Department of Electrical and Computer Engineering
The Johns Hopkins University
520.648 Compressive Sensing and Sparse Recovery – Spring 2018

Homework Assignment V

Computer Assignment:

This exercise confirms the feasibility of compressed sensing on real signals, particularly images, where the sparsity level S is unknown and there might be noise in the collected measurements.

The sensing scheme under consideration are: Random Gaussian and Random Subsampling (directly in the pixel domain). You will find the following three images: Phantom (synthetic), Brain (real) and Boat (real). The two sparsifying matrices that you should consider are: DCT and Wavelet (optional). For DCT, you would like to use a small patch size, say 8×8 or 16×16. However, for Wavelet (optional), you would like to set the patch size to be as large as the image itself. Compute the distortion based on the peak signal-to-noise ratio, often abbreviated PSNR, defined as follows

$$PSNR = 10 \log_{10} \frac{MAX^2}{MSE} \quad \text{where} \quad MSE = \frac{1}{N^2} ||\hat{\mathbf{x}} - \mathbf{x}||_2^2.$$

For our three test images, $MAX = 255$ (the maximum dynamic range) and N is the image dimension. Use the psnr.m file in the package to plot the PSNR between the recovered images and the original with respect to various numbers of measurements M.

What are your observations on how to obtain the best recovery performance? Which sensing scheme is better? Which sensing scheme do you prefer?

Due date: **Thurs, March 8** in lecture