CAP5415 Computer Vision
Programming Assignment # 1

1. Write a function Convolution(Image I, Kernel H) that has arguments
   a. Image I (Images may be of varying sizes and you may want to give the
      size as arguments. If you are using MATLAB, you can compute size
      within the function)
   b. Kernel H (Again, you should allow varying size Kernels)

   The output of function should be the convolution of I with H. Test your function
   and show results on the following Kernels.
      i. Averaging Kernel (3×3 and 5×5)
      ii. Gaussian Kernel (σ = 1, 2, 3) Use (3σ + 1)×(3σ + 1) as size of
          Kernel (You may want to write a separate function to generate
          Gaussian Kernels for different values of σ)
      iii. Roberts Edge Operators: \[
               \begin{bmatrix}
                     1 & -1 \\
                     -1 & 1
               \end{bmatrix}
           \quad \text{and} \quad
               \begin{bmatrix}
                     -1 & 1 \\
                     1 & -1
               \end{bmatrix}
         \]
      iv. Sobel Edge Operators \[
               \begin{bmatrix}
                     0 & 0 & 0 \\
                     1 & 2 & 1
               \end{bmatrix}
           \quad \text{and} \quad
               \begin{bmatrix}
                     -1 & 0 & 1 \\
                     -2 & 0 & 2
               \end{bmatrix}
         \]
      v. Prewitt Edge Operators \[
               \begin{bmatrix}
                     -1 & 1 & 1 \\
                     -1 & 2 & 1 \\
                     -1 & 1 & 1
               \end{bmatrix}
           \quad \text{and} \quad
               \begin{bmatrix}
                     -1 & 1 & 1 \\
                     -1 & 2 & 1 \\
                     -1 & 1 & 1
               \end{bmatrix}
         \]

2. Write a function Reduce(Image I) that has an image as an input and the output
   should be re-sampled copy of half the width and height of the input image. Use
   the two 1D gaussian kernels as discussed in class.

3. Write a function Expand(Image I) that has an image as an input and the output is
   the expanded copy of input image, twice the width and height of original image.

4. Use the Reduce function in (2) to write a function GaussianPyramids(Image I,
   Levels n) that produces n levels of gaussian pyramid for image I.

5. Use the above functions to write a function LaplacianPyramids(Image I, Levels n)
   that produces n levels of Laplacian pyramid of image I.
Deliverables:
1. Report including Input and Output images (Soft Copy)
2. Code (Soft copy)

Send your assignments by email to rcen@cs.ucf.edu.
Submission Deadline: February 11, 2003 (23:59)