Sparse Coding Minimizing ℓ_0: Matching Pursuit

Mathematical Models and Methods for Image Processing

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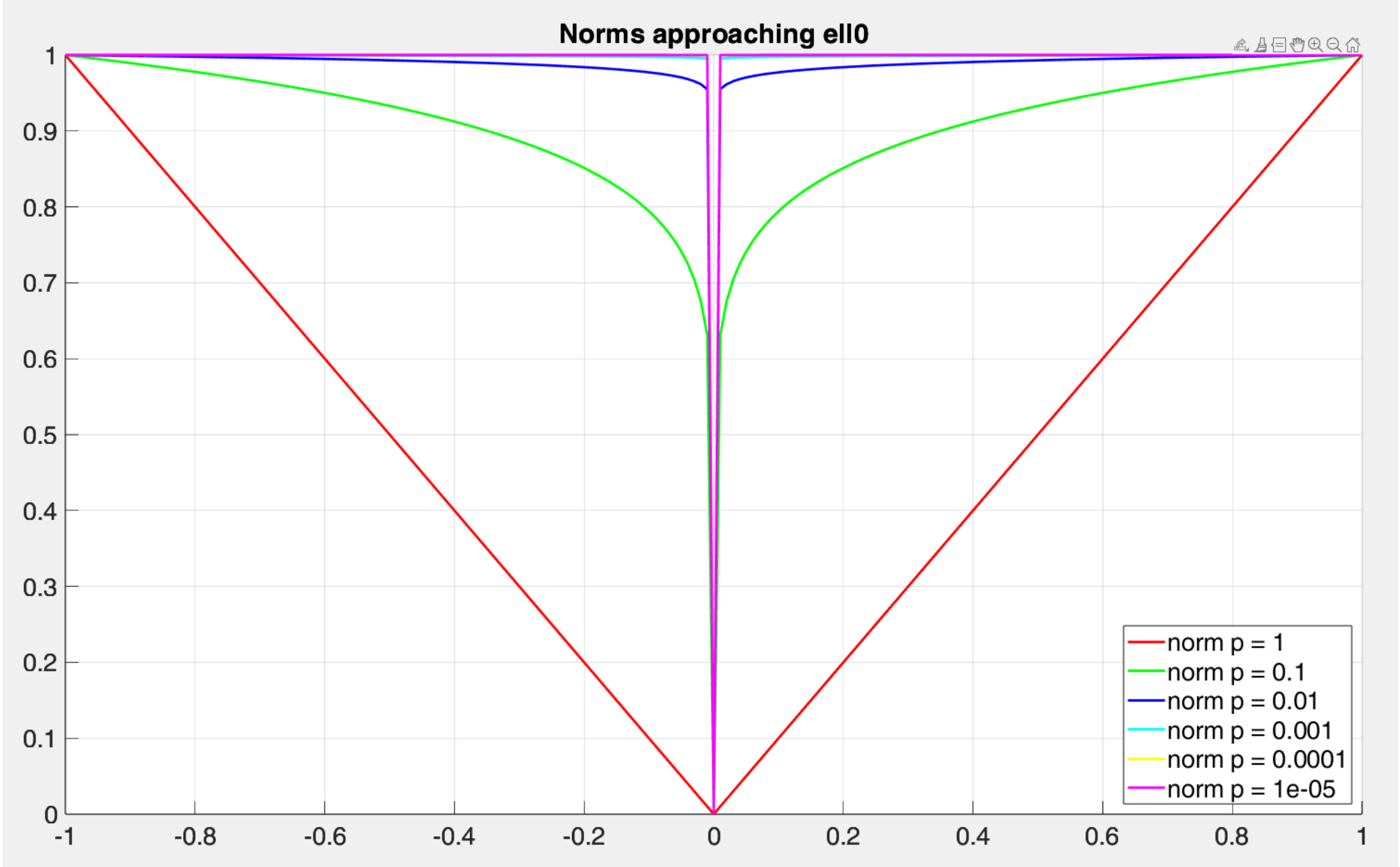
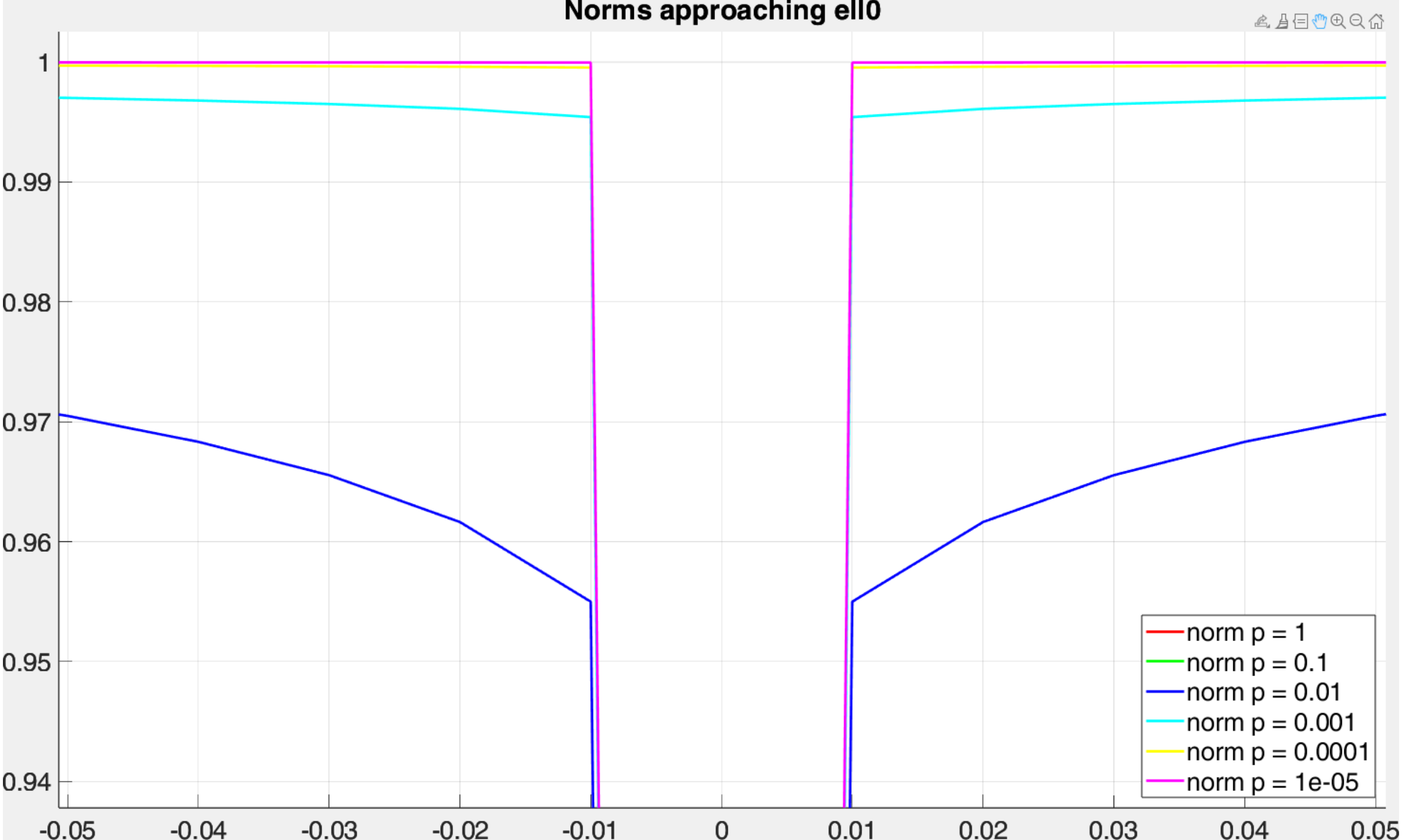

Norms approaching ell0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
norm p = 1
norm p = 0.1
norm p = 0.01
norm p = 0.001
norm p = 0.0001
norm p = 1e-05


Norms approaching ell0
1
0.99
0.98
0.97
0.96
0.95
0.94
-0.05
-0.04
-0.03
-0.02
-0.01
0
0.01
0.02
0.03
0.04
0.05
norm p = 1
norm p = 0.1
norm p = 0.01
norm p = 0.001
norm p = 0.0001
norm p = 1e-05

Assignment

Matching Pursuit

Implement the Matching Pursuit

Take the setup of Assignment 5 and:

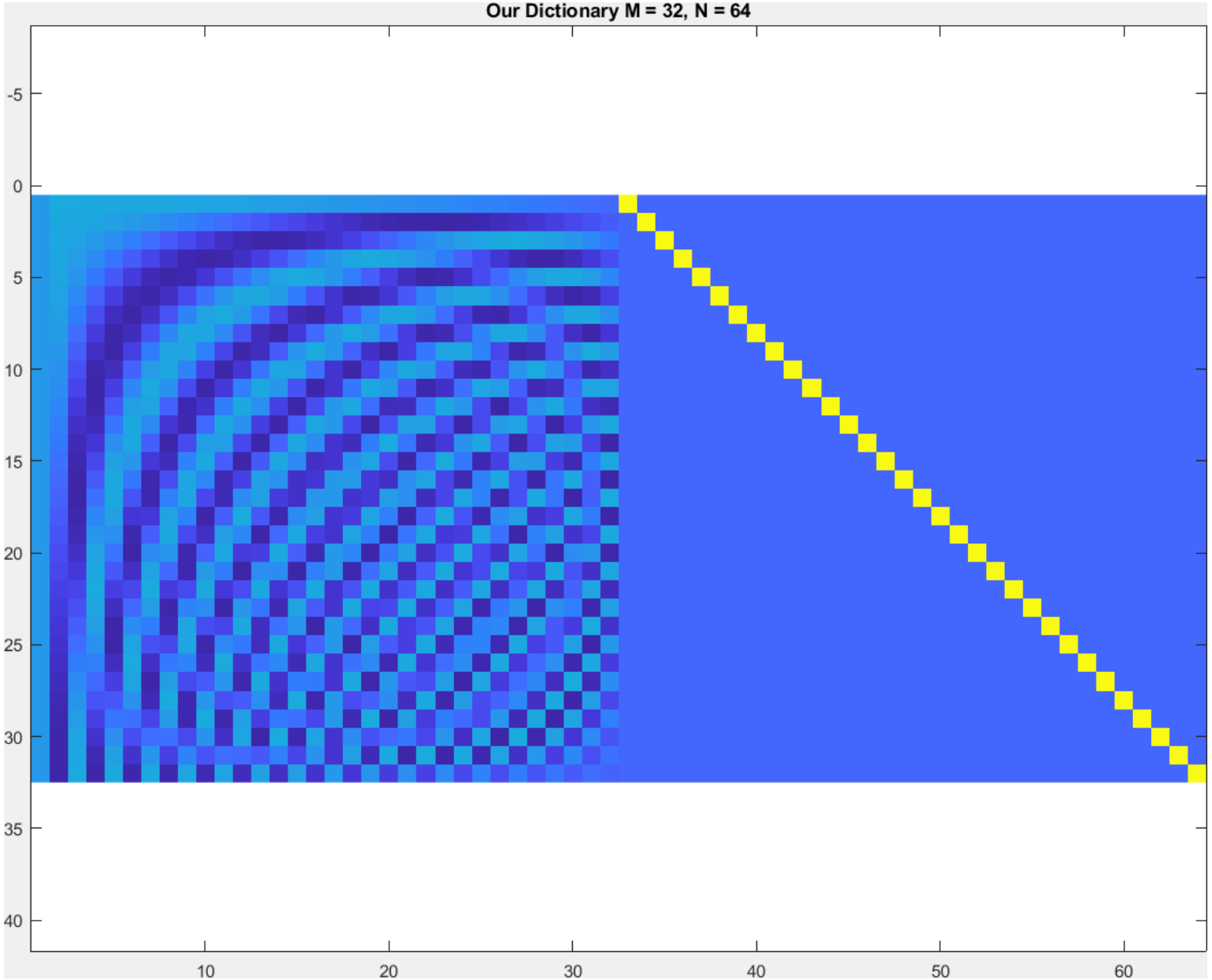
- Implement matching pursuit to solve

$$\hat{\boldsymbol{x}} = \underset{\boldsymbol{x}\in\mathbb{R}^M}{\operatorname{argmin}} \|\boldsymbol{x}\|_0 \quad \text{s.t.} \quad D\boldsymbol{x} = \boldsymbol{s}$$

- Where $D = [DCT, C]$ and $\boldsymbol{s}$ is an L −sparse signal w.r.t DCT and 1 −sparse signal w.r.t. the canonical basis C

- Implement the Matching Pursuit algorithm and check the recevored support

The Dictionary



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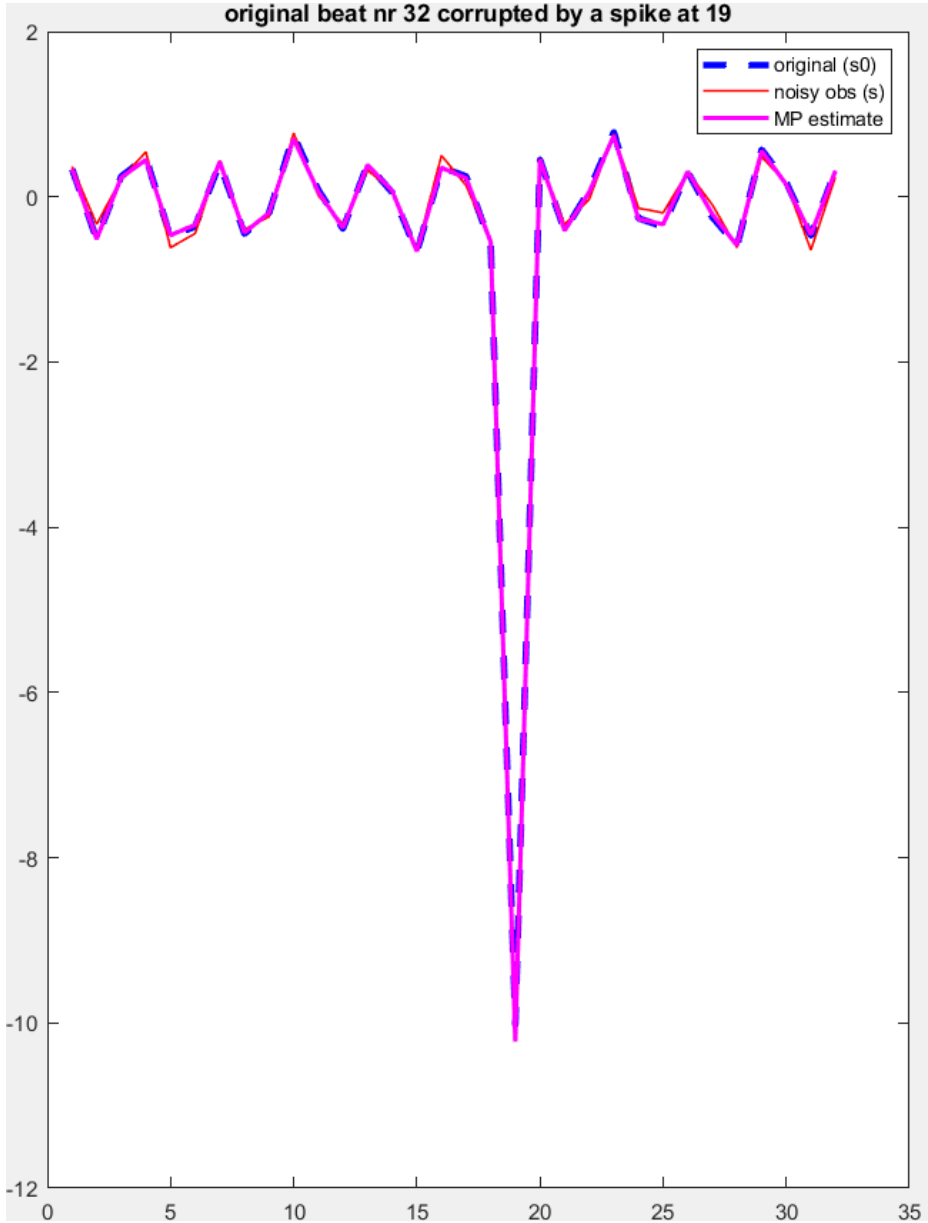
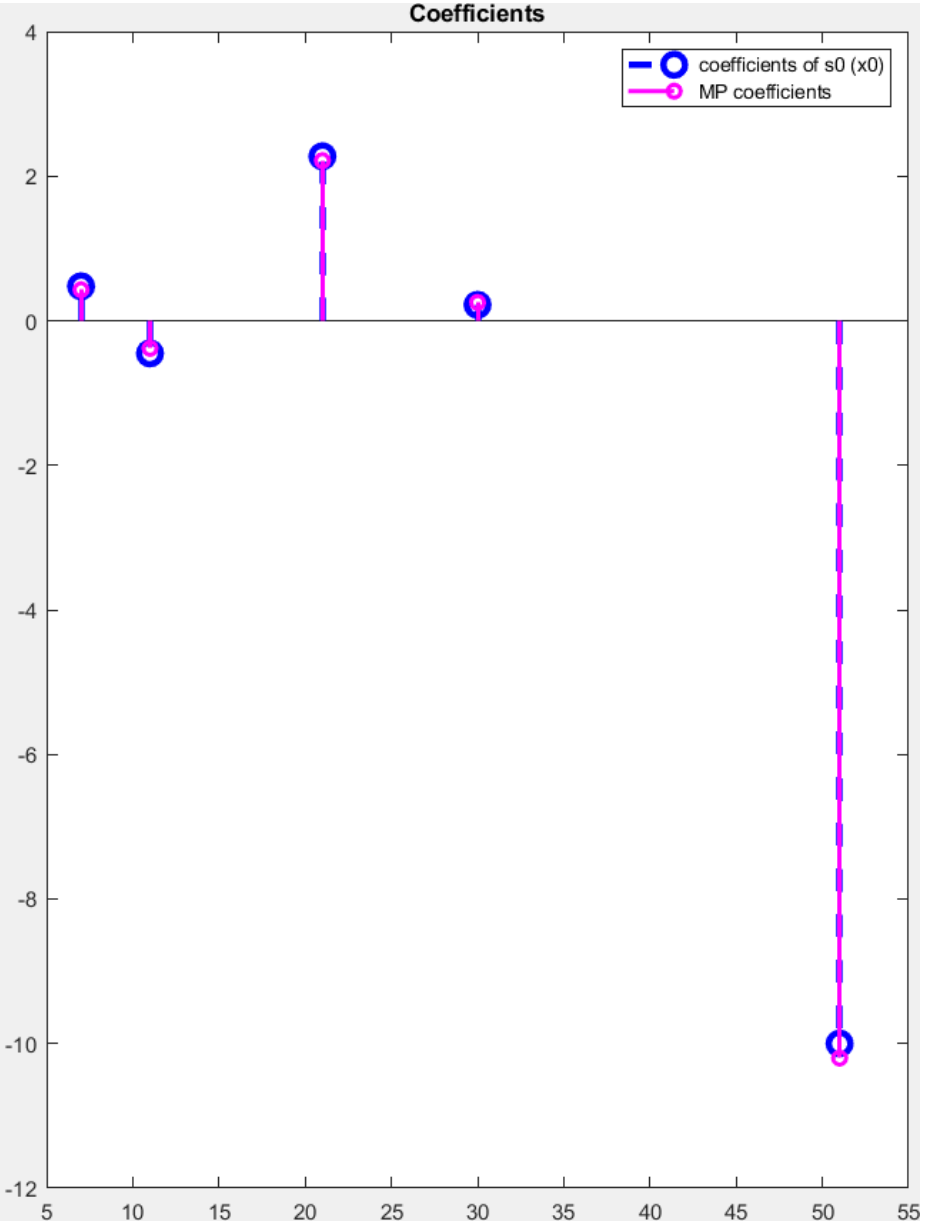
Results of Sparse Coding w.r.t. $D = [DCT, C]$





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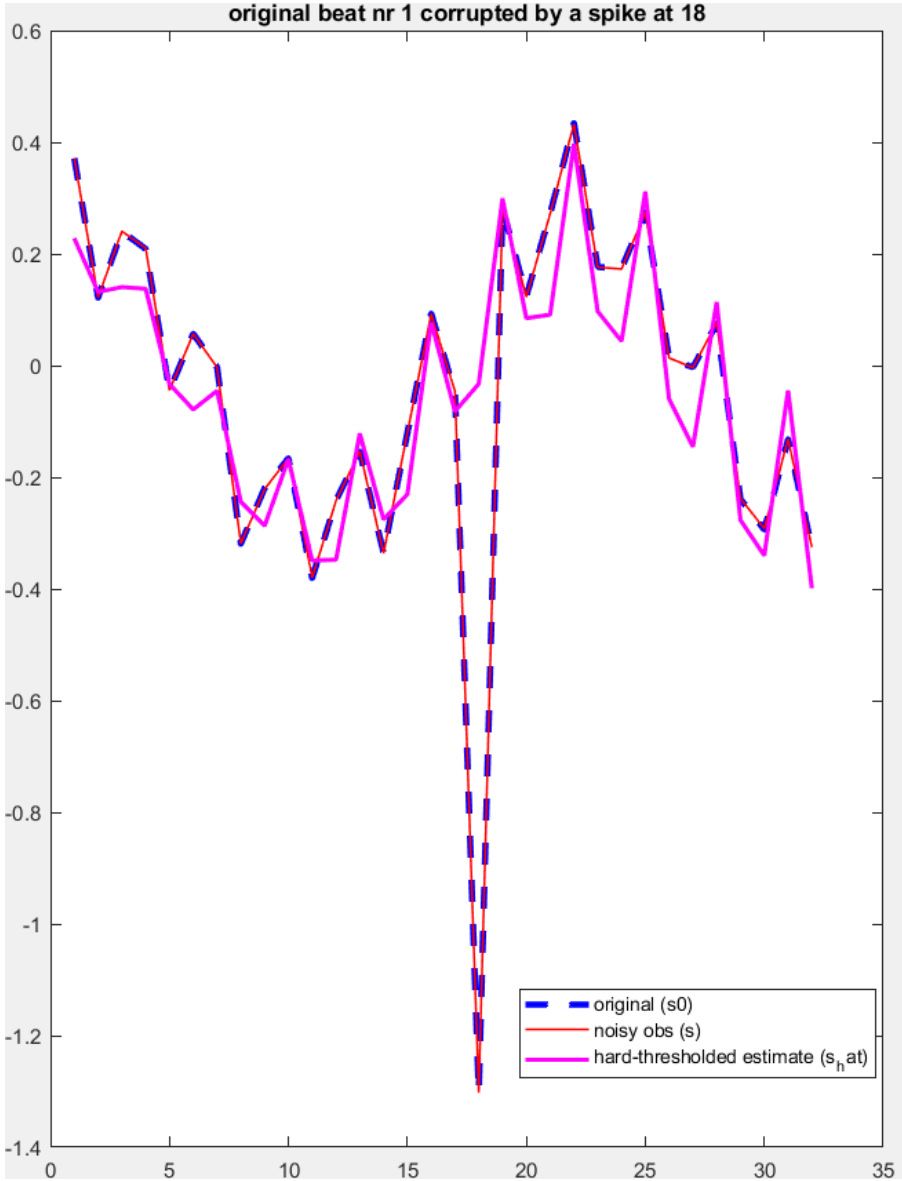
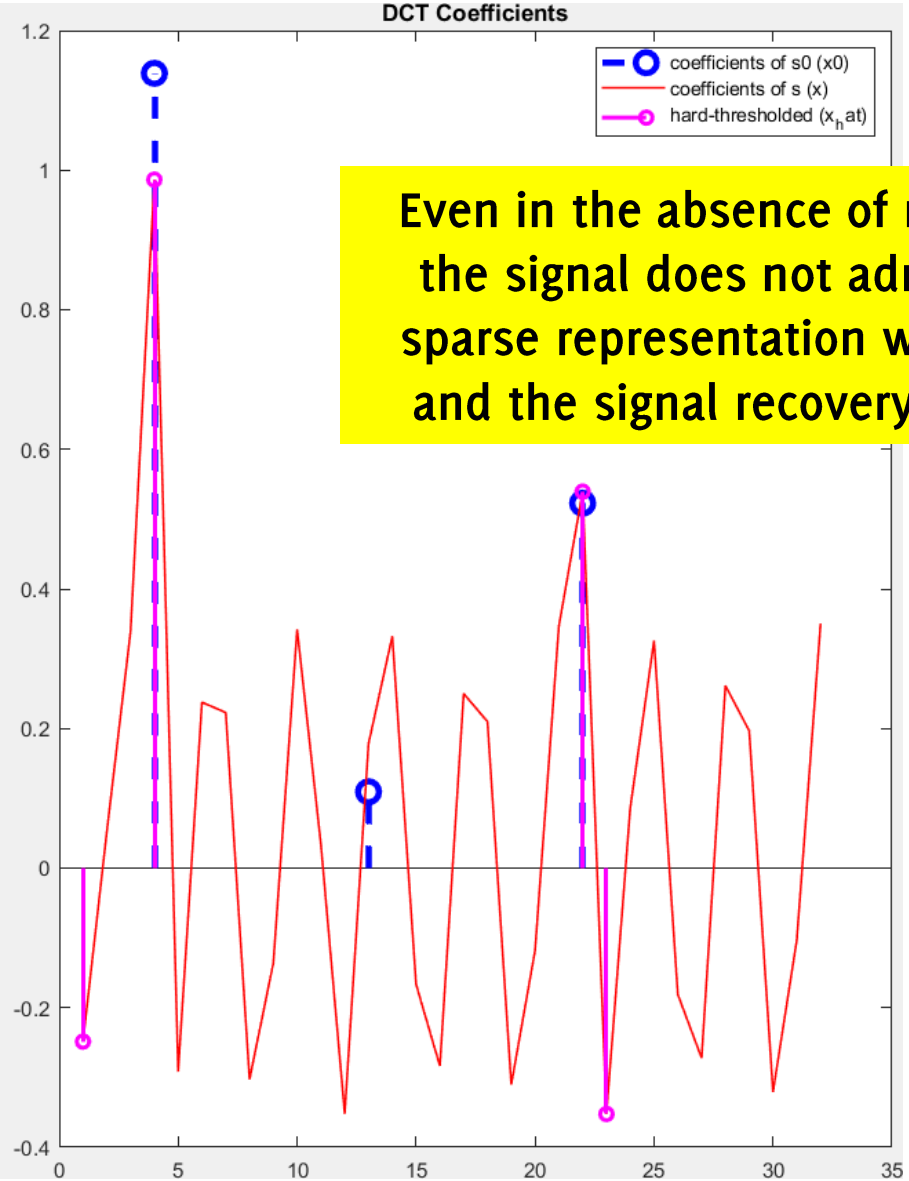
Results of Orthogonal Projection over DCT





Even in the absence of noise, the signal does not admit a sparse representation w.r.t. D and the signal recovery fails

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