Early Vision
(I)

Introduction to Computational and Biological Vision

CS 202-1-5261

Computer Science Department, BGU

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Processing at the sensor level

How different are these designs?
Processing at the sensor level

Limulus Polyphemus (Horseshoe crab)
Processing at the sensor level

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Processing at the sensor level

Haldan Hartline’s experiments
Processing at the sensor level

(Classical) receptive field of a cell

A region of the retina (visual field)
that must be stimulated directly
in order to obtain a response in that cell

[Sherrington 1906]
[Hartline 1938]
[Kuffler 1953]
Processing at the sensor level

Hartline’s lateral inhibition
Processing at the sensor level

Lateral inhibition in the Limulus

• Nearby receptors mutually inhibit each other.
• Inhibition increases with the intensity of the inhibiting illumination.
• Inhibition increases with the area of the inhibiting illumination.
• Inhibition diminishes with the distance of the inhibiting illumination.
• Inhibition is independent of excitation level

[Hartline, Wagner, and Ratliff 1956]
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Lateral inhibition in the Limulus – HOW?
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Why lateral inhibition?

Contrast and boundary enhancement!!
Processing at the sensor level
Processing at the sensor level

Mach Bands

Ernst Mach (1838-1916)
Processing at the sensor level

What can be computed with lateral inhibition?

What cannot be computed?

What is an appropriate abstraction and formalism?