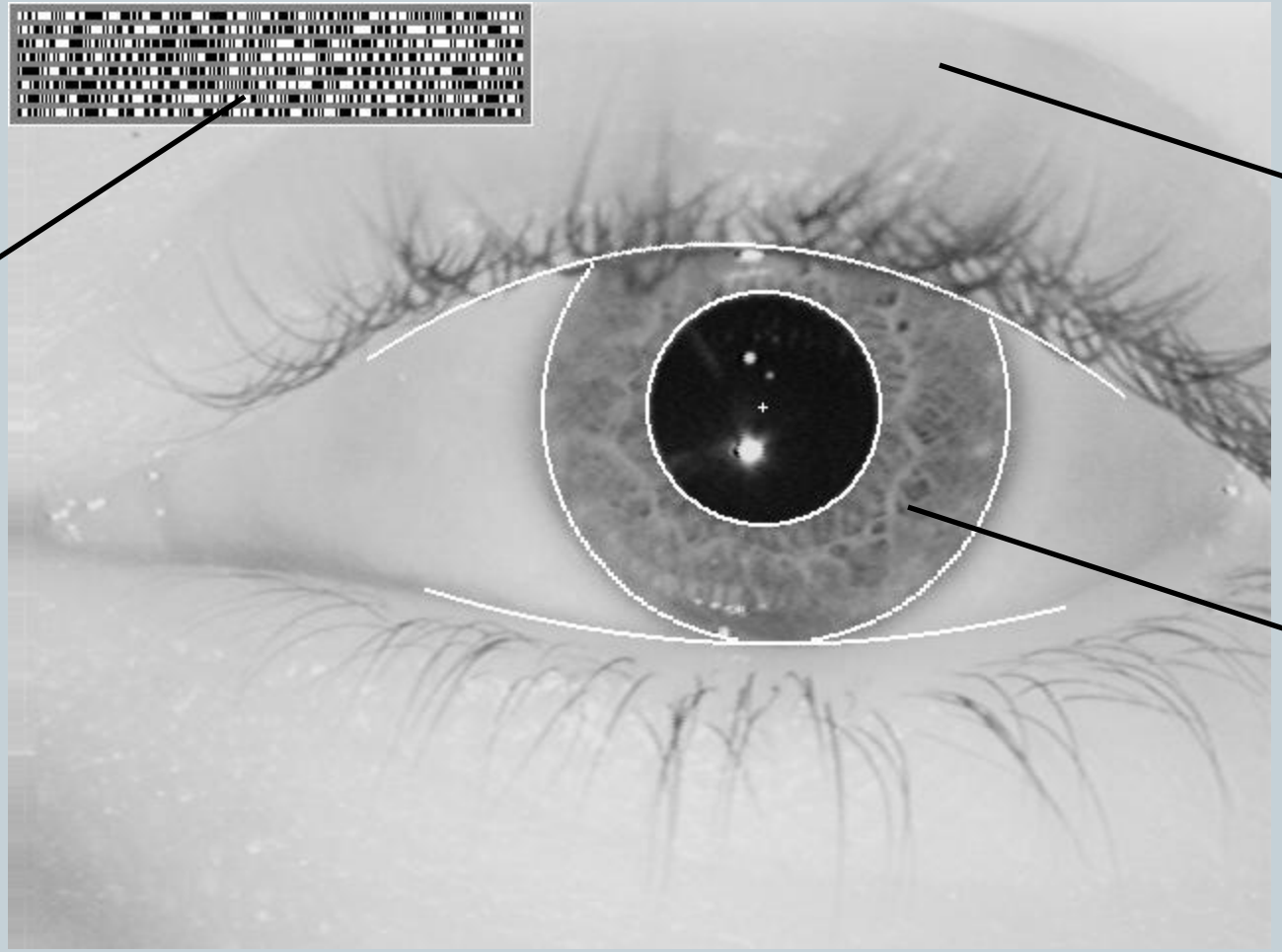
Iris Recognition

Assignment

- Do any four of the following (if you do all five, you will get 25% bonus - from assignment component):
- Use LFWa Database and perform multitask learning for attribute prediction
- Use LFW database and following the protocol, perform face recognition with your choice of DL algorithm
- Using IIITD fingerprint database, implement fingerprint recognition of your choice
- Using IIITD Iris database, implement iris recognition of your choice
- Using Multimodal database, implement fusion algorithm of your choice

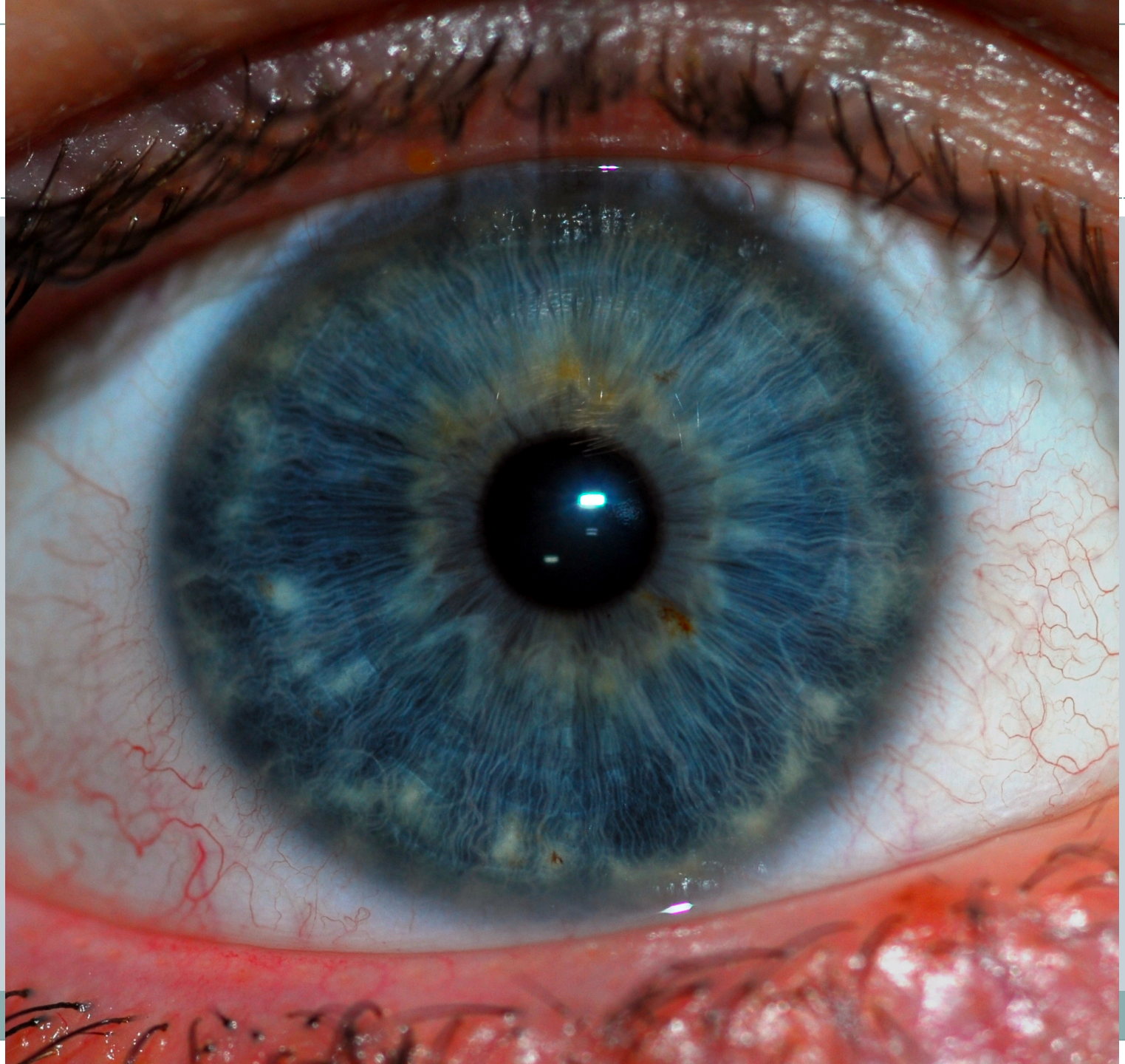
How Iris Recognition Works



Iris Code

Eye Image Captured using NIR Camera

Segmented Iris

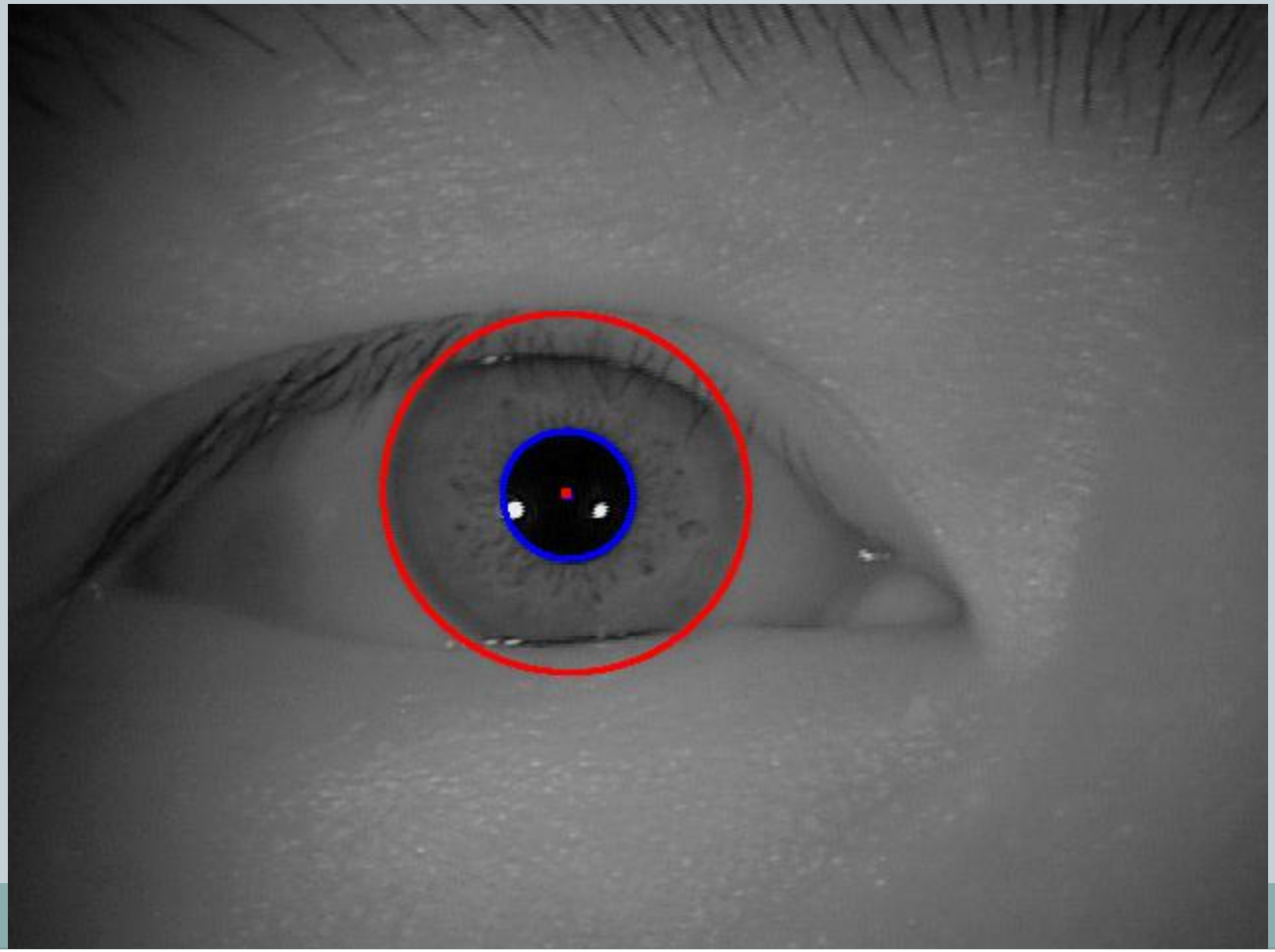


Iris Capture

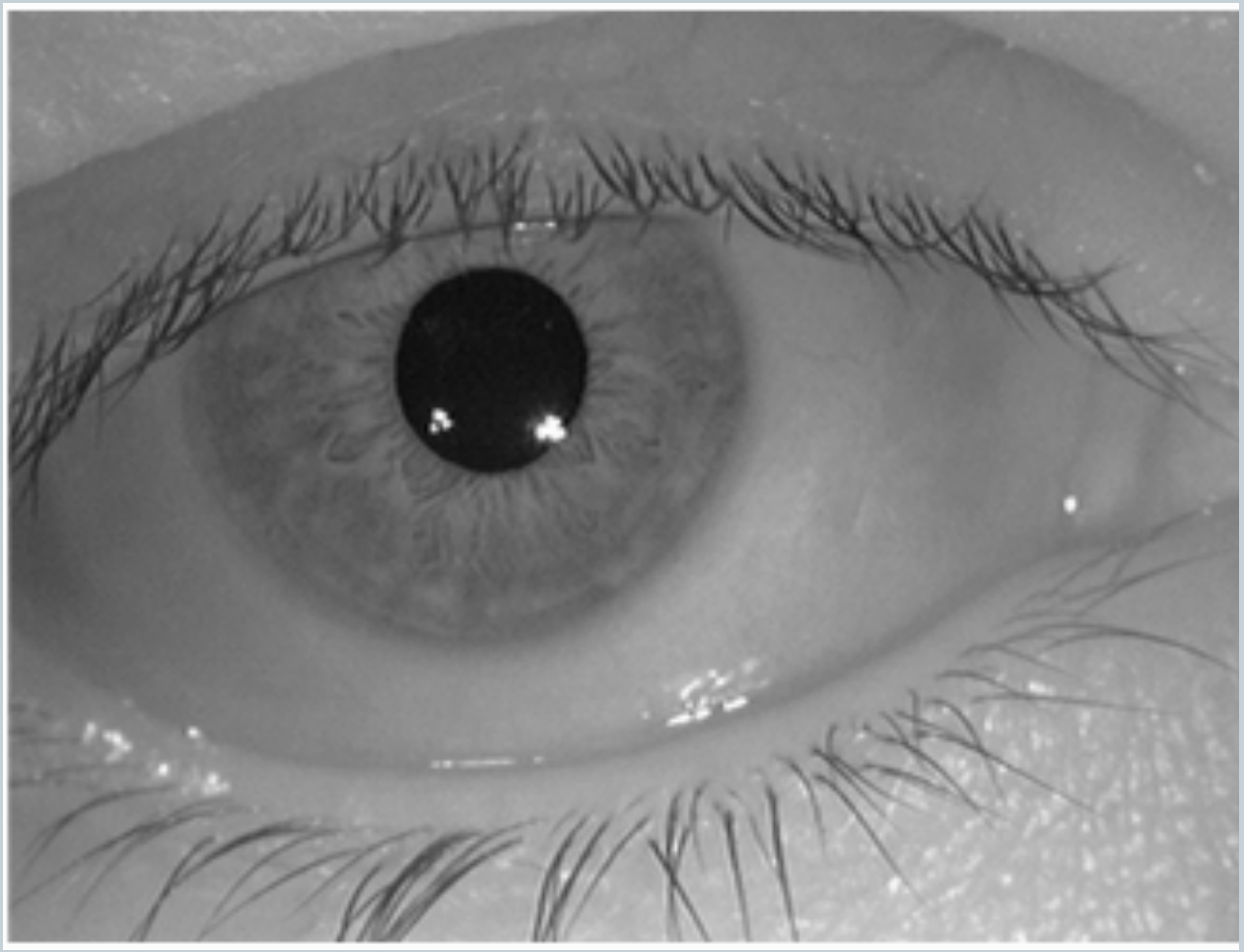
- NIR camera:
  - 700 – 900 nm wavelength
  - Single eye or dual eye camera
- User cooperation is required

Iris Segmentation

- Given an eye image, how do we detect iris?



Let us see how do we do iris segmentation



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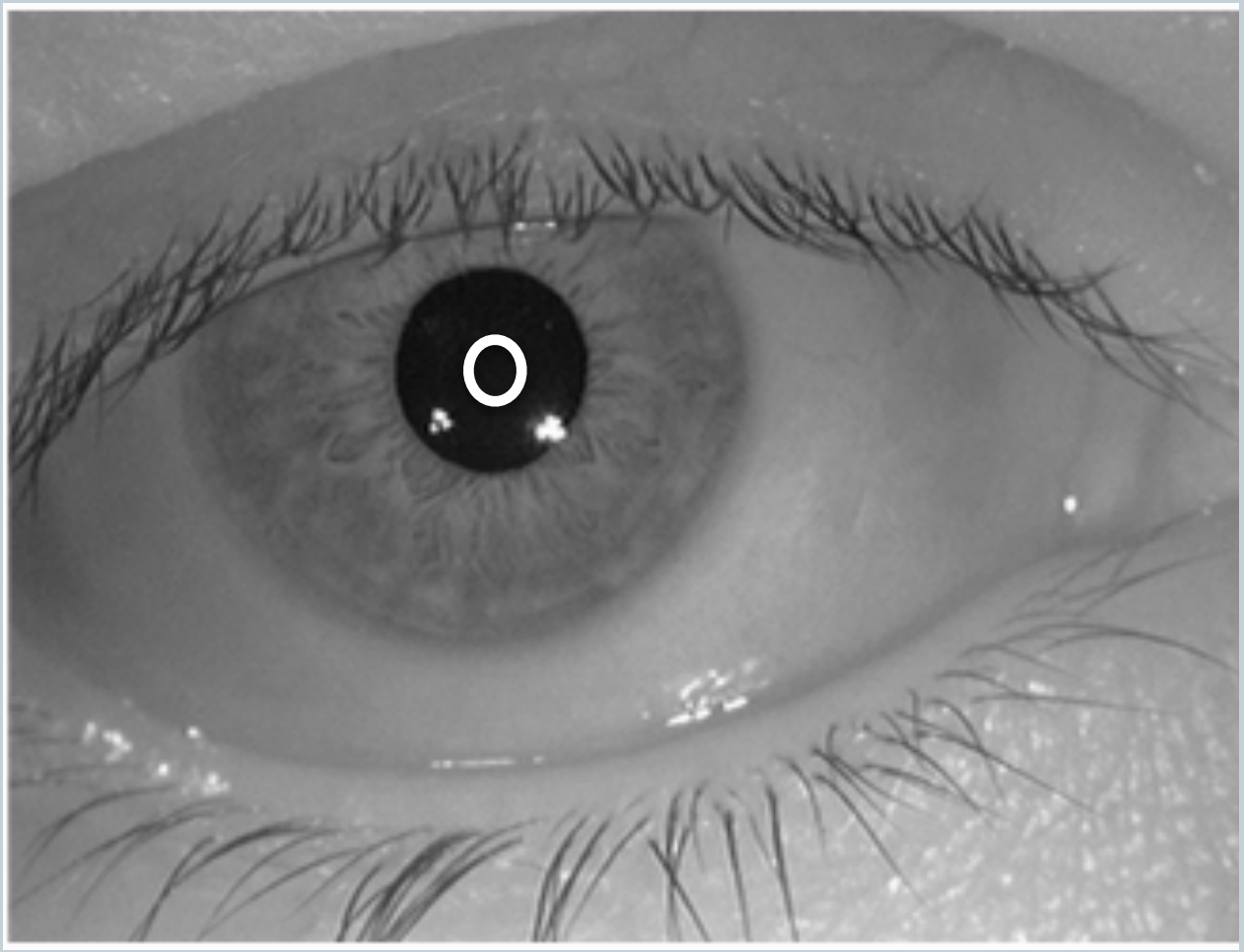

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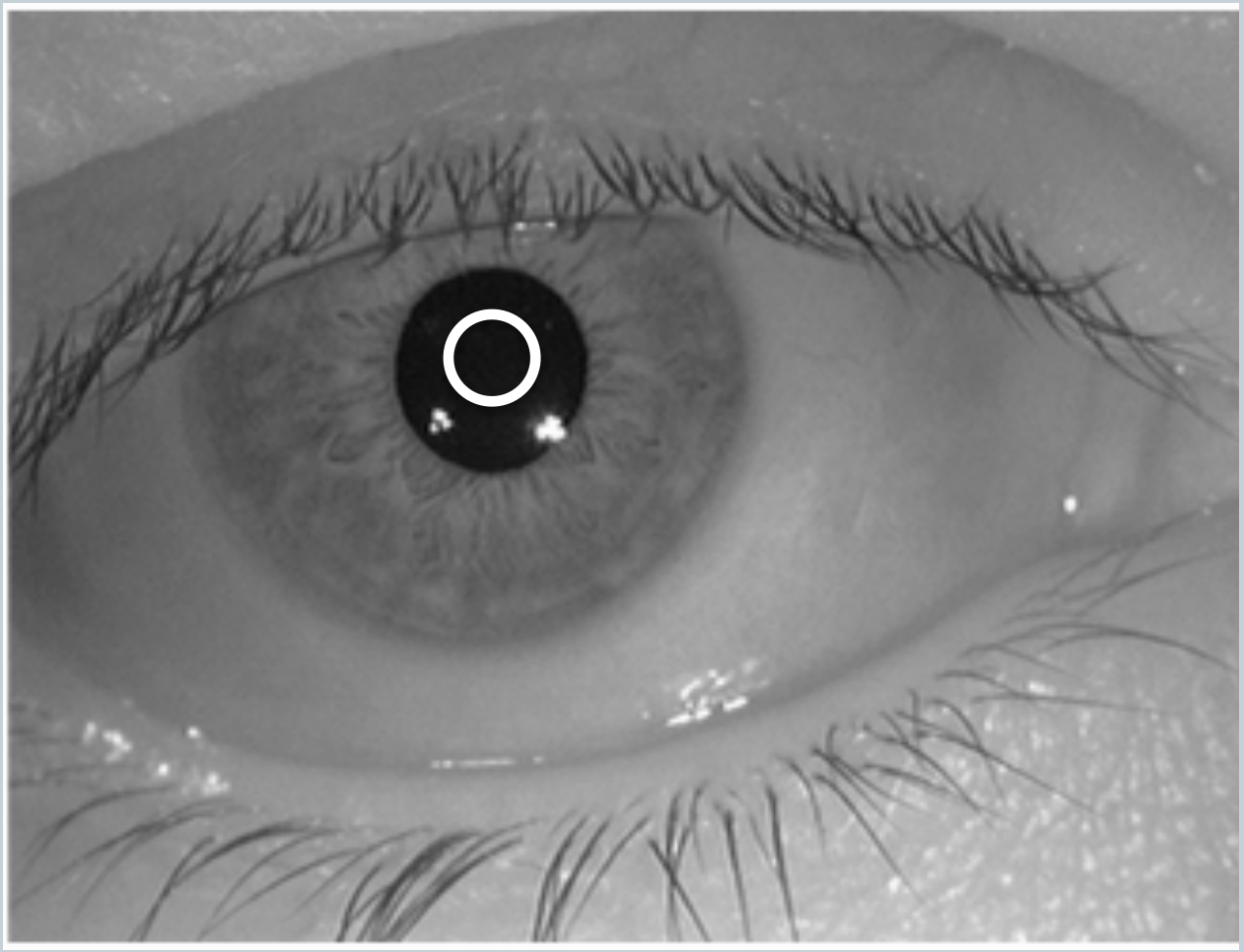

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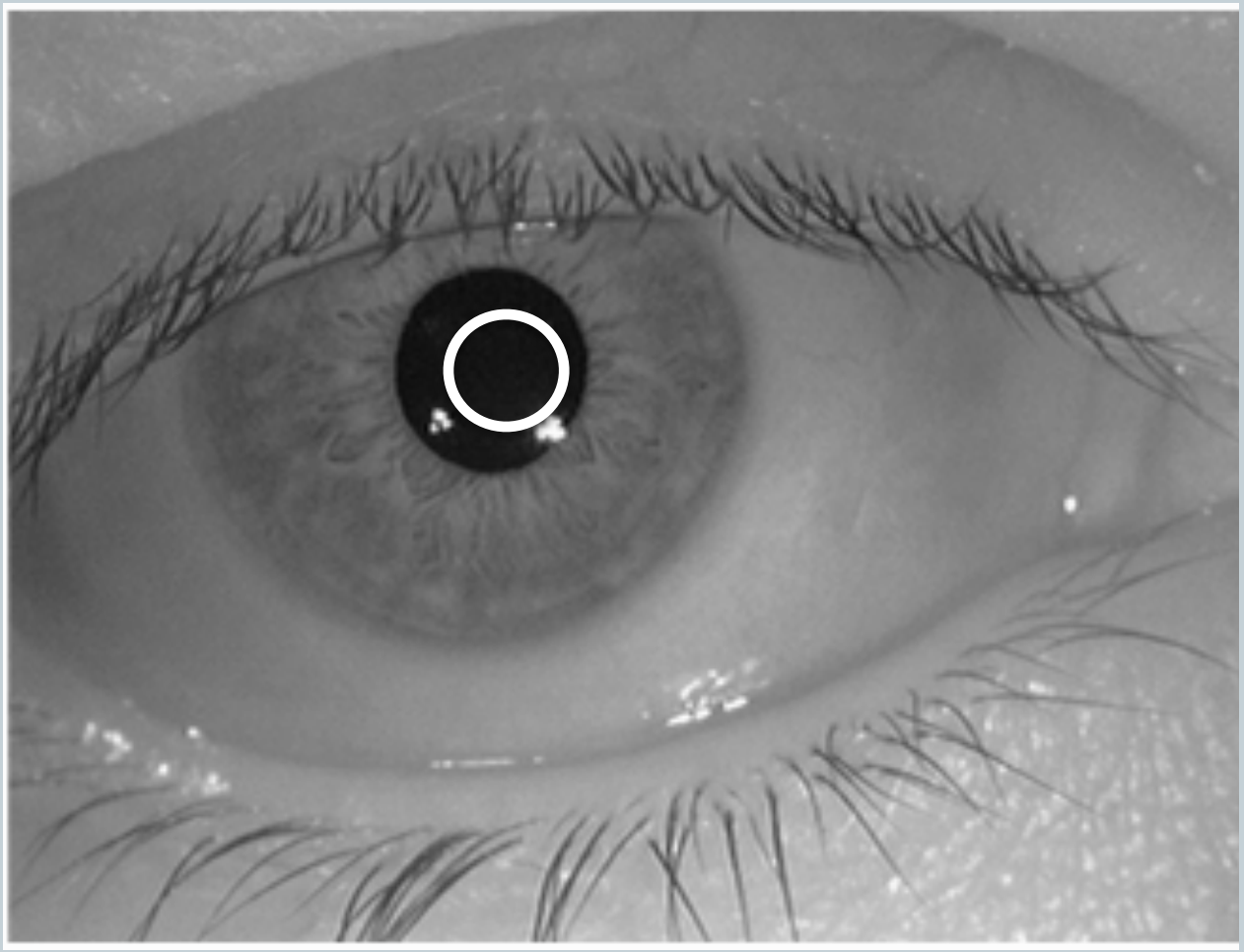

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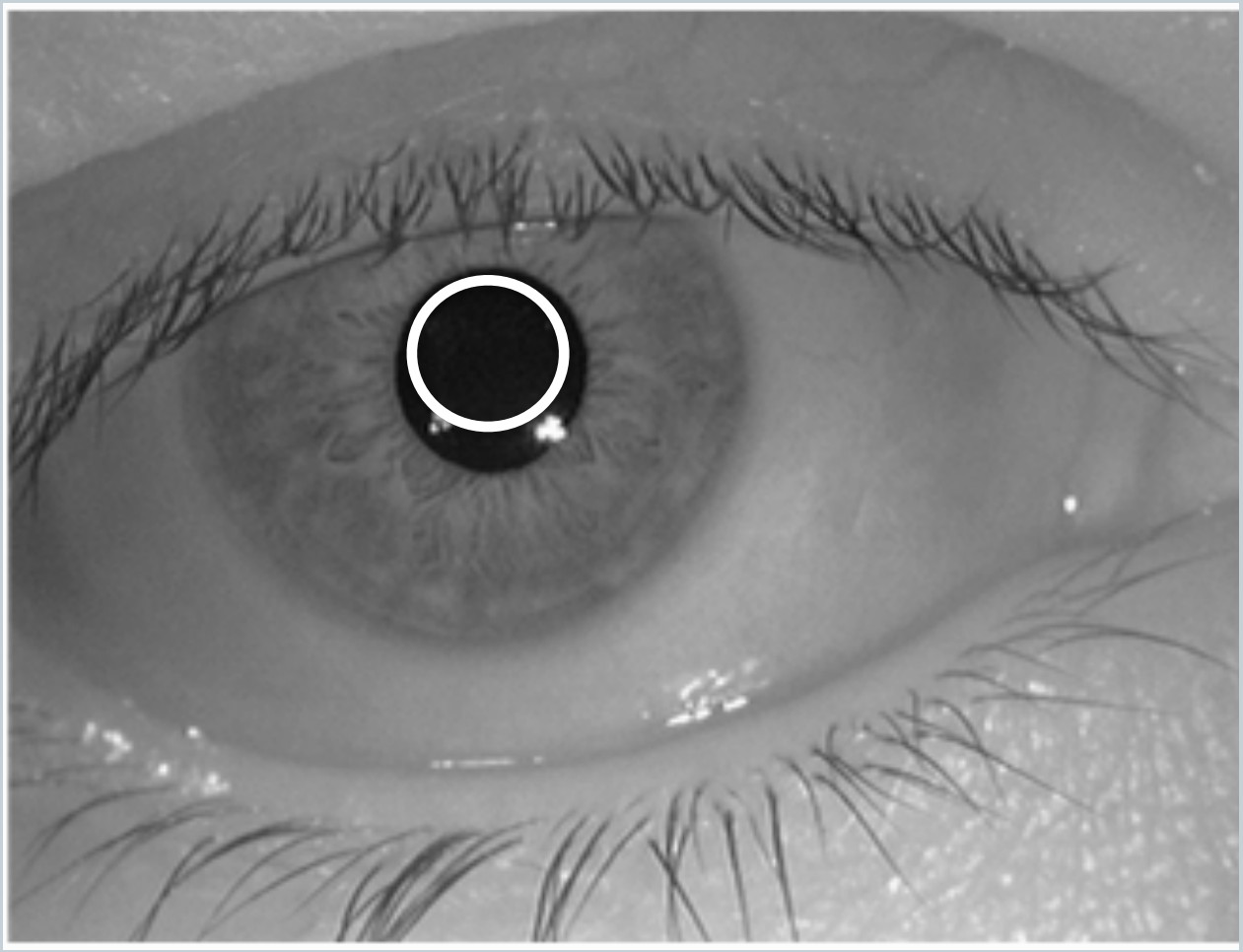

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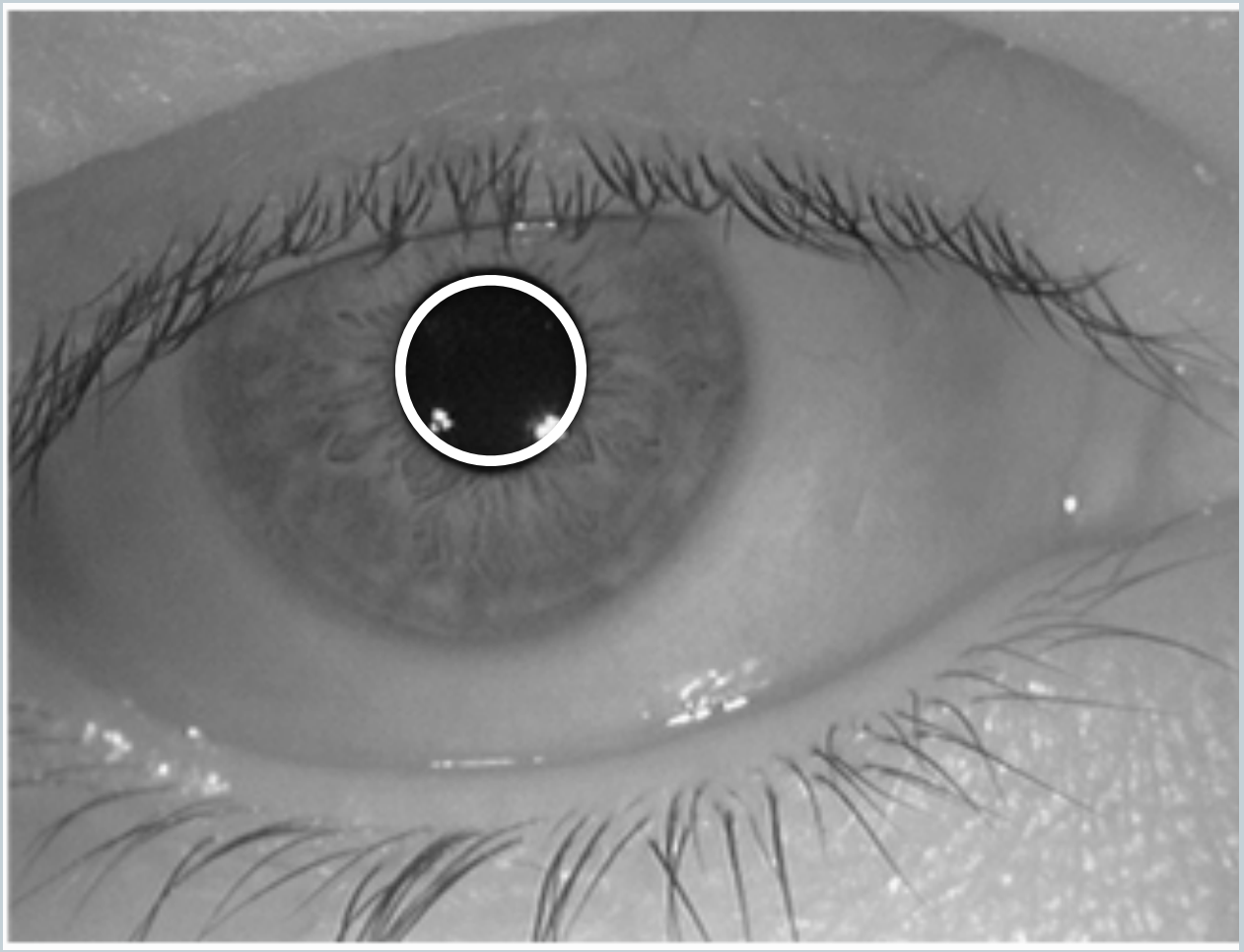

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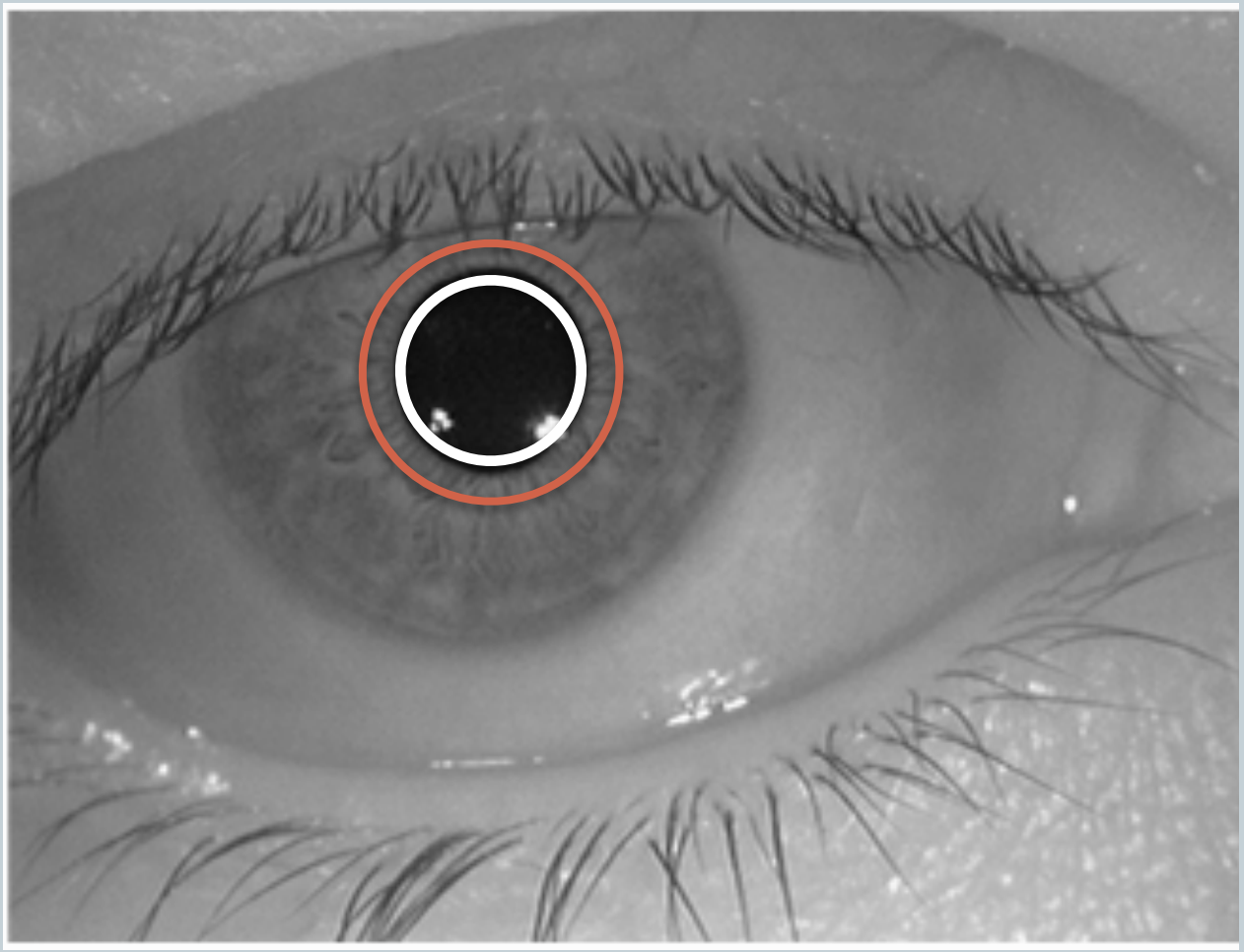

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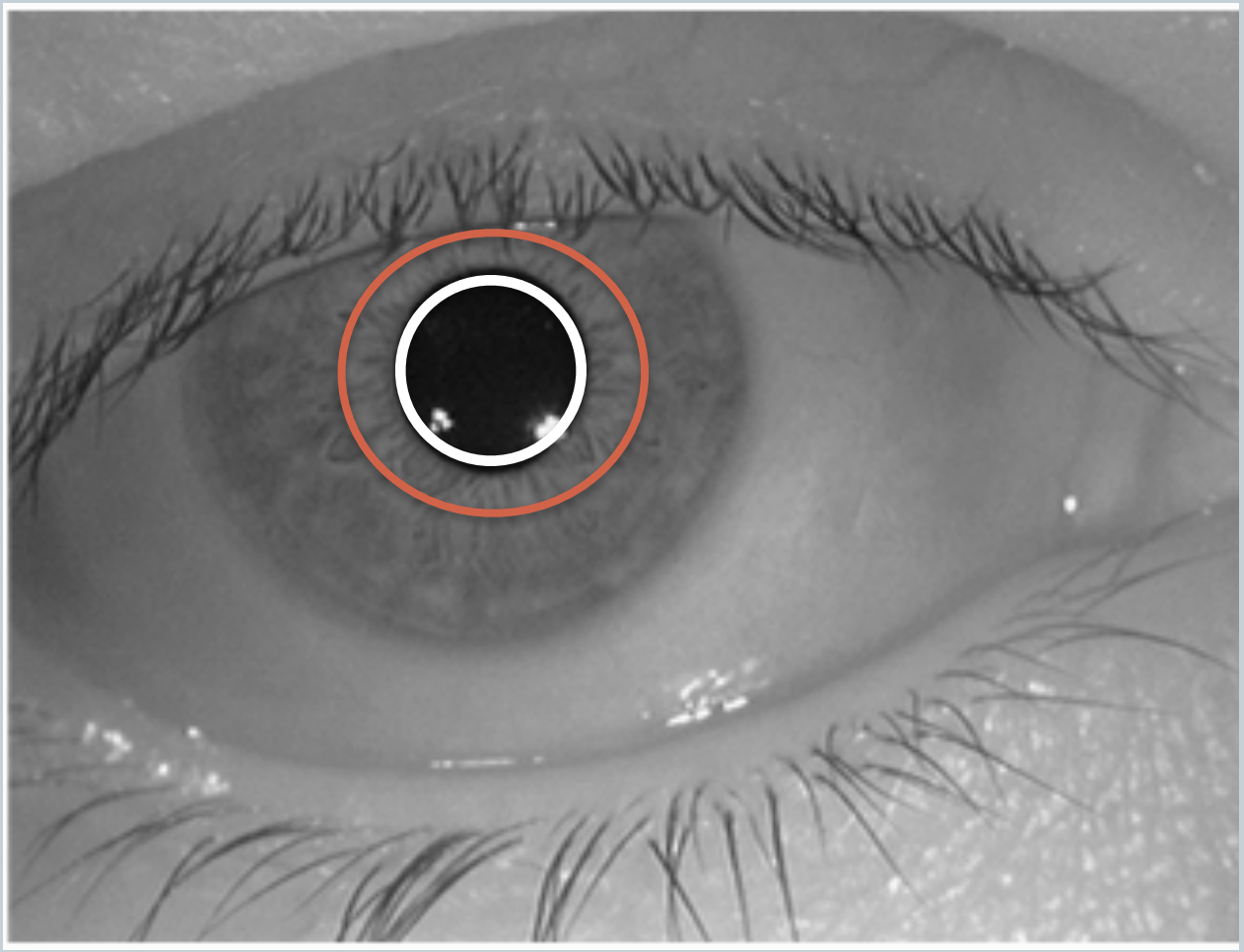

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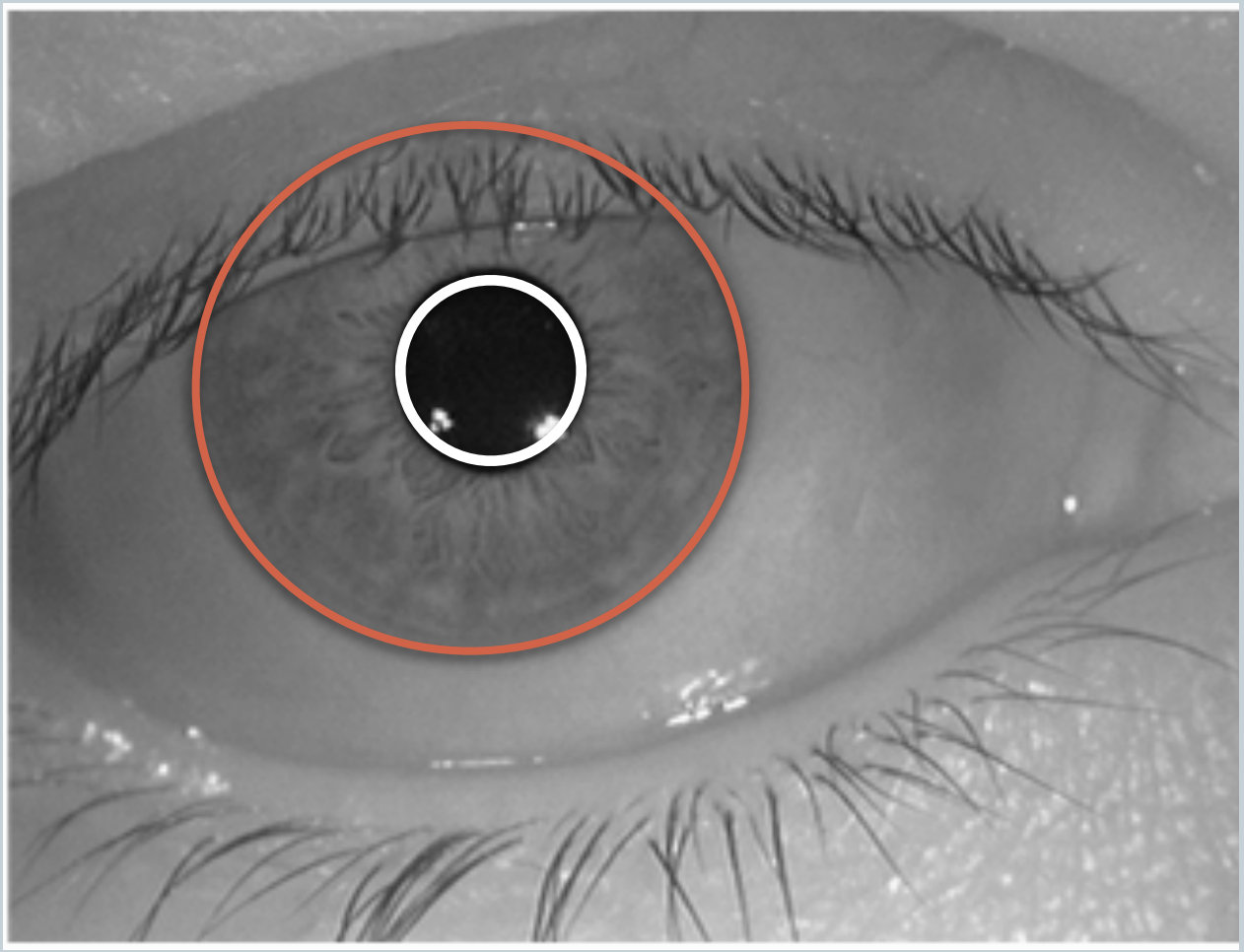

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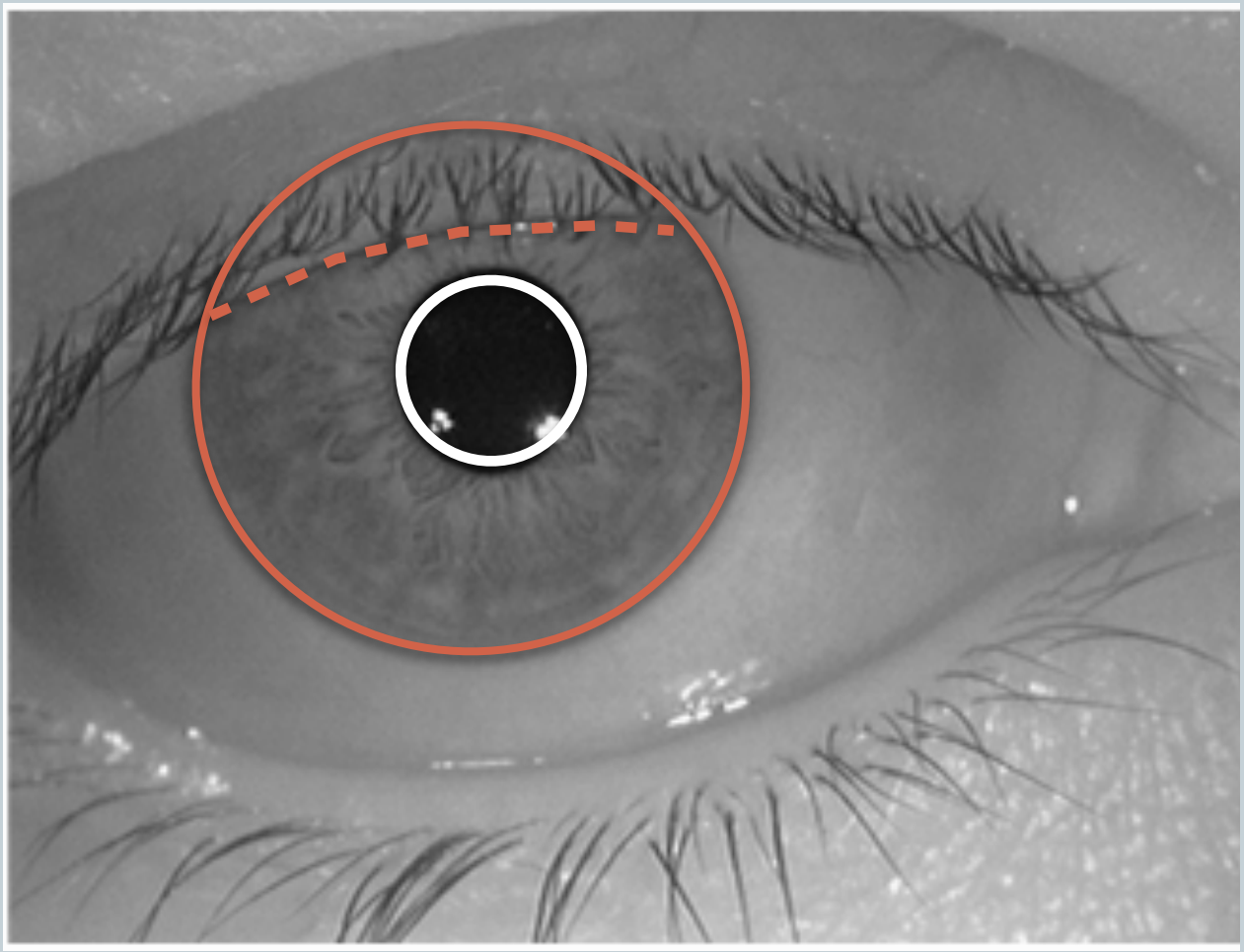
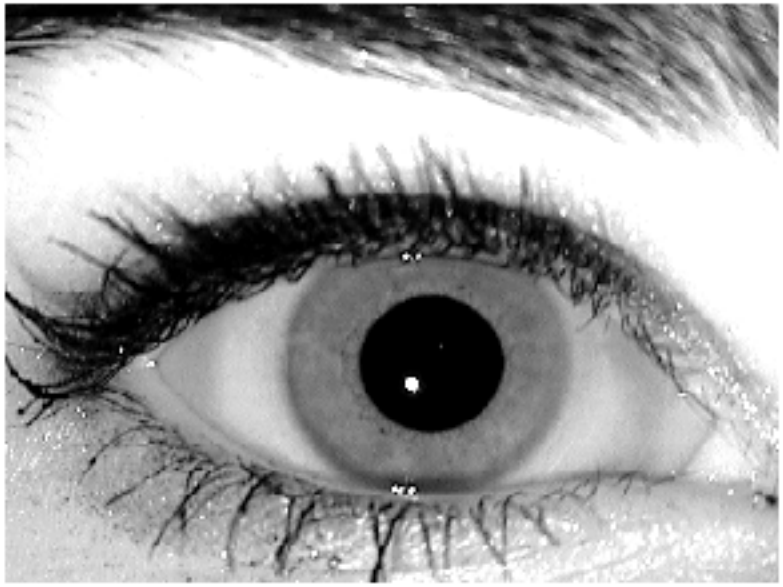
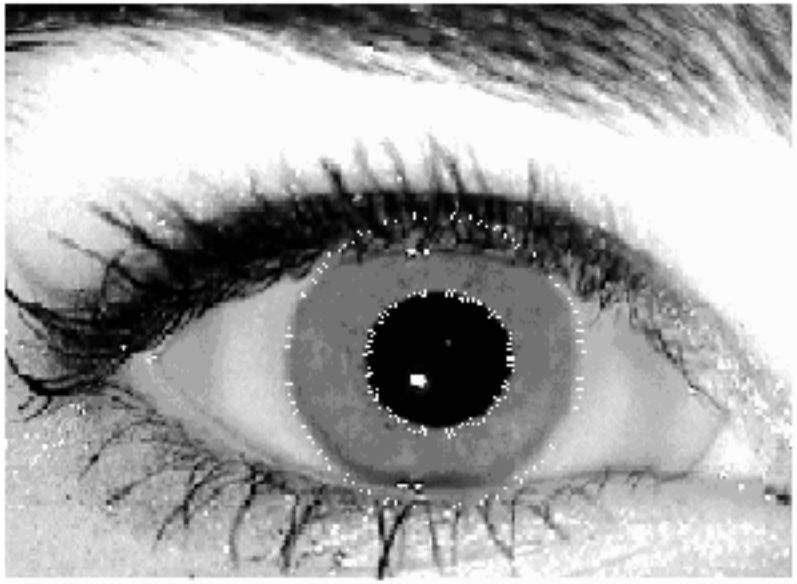
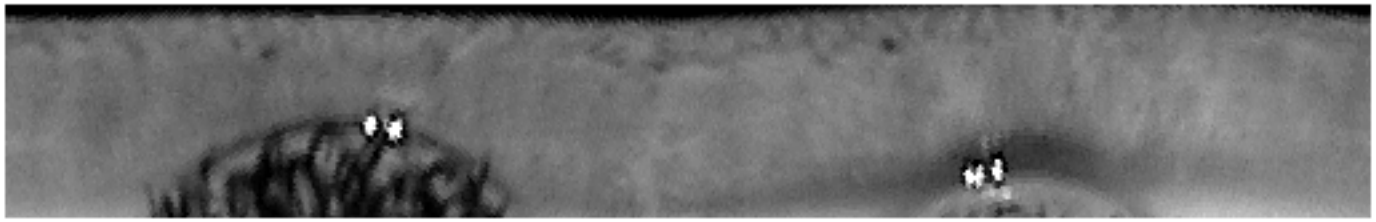




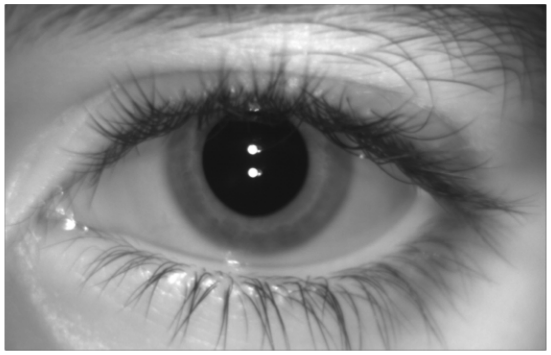


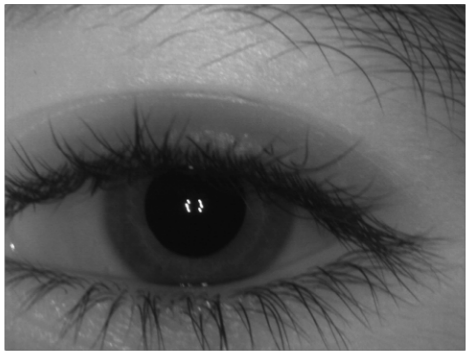



009_1_1.bmp - Iris View
Now that the iris has been identified, select from the buttons below.
Unwrapped
Histogram
Heatmap
Search Database
Add to Database

Once segmented, what is the next step?

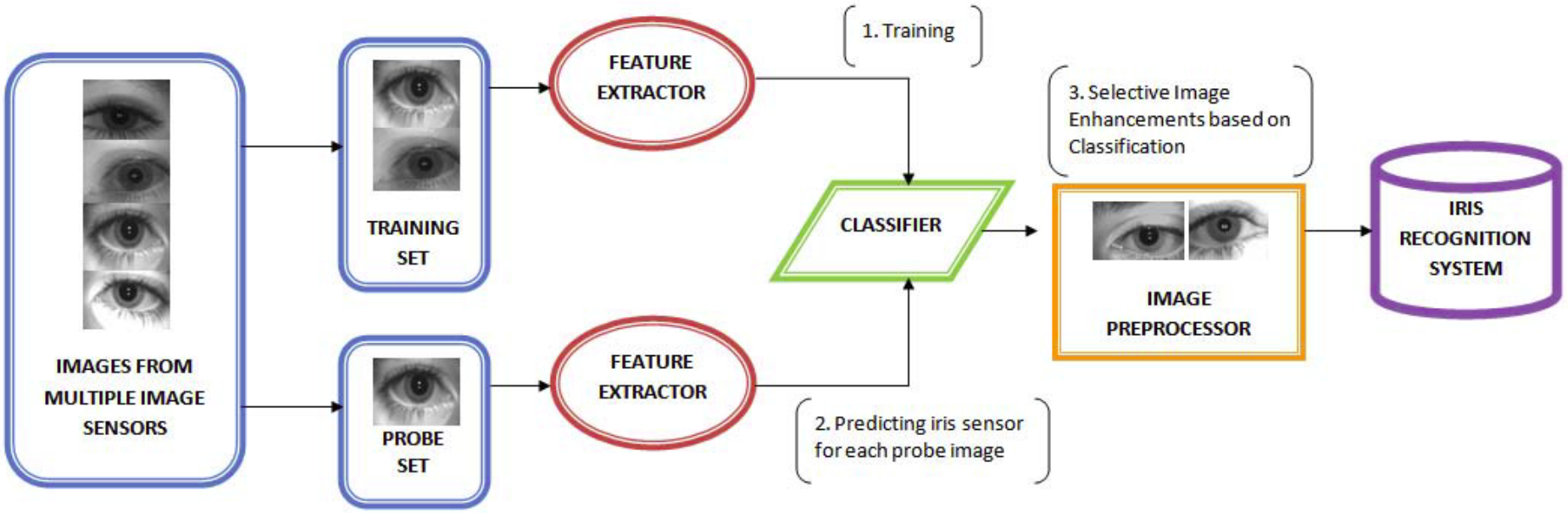
Once segmented, what is the next step?





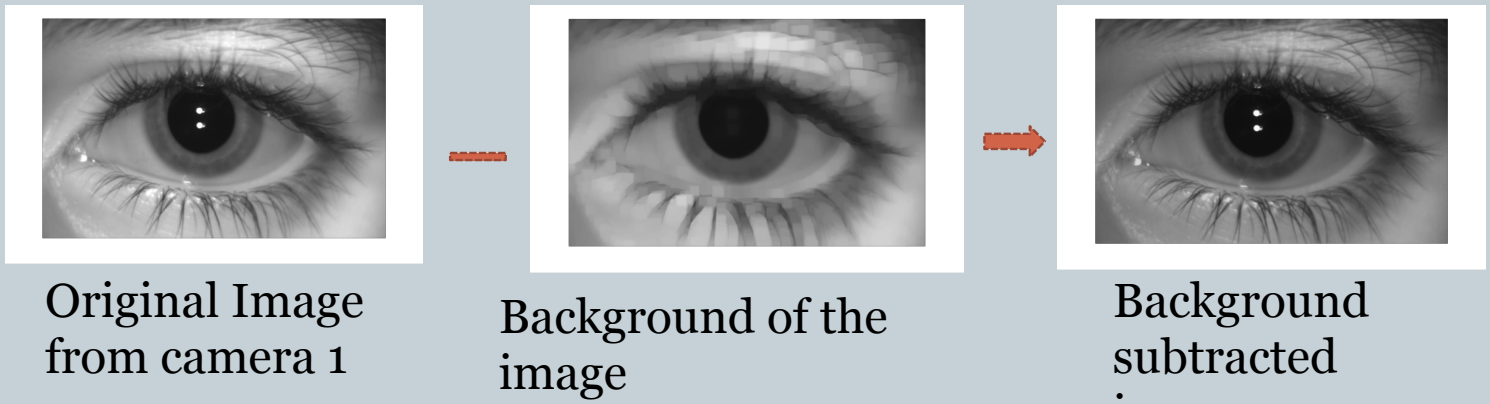
Eye image of a person - two sensors

Image Enhancement Framework



Pre-Processing Algorithm

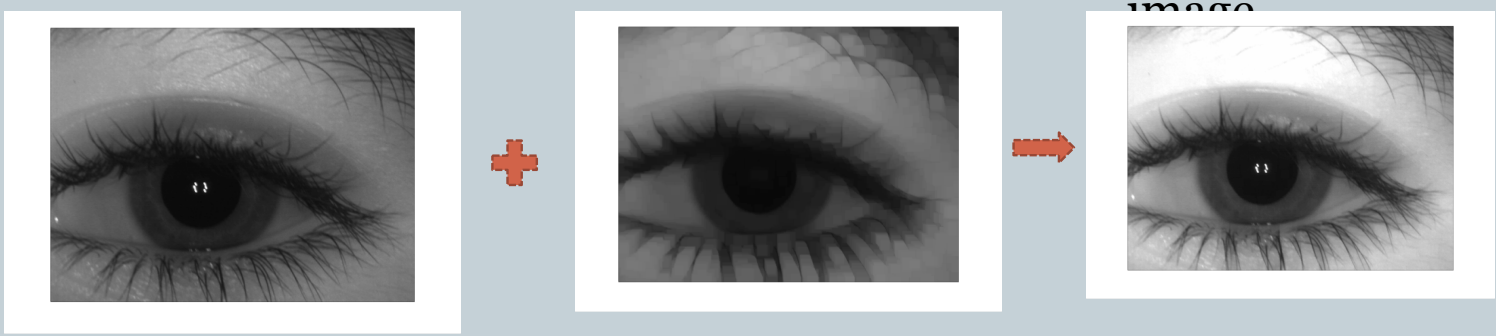
- Image Enhancements Technique



Original Image from camera 1

Background of the image

Background subtracted image



Original Image from camera 2

Background of the image

Background added image

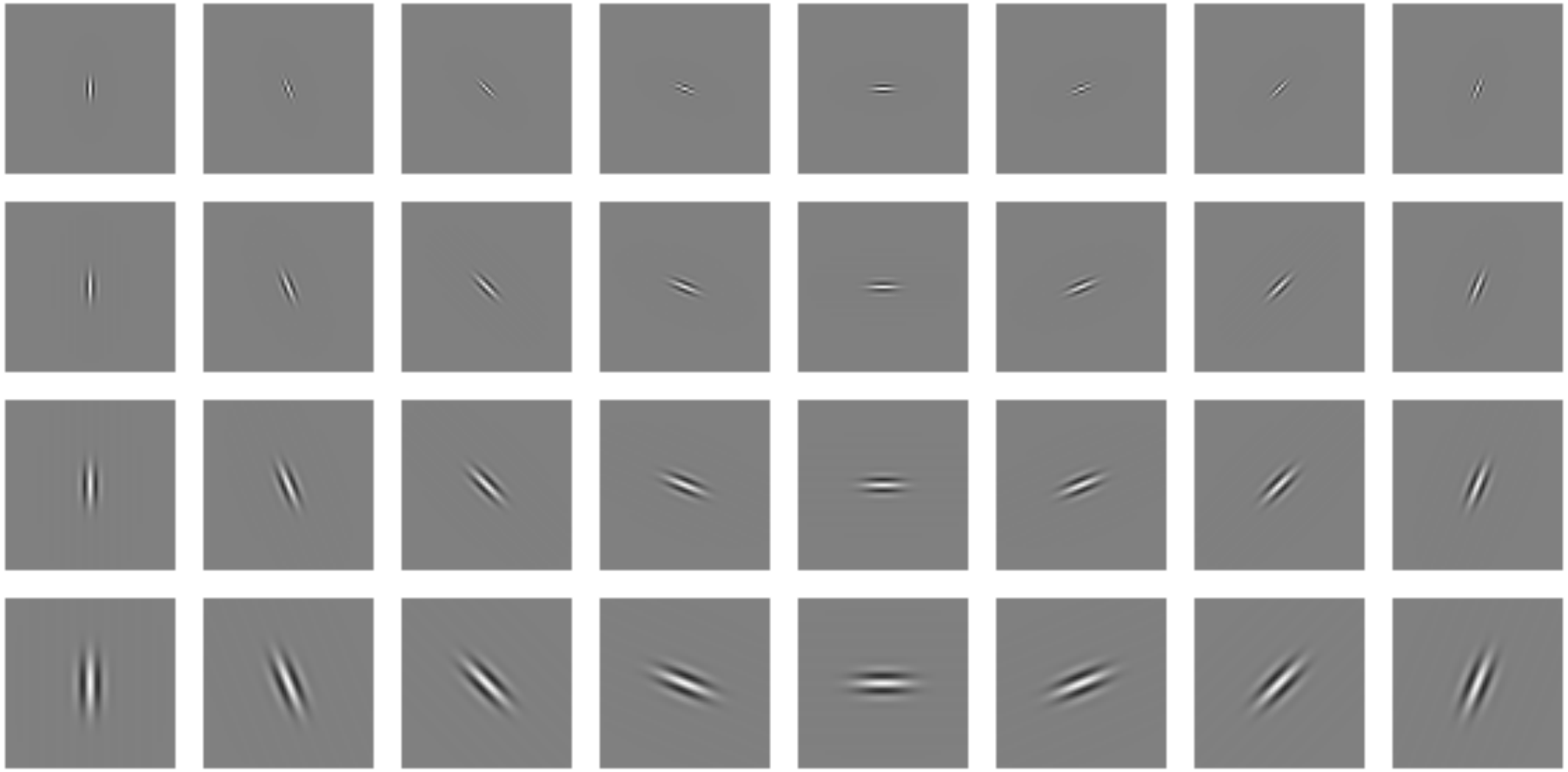
Feature Extraction

- Gabor Filter
  - Gaussian over Sinusoidal
  - Log form in Fourier domain is represented as

$$G_{r_0,\theta_0}(r,\theta) = exp\left(-2\pi^2\sigma^2\right)\left[(ln(r) - ln(r_0))^2 s^2 + (ln(r)sin(\theta - \theta_0))\right]$$

  - Two parameters: scale and orientation

Feature Extraction



Feature Extraction

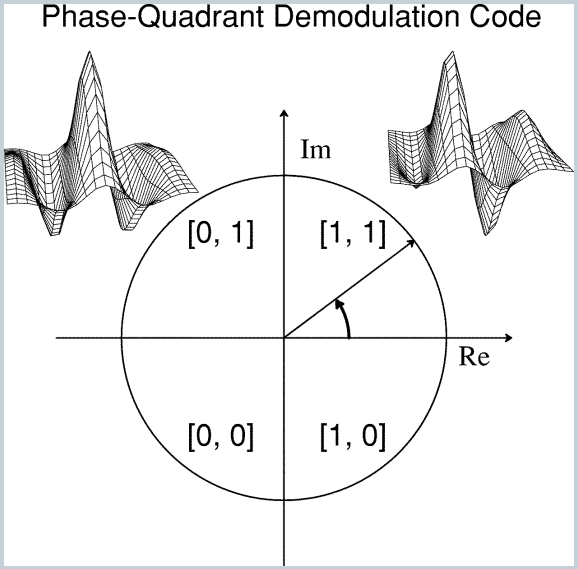
- Convolve an iris image with Gabor filter/transform

$$A = I * G$$

- Compute phase features (how?)
- Is there any problem in this approach?

Feature Extraction

- Apply Neural Network to compute convolved image
- After convolution, compute phase features and then quantize it
  - how?



- Matching is performed using Hamming Distance

$$\mathrm{HD} = \frac{\|(codeA \otimes codeB) \bigcap maskA \bigcap maskB\|}{\|maskA \bigcap maskB\|}.$$

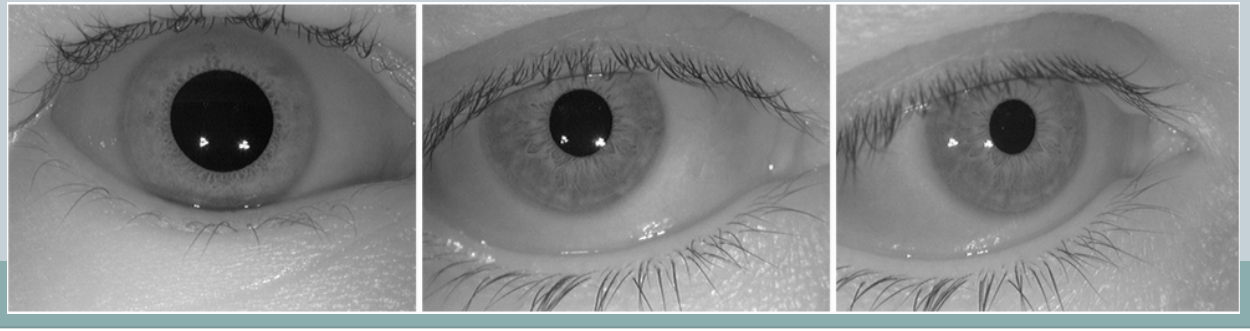
Challenges in Iris Recognition

Image Quality

Illumination

Off-angle

Occlusion



Emerging Challenges

Cross Sensor Matching

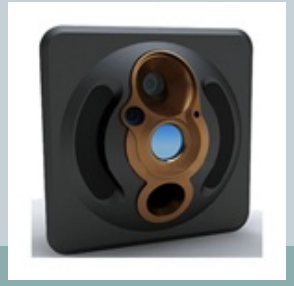
- Difference in wavelengths within the near infrared spectrum
- Illumination
- Other hardware related aspects

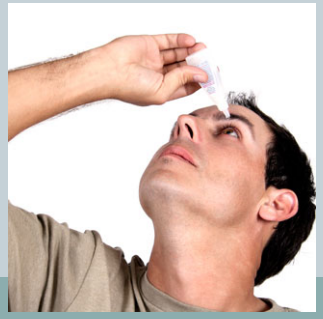
Alcohol Influence

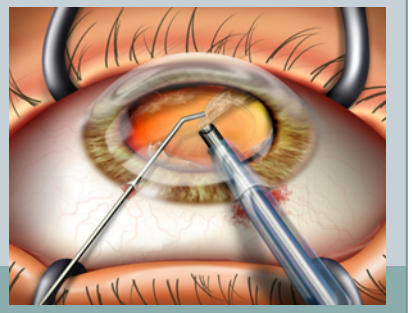
- Pupil Dilation
- Pupil Constriction
- Variations in the limits of dilation/ constriction

Pupil Dilation and Cataract Surgery

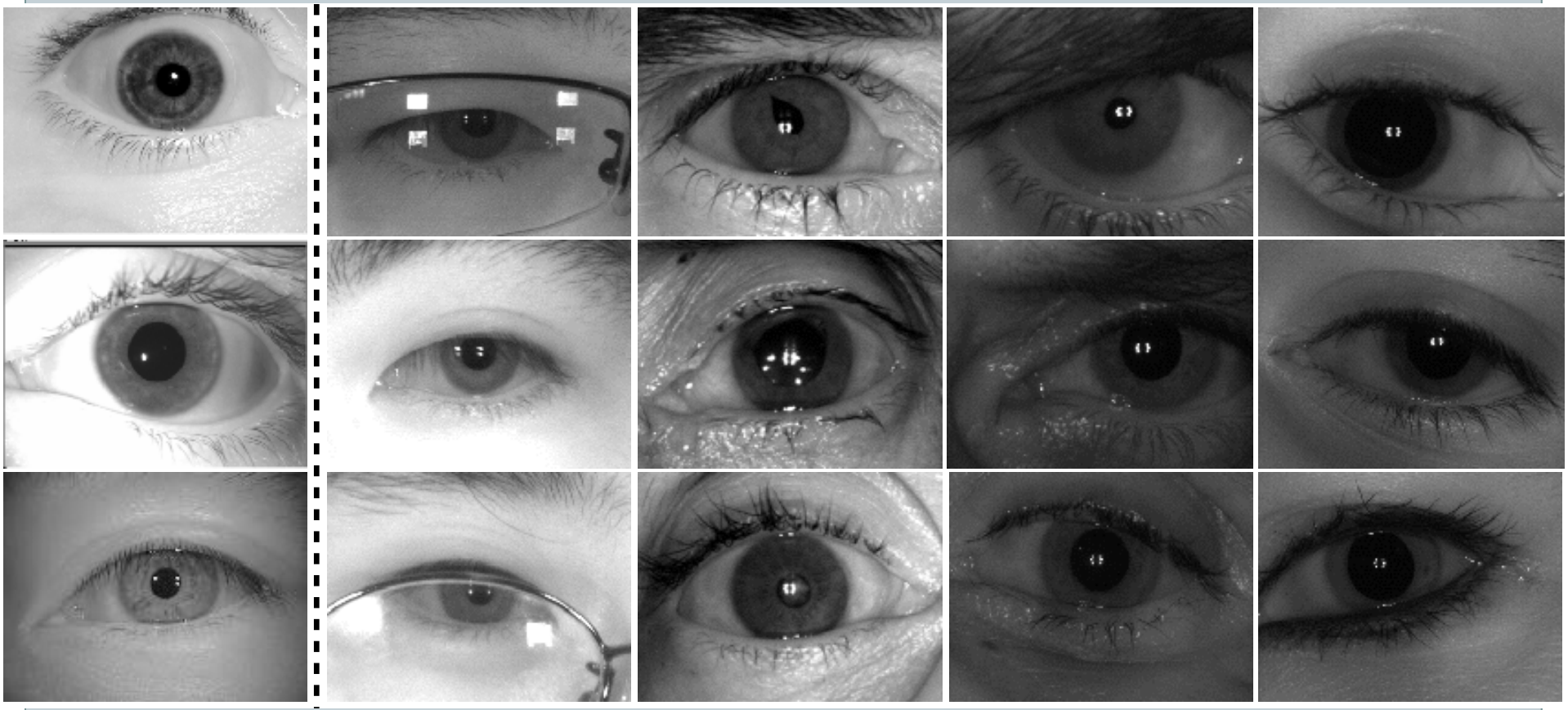
- Interference with the anatomy of the eye
- Insertion of artificial lens







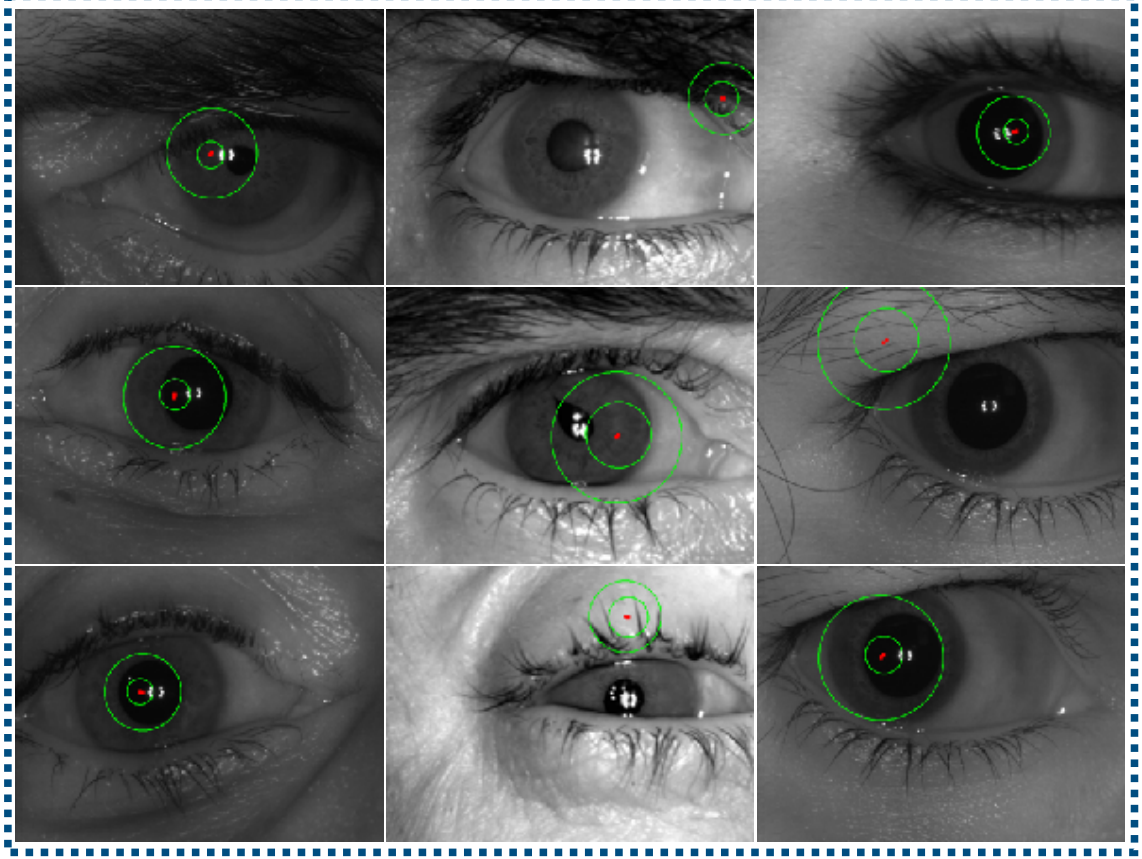
Modern (DL) Algorithms

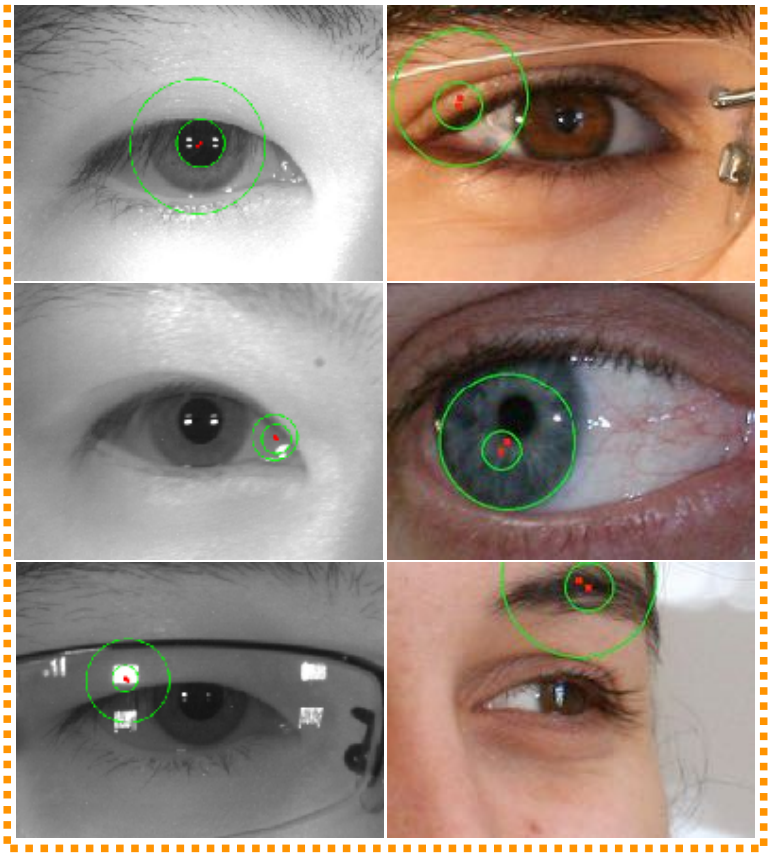


Modern (DL) Algorithms

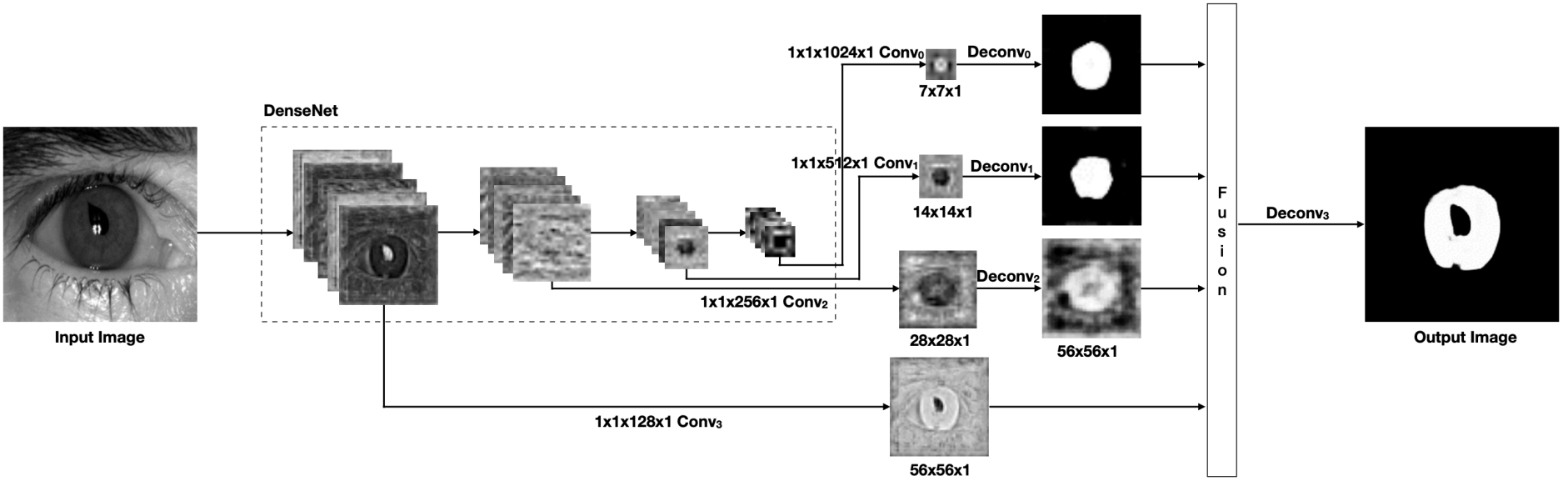
User-Eye-Condition

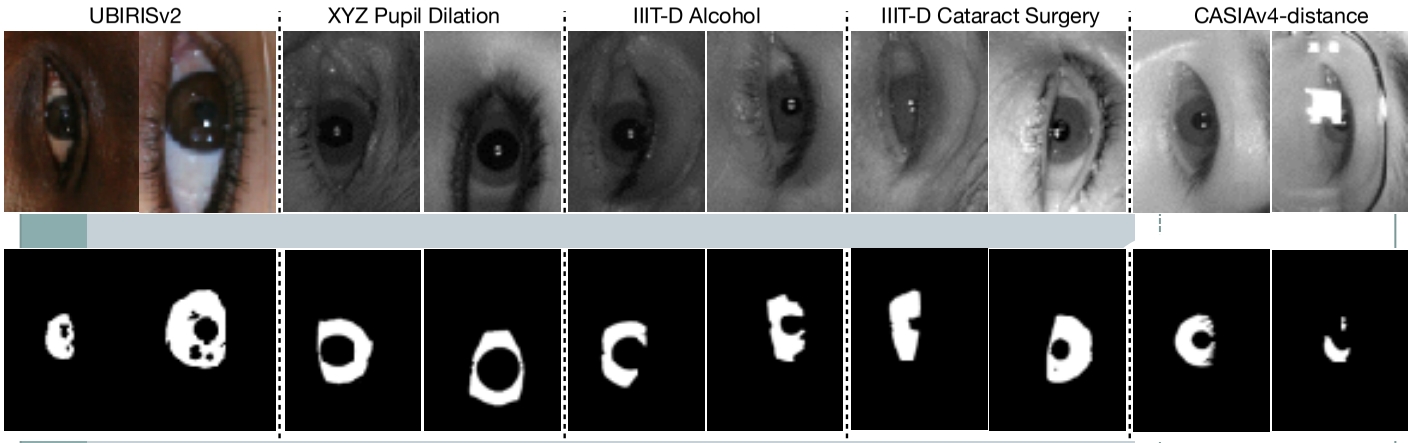
User-Sensor-Interation



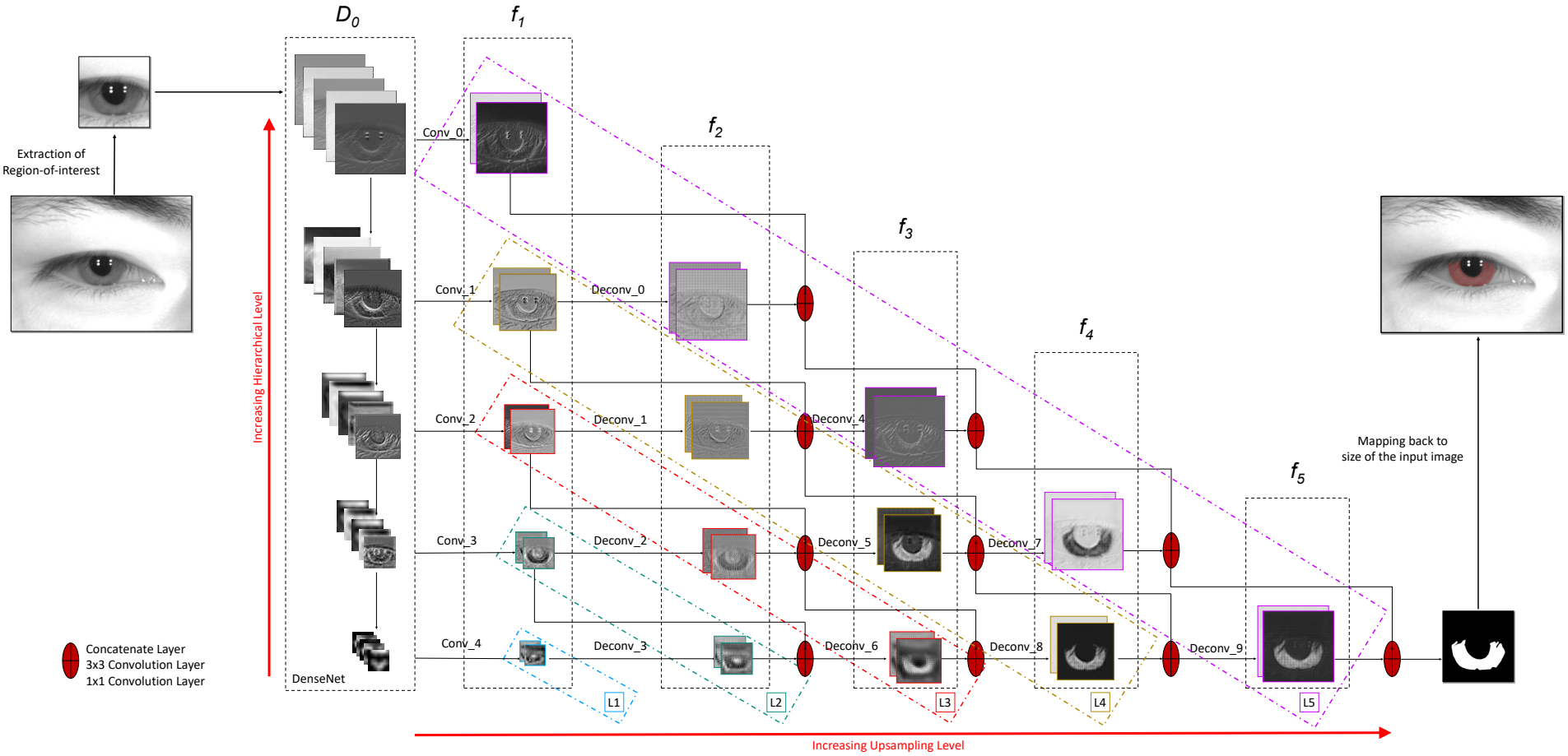


DL Algorithm




UBIRISv2
XYZ Pupil Dilation
IIIT-D Alcohol
IIIT-D Cataract Surgery
CASIAv4-distance

DL Algorithm



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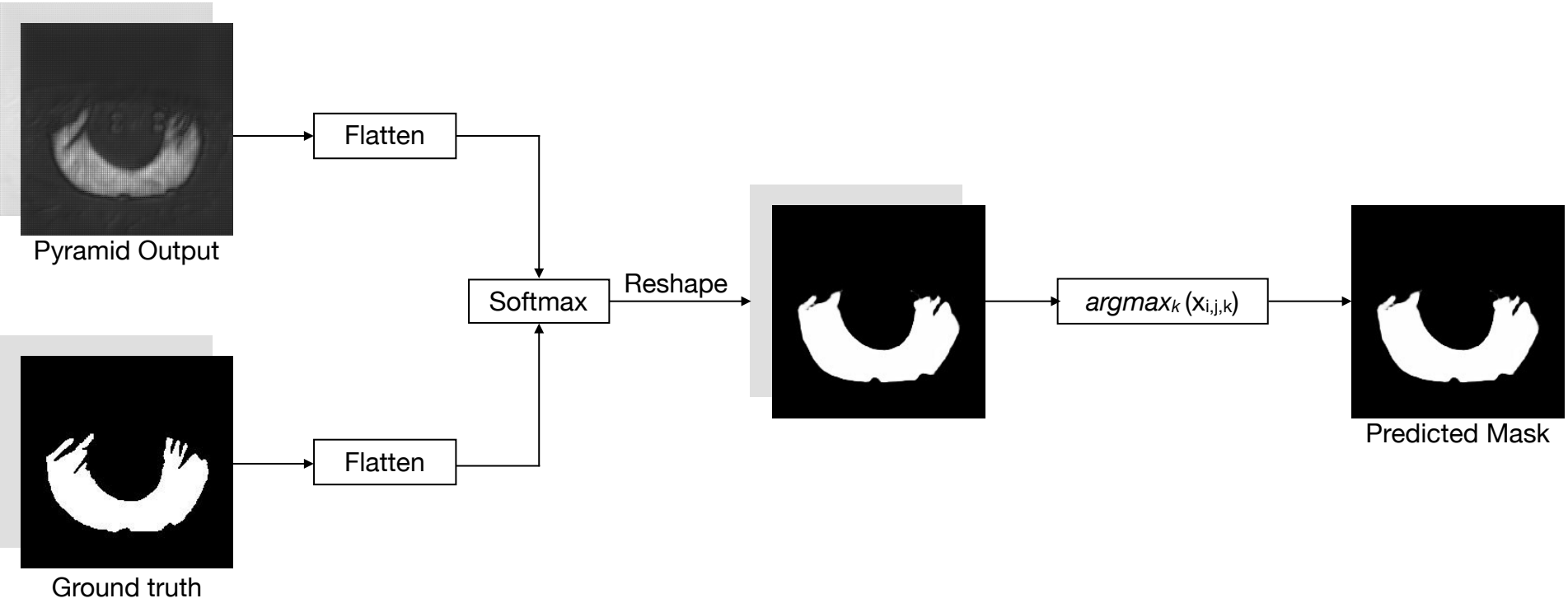

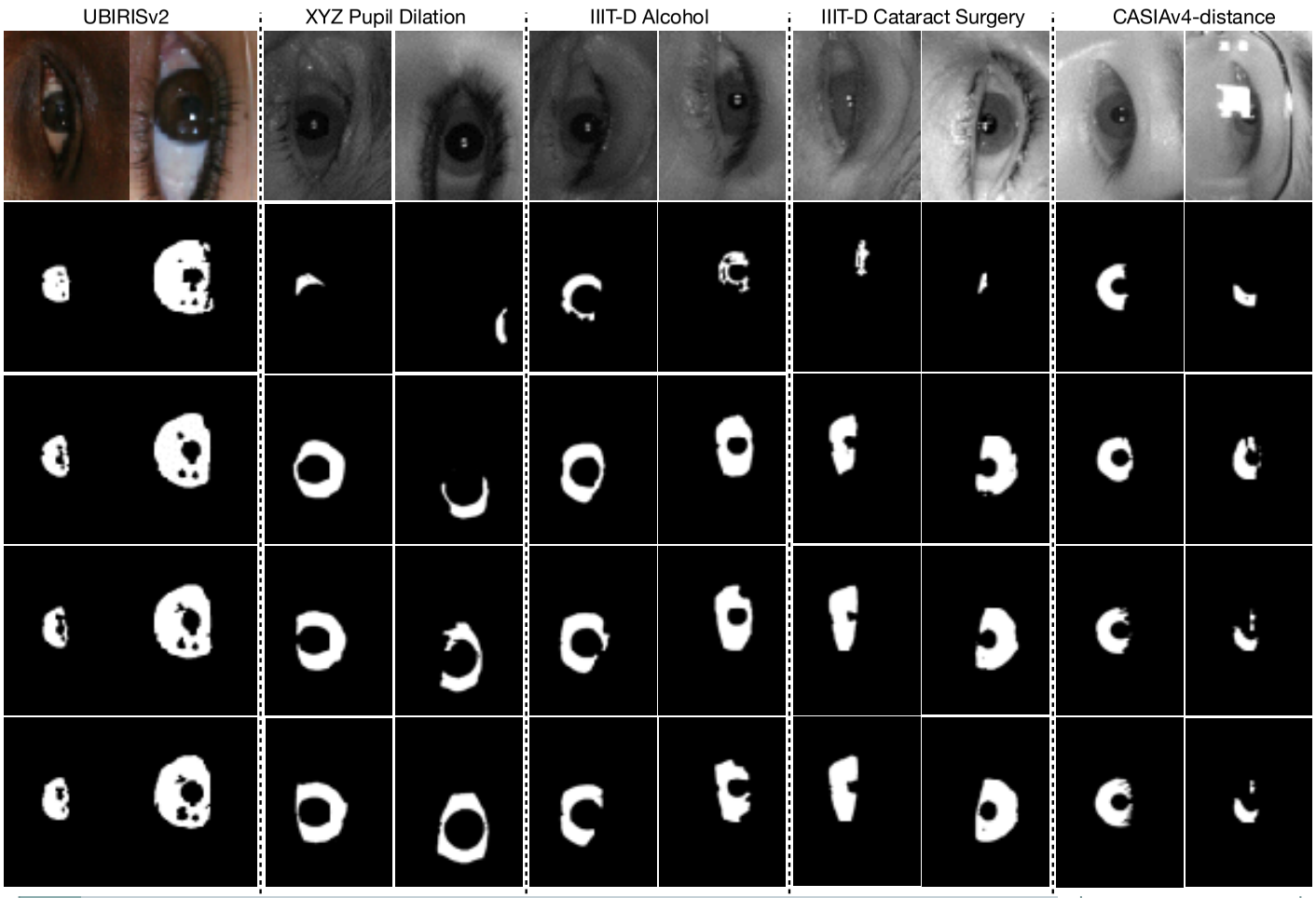
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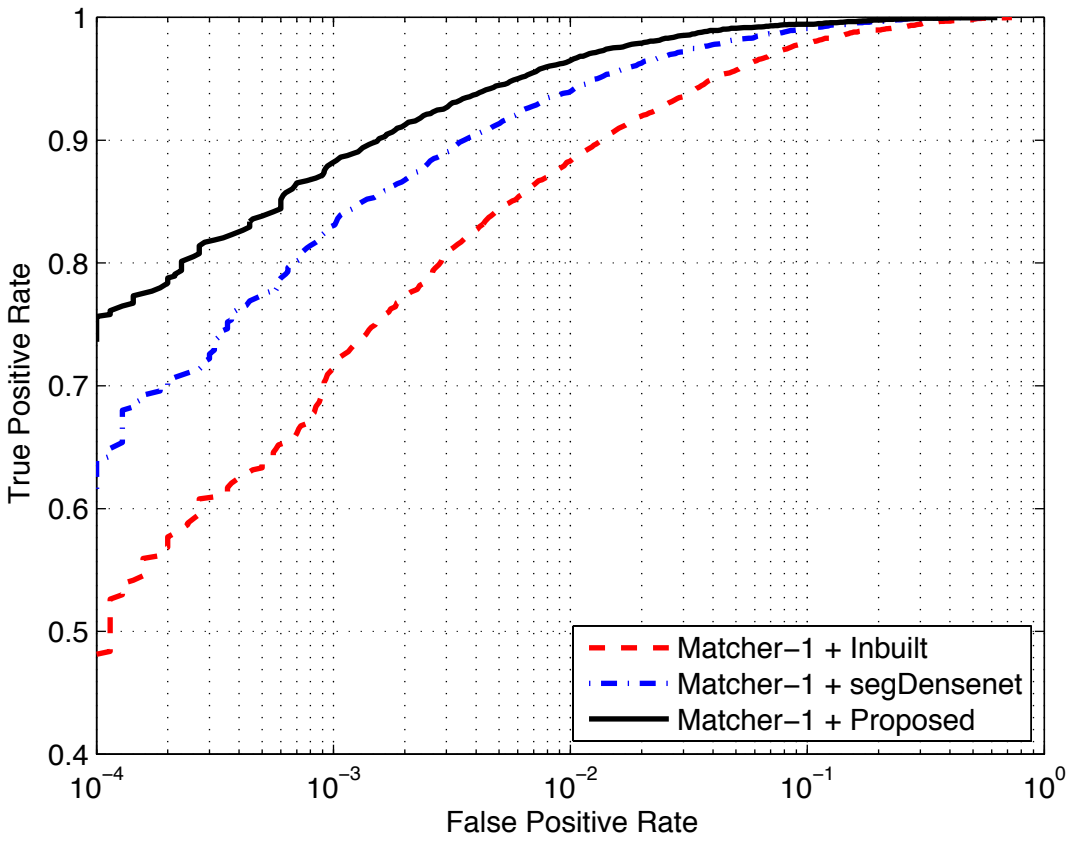
How to evaluate?



Ocular Recognition