Oct 22, 2009

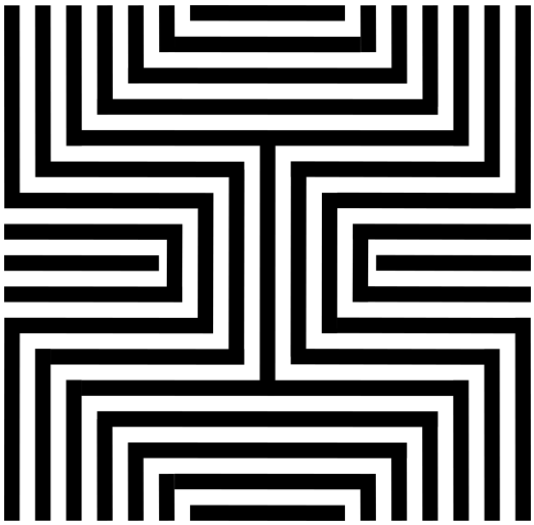
Visual Pattern Recognition

Taylor J. Meek

Overview

- Physiological Visual System
  - Difference Detectors and Visual Aftereffects: Color, Lines, Orientation, Movement
    Finding the Feature Detectors: Physiological versus Cognitive ←→ Fatigue Transfer
  - Building Feature Detector Systems: Simple, Complex, Hyper-Complex, Higher-Level (Cognitive)
- Cognitive Feature Parsing
  - Physiological Nystagmus (Eye Jitters) → The Image Segmentation Problem
  - Feature Classes + Relations → Geons? + Relations → Objects?
- Pattern Recognition and Pandemonium

Definitions



(Lindsay & Norman, 1977)

Rods: Photoreceptors highly sensitive to light, but not to color.
Cones: Photoreceptors that are color sensitive, concentrated in the fovea.
Fovea: The central part of the retina containing only cone cells responsible for the sharpest vision.
Neuron: A cell which receives signals from other cells, and sends out a constant base signal which can be increased by receiving excitatory signals and decreased by inhibitory signals.
Dendrite: Branches of the neuron leading to the nucleus where the majority of the input to the neuron occurs.
Axon: The cable-like structure that carries the signals from the neuron to other neurons.
Axon Terminal: The terminations of the axon which communicates to target neurons.
Photoreceptors: Specialized neurons, Rods and Cones, transmitting in response to light.
Bipolar Cells: Neurons exciting in response to one cell and inhibiting in response to another, thus neutrally activated when both signals are equal, activating more when excited, and activating less when inhibited.
Ganglion Cells: Neurons with axons several inches long; they carry the signals from the Bipolar Cells out of the eye to the brain. (Bundled together forming the optic nerve.)
Visual Cortex: The rear portion of the brain primarily responsible for deep visual processing.

Desensitization: The tiring of neurons and detectors leading to aftereffects which can indicate the nature and cognitive location of those detectors.
Nystagmus: Involuntary eye movements, mostly non-perceived, which might contribute to the segmentation of images and the relations between those segments.
Segmental Image Loss: The phenomenon of meaningful chunks of images vanishing when nystagmus is suppressed.
Geons: Representations of volumetric (geometric) shapes, comprised of several related features, and which can combine in a number of configurations across a large variation of scale and proportion to represent objects.

Bibliography

Biederman, I. (1995). Visual Object Recognition. In D. N. Osherson, & S. M. Kosslyn (Eds.), *An Invitation to Cognitive Science* (2 ed., Vol. 2, pp. 121-165). Cambridge: The MIT Press.

Crowder, R. G., & Wagner, R. K. (1992). *The Psychology of Reading: An Introduction* (2 ed.). New York: Oxford University Press.

Dodwell, P. C. (1970). *Visual Pattern Recognition.* New York: Holt, Rinehart and Winston, Inc.

Lindsay, P. H., & Norman, D. A. (1977). *Human Information Processing: An Introduction to Psychology* (2 ed.). New York: Academic Press, Inc.