Lab 1 WD. QINGCHEN ZHANG.

Recover Sparse Signal from Under-sampled Observations.

Exercise 1

From $y = Ax$.

As A is defined as $m \times n$ matrix.

x is an $n \times 1$ matrix,

$$x = A^{-1} y.$$

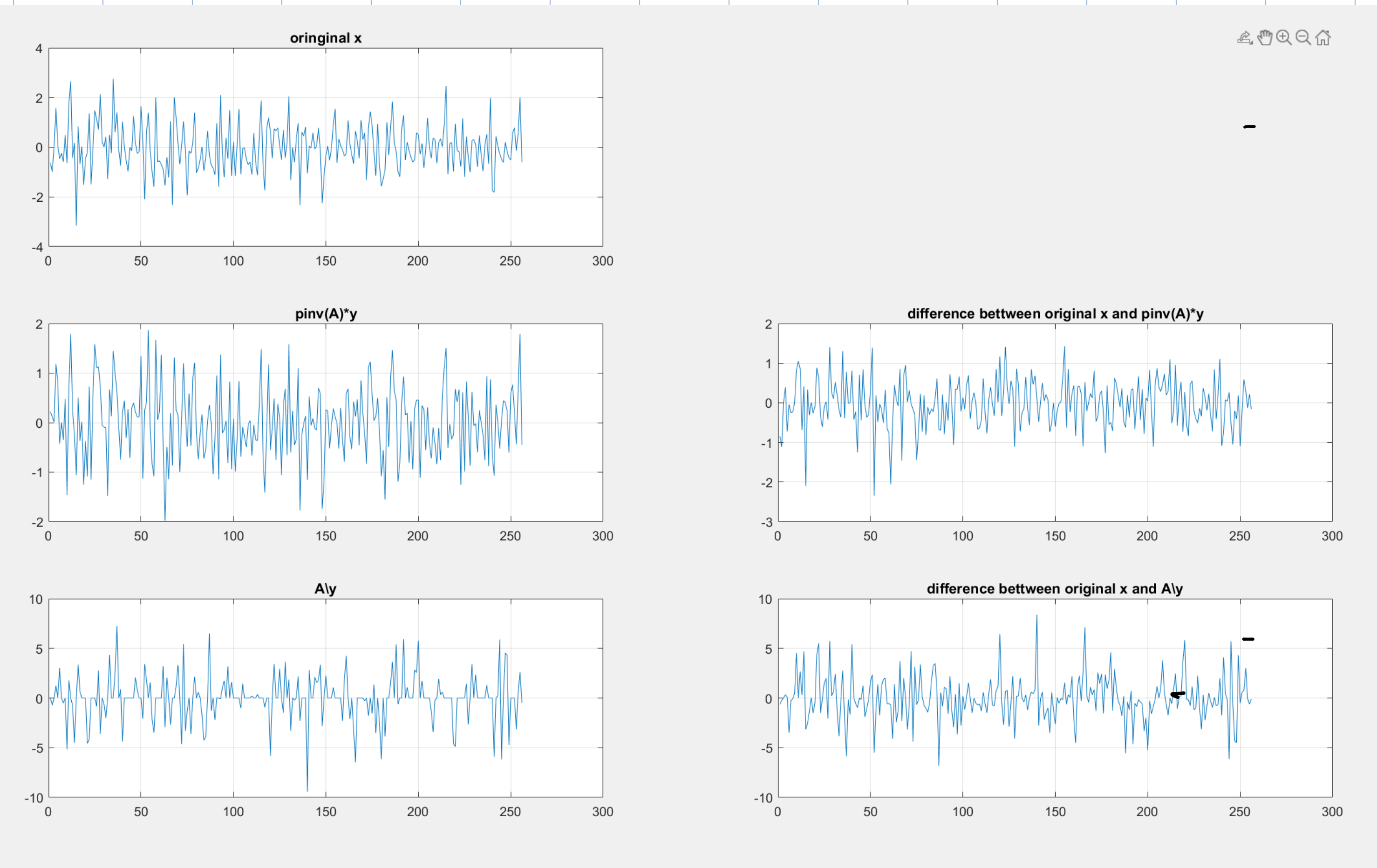
x is the original signal to be recovered.

y is the vector of measurements.

A is the measurements matrix.

Assume l_2-norm, aim to normalize each column of A.

In matlab using 'normc( )'



Pseudoinverse Method : $\hat{x}_1 = \text{pinv}(A) \times y$

Least Squares Method : $\hat{x}_2 = A^{+} y$

In matlab using $x = A \backslash y$

Compare each signal with original signal in Matlab, discover that they are different with each other.

Exercise 2.

Exit: 1. tolerance level 10^{-6}

2. iterations 20

OMP: 1. Obtain supp( ). by using max(abs(y))

Residual obtain by union( ).

2. $A_S^+ y$ obtained in Matlab pinv(A)*y.

SP: Initialization

$S = supp(H_s(A^* y))$ is intepreted in Matlab as find(abs()>0.1xabs)

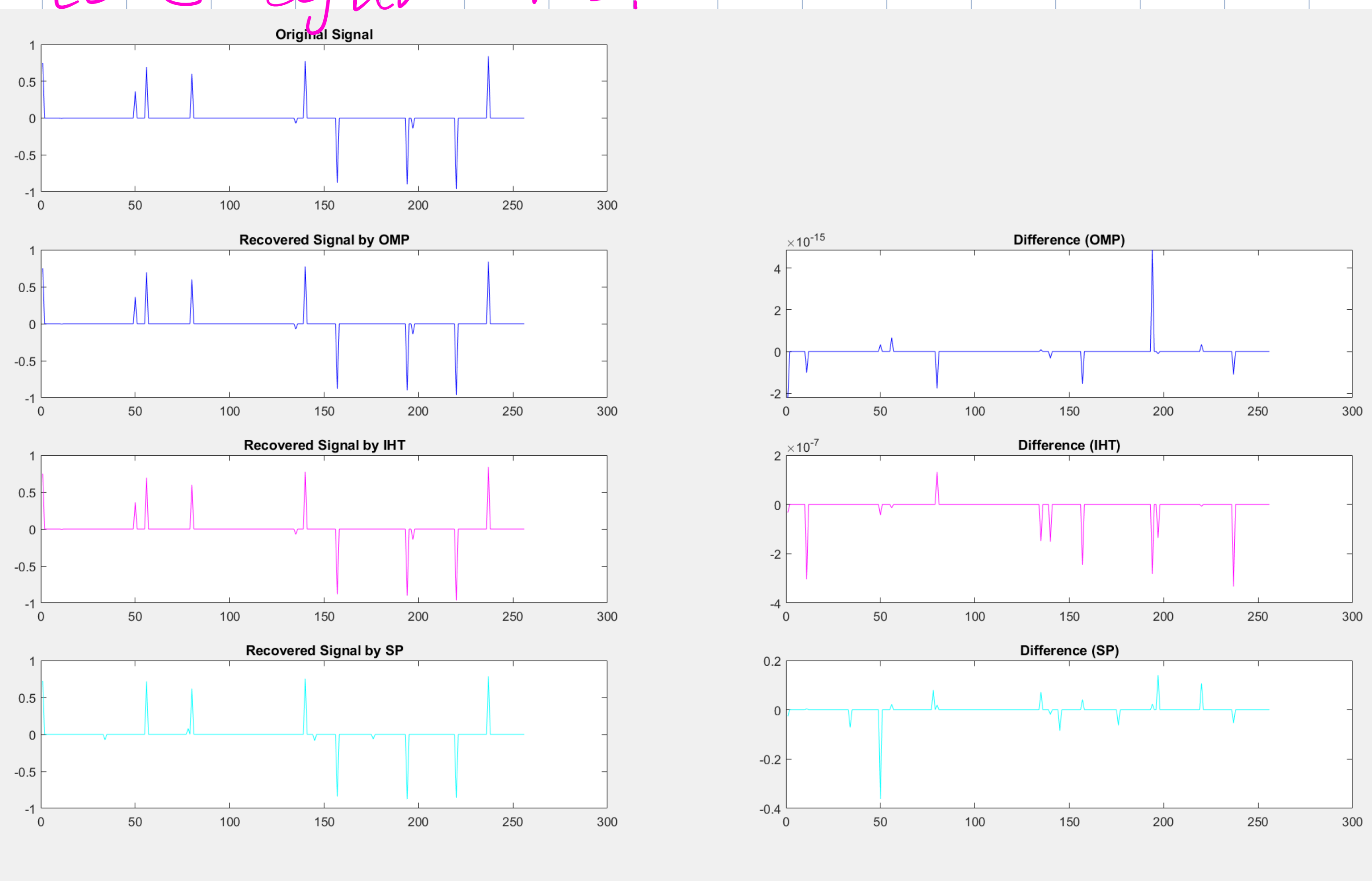
the threshold is setted at 0.1

$b_S = A_S^+ y \Rightarrow$ bT = A\y;

IHS: Write a function of Hs, which keeps S the largest magnitude components as its input, and set the rest as 0.

Matlab figure:

OMP add one index at a time to the support set. SP. expand the support set by S indices and shrink it back to S afterwards.



IHT updates the estimate directly.
Without maintaining a support set.