DATA.STAT.770 Dimensionality Reduction and Visualization, Spring 2021

Exercise set 6 solutions.

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Part D: Human Perception

Problem D1: Simultaneous Brightness Contrast

Linear spatial filtering by oriented receptive fields followed by contrast-response normalization controls the difference of brightness perception. The perceived intensity of regions in many visual stimuli can be predicted by the model easily. The difference of Gaussian model of Spatial filtering can be responsible for the gradient structure of induction. In that case striking in grating induction, also occurs within the test fields of classical simultaneous brightness contrast and the white stimulus. The changes in the magnitude of white effect and grey as a function of inducing grating spatial frequency, and the pattern and magnitude of brightness can be predicted by the DOG model.

A grey patch placed on a dark background looks brighter than the same patch on a light background because, at the point where a uniform area meets a luminance ramp, a bright band is seen, and Mach bands appear where there is an abrupt change in the first derivative of a brightness profile. When a sequence of gray bands is generated, the bands appear darker at the edge than at the other, even though they are uniform. On the other hand, Comparing the brightness of the gray rectangles, its left side looks brighter than the right side even though the whole rectangle is of a single color. It is basically because of visual illusion. This illusion can be explained by what we know about the visual processing in the retina. Retinal responses depend on the local average image intensity.

When the background is black so the average intensity there is small. On the other hand, when the background is white so the average intensity there is large.

Receptive field of a cell is the area over which a cell responds to light so the patterns of light falling on the retina influence the way the neuron responds.

Problem D3: Gestalt Laws

Continuity & symmetry laws.