COMPRESSIVE SENSING REPORT

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1. Basis Pursuit

Figure 1- 3 below explores mean square errors of the recovery algorithms basis pursuits from spgl package. The plots show MSE (actually SE, which is proportional here) as a function of the number of measurements. The first case is a basic measurement of a sparse vector, the second case is sparse in a dictionary, and the third case adds some small gaussian noise.

2. OMP and IHT

For the next part, we look at the same setting, but for iterative hardthresholding and orthogonal matching pursuit algorithms. We have scaled the errors by the norm of x to give a relative error and compare better different number of measurements. We see that they are far superior for low number of measurements then basis pursuit, the latter catching up for large number of measurements.

Date: 15 April 2016.

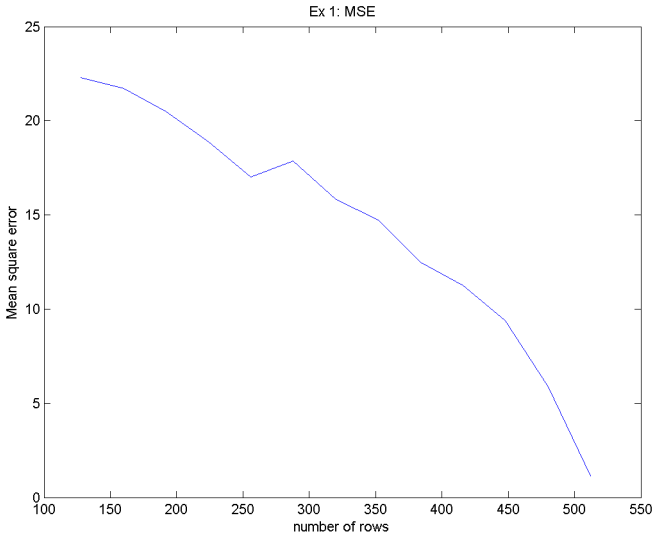

Figure 1. Exercise 1

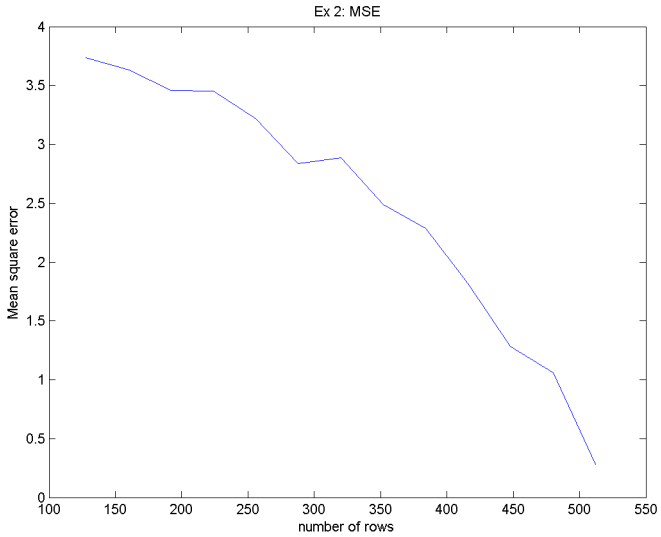

FIGURE 2. Exercise 2

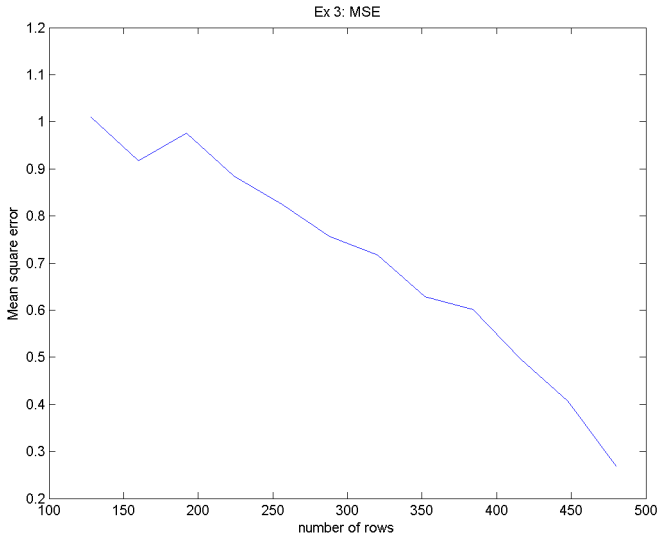

FIGURE 3. Exercise 3

3. Distance Preserving Projections

In this last section, we explore the tendency of a random projection to preserve distances. We do so by generating 30 vectors of dimension 50. We also look at when we increase the dimension to 500. For each case, we again perform an increasing number of measurements, and look at the pairwise distances compared to the non-transformed distances in relative size. The relative errors are plotted in Figure 6 and Figure 7. It seems that the dimension does not affect the results. The distances are better preserved with a small number of measurements than a higher one.

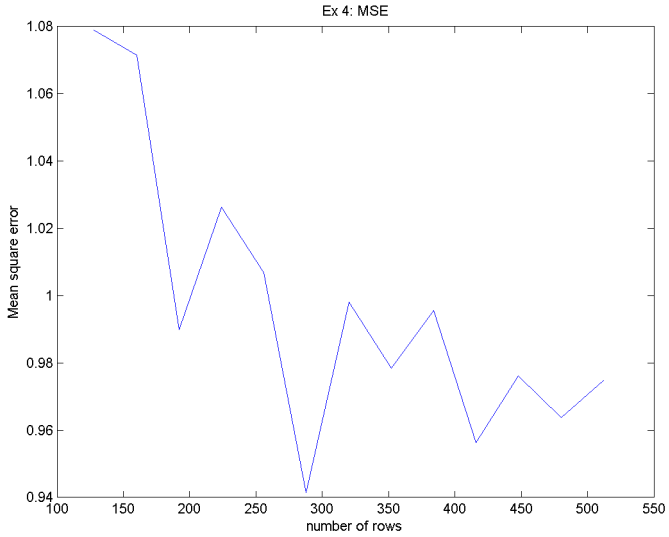

FIGURE 4. Exercise 4

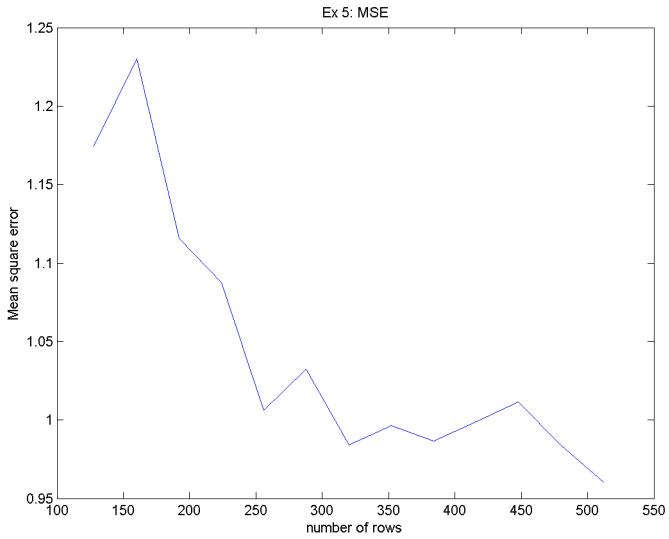

FIGURE 5. Exercise 5

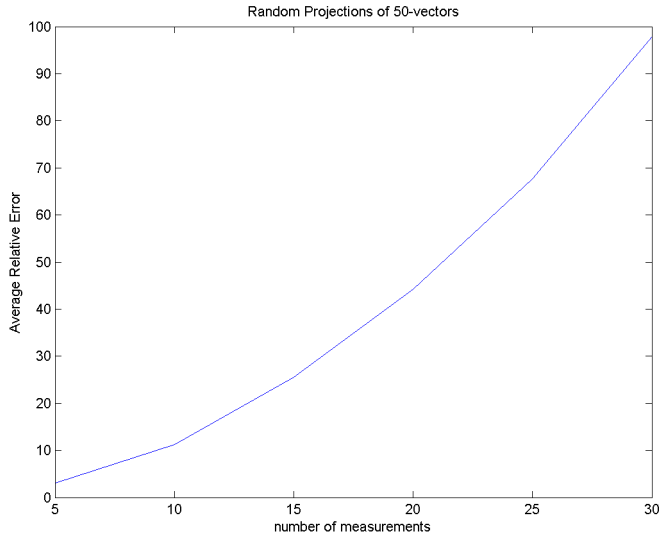

FIGURE 6. Exercise 6: 30 vectors of dimension 50

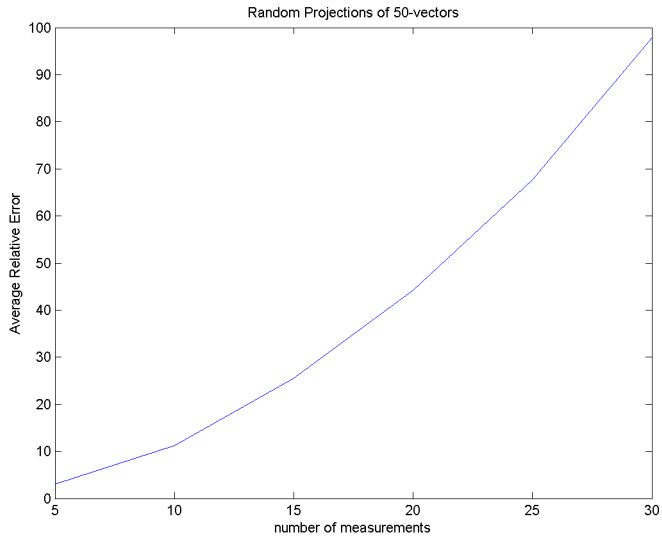

FIGURE 7. Exercise 6: 30 vectors of dimension 500