

**CAP5415 Computer Vision Fall 2012**  
**Programming Assignment # 1**  
**(Due 09/13/12)**

1. Write a function  $Q = \text{convolution}(\text{Image } I, \text{Kernel } H)$  that has arguments

- a. Image  $I$  (Images may be of varying sizes and you may want to give the size as arguments. You can use the *size* function in Matlab.)
- b. Kernel  $H$  (Again, you should allow varying size Kernels.)

The output of the function,  $Q$ , should be the convolution of  $I$  with  $H$ . Test your function and show results on the following Kernels, using the provided sample images within the assignment.

- i. Averaging Kernel ( $3 \times 3$  and  $5 \times 5$ )
- ii. Gaussian Kernel ( $\sigma = 1, 2, 3$ ) Use  $(3\sigma + 1) \times (3\sigma + 1)$  as size of Kernel (You may want to write a separate function to generate Gaussian Kernels for different values of  $\sigma$ .)

iii. Sobel Edge Operators:  $\begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix}$  and  $\begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$

iv. Prewitt Edge Operators:  $\begin{bmatrix} -1 & 0 & 1 \\ -1 & 0 & 1 \\ -1 & 0 & 1 \end{bmatrix}$  and  $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ -1 & -1 & 1 \end{bmatrix}$

2. Apply the generated Averaging and Gaussian Kernels on the provided image “balloonGrayNoisy.jpg” to perform noise filtering and show the outputs. Test different filter sizes.

3. Perform edge detection on the “buildingGray.jpg” using the Sobel and Prewitt Operators and show the outputs (Compute horizontal and vertical gradients and then the magnitude of the gradient. Apply a threshold.)

**Deliverables:**

- 1. Report including Input and Output images (Soft Copy)
- 2. Code (Soft copy)

Please send your assignments by email to [berkansolmaz@yahoo.com](mailto:berkansolmaz@yahoo.com)

Submission Deadline: 09/13/2012 (23:59)