Due Date Oct 3. Fall 2017. Homework 1

Prof. Alan Yuille

September 18, 2017

Due on Oct 3 . Submit pdf file on Blackboard by 11:59:59 PM on the due date. Format file name as *firstname*-*lastname*-hw1.pdf. Do not include the iPython notebook code in the pdf submission as it is not required. If you have any questions about the homework, email TA Donald Li: sli97@jhu.edu

Question 1. Visual Illusions (12 points)

Visual illusions teach us about the assumptions that the brain makes when interpreting images. These assumptions are often correct but oc- casionally wrong, as shown by the illusions. Write a few (two or three) sentences explaining each of the illusions below. Which ones of them in- volve low-, mid-, or high-level vision? Note that all these illusions are discussed in the Early Vision chapter by Yuille and Kersten. (each worth 2 points)

1. Neon color spreading `http://www.michaelbach.de/ot/col-neon/index.html`
2. Motion binding `http://www.michaelbach.de/ot/mot-motionBinding/index.html`

3. Hollow face illusion `http://www.michaelbach.de/ot/fcs_hollow-face/index.html`

4. Dalmatian dog `http://www.michaelbach.de/ot/cog_dalmatian/index.html`

5. Ball in box `http://youtu.be/hdFCJepvJXU`

6. Checker-shadow illusion `http://www.michaelbach.de/ot/lum-adelsonCheckShadow/index.html`

Question 2. Linear Filters (12 points)

1. In the class, we discussed about the model of simple and complex cells, briefly describe the difference between them. (i.e. input, type of information that are sensitive to, etc) (4 points) Are complex cells considered to be a linear filter of its input, and why or why not? (2 points)

2. What kind of information does a first derivative of Gaussian filter capture from an image? (1 point) How about the second order derivative of the Gaussian filter? (1 point) What is a quadrature pair, and how it is linked to the second order derivative of the Gaussian filter? (2 points) Suppose you would like to smooth the image after applying a first derivative of Gaussian filter by a Gaussian filter, does the order of applying filters matter (i.e. chage the order of applying the Gaussian and the derivative of Gaussian filter), and why or why not? (2 points)

Question 3. Experimental Section: Filtering sinusoid input (16 points) This question is to probe receptive field models of neurons, such as Gabor functions and Laplacian of a Guassian, using sinusoid input. Full description is given at the

webpage below.

http://nbviewer.jupyter.org/github/shipui2005/ProbHW1/blob/HW1/HW1Intro.ipynb