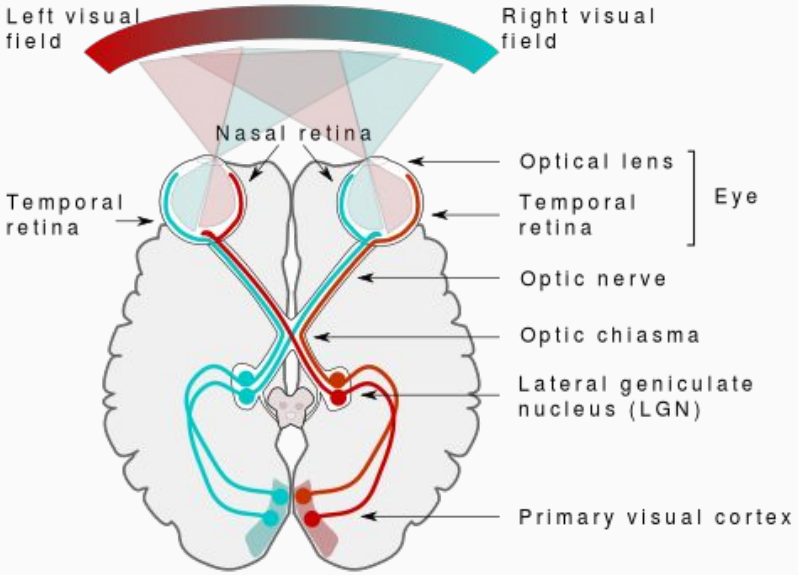
CSE428: Image Processing

Lecture 2: HVS, Image Sensing and Digitization

Outline

- Human Visual System (HVS)
- Image Sensing
- Sampling and Quantization
- Digital Image Representation

Human Visual System (HVS)



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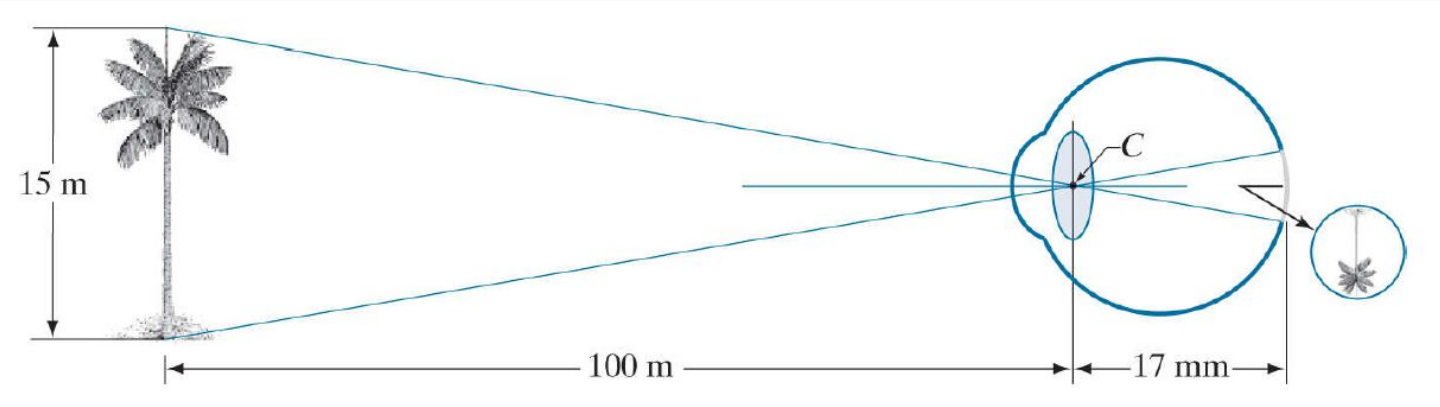
- Visual perception - key role in image processing
- **Eye** - sensor of the HVS
- **Brain** - image processing
  - Integrates intelligence and experience with input

Human Visual System (HVS)

Image formation in human eye

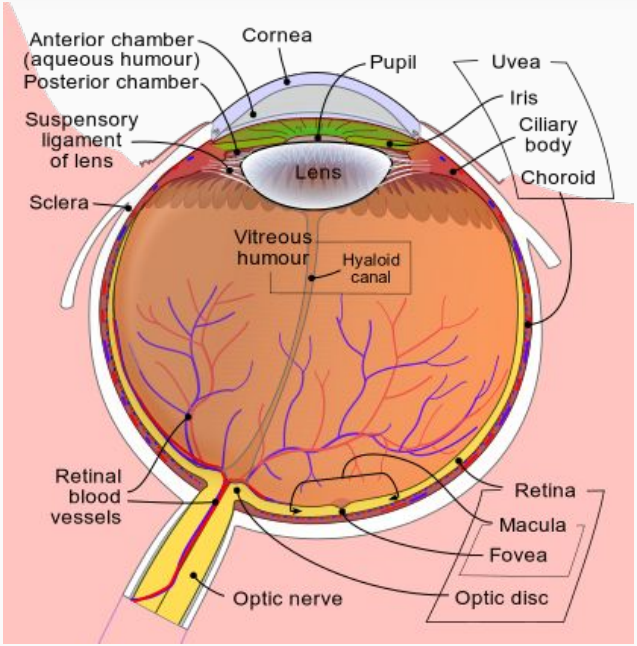


By Rafael C. Gonzalez & Richard E. Woods, 2018, *Digital Image Processing*, 4th Edition

$$h/17\ \text{mm} = 15\ \text{m} / 100\ \text{m}$$

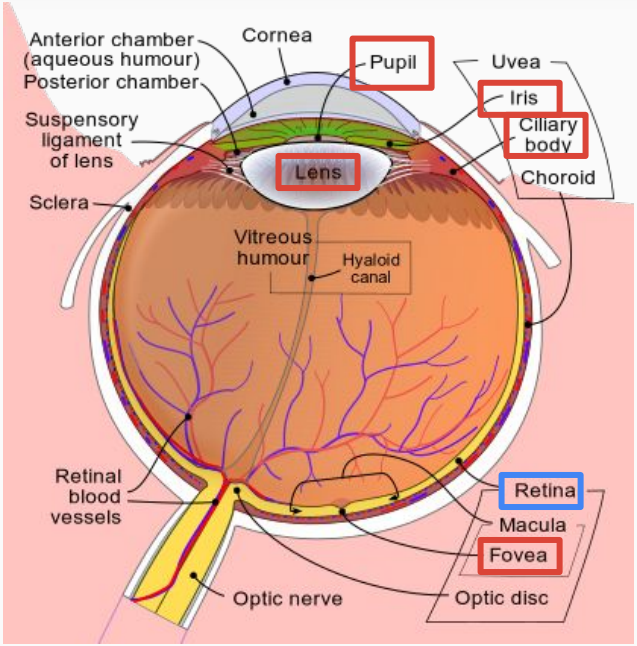
Human Visual System (HVS)

Structure of the eye



Human Visual System (HVS)

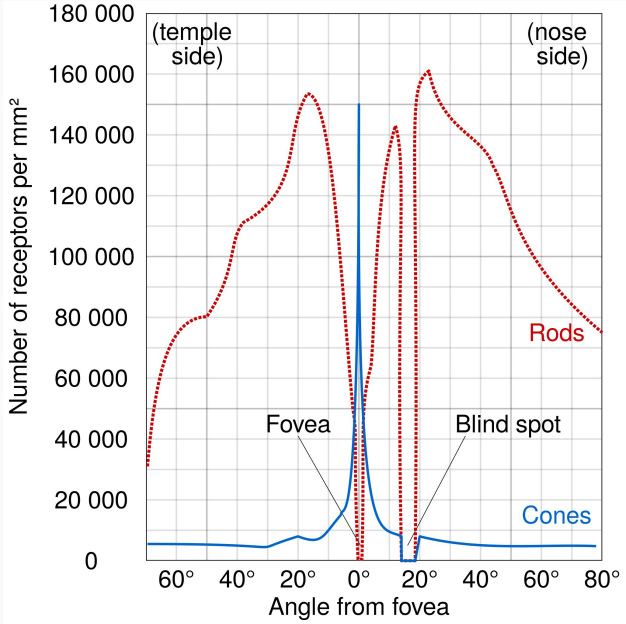
Structure of the eye



- **Iris & Pupil** - Controls the amount of light
- **Ciliary Body** - adjusts the focal length of optical **lens**
- **Retina** - Receptors (sensors) of 2 types, cones and rods
- **Fovea** - focusing region

Human Visual System (HVS)

Cones and Rods

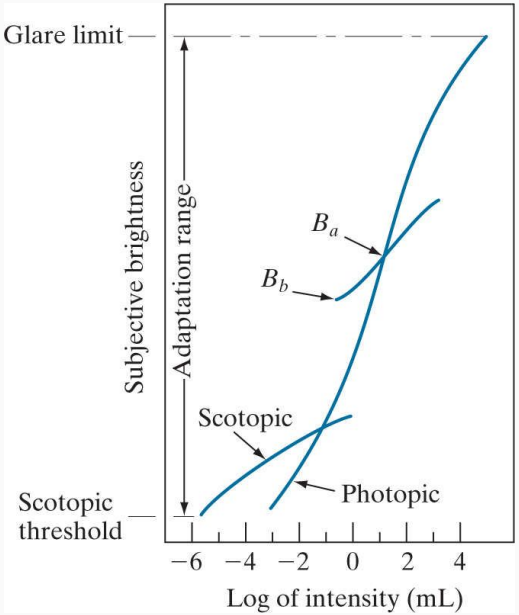


- **Cones** - Low in number. Concentrated on a central position called fovea. Highly sensitive to color. Fine details response since each cone connected with a nerve.

- **Rods** - High in number. Distributed over the optic globe. Sensitive to low light vision with no color information. Low resolution response since several rods connected with a nerve.

Human Visual System (HVS)

Brightness Adaptation



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- Camera *captures* **intensity**, objective
- We *perceive* **brightness**, subjective
- Subjective brightness is a logarithmic function of light intensity
- Adaptation range for photopic vision is quite high, but overall adaptation due to scotopic vision is quite low.
- Thus, for a given set of brightness (say Ba) condition, the range of discriminative intensity level of HVS is rather small (shown as curve of Ba-Bb).