Identification of a Person Using a Different Database by Iris.

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Abstract

Today, iris recognition plays a significant role in numerous applications, particularly in person detection. Iris recognition techniques utilize the physiological traits of a person's eye for identification. Most biometric iris detection systems capture the image of the eye and the region of interest, making the ocular image crucial for detection. The human iris is a data-rich biometric identifier that remains constant throughout a person's life and offers a high level of security [1]. These iris images are stored in databases, which are used to retrieve eye images taken under different circumstances. Various types of databases are available on the internet, allowing users to access them for free. This essay aims to examine the properties of the iris and compare multiple iris image databases.

Keywords: *Iris recognition, Biometric, Matlab, Iris picture database.*

1. Introduction

We currently reside in a digital era where computer and smartphone applications have become an integral part of our lives, simplifying our daily tasks. However, it is important to note that not all of these programs prioritize security. Technological advancements have made information storage and transportation more convenient with various database systems, storage devices, and networks. These technologies allow remote access to information without physical proximity. Consequently, the development of an effective user authentication and access control method becomes crucial.

Traditional authentication methods often require individuals to remember multiple passwords, PINs, tokens, or answer personal questions such as "What's the name of your pet?" [2]. To address these challenges, authentication based on individual identification is commonly used, and iris recognition is a popular approach in applications requiring authentication [3]. Iris recognition has the advantage of using the user's iris as a password, eliminating the need for external tokens or passwords. Additionally, the biometric technology of iris detection proves beneficial, especially in situations where individuals conceal their faces, such as wearing masks or veils.

Designing an optical pathway for iris imaging from a significant distance is a complex task due to the small size of the human iris and the requirement for precise optics. However, this challenge can be overcome by carefully determining parameters such as brightening force, focus point, cameras, and separation. Many companies have created readily accessible and free iris image datasets on the internet, taking into account these factors. This essay examines the properties of the iris and compares multiple iris image databases.

The remainder of this article's many sections are organised as follows. The second segment explains the creation of an iris texture. In the third region, various databases with iris images are introduced. Similar to how the third section ends, the fourth section contains the finished article.

2. Introduction Of Iris Texture

Figure 1 illustrates the concept of iris texture, which refers to the distinctive patterns and characteristics present on the surface of the iris. The iris, the colored part of the eye encircling the pupil, performs essential functions in regulating light entry and determining eye color. It comprises muscles that control the pupil's size, adjusting it according to different lighting conditions.

The uniqueness of iris texture lies in its intricate and individualized nature, similar to fingerprints. Each person is believed to possess a unique iris texture, making it a valuable trait for identification purposes. The fine details of the iris, such as lines, furrows, and crypts, collectively contribute to its distinct texture.

The field of biometrics, particularly iris recognition systems, has shown considerable interest in iris texture. Specialized cameras capture high-resolution images of the iris, enabling the extraction of its unique texture features. These features are converted into mathematical templates, which can then be stored in databases for future comparison and identification.

Using iris texture for identification offers several advantages. It exhibits a high level of distinctiveness, remains stable over time, and is resistant to alteration. Unlike other biometric identifiers like fingerprints or facial features, the iris is safeguarded by the cornea and aqueous humor, rendering it less susceptible to damage or modification. Moreover, the texture patterns of the iris tend to remain relatively consistent throughout an individual's lifetime, providing a reliable method of identification.

In conclusion, iris texture pertains to the distinct patterns and characteristics present on the surface of the iris. Its uniqueness and stability make it an ideal biometric identifier, particularly in iris recognition systems. The study and application of iris texture have significantly contributed to the field of biometrics, enhancing security and identification processes across various domains. [5].

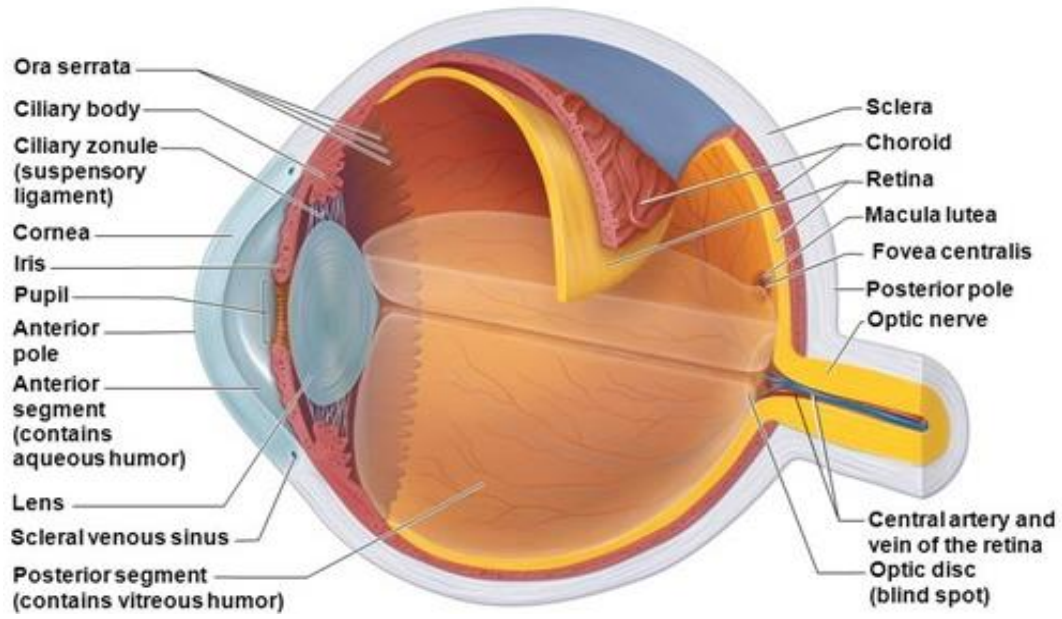

Figure 1. Iris Internal Structure Picture [4].

3. Database of an Iris Picture

The detection of a person relies on the biological characteristics of the iris. Due to its unique attributes, researchers have shown considerable interest in this topic and have proposed numerous approaches. They conducted various experiments and tests using iris images. However, creating their own dataset proved to be challenging. Consequently, the availability of a database becomes essential for studying the biological characteristics of the iris and person detection [1]. The following section provides a detailed explanation of the different freely available datasets accessible on the internet.

1) UBIRIS

This database is unconstrained Biometrics IRIS (UBIRIS) database. This database is subdivided into two sections

i) UBIRIS V1 database for iris picture.

a) The UBIRIS V1 database contains low-noise iris images specifically designed for robust iris recognition in person detection. During the image capture process, various sources of noise are taken into consideration, such as light reflection, obstructions from eyelashes and eyelids, low focus, rotated iris, blur, motion, and more. The images are captured from a distance of 20 cm to 30 cm.

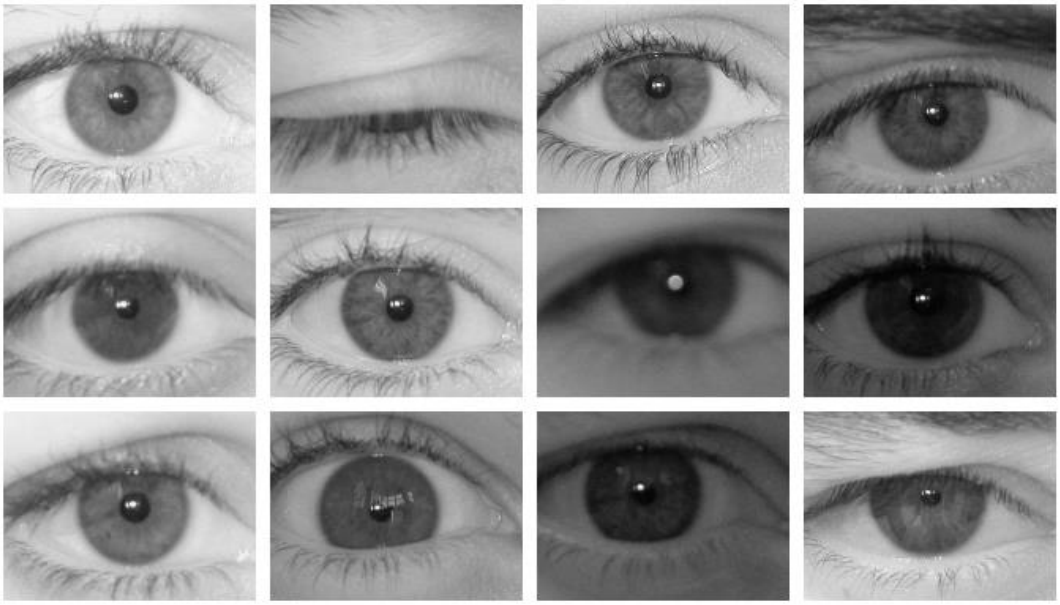

Figure 2. Database of UBIRIS v1 iris pictures [6].

b) The UBIRIS V1 database was created by the University of Beira in 2004. It comprises a total of 1877 iris pictures collected from 241 individuals over two different sessions conducted within a two-week period. The images were captured using a Nikon E 5700 V1.0 camera with a focal length of 71mm and an exposure time of 1/30 sec. The output from the camera provides RGB pictures with a resolution of 2560 x 1704 and a color depth of 24 bits, with both vertical and horizontal resolutions set at 300 dpi. c) To reduce file size for easier uploading and downloading from the internet, the captured pictures are converted to grayscale with dimensions of 300 x 400. All the images are available in JPEG format. The pictures are captured in two different sessions, with noise reduction performed using contrast, luminosity, and reflection considerations in the first session, and the same parameters adjusted for natural light sources in the second session. Figure 3 displays the UBIRIS V1 pictures classified based on parameters such as focus, reflection, and iris visibility, categorized as Good, Average, and Bad. Sample pictures from the UBIRIS V1 database can be seen in Figure 2.

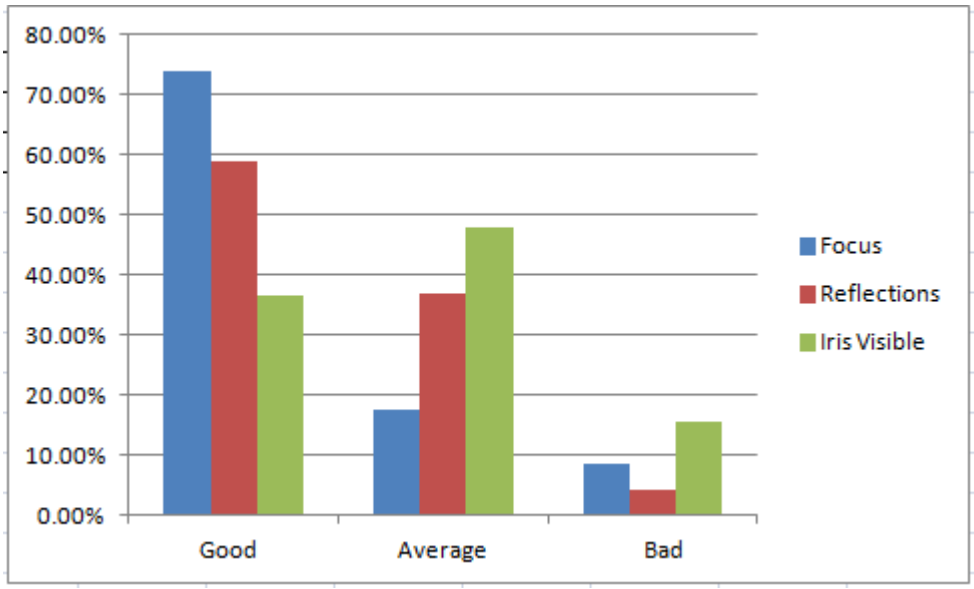

Figure 3. Picture quality of UBIRIS v1 [7].

ii) UBIRIS V2 database for iris picture.

The mentioned database is referred to as the UBIRIS V2 database, which involves the following details:

a) The UBIRIS V2 database captures pictures from a distance of 4 to 8 meters. Similar to the UBIRIS V1 database, the image capture process considers various sources of noise, including light reflection, obstructions from eyelashes and eyelids, low focus, rotated iris, blur, motion, and more. Additionally, additional parameters such as visible wavelength, movement, and distance are taken into account [8].

b) The UBIRIS V2 database was created by the University of Beira in 2004. It contains a total of 11,102 iris pictures obtained from 261 individuals across multiple sessions with a two-week interval. The pictures were captured using a Canon EOS 5D camera with a focal length of 400mm, an exposure time of 1/200 sec, a shutter speed of 1/197, and an ISO-1600 speed. The camera output provides RGB pictures with a resolution of 800x600 and a color depth of 24 bits, with vertical and horizontal resolutions set at 72 dpi. The lens aperture ranges from F/6.4 to F/7.

c) The captured pictures are represented in the sRGB color space and can be easily uploaded and downloaded from the internet. They are available in TIFF format.

The UBIRIS V2 database comprises iris pictures with heterogeneous characteristics, including out-of-iris images, dark irises, partially captured irises, irises with lighting reflections, irises with specular reflections, irises captured in poor lighting conditions, iris obstructions due to hair, contact lenses, glasses, eyelashes, and eyelids, motion-blurred iris images, rotated iris images, poorly focused iris images, and off-angle iris images [8]. Sample pictures from the UBIRIS V2 database are presented in Figure 4.

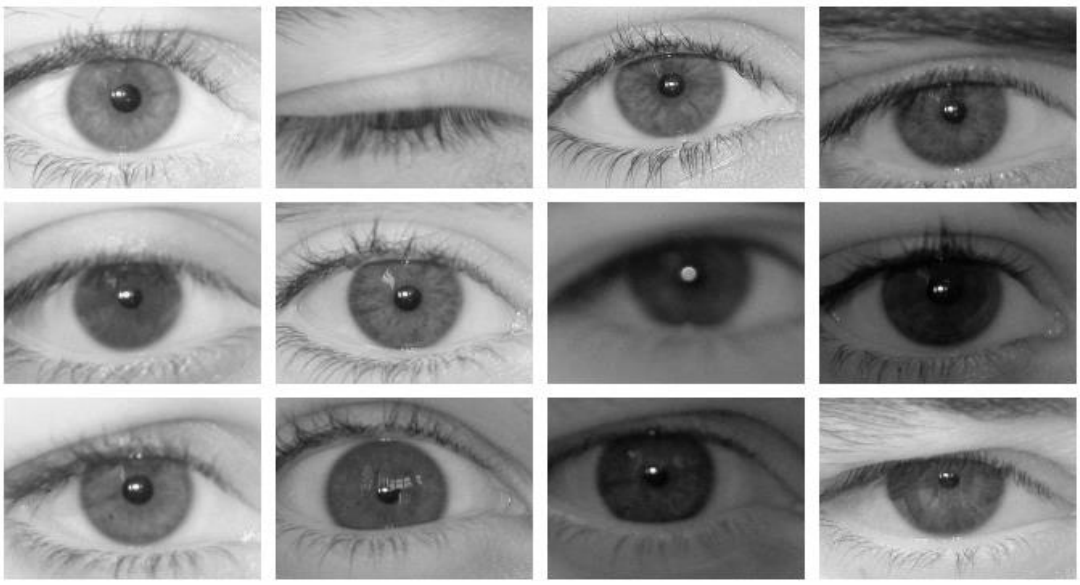

Figure 4. Database of UBIRIS v1 iris pictures [6].

2) UPOL

This database is developed by University of Palackeho and Olomouc (UPOL) database.

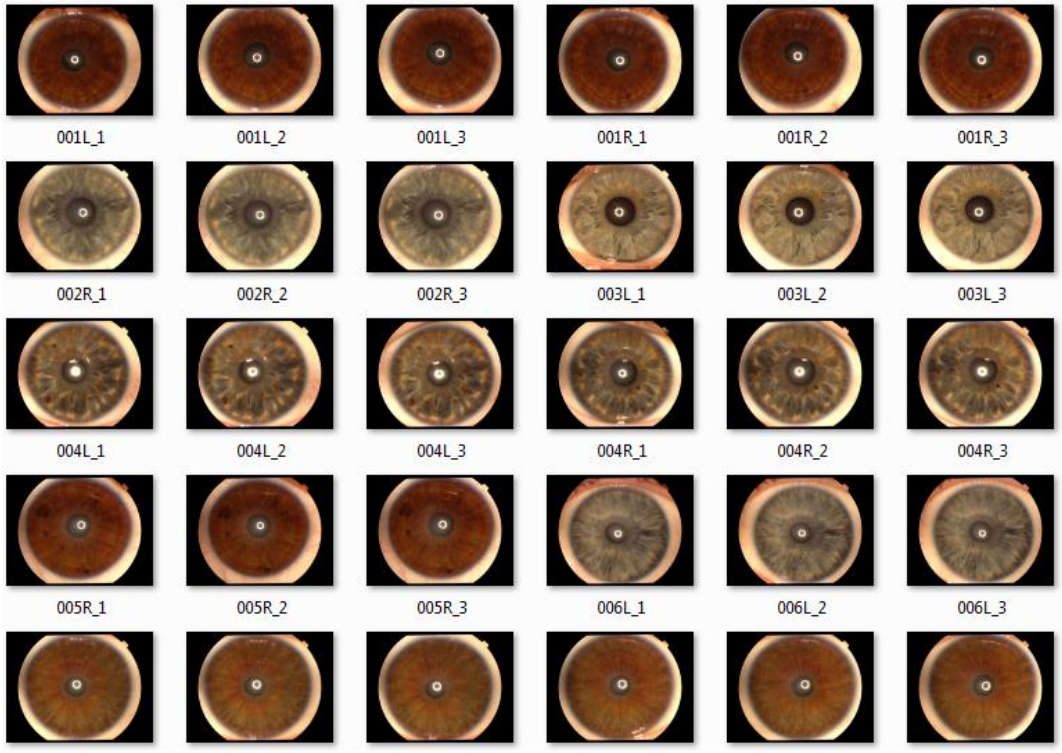

Figure 5. Database of UPOL iris pictures [9].

The mentioned database is known as the UPOL database, and it includes the following information:

a) The UPOL database captures pictures from a distance of 20 to 30 centimeters. It is noteworthy that this is the first database to utilize a visible wavelength light source for imaging purposes.

b) The UPOL database was created by the University of Palackeho and Olomouc. It consists of a total of 384 iris pictures obtained from 64 individuals. Each person

has three pictures captured from their left eye and three pictures from their right eye. The camera used for capturing the pictures is the SONY DXC-950P 3CCD, which is attached to the TOPCON TRC50IA optical device. The camera output provides RGB pictures with a resolution of 576x768 and a color depth of 24 bits [9].

c) The captured pictures are represented in the RGB color space and can be easily uploaded and downloaded from the internet. They are available in PNG format. Since a visible wavelength light source is used, the captured pictures are devoid of noise. The visible wavelength light source does not affect the human iris. Sample pictures from the UPOL database can be seen in Figure 5.

3) WVU

This database is developed by West Virginia University (WVU) database.

The mentioned database is known as the WVU database, and it includes the following information:

a) The WVU database captures pictures from a close distance. During the image capture process for this dataset, various sources of noise are considered, including rotated images, environmental light reflections, poor focus, obstructions, off-angle captures, and more [10].

b) The WVU database was created by the West Virginia University. It comprises a total of 1852 iris pictures. The capturing of pictures is done using a hand-held camera called OKI. Sample pictures from the WVU database can be seen in Figure 6.

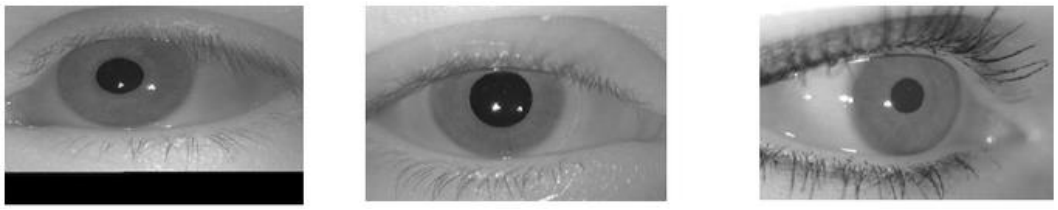

Figure 6. Database of WVU iris pictures [10].

4) ICE

The mentioned database is developed by the National Institute of Standards and Technology (NIST) and is called the Iris Challenge Evaluation (ICE).

a) The ICE database captures pictures from a close distance using a near-infrared (NIR) light source. During the image capture process for this dataset, various sources of noise are considered, including occlusion of eyelashes, poor focus, obstructions, off-angle captures, and more [11].

Figure 7. Database of ICE iris pictures [11].

b) The ICE database was created by the National Institute of Standards and Technology (NIST). It consists of a total of 2954 iris pictures. Sample pictures from the ICE database can be seen in Figure 7.

5. MMU This database is developed by Multimedia University (MMU) database.

a) The MMU1 database captures pictures from a distance of 7-25 cm using a visible NIR light source for imaging purposes. The MMU2 database captures pictures from a distance of 47-53 cm, also utilizing a visible NIR light source. During the image capture process for both datasets, various sources of noise are considered, including eye rotation, poor focus, obstructions, off-angle captures, and more [12].

b) The MMU database was created by the University of Multimedia. It comprises a total of 450 iris pictures for MMU1 and 995 pictures for MMU2. The LG Iris Access 2200 camera is used for capturing pictures in MMU1, while the Panasonic BM-ET100US camera is used for MMU2 [12]. Sample pictures from the MMU database can be seen in Figure 8.

Figure 8. Database of MMU iris pictures [12].

6) BATH

This database is developed by University of Bath by Smart Sensor Limited (BATH) database.

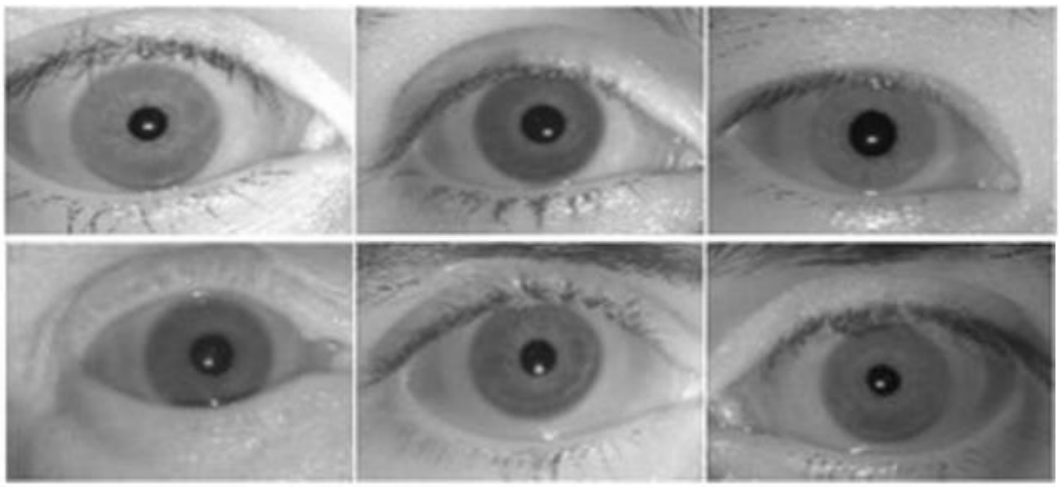

Figure 9. Database of BATH iris pictures [13].

a) The BATH database captures pictures from a distance of 7-25 cm using a visible NIR light source for imaging purposes. During the image capture process for this dataset, various sources of noise are considered, including focus blur, occlusion with eyelids/eyelashes, and deviated gaze. These pictures are suitable for iris recognition [13].

b) The BATH database was created by the University of Bath in collaboration with Smart Sensor Limited. It consists of a total of 32,000 high-quality iris pictures taken from 800 individuals. The ISG LW-1.3-S-1394 1.3-megapixel camera is used for capturing the pictures. The output obtained from the camera provides RGB pictures with a resolution of 1280×960 and 24-bit color depth. During the capture process, the camera captures 200 frames for each person, and the best 20 frames are stored in the database. Sample pictures from the BATH database can be seen in Figure 9.

7. IITD This database is developed by the Indian Institute of Technology Delhi (IITD) database.

a) The IITD database captures pictures from a small distance and utilizes an indoor environment for imaging purposes [14].

b) The IITD database was created by the Indian Institute of Technology Delhi. It contains a total of 2240 iris pictures taken from 224 individuals. All the pictures in this database are available in bitmap format. The JIRIS JPC1000 digital CMOS camera is used for capturing the pictures, resulting in grayscale images with a resolution of 320×240. Sample pictures from the IITD database can be seen in Figure 10.

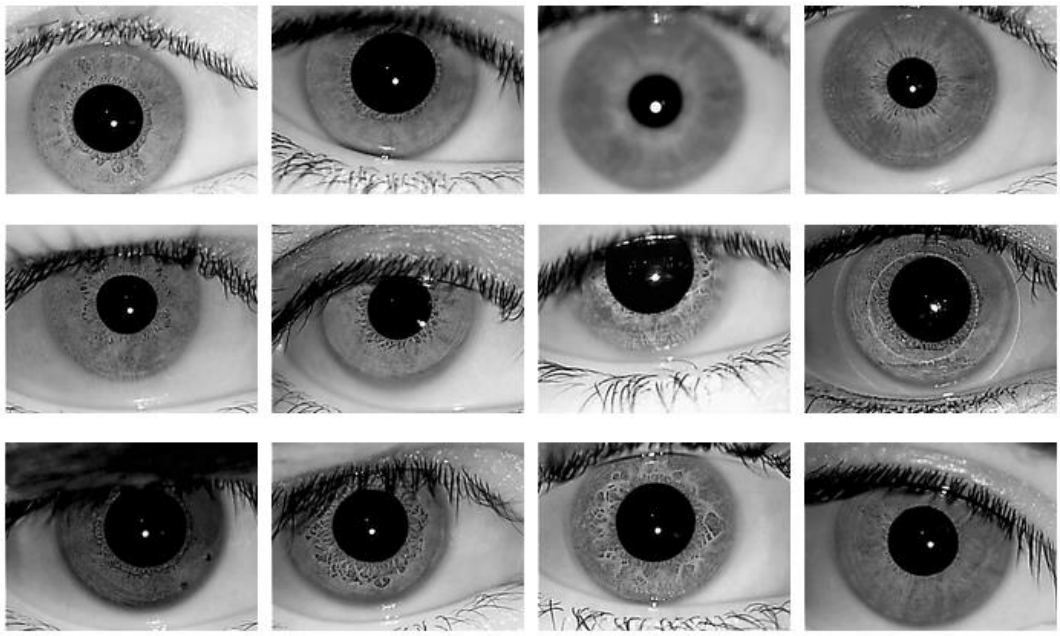

Figure 10. Database of IITD iris pictures [14].

8) CASIA

This database is developed by Chinese Academy of Science - Institute of Automation (CASIA) database. This database is subdivided into FOUR sections

i) CASIA V1 database for iris picture.

a) The CASIA V1 database captures pictures from a small distance [15].

b) The CASIA V1 database was created by the Chinese Academy of Science - Institute of Automation. It consists of a total of 756 iris pictures taken from 108 individuals. The pictures in the database are divided into two sections: a training section and a testing section. For capturing the pictures, a homemade iris camera with NIR 850nm illuminators, eight circularly fitted, is used. The output obtained

from the camera provides grayscale pictures with a resolution of 320×240. Sample pictures from the CASIA V1 database can be seen in Figure 11.

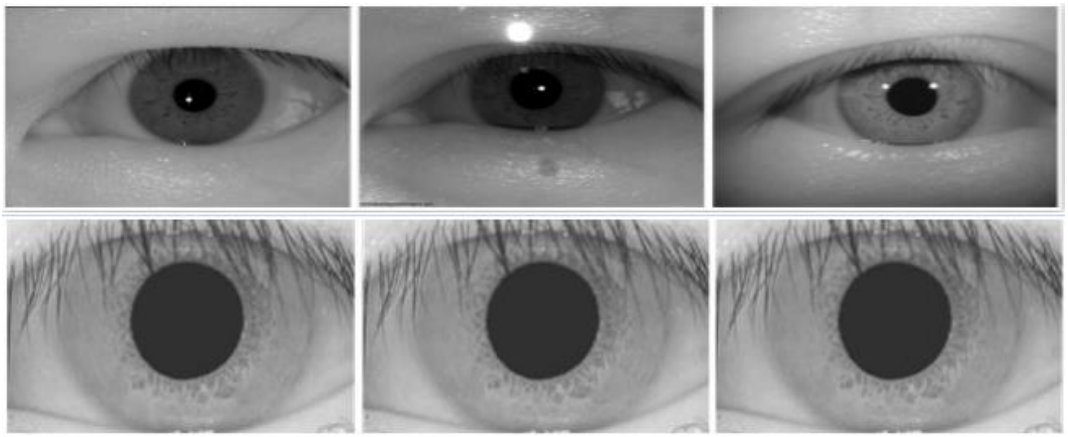

Figure 11. Database of CASIA V1 iris pictures [16].

ii) CASIA V2 database for iris picture.

a) The CASIA V2 database contains pictures captured from a small distance [15].

b) The CASIA V2 database was created by the Chinese Academy of Science - Institute of Automation. It consists of a total of 2400 iris pictures taken from different individuals. The pictures in the database are collected using two different devices. The first 1200 pictures are captured using OKI's Irispass-h device, while the next 1200 pictures are captured using the Chinese Academy of Science's CASIA-Iris cam. The output obtained from the camera provides grayscale pictures with a resolution of 640×480. Sample pictures from the CASIA V2 database can be seen in Figure 12.

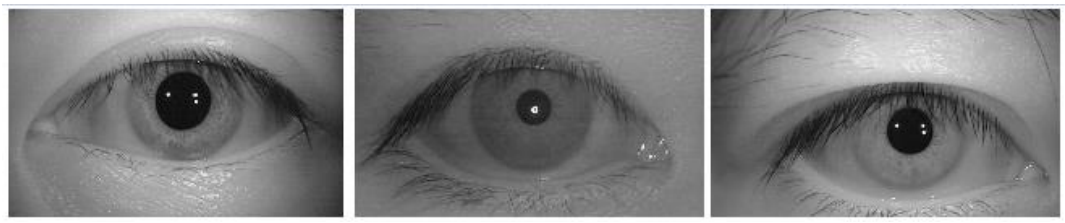

Figure 12. Database of CASIA V2 iris pictures [16].

iii) CASIA V3 database for iris picture.

a) The CASIA V3 database consists of pictures captured from a small distance [15]. During the capture process, various noisy parameters were considered.

b) The CASIA V3 database was created by the Chinese Academy of Science - Institute of Automation. It contains a total of 22,034 iris pictures obtained from 700 individuals. The database is divided into three sets: Interval, Lamp, and Twins.

c) The Interval database pictures were captured using a LED NIR light source and comprise 2,639 pictures. These pictures were taken from a small distance and are available in JPG format. The resulting images are grayscale with a resolution of 320×280.

d) The Lamp database pictures were captured using a visible light on-off factor and consist of 16,212 pictures. These pictures were captured from a small distance and are available in JPG format. The resulting images are grayscale with a resolution of 640×480. This dataset includes non-linear deformations and dilation in pupil size.

e) The Twins database pictures were captured at the annual twin's festival in Beijing and include 3,183 pictures of 100 pairs of twins. These pictures were captured from a small distance and are available in JPG format. The resulting images are grayscale with a resolution of 640×480. Sample pictures from the CASIA V3 database can be seen in Figure 13.

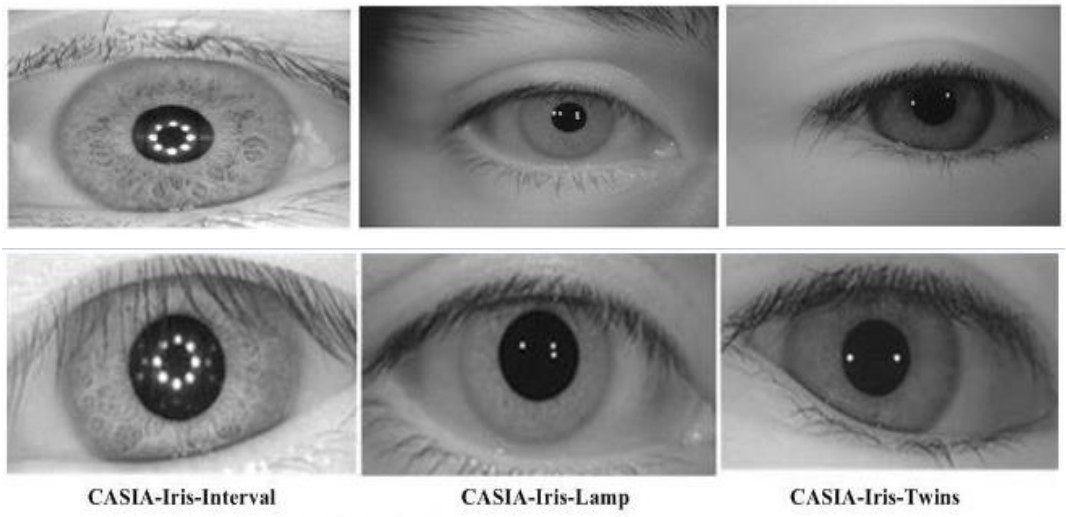

Figure 13. Database of CASIA V3 iris pictures [16].

iii) CASIA V4 database for iris picture.

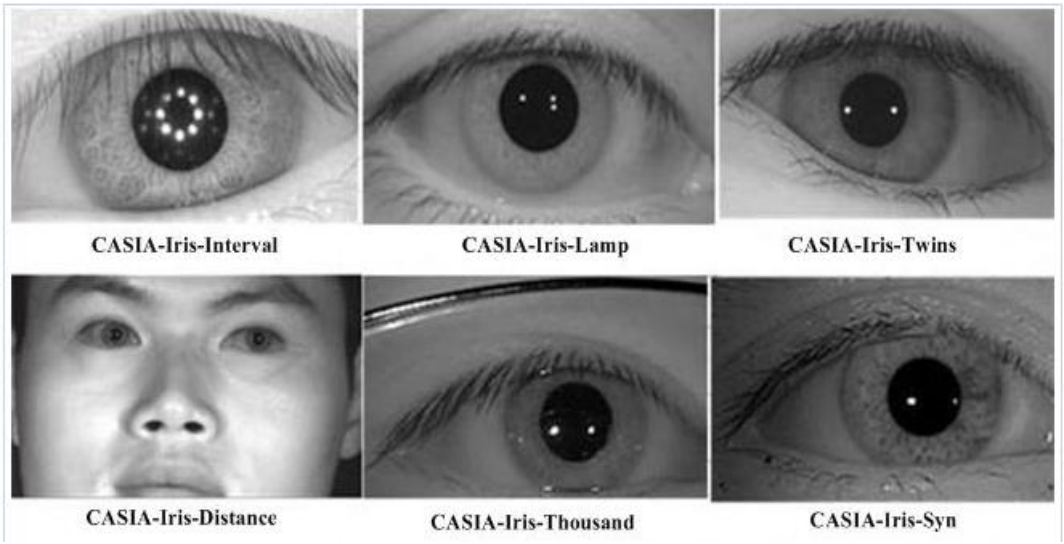

Figure 14. Database of CASIA V4 iris pictures [16].

a) The CASIA V3 database captures pictures from a distance of 3 meters, considering various noisy parameters such as moving subjects, poor quality, and long distances.

b) The CASIA V4 database was created by the Chinese Academy of Science - Institute of Automation, containing a total of 2576 iris pictures from different individuals. The captured images are grayscale with a resolution of 2352×1728. Sample pictures from the CASIA V3 database can be seen in Figure 14.

4. Conclusion

This paper presents a comparison of various freely available iris picture datasets found on the internet. The UBIRIS V1, UBIRIS V2, and UPOL datasets were captured under noisy conditions with a visible wavelength light source. On the other hand, the WVU, ICE, MMU, BATH, IITD, and CASIA datasets were captured under noisy conditions with a NIR light source. All of these datasets are used for iris recognition purposes. After comparing these different databases, it is evident that the UBIRIS V2 database is the most suitable for iris recognition at a distance.

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