

# **OSAC 2024-N-0004**

# **Standard Guide for Capturing Iris Images for Use with Iris Recognition Systems**

Facial & Iris Identification Subcommittee  
Digital/Multimedia Scientific Area Committee (SAC)  
Organization of Scientific Area Committees (OSAC) for Forensic Science



## OSAC Proposed Standard

# OSAC 2024-N-0004 Standard Guide for Capturing Iris Images for Use with Iris Recognition Systems

Prepared by  
Facial & Iris Identification Subcommittee  
Version: 2.0  
November 2024

---

### **Disclaimer:**

This OSAC Proposed Standard was written by the Facial & Iris Identification Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science following a process that includes an [open comment period](#). This Proposed Standard will be submitted to a standard developing organization and is subject to change.

There may be references in an OSAC Proposed Standard to other publications under development by OSAC. The information in the Proposed Standard and underlying concepts and methodologies may be used by the forensic science community before the completion of such companion publications.

Any identification of commercial equipment, instruments, or materials in the Proposed Standard is not a recommendation or endorsement by the U.S. Government and does not imply that the equipment, instruments, or materials are necessarily the best available for the purpose.

## Standard Guide for Capturing Iris Images for Use with Iris Recognition Systems

### Scope

1.1 This guide is intended for use by practitioners who are choosing, setting up, and operating equipment designed to capture iris images for use with automated Iris Recognition Systems.

1.2 This document provides guidance for the proper collection of iris images captured in well-controlled environments (e.g., booking stations) and semi-controlled environments (e.g., field capture).

1.3 This document provides equipment guidance for capturing iris images in the near-infrared (near-ir) region of the electromagnetic spectrum from approximately 700 nm to 900 nm. It does not address visible light spectrum (from 380 to 700 nanometers) images or video captured via conventional cameras.

1.4 This standard does not purport to address safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

## 2. Referenced Documents

### 2.1 Biometric Standards:

2.1.1 ANSI/NIST-ITL-1-2011 Update 2015: Data Format for the Interchange of Fingerprint, Facial and Other Biometric Information

2.1.2 ISO/IEC 29794-6:2015 - Information Technology - Biometric sample quality - Part 6: Iris image data

2.1.3 NIST Interagency Report 8013: IREX V Guidance for Iris Image Collection

2.1.4 NIST Special Publication 500-280 – Mobile ID Device Best Practice Recommendation  
Version 1.0 (Section 8)

2.1.5 NIST TN-2018: Standards Relevant for Iris Camera Acquisitions

### **3. Terminology**

3.1 Canthus, *n*: plural canthi. The corner at each side of the eye where the upper and lower eyelids join.

3.1.1 Discussion: The medial (sometimes called inner) canthus is adjacent to the nose; the lateral (sometimes called outer) canthus is adjacent to the temple.

3.2 Iris texture, *n*: the totality of features that can be captured in an image of an iris; these features can be used for identification.

3.3 Near-infrared wavelength spectrum, *n*: in the context of this document, 700 to 900 nanometers; the range of wavelength recommended in ISO standards for use in iris recognition cameras.

3.4 Specular reflection, *n*: reflections of a scene off the outer and inner surfaces of the eye.

3.4.1 Discussion: Specular reflections create false features on the iris that negatively impact recognition accuracy. They typically show what is in front of the subject and result from improper ambient lighting.

3.5 Visible light spectrum, *n*: in the context of this document, 300 to 700 nanometers; the range of wavelengths used in conventional photography.

## 4. Significance and Use

4.1 Image quality is a critical factor in the performance of iris recognition systems and the performance of iris image examiners.

4.2 Many iris images are submitted to a database in an ANSI-NIST ITL-1100 Electronic Biometric Transmission Specification (EBTS) file. The images extracted from the cameras may have to be processed through a middleware to be formatted correctly prior to adding to the EBTS file. The image must not be lossy compressed at any stage of the process and should be saved in a lossless compression format.

4.3 For the purpose of this discussion, image quality factors may be characterized into the following categories:

4.3.1 Subject characteristics: characteristics that affect the visibility of the iris texture; these include eyelid opening and eyelash length, subject capability to present an on-axis, well-aligned image.

4.3.2 Ambient environment: factors that can affect the iris camera or the subject; these include the brightness of visible light which can affect the subject's pupil dilation and the presence of extraneous near-ir light sources, such as sunlight, which can generate specular reflections that will be seen in the near-ir images collected by the iris camera.

4.3.3 Iris camera: This camera has characteristics including depth of focus, field of view, single-eye vs. dual-eye, and operator interface.

4.3.4 Operator skill: the best camera can take poor images of a good subject when not used according to best practices for the camera.

## 5. Scenarios

### 5.1 Controlled acquisition

5.1.1 This scenario is when all constraints can be controlled, including image capture equipment, the capture environment, and the pose and positioning of the subject. An example scenario is the well-controlled booking process at a criminal justice facility.

### 5.2 Semi-controlled acquisition

5.2.1 This scenario refers to when some, but not all, constraints can be controlled. In these situations, ambient conditions may not be well controlled, the level of subject cooperation may be diminished, and other conditions may create additional stress on the operator. An example is law enforcement mobile capture.

5.3 See Figures 1 and 2 for examples of good and poor iris image captures in both controlled and semi-controlled environments and mitigation strategies. Section 6 presents a list of factors related to the quality of captured iris images.

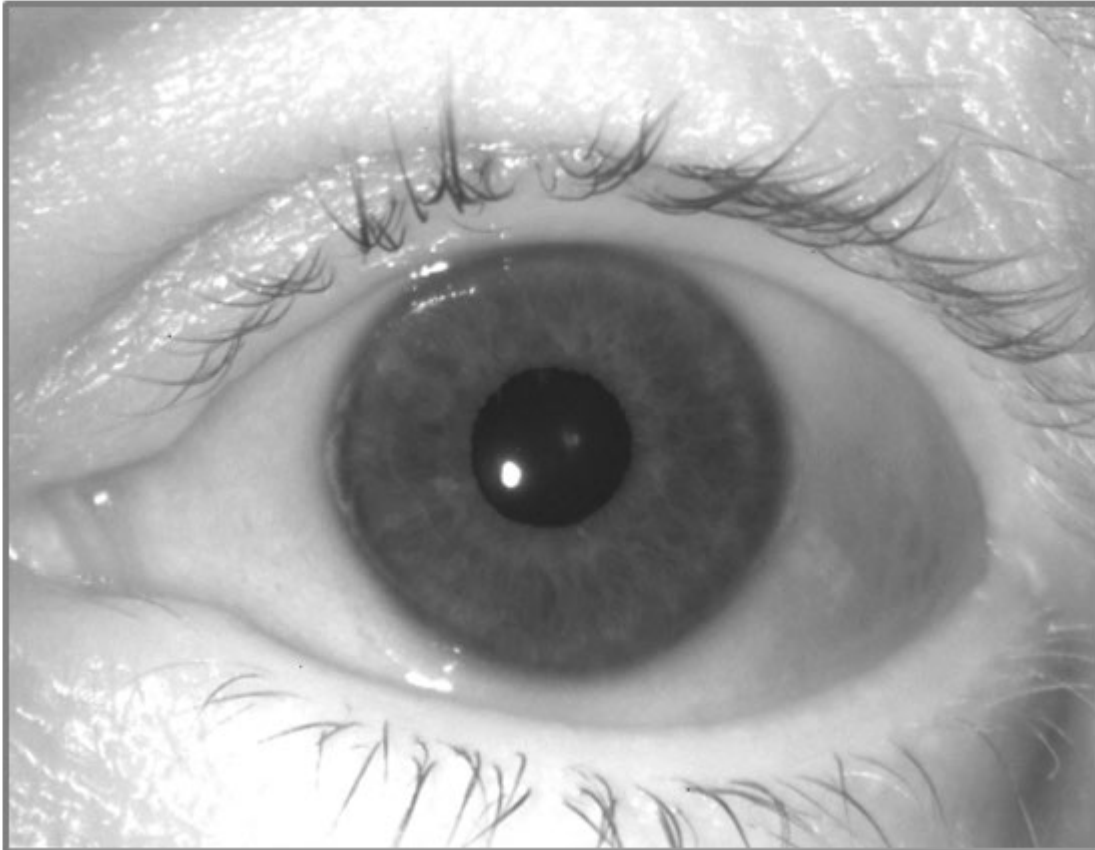
5.4 Automated image quality assessment may be built into cameras. It is strongly recommended that image quality is assessed at the time of capture to provide immediate feedback to the camera operator.

## 6. Important Factors Related to Iris Image Capture

The important factors related to capturing iris images are summarized in the following tables:

- environmental factors (Table 6.1), discussing ambient illumination and camera location,
- subject pose (Table 6.2), discussing optimal subject position including their distance to the sensor, situations when subjects wear glasses or contact lenses (both transparent and textured), and ways to minimize occlusions of the iris pattern,

- capture device and operator's behavior (Table 6.3), discussing camera type, iris illumination implemented by the camera, dual-eye vs. single-eye capture mode, Failure to Acquire, image format, iris image quality, and data compression.

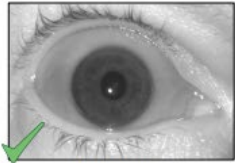
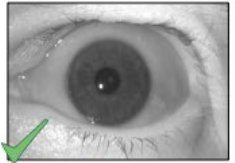


**FIG. 1 Example of a Good Quality Iris Image, from IREX-V Slide Deck<sup>1</sup>**

---

<sup>1</sup> <https://www.nist.gov/itl/iad/image-group/irex-v-homepage>


CORRECT

- ✓ Eyes wide open
- ✓ Iris centered and fully visible
- ✓ Eyes looking at camera
- ✓ Sharp, in focus
- ✓ Few reflections or specular highlights
- ✓ Correct left and right labels

INCORRECT


EYELID: OCCLUSION OF IRIS



X

Ask subject to open eyes wide. Subject may use fingers to hold eyes open.


EYEGLASSES: OCCLUSION AND REFLECTIONS



X

Remove eyewear

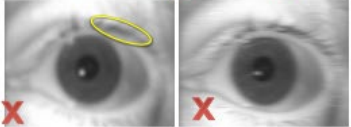
IRIS ABSENT



X

Remove glasses, align camera with eyes


BLUR: FOCUS (L) MOTION (R)



X

Hold camera still and at proper distance from subject


BACKGROUND REFLECTIONS ON IRIS



X

Avoid bright scenes in front of the subject

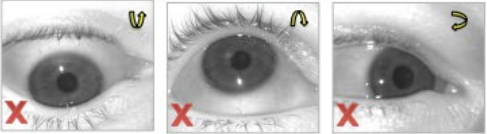
UPSIDE-DOWN



X

Properly align camera with subject

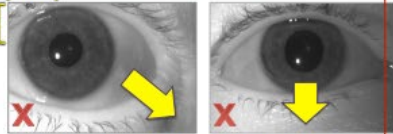
IMPROPER GAZE ANGLE



X

Instruct subject to look directly at the camera or fixation light


IRIS CLOSE TO EDGE



X

Align camera axis with eye(s)


ROTATION



X

Align camera with subject


EXCESSIVE DILATION



X

Wait for drugs to wear off; increase ambient light


UNEVEN ILLUMINATION



X

Verify all LEDs are working and not covered


LOW CONTRAST



X

Verify all LEDs are working and not covered

PATTERNED CONTACT LENS



X

Ask to remove, or do not acquire iris

Poster developed by NIST in furtherance of its statutory responsibilities under the Federal Information Security Management Act (FISMA) of 2002, Public Law 107-347. The IREX Program (iris.nist.gov/irex) advances high performance iris recognition through standards development and testing.

**Fig. 2 Examples of Good and Poor Image Captures, Poster<sup>2</sup> from IREX-V<sup>3</sup>**

<sup>2</sup> [https://www.nist.gov/system/files/documents/2021/07/19/irex\\_v\\_poster\\_20140612.pdf](https://www.nist.gov/system/files/documents/2021/07/19/irex_v_poster_20140612.pdf)

<sup>3</sup> <https://www.nist.gov/itl/iad/image-group/irex-v-homepage>



### 6.1 Important environmental factors when capturing iris images

No.	Item	Description	Comments
1	Ambient Illumination	Ambient lighting with illumination of typical office space levels should be utilized.	<p>Areas with direct or indirect sunlight should be avoided.</p> <p>Bright incandescent lighting should be avoided.</p> <p>Dark rooms should be avoided unless the iris capture device provides its own source of visible illumination.</p>
2	Camera location	As recommended by the camera manufacturer/vendor.	

### 6.2 Important factors regarding subject pose

No.	Item	Description	Comments
1	Subject position	The subject should remain still with the eye gaze directed towards the camera axis with the head position square to the camera sensor.	Eye gaze angle is a specific image quality metric.
2	Glasses	The subject shall remove glasses prior to image capture for enrollment scenarios.	Glasses may obstruct portions of the eye due to specular highlights, scratches, or dirt on the surface of the lens.
3	Contact lenses	Contact lenses obscuring the iris texture (e.g. patterned cosmetic lenses) shall be removed prior to image capture.	<p>Iris images shall not be captured if the subject cannot remove patterned cosmetic contact lenses.</p> <p>Clear contact lenses not obscuring the iris texture need not be removed.</p>

5	Distance	The minimum distance between the iris capture device's lens and the subject's eye is typically 100 millimeters.	This distance is acceptable as non-intrusive and avoids excessive geometric distortion.
6	Occlusion <sup>4</sup>	Minimize anything, for example, hair, fake eyelashes, that would obscure the iris texture.	The subject may use their fingers to open the eyes wider if the iris is obscured.

### 6.3 Important factors regarding capture device and operator behavior

No.	Item	Description	Comments
1	Camera type	Cameras capable of capturing images in the near-IR wavelength shall be used. Conventional visible full-spectrum image capture should not be used.  The camera shall meet "ISO/IEC 29794-6:2015 Information technology — Biometric sample quality - Part 6: Iris image data."	Iris images are captured in non-visible wavelengths, making them different from images taken using a conventional camera.
2	Camera Illumination	Monochrome near-ir or near-ir channel of a color sensor: Near-infrared wavelength bandwidth (approximately 700 to 900 nm) shall be used.	Illumination shall comply with safety specification ISO 62471- 1 "Exempt" category (i.e., it must be eye-safe in all circumstances).
3	Capture	Devices used for capturing iris images should capture both left and right images simultaneously or quasi-simultaneously (within a few milliseconds).	Using a dual-eye capture mode camera reduces the possibility of mislabeling the individual images (right or left), while also allowing more accurate estimation of the

<sup>4</sup> Obstruction is occasionally used in the discussion of blocking the view of iris texture in the iris recognition modality. In the face recognition modality, the term obstruction is used somewhat more frequently, particularly among human face image examiners. We use the term occlusion here in order to conform to the norms of the iris recognition community.

			<p>roll angle<sup>5</sup>, thereby reducing the need for the system to search the image in different roll angles. This will potentially translate to higher accuracy and comparison speed.</p> <p>If not mounted, the iris camera should include an orientation sensor that prohibits the iris capture process if the device is upside down.</p>
4	Failure to Acquire (FTA)	Failure to acquire occurs when the device is unable to acquire an iris image of the quality required in a specific scenario within a specified time period.	FTA depends on the scenario, environment, algorithm, and equipment. The system owner must determine the acceptable FTA in consultation with the system vendor.
5	Compression	Iris images from a device shall be uncompressed or losslessly compressed.	
6	Image Format	The device shall supply images in a standard format (e.g., bmp, png) suitable for use by matching and encoding systems.	<p>The image format should be compatible with the middleware of the applicable system.</p> <p>Different image formats may have different data storage and transmission requirements.</p>
7	Image Quality Metrics	The camera should encourage operator behavior that will generate images that are ISO/IEC 29794-6:2015 compliant. Examples of compliant and non-compliant images are seen in Fig. 2 of this document.	Image quality (e.g., usable iris area, sharpness, and positioning of the iris in the center of the image) and consistency have a direct impact on matching capability.
8	Operator Behavior	As recommended by the camera manufacturer/vendor.	E.g., ensure the operator's fingers are not obscuring any part of the camera lens or illumination array.

<sup>5</sup> rotation of the eye around a line extending from the pupil to the camera