

# Iris Quality from Image Acquisition

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**LG Electronics USA Inc.,  
Iris Technology Division  
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# LG at a Glance

- **Founded: 1947**
- **2006 Total Sales: 93 Billion USD**
- **Business Fields: **Electronics**, Chemicals, Telecommunication & Services**
- **Number of Companies: 31**
- **Overseas Subsidiaries: 130**
- **Employees: 160,000+**

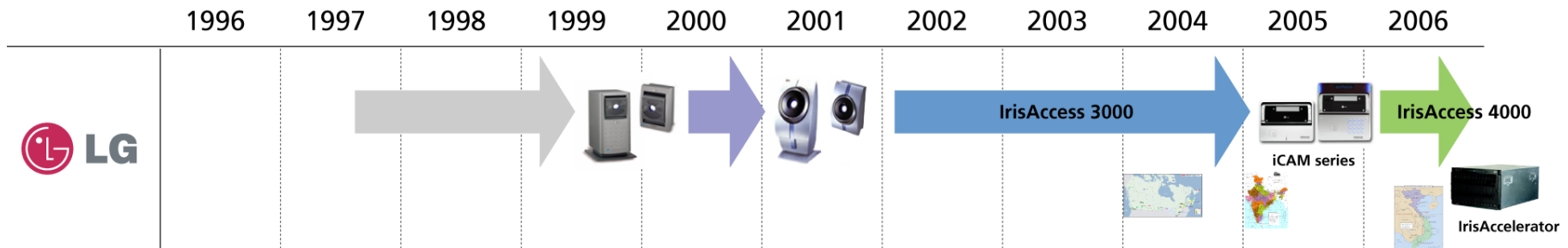
# LG Electronics



- **Makes many products under LG Brand and as OEM producer**
- **Consumer Electronics**
- **Security Business**
  - Surveillance/Monitoring
  - Iris Technology

# LG Electronics USA Inc. Iris Technology Division

- Began Iris in 1997
- Established US operations in 2002
- Third Generation Product
  - LG 2000/2200 Series
  - LG 3000 Series
  - LG 4000 Series



# Contents

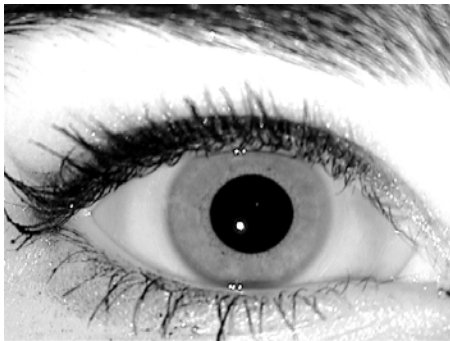
- **Importance of Iris Quality**
- **Camera Design to Ensure Quality**
- **Future Work**
- **Conclusion**

# Well Known Iris Quality Metrics

- Iris Diameter
- Motion Blur
- Focus
- Contrast
- Visibility (Measure of Occlusion)
- Texture
  
- Iris recognition performance depends if subject is wearing glasses

# Effect of Motion Blur

- Images simulated with linear motion blur (ICE 2005)
- Parameters: direction, extent



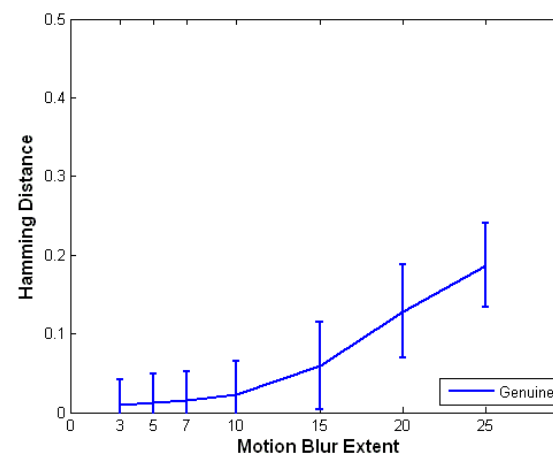
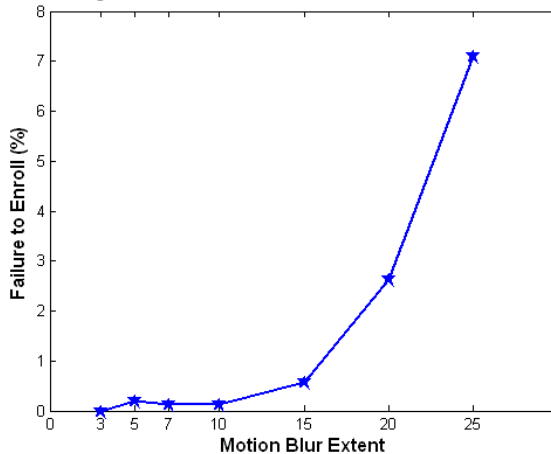
Original image



Motion Blurred (45°, 10)

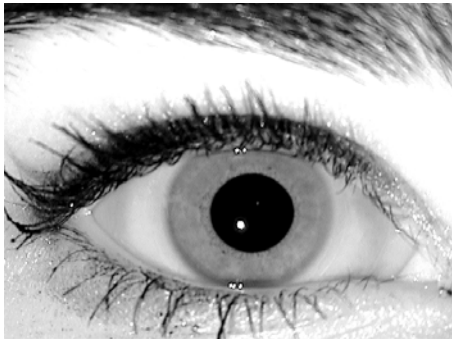


Motion Blurred (45°, 25)



# Effect of Out-of-Focus Blur

- Images simulated with Gaussian blur (ICE 2005)
- Parameters: variance, filter-size



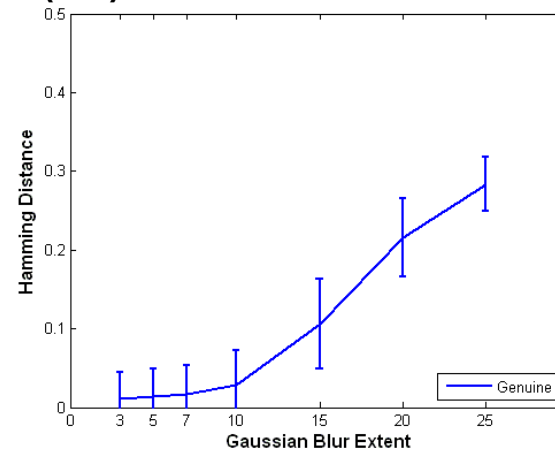
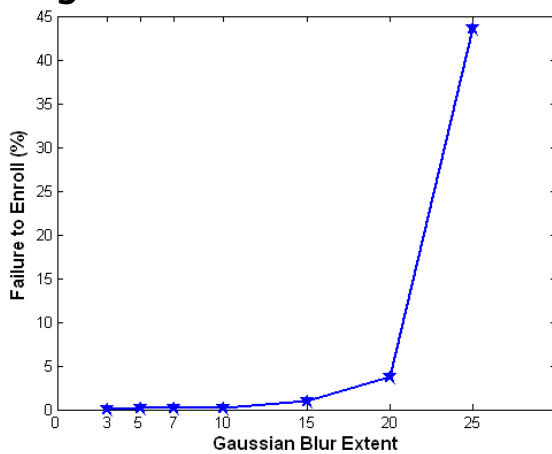
Original image



Gaussian blurred (10 )



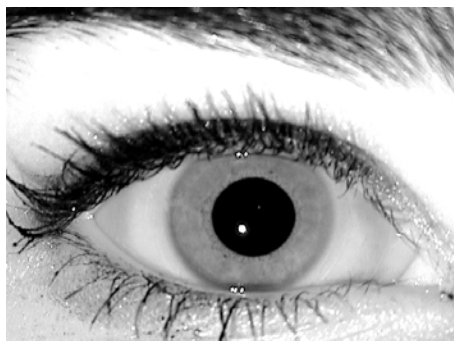
Gaussian blurred (25)



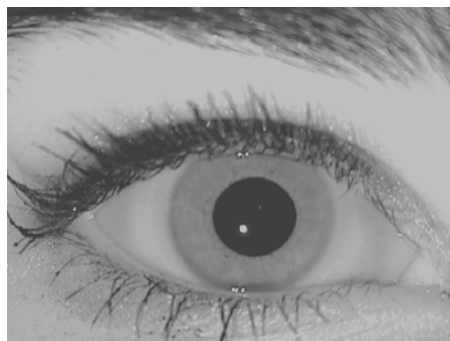




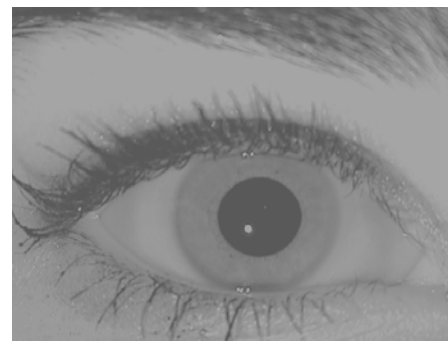
# Effect of Reduced Contrast



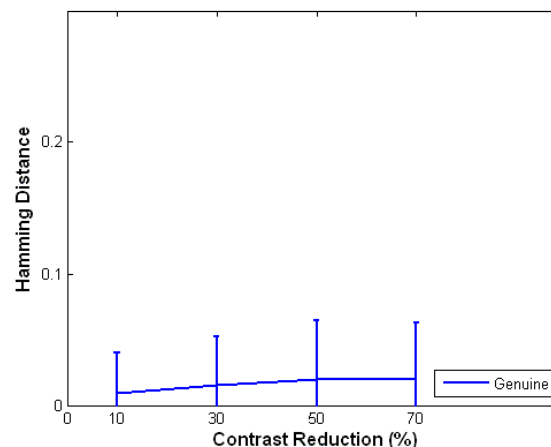
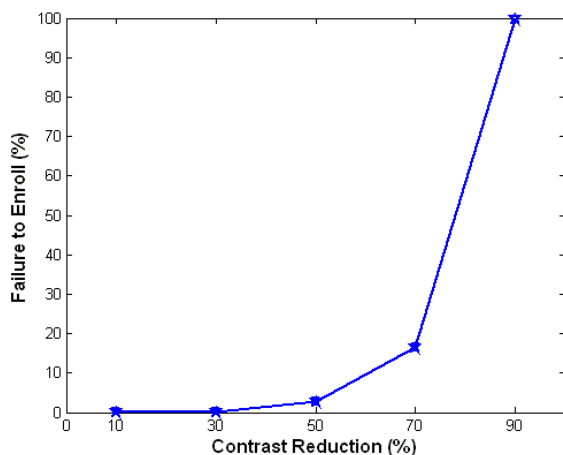
Original image



Contrast reduction: 50%



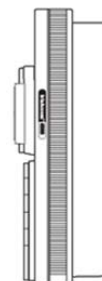
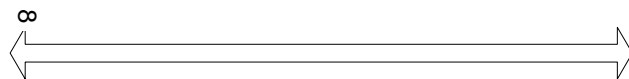
Contrast reduction: 70%



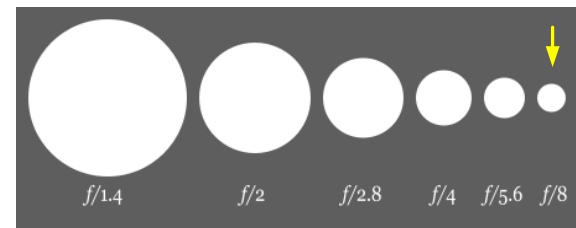


# Camera Design to Reduce Motion Blur

- ↑ Flexibility      ⇒      ↑ Depth of field



- ↑ Depth of field      ⇒      ↓ Aperture



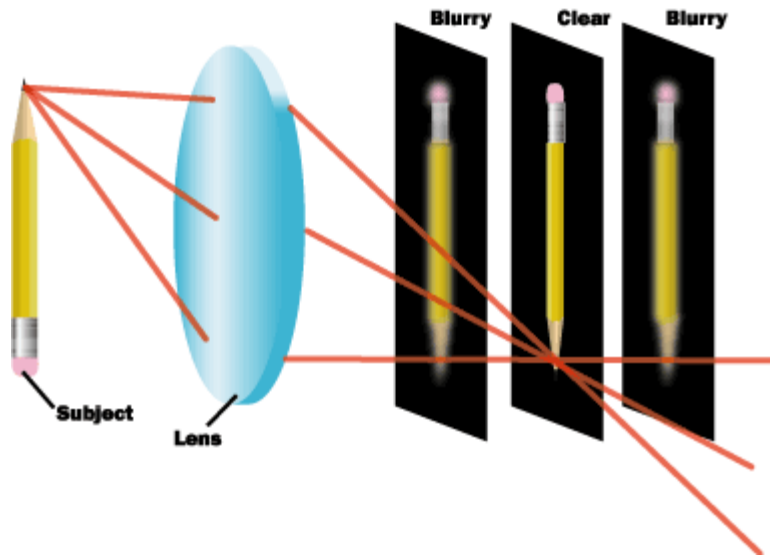
- ↓ Aperture      ⇒      ↓ Shutter speed,      ↑ Illumination

- ↓ Shutter speed      ⇒      ↑ Motion blur,      ↓ Quality

- Shutter speed has to be high and thus DOF shallow!



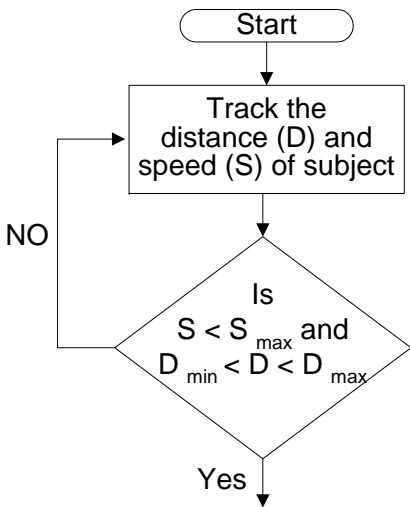
# Camera Design to Ensure Focus



- If object (iris) not in focus ➔ Blurred image
- To avoid out of focus image ➔ Auto focus lens
- Auto focus lens ➔ Requires the exact position of eyes from camera



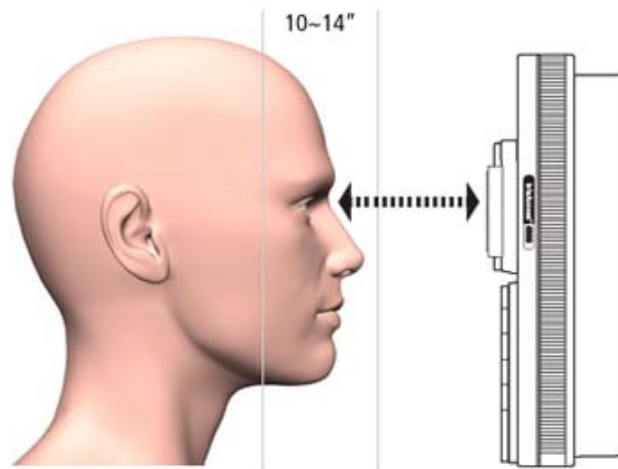
# Camera Design to Ensure Focus



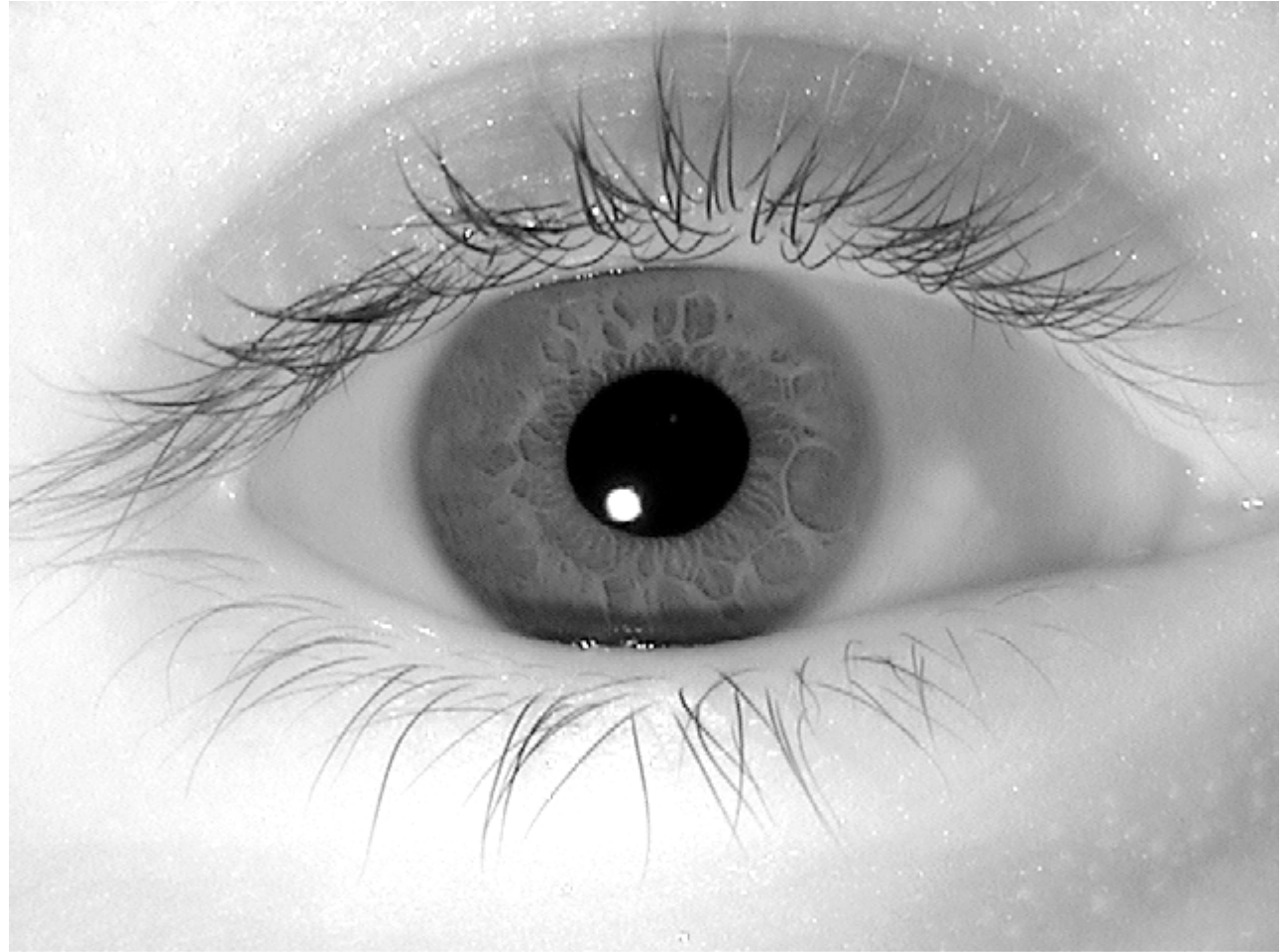
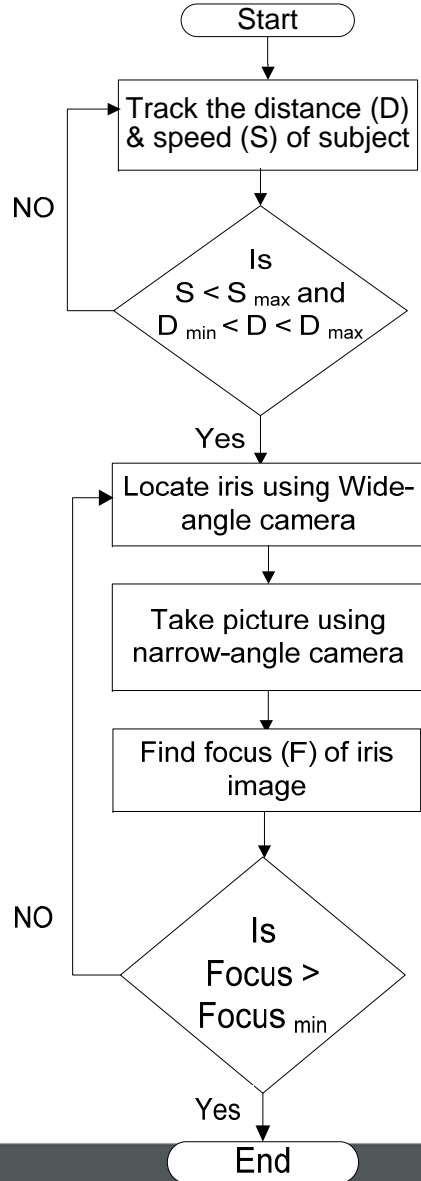
## Visual Feedback



- Not in range
- In range

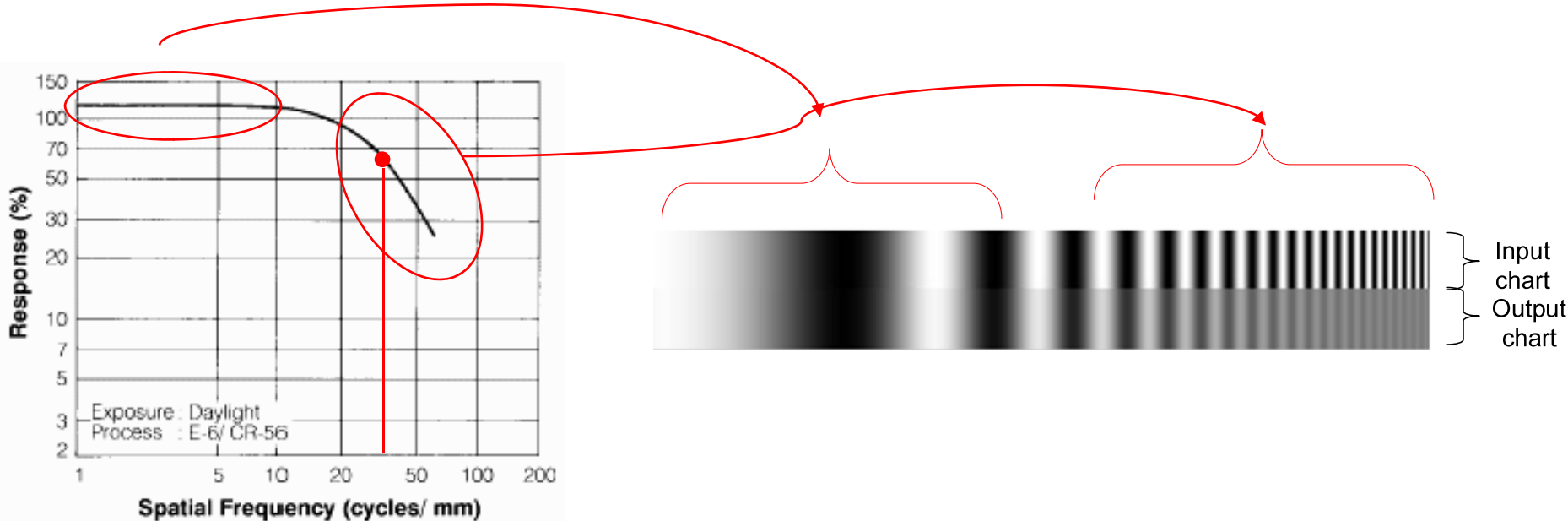


# Camera Design to Ensure Focus



# Camera Design to Ensure Contrast

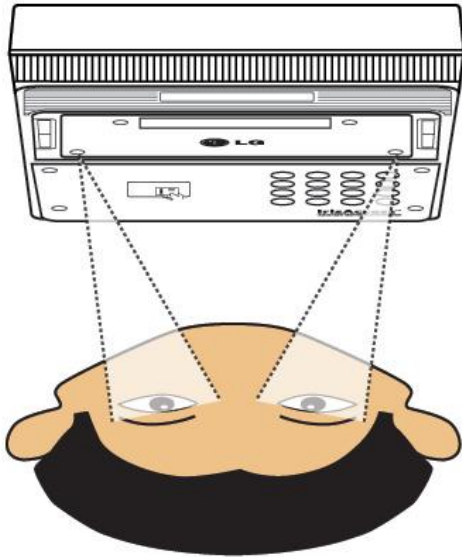
- Modulation transfer function (MTF)
  - Measurement of the lens' ability to transfer contrast from reference chart to an image plane at specific resolution (lines per mm)



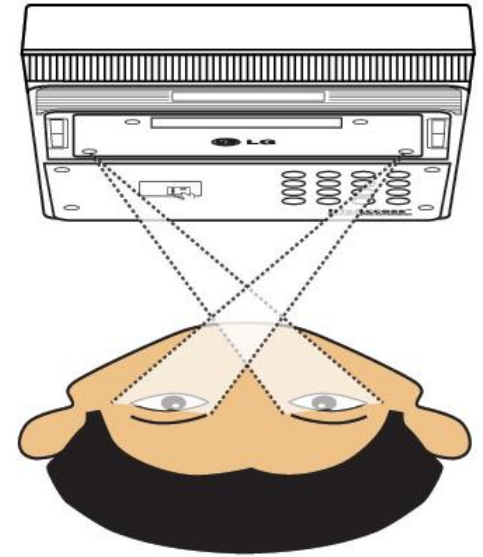
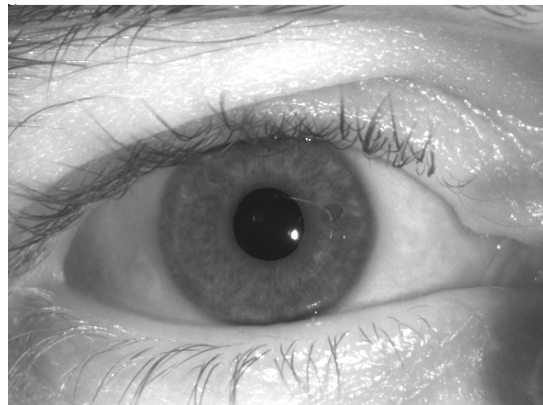
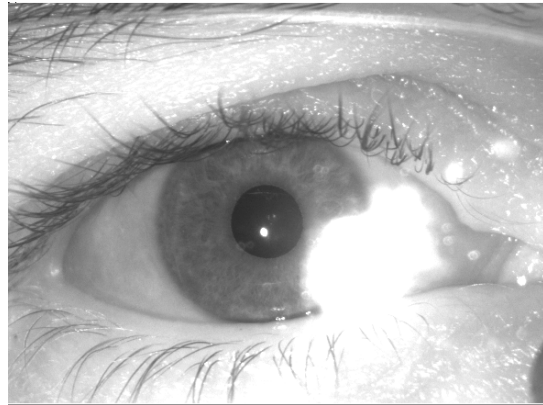
- ↑ Contrast (sharpness) ⇒ ↑ Optical resolution
- ISO standard: at 60% modulation, 4 lp/mm – enough?

# Camera Design to Ensure Quality - Glasses

- If a subject is wearing glasses, there is a possibility of reflections which can affect recognition performance



Direct Illumination



Cross Illumination

# Camera Design – Additional Factors

- **Single/Two eye camera**
  - Two-eye camera has very less scope for rotation of eyes
- **CCD/CMOS**
  - Size, cost and sensitivity
- **Illumination wavelength and power**
  - Governed by eye safety standards



# Future Work

- **Analysis and processing tool for a large collection of iris images from various sources (cameras)**
- **Evaluation of iris recognition algorithms**
- **Interoperability study of iris recognition**
- **Effect of various quality factors on different algorithms**

## **Iris Capture and Analysis Platform (ICAP)**

- **Will facilitate the analysis and processing of a large collection of iris images**

# Conclusion

- **Iris Diameter, Motion Blur, Focus, Contrast and Optical resolution are important parameters for acquiring high quality iris images**
- **Wise camera design can eliminate many challenges of iris recognition**
- **Need of a tool to study effect of quality metrics on different algorithms and images from different sensors**



# Thank you!

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