Coursework 1: Convolution & Kernels

Please note:

- **Use Python3/OpenCV for your implementation**
- **Python/OpenCV code snippets are provided on Blackboard to help you with your coursework implementation. It is not compulsory to use them but it may help to speed up your implementation process. They have been tested with Python 3.7.4 and OpenCV 4.2.0.**
- **Python3 is required.**

1. Write a short function in 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.

   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 gradient images, and then find the edge strength image given by the gradient magnitude (combined 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?