

Usefulness of Existing Iris Databases and Future Priorities

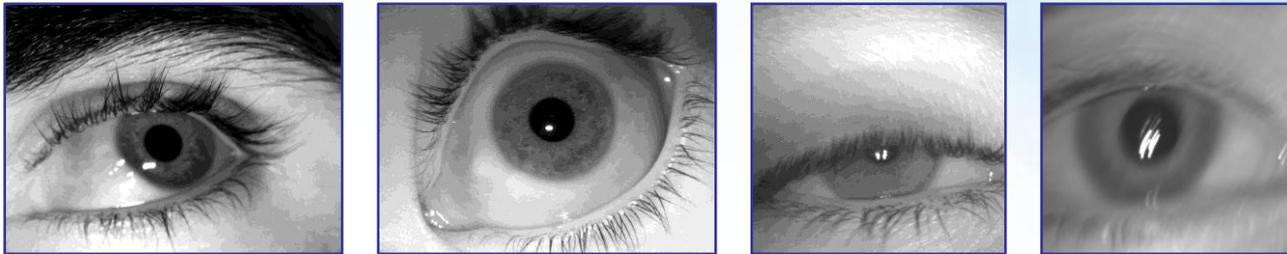
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Current State of Iris Recognition

- Iris recognition is extremely accurate when the quality of the images is good.
- The IREX III supplemental report found that of 1,013 searches that failed to return the correct mate (for any of the top 3 matching algorithms), in every case there was some problem with one of the images.



- Performance of an operational system will be determined by the poorest quality samples and how frequently they occur.

Available Iris Datasets

Notre Dame

- ND-IRIS-0405
- Cross Sensor
- Time Lapse
- Template Aging
- Contact Lenses
- Gender Prediction
- Face / Ocular Challenge

West Virginia University

- Multi-modal
- Off-Axis
- Synthetic Iris

University of Beira

- UBIRIS.v1
- UBIRIS.v1

SmartSensors

- IrisBase

CASIA

- Iris-Thousand
- Iris-Interval
- Twins
- Long Range
- Synthetic Iris
- Iris-Lamp

Clarkson University

- Q-FIRE (face + iris)
- Liveness Detection

UTIRIS

- Visible + Near-IR

BioSecure

- Desktop Dataset

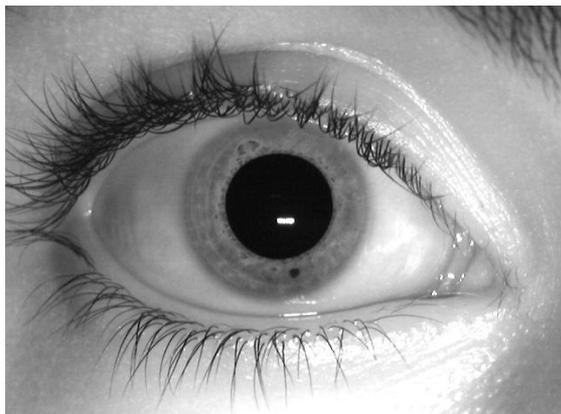
MultiMedia University

- MMU1

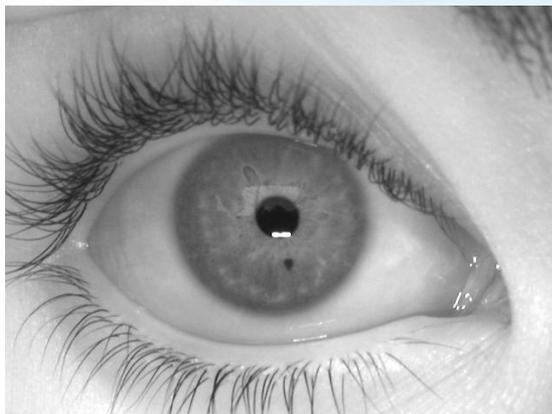
Pupil Dilation

“[W]hen matching ... images of the same person, larger differences in pupil dilation yield higher template dissimilarities.”

- Hollingsworth, Bowyer, Flynn
Computer Vision and Image Understanding, 2009

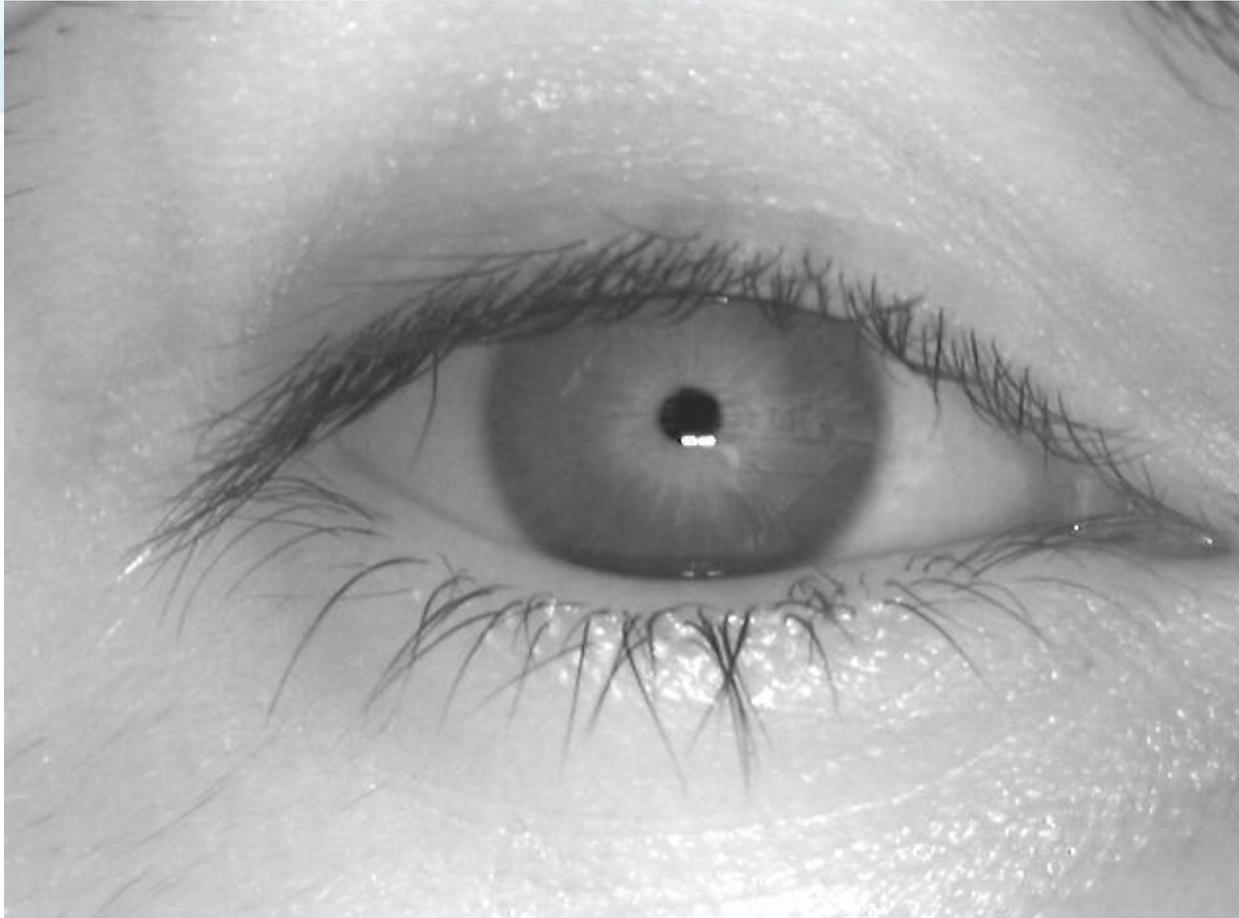


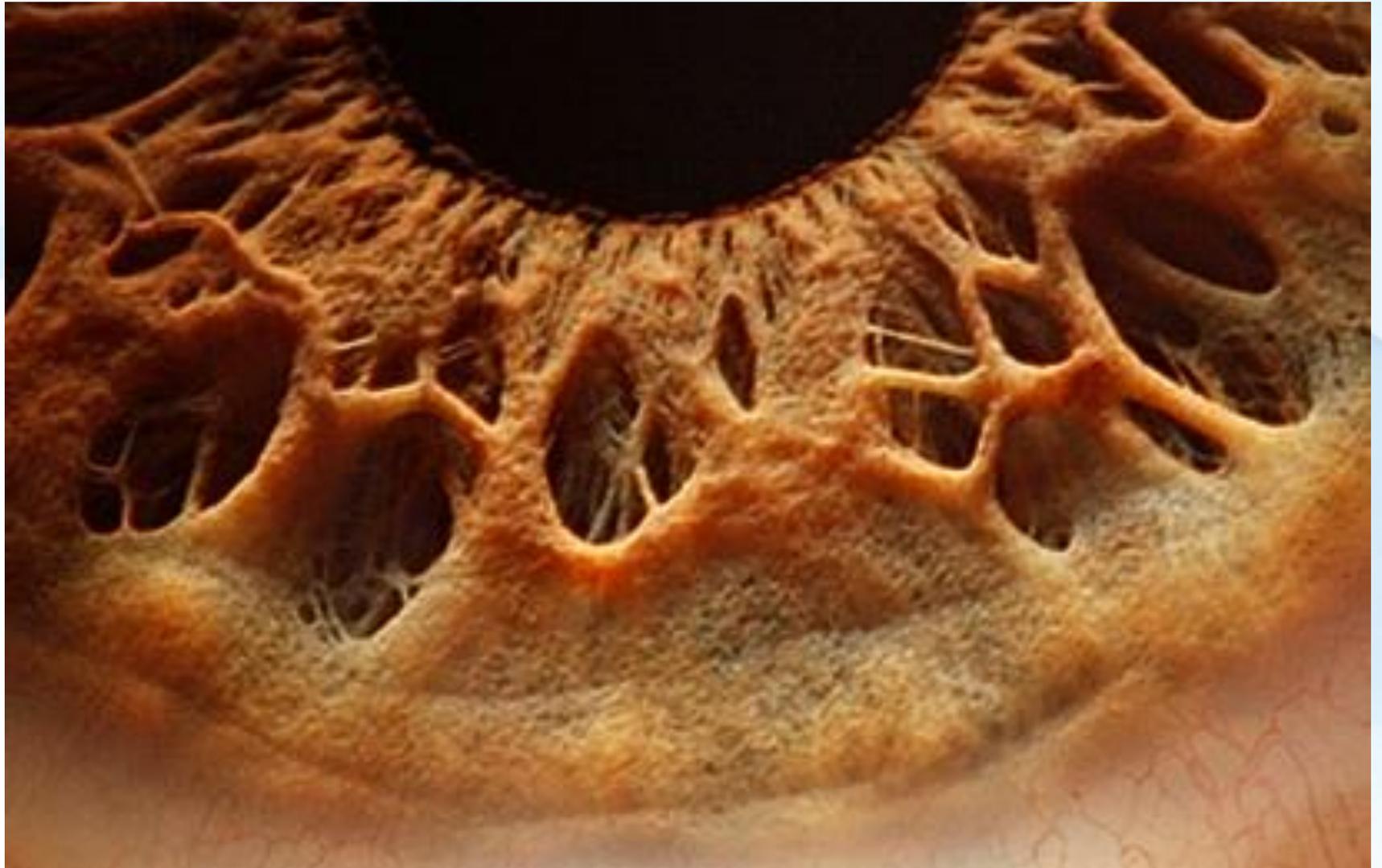
Dilated



Constricted

Pupil Dilation

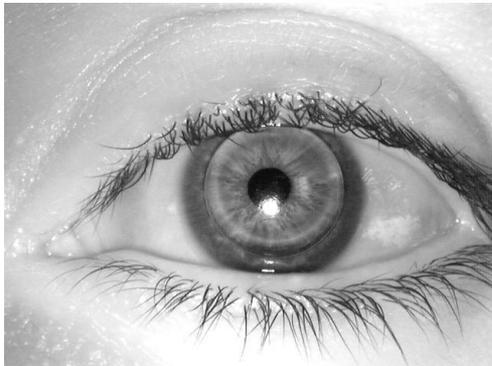




Contact Lenses

Two types:

- 1) Vision correction lenses
- 2) Patterned contact lenses



Vision Correction



Patterned Contact
spoofing?

Notre Dame has a dataset of iris images of people wearing contact lenses:
http://www3.nd.edu/~cvrl/CVRL/Data_Sets.html

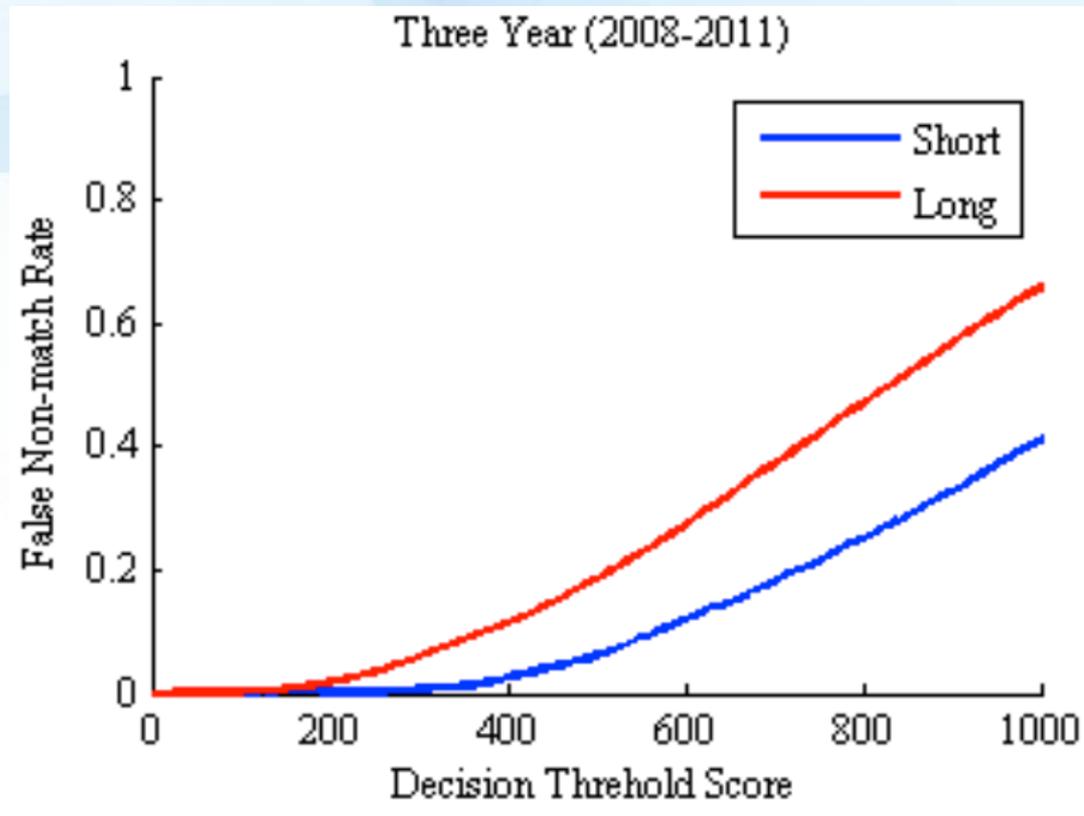
Iris Ageing

Iris Ageing

Irreversible changes to the healthy iris or neighboring anatomy that yield mated dissimilarity scores that increase monotonically with time-separation of the compared images.

- IREX VI

Iris Ageing*

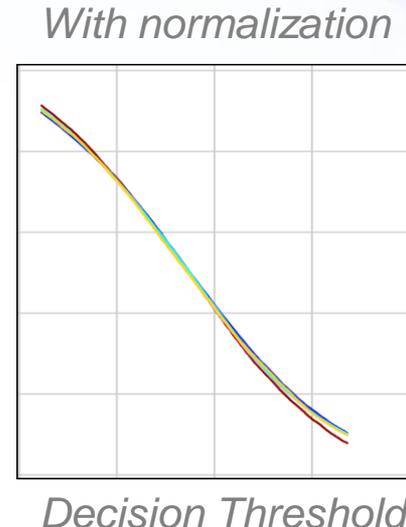
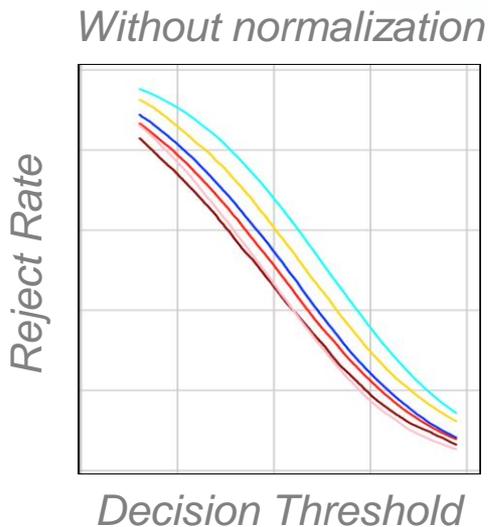


* Fenker and Bowyer use a different definition of 'template ageing'.

Figure Source: "Analysis of Template Aging in Iris Biometrics." Fenker and Bowyer, *IEEE Computer Society Biometrics Workshop*, 2012

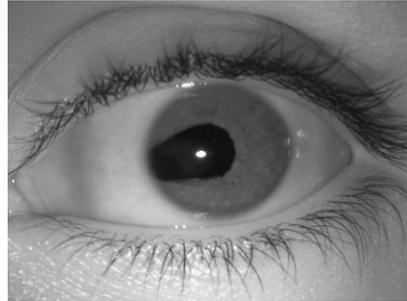
Iris Ageing

- IREX VI includes a comprehensive re-analysis of the Notre Dame iris collections.
- It also searched for an ageing effect in two other iris datasets:
 - NEXUS (Canadian border crossing)
 - OPS (Operational data from DoD)
- Conclusion: “[W]e find no evidence of a widespread iris ageing effect”
- The re-analysis of the Notre Dame data concluded that when you normalize for pupil dilation and eyelid occlusion, the apparent ageing effect goes away.

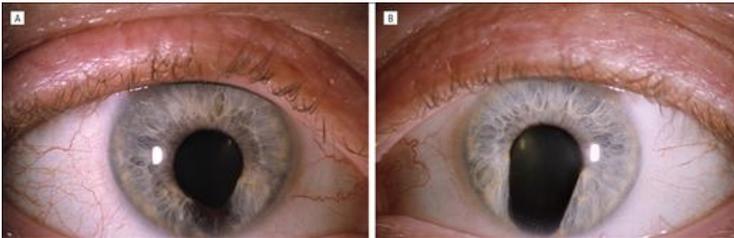


Irregular Pupils

The IREX III Failure Analysis Report determined that 45 of 1,013 failed searches probably failed due to abnormal pupil shapes.



Possible Medical Explanations:



Coloboma



Tadpole Pupil

Illumination

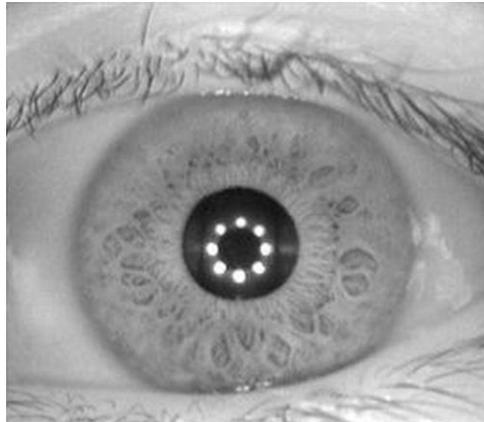
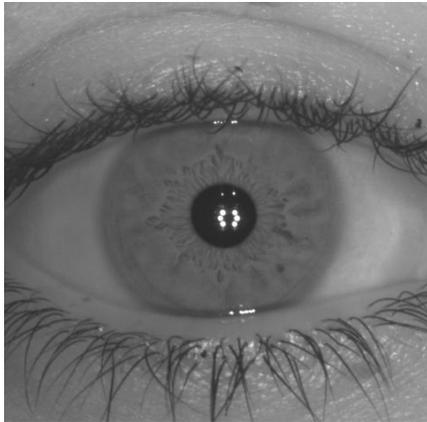
Differences in illumination can make non-flat surfaces appear different.



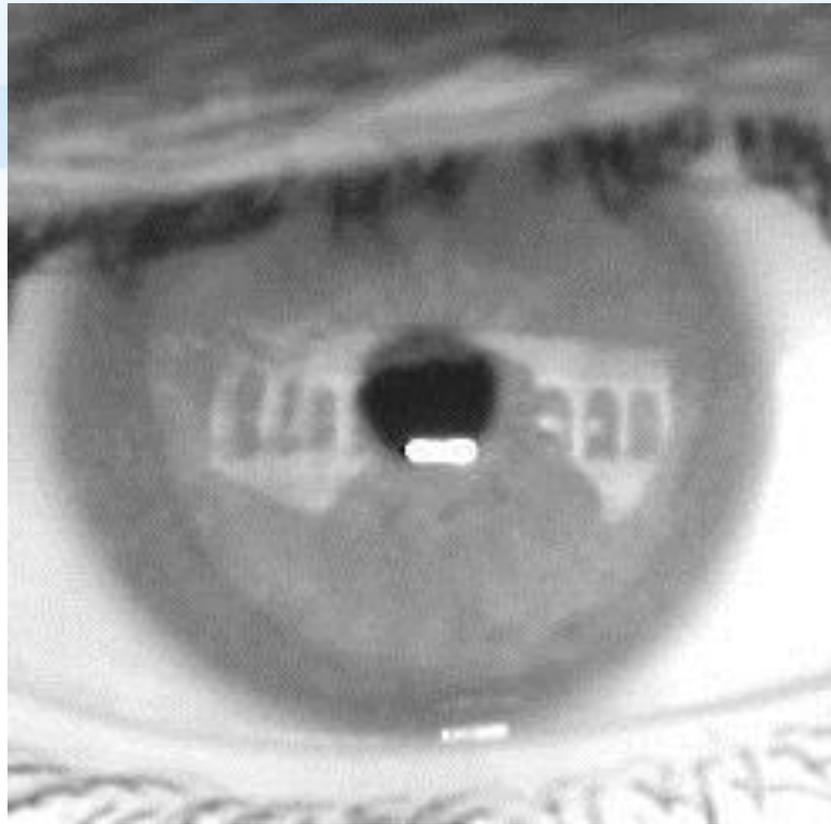
source: landsat.gsfc.nasa.gov

Illumination

- Most cameras illuminate from the front to restrict specular highlights within the pupil.
- Differences in illumination can still occur due to ambient lighting.
- Ambient lighting can also introduce Purkinji Images.



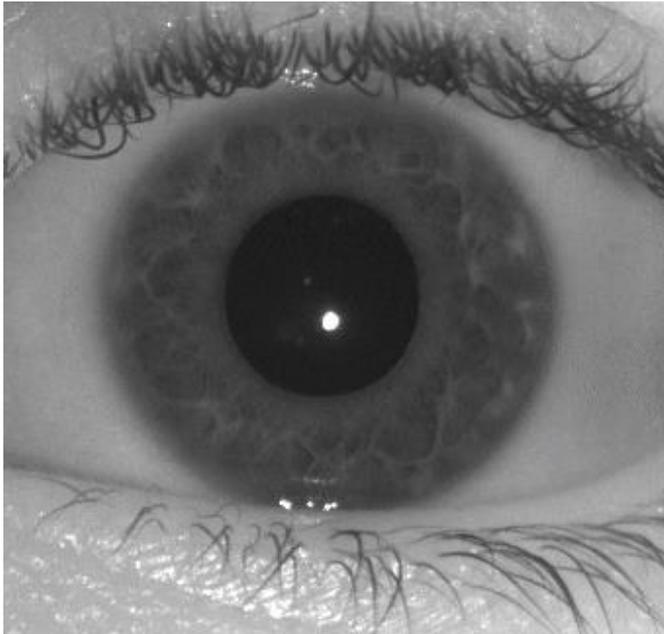
Illumination



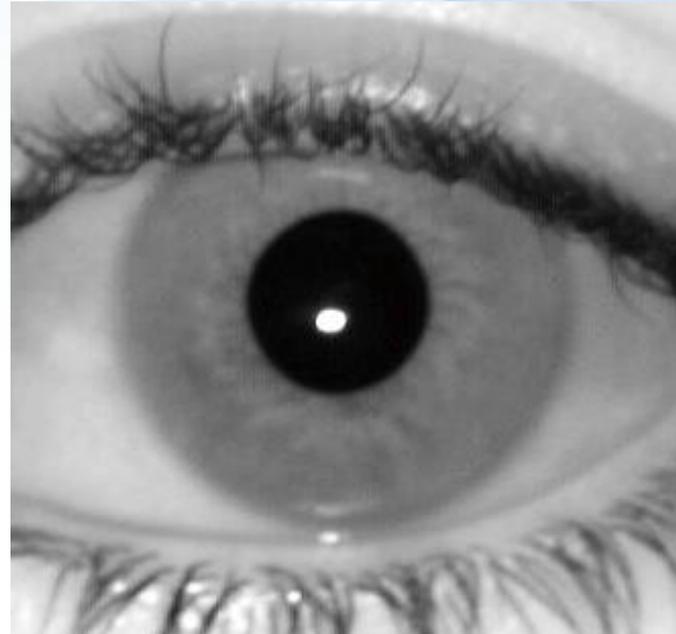
NOTE: CASIA-Iris-Lamp 4.0 contains images where a lamp was turned on near the subject to 'introduce more intra-class variations', but the images do not contain noticeable Purkinji Images.

Eye Colour

- Does the colour of the eye affect recognition accuracy?
- Lighter coloured eyes seem to have more pronounced features (at least according to my own personal observation!)



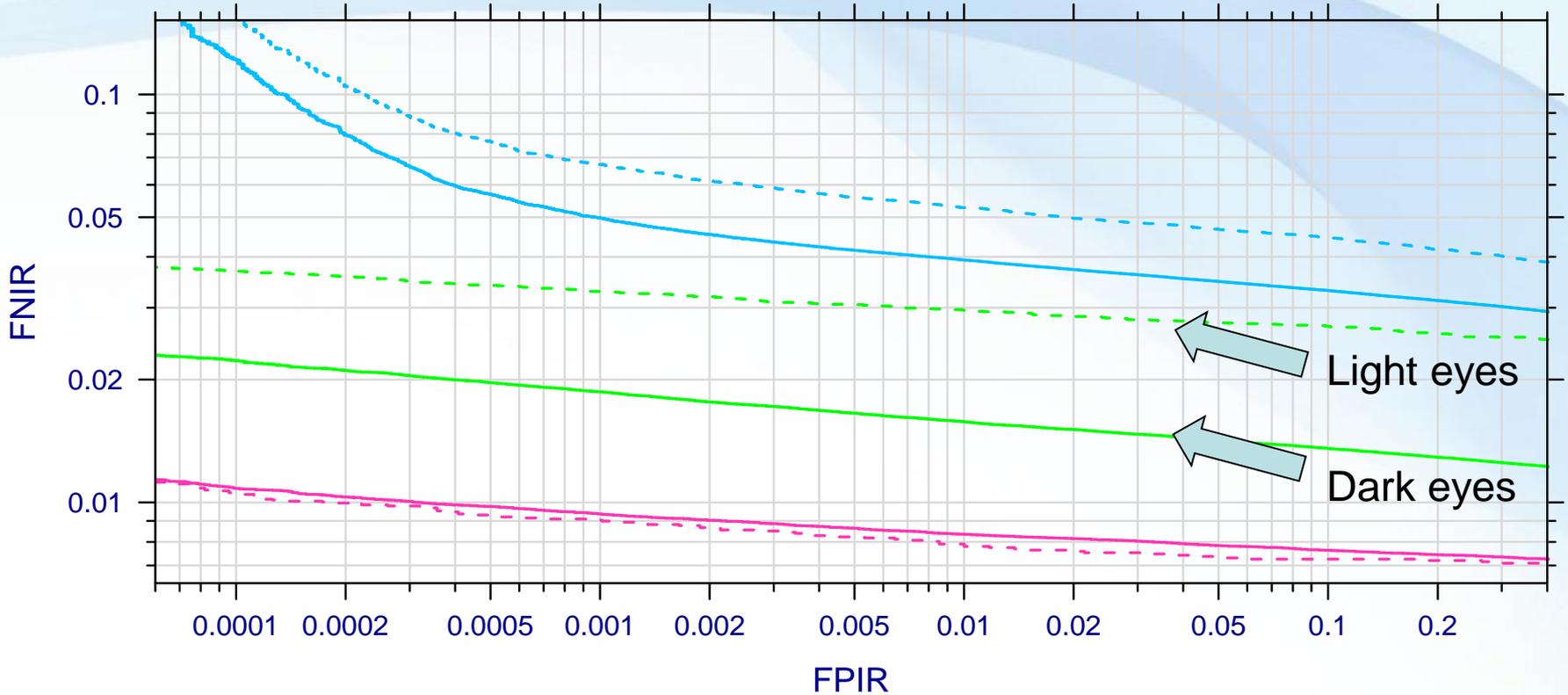
Green Eye



Brown Eye

Eye Colour

D02P, blue/green/grey - - - - G01P, blue/green/grey - - - - I02P, blue/green/grey - - - -
D02P, brown _____ G01P, brown _____ I02P, brown _____



(Enrolled Population Size = 1,600,000)

← Light eyes
← Dark eyes

Iris as a Forensic

Forensic Science

“The application of scientific knowledge and methodology to legal problems and criminal investigations.”

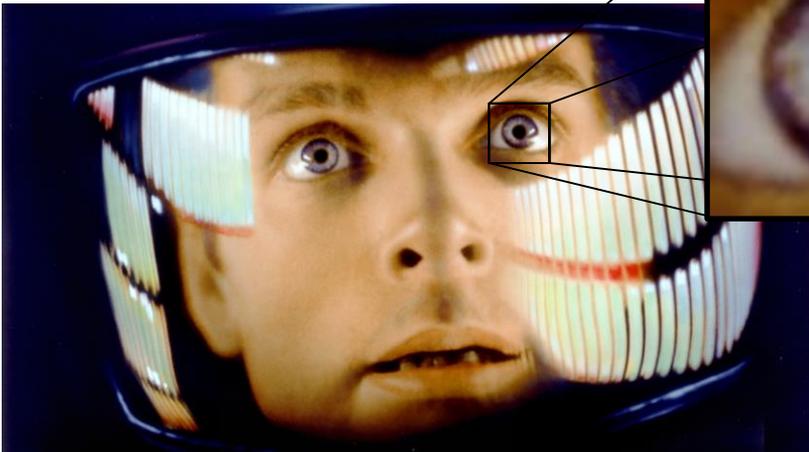
- legal-dictionary.thefreedictionary.com



Source: National Geographic



Webcam Image



Source: 2001: A Space Odyssey (film)

Future Areas of Research

- Surgical alterations
- Neo-natal
- Ageing
- Iris at a distance
- Abnormal Pupils
- Purkinji Images

Also, larger sets of iris images wouldn't hurt (i.e. with more subjects represented).

Datasets Referenced

University of Tehran (UTIRIS) – Visible and Near-IR iris captures.

<https://utiris.wordpress.com/>

Notre Dame (ND) – Iris Ageing, Contact Lenses (and more)

http://www3.nd.edu/~cvrl/CVRL/Data_Sets.html

CASIA-Iris-Lamp – Images with a side lamp turned on/off

<http://biometrics.idealtest.org/>

Thanks

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<http://iris.nist.gov/>