BENG280A, Principles of Biomedical Imaging 10/03/06
Fall Quarter 2006

HOMEWORK #2
Due at the start of Class on Thursday 10/12/06

Homework policy: Late homeworks will be marked down by 20% per day. If you know that you need to turn in a homework late because of an emergency or academic travel, please let the TA know ahead of time. Collaboration is encouraged on homework assignments, however, the homework that you submit should reflect your own understanding of the material.

Readings:
Review chapters 4 and 5 in the textbook as necessary. Read Sections 2.1; 2.2.1-2.2.2; 2.2.4; 2.3.1- 2.3.3. Read Sections 6.1 and 6.2; Preview Section 6.3.

Problems:

1. Derive and sketch the answers for the following expressions where * denotes convolution:
   a) $m(x) = \left[2\delta(x-1) + 2\delta(x+1)\right] * rect(x/5)$
   b) $m(x) = \left[2\delta(x-1) - 2\delta(x+1)\right] * \sin(\pi x)$
   c) $m(x,y) = \left[\delta(x,y) + \delta(x-1/2,y) + \delta(x+1/2,y) + \delta(x,y-1) + \delta(x,y+1)\right] ** rect(x,y/2)$
   d) $m(x,y) = \left[\delta(x,y) + \delta(x-0.5,y) + \delta(x+0.5,y)\right] ** \left[\delta(x-0.5,y) + \delta(x,y+1)\right]$

2. Problem 2.27 (parts a and b)
3. Problem 5.21
4. Problem 6.1
5. Problem 6.3

Matlab Exercise:

We will be using MATLAB throughout the course. The purpose of this exercise is to familiarize you with some of the MATLAB commands used for displaying and manipulating images.

1. Use the MATLAB command *zeros* to create a 128x128 matrix of zeros.
2. Now fill in your matrix with 2 Kronecker delta functions that are spaced 5 voxels apart.
3. Use the Gaussian blurring functions from last week's homework, except now allow the blurring matrix to be a 17x17 matrix.
4. Experiment with different widths (*w* parameter defined in last week's HW) of the Gaussian blurring function.
5. At what width *w* are the two delta functions "blurred" together in a fashion that it is not possible to tell that there are two points?
6. How is the width *w* of the Gaussian function found in part 5 related to its full-width-half maximum (FWHM)?
7. Turn in a few sample images along with your answers to the questions.