CMSC 25010 HW 6

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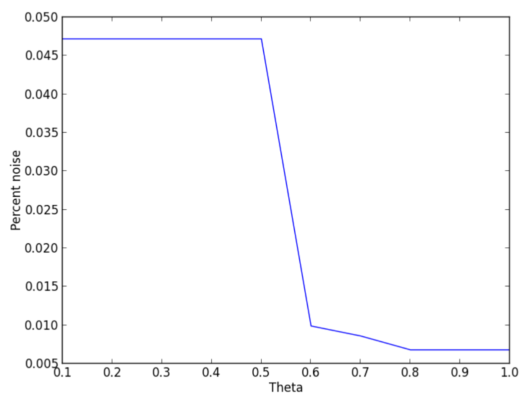
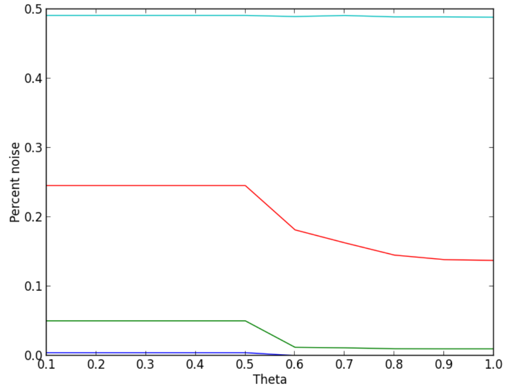
1 Optimal θ values

To determine the optimal θ value, I ran a number of various tests. In first test I performed, I used the circle of radius 40. I kept μ constant at 0.05 (so 5 percent of the bits were flipped). I measured the fraction of pixels in the denoised image that were different from those in the original image. Here are my results:



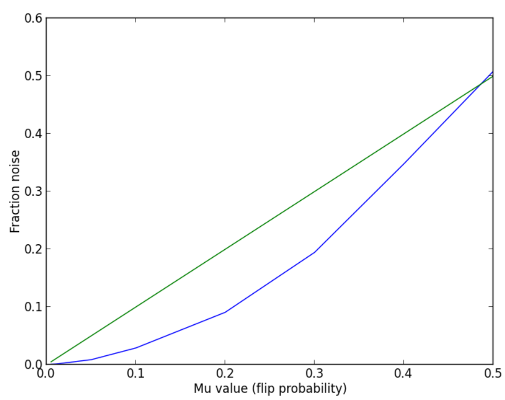
As you can see, there is a very sharp drop-off of effectiveness in θ value. For values 0.5 and lower, the θ was too low to make a difference. However, at $\theta = 0.6$, the error rate dropped to about 0.01, and at higher θ values, the error rate converged to about 0.006. Then, I wanted to compare the effect of μ, the number of bits flipped, on the parameter θ. I looked at μ values of 0.005 (blue), 0.05 (green), 0.25 (red), and 0.5 (turquoise). Below are my results:



These results indicate that the higher the θ value, the more accurate the denoting algorithm (even though it plateaus at around 0.7). Thus, I will use $\theta = 0.9$ in the rest of my analysis.

2 Maximum Noise Level

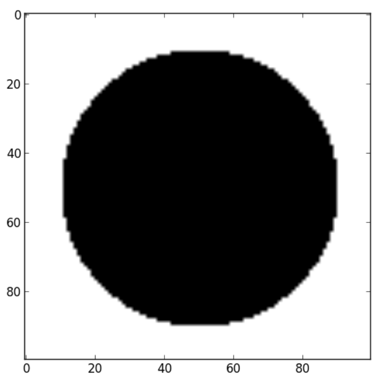
To determine the maximum noise level my denoising algorithm could handle, I calculated the error as above for many different μ values. Below are my results.



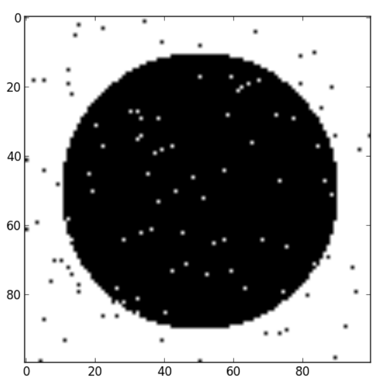
The blue line indicates the fraction error, and the green line is used as a reference to compare against the baseline error. At very low μ values, the denoising algorithm works very well. Between $\mu = 0.2$ and $\mu = 0.3$, the algorithm reduces the noise by approximately a half, but after $\mu = 0.3$, the picture is too noisy to recover.

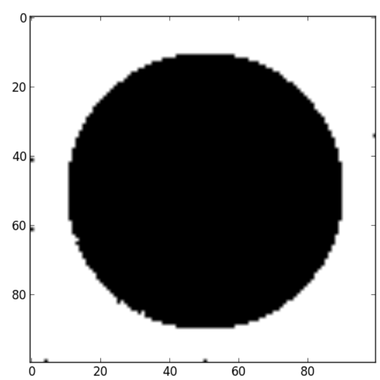
3 Image Examples

The original circle, with radius 40:

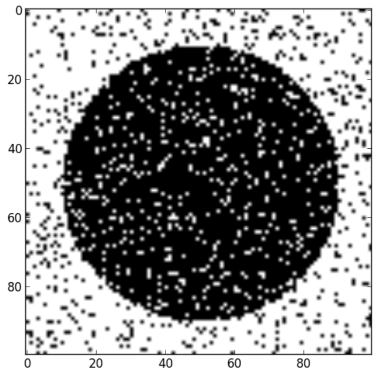


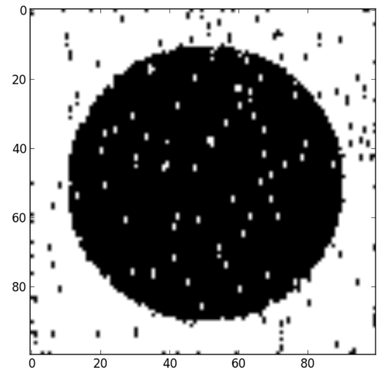
Circle with noise at $\mu = 0.01$ and its denoised version:



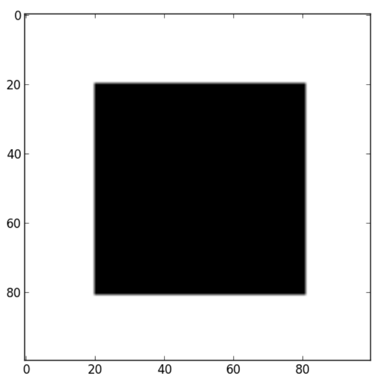


Circle with noise at $\mu = 0.1$ and its denoised version:

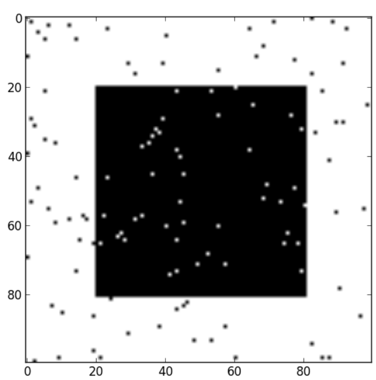


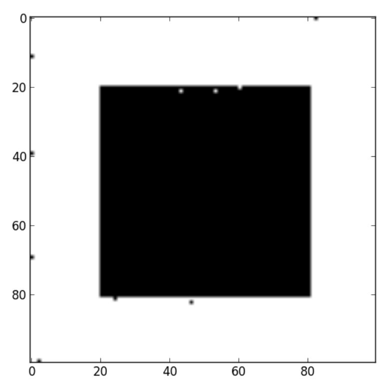


A square:

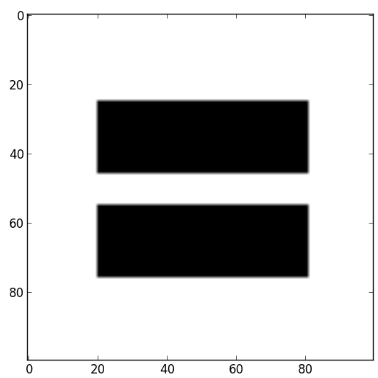


Square with noise at $\mu = 0.01$ and its denoised version:





An equals sign:



Equals sign with noise at $\mu = 0.01$ and its denoised version: