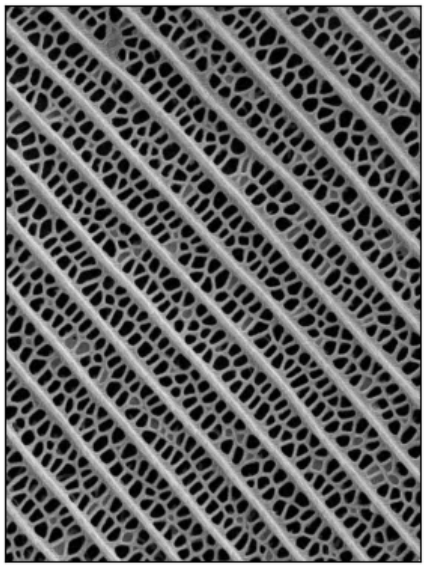
EEL 4930/5934
Introduction to Biomedical Image Analysis
Assignment – 9
Due: 04/11/2024, Noon

Edge detection in the presence of noise

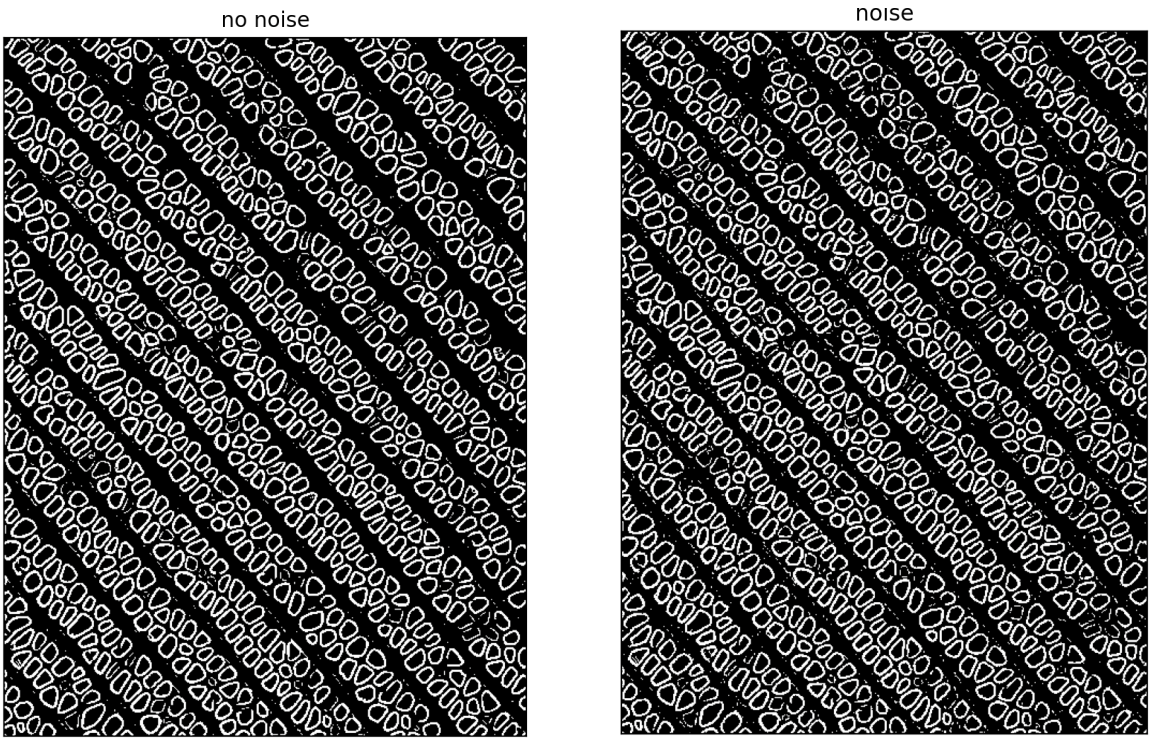
As discussed in lecture, detecting edges involves approximating the derivative of pixel values in a 2-D setting. In 1-D signals, a square signal has easily detected edges because there is a sudden ascent and descent in signal intensity. However, when there is noise in the signal these sudden changes are not as easily perceived.

Question 1:

(a) Load the '*ButterflyWing.PNG'* image. Generate a noisy output by applying Gaussian noise to the grayscale image using a mean of 0.2 and a variance of 0.1. Include output below. **(2+2 = 4 pts)**

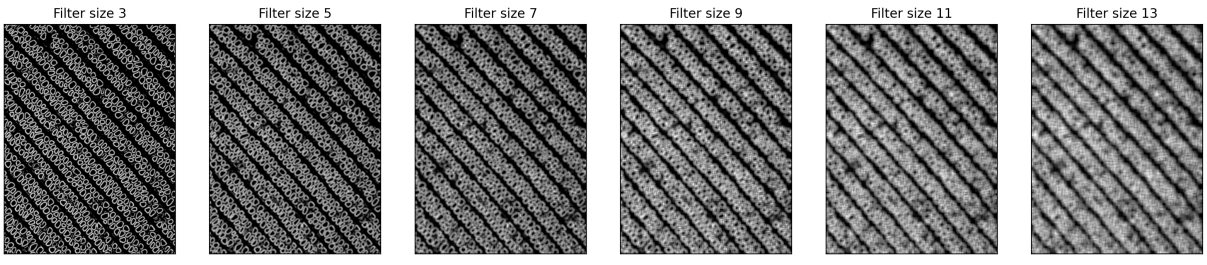


(b) Apply an edge filter to both the binarized original and binarized noisy image. (*Hint: Look at edge() command.)* Include output below. How successful was the edge detection in the presence of Gaussian noise? **(2+2+2 = 6 pts)**



Although they appear similar, the two images are in fact different. You can see this in the gaps between areas of the image, where the one with noise has a bit more pixel noise than the one without noise. Either way, the binarization is really good.

(c) Apply a low-pass filter to the noisy image and then use the same edge filter as in part (b) to detect the edges. Experiment with at least 5 different filter sizes. How does the output compare to the edges detected on the original noisy image? What is the effect of applying a low-pass filter to a noisy image and how does it impact edge detectability? **(5 + 2.5 + 2.5 = 10 pts)**



The output with filter size 3 and even 5 is almost perfect – there is no noise and the only issue is that some edges are not as thick and appear muted. As the size of the filter increases, the edges begin to overlap and become blurry.