

Exercise 5, December 3, 2015, to be handed in December 10.

Think about how neurons in visual cortex area 17 or V1 encode the location of a spot of light on the one hand, and its level of brightness (intensity or contrast relative to background) on the other hand. [In both cases, look at the coding principles as idealizations, that describe the facts only approximately.]

1. Encoding of intensity by rate:
 - (a) What is the space of messages?
 - (b) What is the code space?
 - (c) Describe the code by describing the mapping between these spaces and making an illustrative drawing.
2. Encoding of retinal location by labeled lines (space code)
 - (a) What is the space of messages?
 - (b) What is the code space? [assume that for every localized stimulus, a single neuron with maximal activation is selected ("winner takes all")]
 - (c) Make a schematic drawing of a tuning curve that could be the basis for receptive fields and mark the location with maximal activation.
3. Maps
 - (a) Describe in words what a neural map is.
 - (b) Illustrate the idea of a map by sketching a topographic map from retinal space to the surface of the primary visual cortex.
4. Read the Box 1.2 in Chapter 1 of the text book "Dynamic Thinking" (on top of the list of downloads on the course webpage). Think about the relationship between coding and forward neural networks. Articulate in a short statement, why forward, but not recurrent neural networks are well characterized by the concept of "coding".