CW2: Coursework for Lecture 5: Convolution & Kernels

Instructions:

Please include pictures of all relevant MATLAB *figures in your answer. Figures can be saved as pictures by choosing* `File->Save As` *in the Figure menubar. You can also add annotation to your figures using* `Insert->Title` *or* `Insert->TextBox`.
The image `kitty.bmp` *can be downloaded from Blackboard or Moodle.*

1. Write a short (about 20 lines of code or less) MATLAB function that performs the convolution between an image, and a 3×3 structuring element, by performing an explicit looping over the image pixels. You should pad the edges of the input image with zeros to deal with the edges and corners of the original image.

   Load the image `kitty.bmp`, and compute the effect of taking the average, and the weighted-average smoothing kernels for the convolution (see the Smoothing Kernels section of Lecture 5).

   You should include a listing of this function code in your answer.

2. By convolving the original image with the appropriate kernels, compute the horizontal and vertical edge images, and hence the edge-strength image.

3. Perform thresholding of the edge strength image, and hence display the major edges of the image. You may find it useful to plot the image histogram for the edge-strength image. Can you find a threshold value that gives the edges of the cat, but not the patterns in the fur, or the wood-grain?

4. Repeat the above steps, but now starting from the weighted mean of the original image. Compare the edge-strength images. What difference has the weighted-mean smoothing made to the edges detected?

MATLAB Hints:
You may find the MATLAB functions `zeros`, `size`, and `sum` useful, as well as the `x.*y` element-wise multiplication operation on arrays.
A 3×3 array can be entered row-by-row into MATLAB by typing
`array_name = [v11 v12 v13;v21 v22 v23;v31 v32 v33];`