowed to disagree due to imaging noise, reflections, etc., while still declaring them to be a match). While there are some medical and surgical procedures that can affect the colour and overall shape of the iris, the fine texture remains remarkably stable over many decades. Some iris identifications have succeeded over a period of about 30 years.

E Shortcomings

Many commercial iris scanners can be easily fooled by a high quality image of an iris or face in place of the real thing. The scanners are often tough to adjust and can become bothersome for multiple people of different heights to use in succession. The accuracy of scanners can be affected by changes in lighting. Iris scanners are significantly more expensive than some other forms of biometrics, as well as password and proximity card security systems. Iris scanning is a relatively new technology and is incompatible with the very substantial investment that the law enforcement and immigration authorities of some countries have already made into fingerprint recognition. Iris recognition is very difficult to perform at a distance larger than a few meters and if the person to be identified is not cooperating by holding the head still and looking into the camera. However, several academic institutions and biometric vendors are developing products that claim to be able to identify subjects at distances of up to 10 meters ("Standoff Iris" or "Iris at a Distance" as well as SRI International's "Iris on the Move" for persons walking at speeds up to 1 meter/sec). As with other photographic biometric technologies, iris recognition is susceptible to poor image quality, with associated failure to enroll rates.

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As with other identification infrastructure (national residents databases, ID cards, etc.), civil rights activists have voiced concerns that iris-recognition technology might help governments to track individuals beyond their will. Researchers have tricked iris scanners using images generated from digital codes of stored irises. Criminals could exploit this flaw to steal the identities of others. Alcohol consumption causes recognition degradation as the pupil dilates or constricts, causing deformation in the iris pattern. The first study on surgical patients involved modern cataract surgery and showed that it can change iris texture in such a way that iris pattern recognition is no longer feasible or the probability of falsely rejected subjects is increased.

F Security considerations

As with most other biometric identification technology, the problem with iris recognition is the problem of live-tissue verification. The reliability of any biometric identification depends on ensuring that the signal acquired and compared has actually been recorded from a live body part of the person to be identified and is not a manufactured template. Many commercially available iris-recognition systems are easily fooled by presenting a high-quality photograph of a face instead of a real fact, which makes such devices unsuitable for unsupervised applications, such as door access-control systems. The problem of live-tissue verification is less of a concern in supervised applications (e.g., immigration control), where a human operator supervises the process of taking the picture.

Methods that have been suggested to provide some against the use of fake eyes and irises include changing ambient lighting during the identification (switching on a bright lamp), such that the pupillary reflex can be verified and the iris image be recorded at several different pupil diameters; analyzing the 2D spatial frequency spectrum of the iris image for the peaks caused by the printer dither patterns found on commercially available fake-iris contact lenses; analyzing the temporal frequency spectrum of the image for the peaks caused by computer displays.

Other methods include using spectral analysis instead of merely monochromatic cameras to distinguish iris tissue from other material; observing the characteristic natural movement of an eyeball (measuring nystagmus, tracking eye while text is read, etc.); testing for retinal retroreflection (red-eye effect) or for reflections from the eye's four optical surfaces (front and back of both cornea and lens) to verify their presence, position and shape. Another proposed method is to use 3D imaging (e.g., stereo cameras) to verify the position and shape of the iris relative to other eye features.

The German Federal Office for Information Security noted that none of the iris-recognition systems commercially available at the time implemented any live-tissue verification technology. Like any pattern-recognition technology, live-tissue verifiers will have their own false-reject probability and will therefore further reduce the overall probability that a legitimate user is accepted by the sensor.

G Deployed applications

United Arab Emirates Iris Guard's Homeland Security Border Control has been operating an expellee tracking system in the United Arab Emirates (UAE) for some years back, 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.

- Aadhaar, India's Unique ID project for its one billion citizens uses Iris scan as one of the identification feature
- 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 planned 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.
- 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 Amsterdam Airport Schiphol, 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.
- 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.

II. RELATED WORKS

Iris images of CASIA-Iris-Interval were captured with our self-developed close-up iris camera. The most compelling feature of our iris camera is that we have designed a circular NIR LED array, with suitable luminous flux for iris imaging. Because of this novel design, our iris camera can capture very clear iris images. CASIA-Iris-Interval is well-suited for studying the detailed texture features of iris images.

A CASIA-Iris-Lamp

CASIA-Iris-Lamp was collected using a hand-held iris sensor produced by OKI. A lamp was turned on/off close to the subject to introduce more intra-class variations when we

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collected CASIA-Iris-Lamp. Elastic deformation of iris texture due to pupil expansion and contraction under different illumination conditions is one of the most common and challenging issues in iris recognition. So CASIA-Iris-Lamp is good for studying problems of non-linear iris normalization and robust iris feature representation.

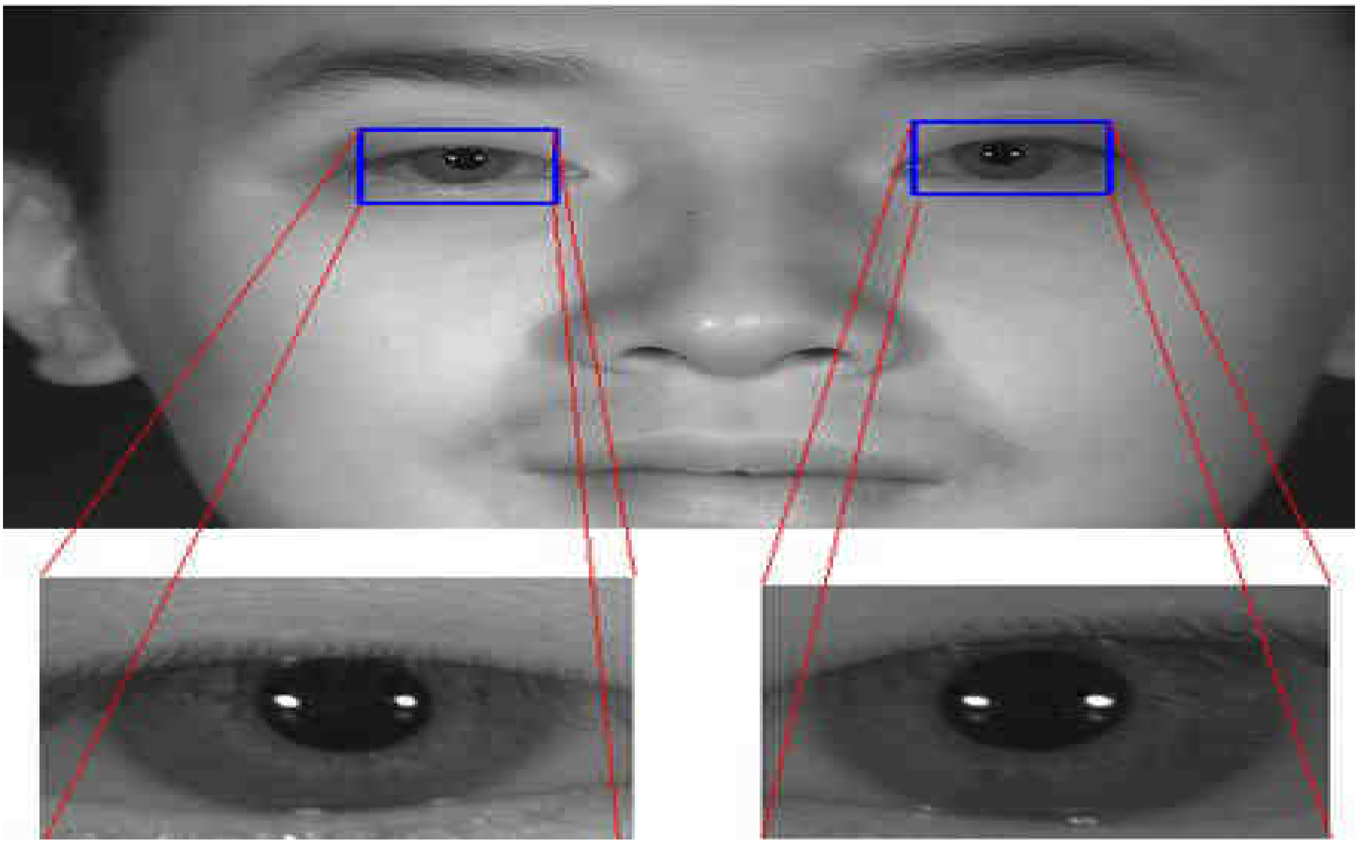

Fig.2.3 An example image in CASIA-Iris-Distance

B CASIA-Iris-Twins

CASIA-Iris-Twins contains iris images of 100 pairs of twins, which were collected during Annual Twins Festival in Beijing using OKI's IRISPASS-h camera . Although iris is usually regarded as a kind of phenotypic biometric characteristics and even twins have their unique iris patterns, it is interesting to study the dissimilarity and similarity between iris images of twins.

C CASIA-Iris-Distance

CASIA-Iris-Distance contains iris images captured using our self-developed long-range multi-modal biometric image acquisition and recognition system . The advanced biometric sensor can recognize users from 3 meters away by actively searching iris, face or palmprint patterns in the visual field via an intelligent multi-camera imaging system. The LMBS is human-oriented by fusing computer vision, human computer interaction and multi-camera coordination technologies and improves greatly the usability of current biometric systems. The iris images of CASIA-Iris-Distance were captured by a high resolution camera so both dual-eye iris and face patterns are included in the image region of interest (Fig. 2.3). And detailed facial features such as skin pattern are also visible for multi-modal biometric information fusion.

D CASIA-Iris-Thousand

ASIA-Iris-Thousand contains 20,000 iris images from 1,000 subjects, which were collected using IKEMB-100 camera produced by IrisKing . IKEMB-100 is a dual-eye iris camera with friendly visual feedback, realizing the effect of "What You See Is What You Get". The bounding boxes shown in the frontal LCD help users adjust their pose for high-quality iris image acquisition. The main sources of intra-class variations in CASIA-Iris-Thousand are eyeglasses and specular reflections. Since CASIA-Iris-Thousand is the first publicly available iris dataset with one thousand subjects, it is well-suited for studying the uniqueness of iris features and develop novel iris classification and indexing methods

E CASIA-Iris-Syn

CASIA-Iris-Syn contains 10,000 synthesized iris images of 1,000 classes. The iris textures of these images are synthesized automatically from a subset of CASIA-IrisV1 with the approach described in (Fig. 2.5(a). Then the iris ring regions were embedded into the real iris images, which makes the artificial iris images more realistic. The intra-class variations introduced into the synthesized iris dataset include deformation, blurring, and rotation, which raise a challenge problem for iris feature representation and matching. We have demonstrated in that the synthesized iris images are visually realistic and most subjects can not distinguish genuine and artificial iris images. More importantly, the performance results tested on the synthesized iris image database have similar statistical characteristics to genuine iris database. So users of CASIA-IrisV4 are encouraged to use CASIA-Iris-Syn for iris recognition research . CASIA-Iris-Syn proves to be successful for most researchers of iris recognition, we will provide more and more synthesized iris images in the future.

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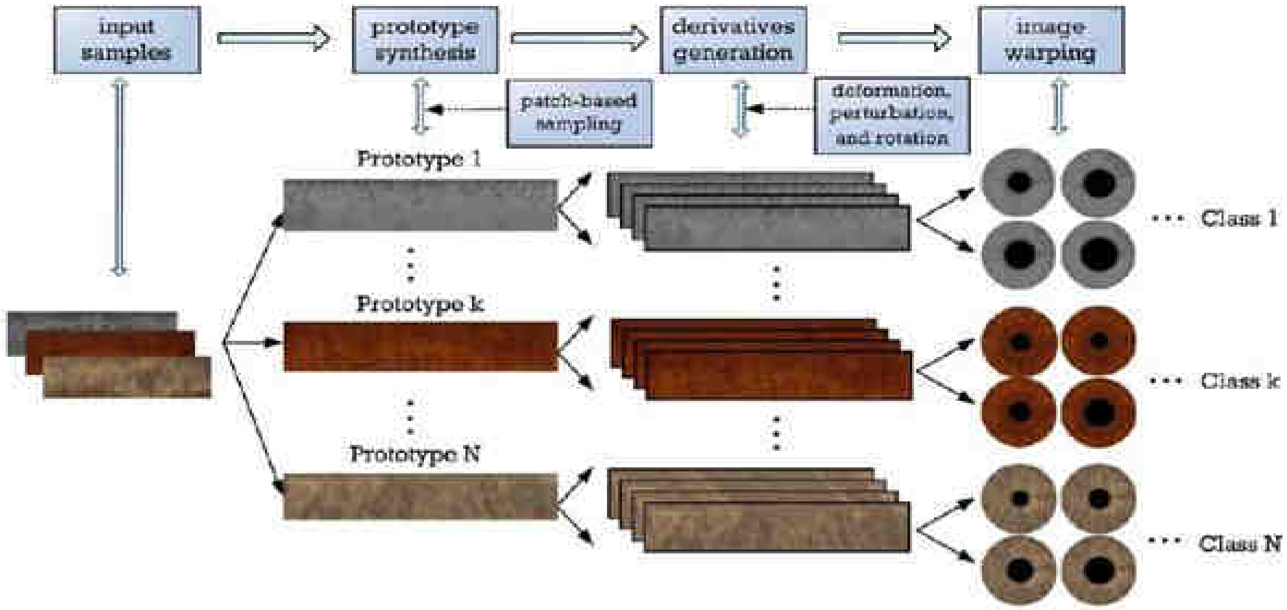

Fig. 2.5(a): Flowchart of the iris texture synthesis method for generation of CASIA-Iris-Syn

Table 2.5: Statistics of CASIA-IrisV4

Subset / Characteristics	CASIA-Iris -Interval	CASIA-Iris -Lamp	CASIA-Iris -Twins	CASIA-Iris -Distance	CASIA-Iris -Thousand	CASIA-Iris -Syn
Sensor	CASIA close-up iris camera	OKI IRISPASS-h	OKI IRISPASS-h	CASIA long-range iris camera	Irisking IKEMB-100	CASIA iris image synthesis algo.
Environment	Indoor	Indoor with lamp on/off	Outdoor	Indoor	Indoor with lamp on/off	N/A
Session	Two sessions for most iris images	One	one	One	One	N/A
Attributes of subjects	Most are graduate students of CASIA	Most are graduate students of CASIA	Most are children participating Beijing Twins Festival	Most are graduate students of CASIA	Students, workers, farmers with wide-range distribution of ages	The source iris images are from CASIA-IrisV1
No. of subjects	249	411	200	142	1,000	1,000
No. of classes	395	819	400	284	2,000	1,000
No. of images	2,639	16,212	3,183	2,567	20,000	10,000
Resolution	320*280	640*480	640*480	2352*1728	640*480	640*480
Features	Cross-session iris images with extremely clear iris texture details	Nonlinear deformation due to variations of visible illumination	The first publicly available iris image dataset of twins	The first publicly available long-range and high-quality iris/ face dataset	The first publicly available iris image dataset with more than one thousand subjects	Synthesized iris image dataset
Total	A total of 54,601 iris images from more than 1,800 genuine subjects and 1,000 artificial subjects					

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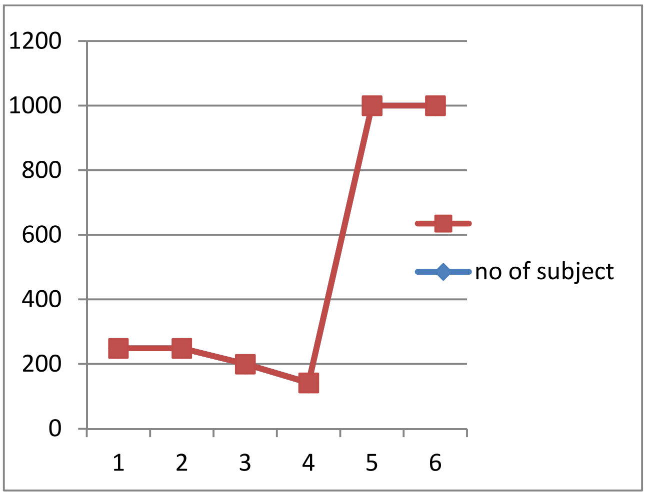

Fig.2.5 (b): A graph of class against subject

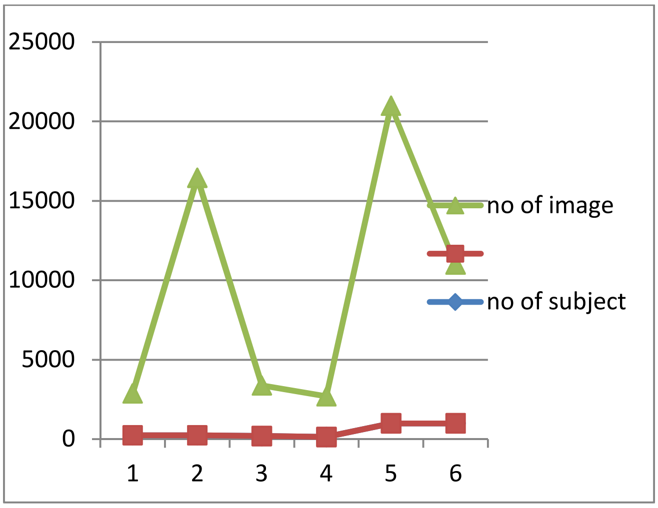

Fig.2.5(c): A graph of image against subject

F Analysis of Result: In fig.2.5 In fig 2.5(c **),** the class increases as the image increases from 2000 to 17000,when the image reaches 17000 ,it starts to decrease .This result is compared to the one in the database,if it rhymes with the one in the database,access is granted to the customer.

III. How Iris Recognition Identifies Rightful Account Owner In ATM Machine

When a customer comes to open an account with a bank, the camera captures the person's iris.
Any measurement at this point, is translated into patterns which serve as signals. These signals are saved and stored in the database. If a customer comes to claim his or her money ,the camera captures the customer's data and then compares it with what it has in its database ,if it matches , the ATM disburses money to the customer,if it does not match ,it denies the customer access.

IV. Conclusion

1. Iris of the eye has been described as the ideal part of the human body for differentiating two persons that may resemble.
2. Iris identification remains the best because it is protected against damage and wear.Unlike fingerprints,which can not be easily recognized after years of manual labour.

V. Recommendation

1. Iris Identification should be adopted by banks, when ATM machines are involved.
2. Ministry should adopt Iris in identifying its workers

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