

Sparse Coding Minimizing ℓ_0 : Matching Pursuit

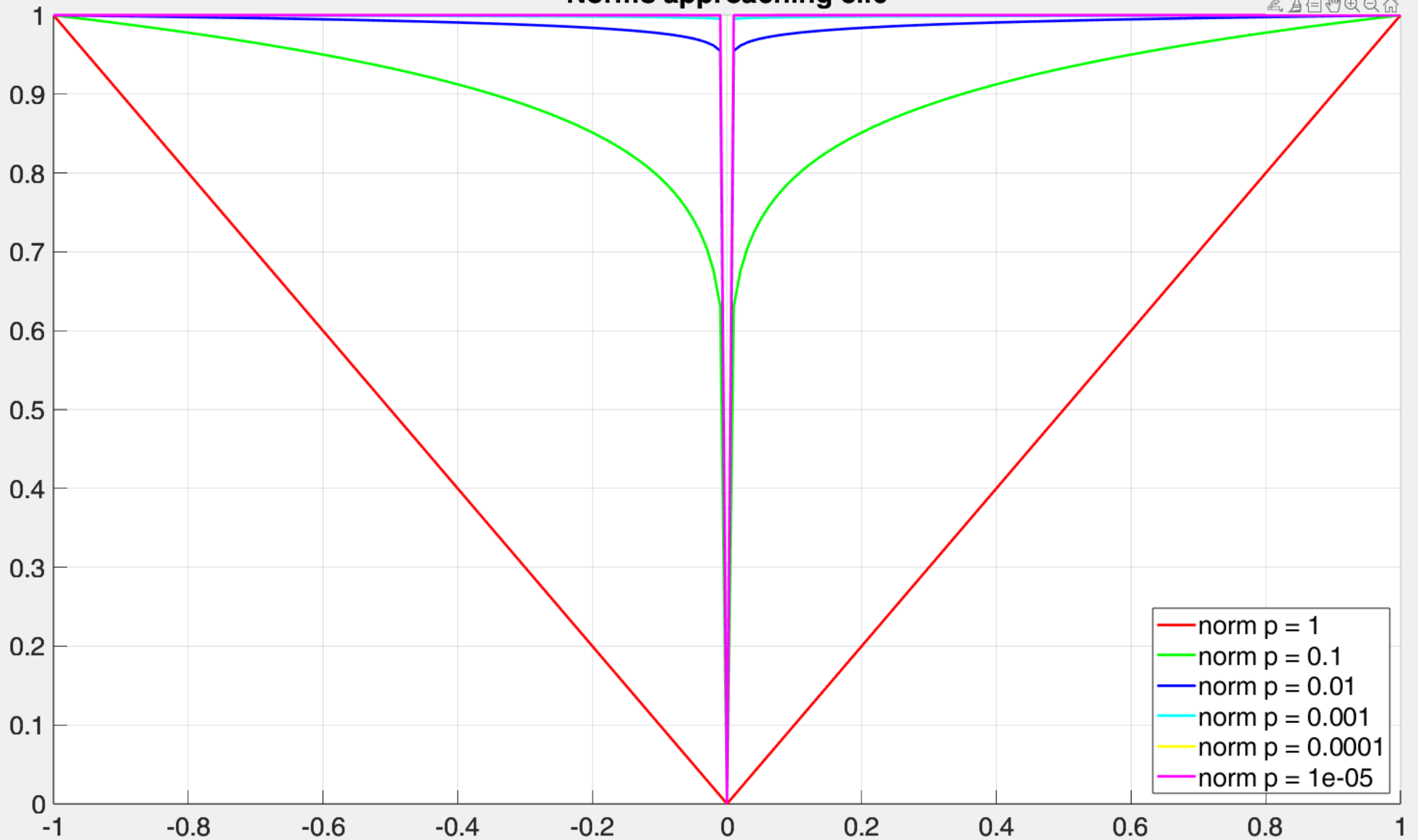
Mathematical Models and Methods for Image Processing

Giacomo Boracchi

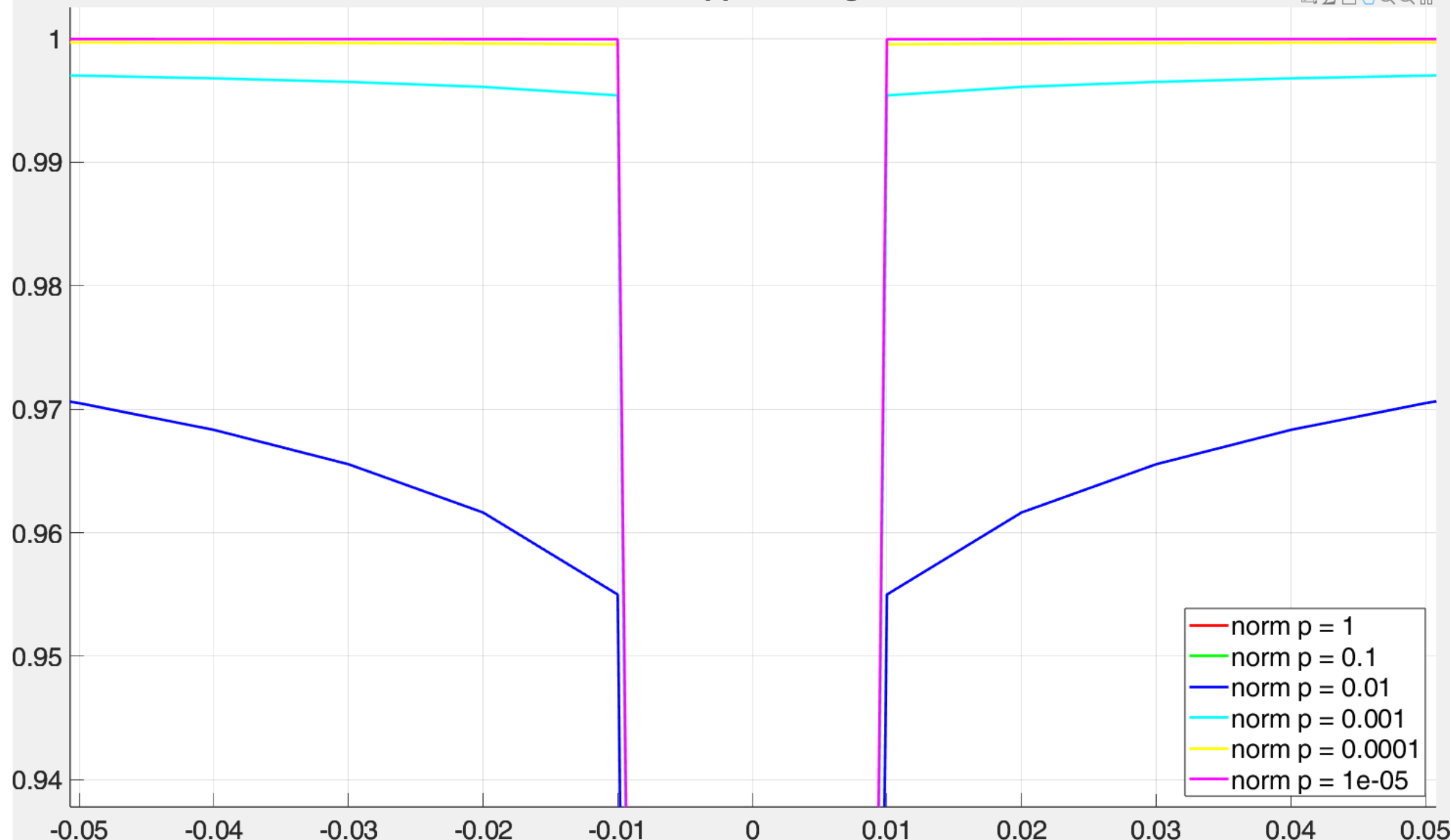
<https://boracchi.faculty.polimi.it/>

March 11th 2025

Norms approaching ell0



Norms approaching ell0



Assignment

Matching Pursuit

Implement the Matching Pursuit

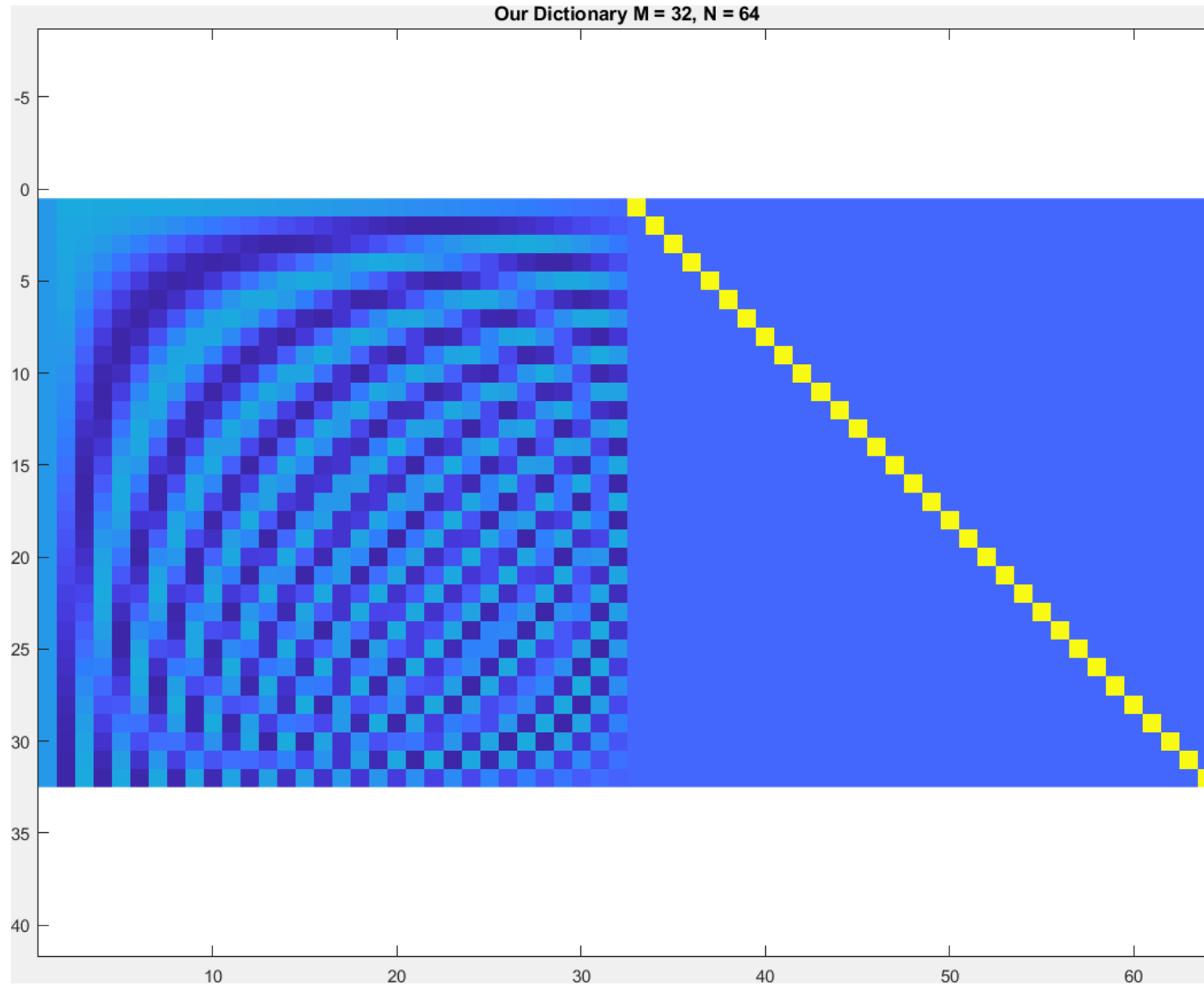
Take the setup of Assignment 5 and:

- Implement matching pursuit to solve

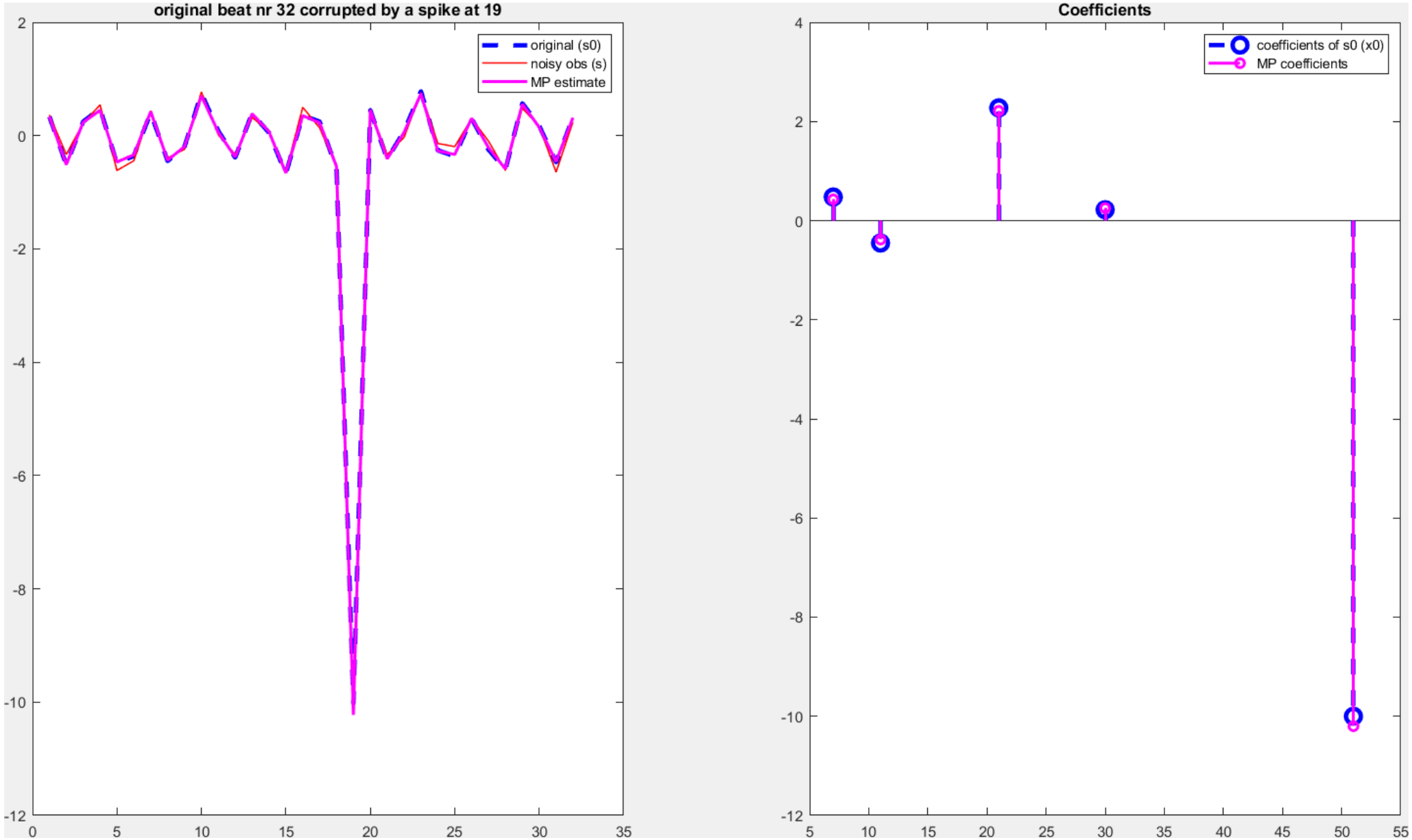
$$\hat{\mathbf{x}} = \underset{\mathbf{x} \in \mathbb{R}^M}{\operatorname{argmin}} \|\mathbf{x}\|_0 \quad \text{s.t.} \quad D\mathbf{x} = \mathbf{s}$$

- Where $D = [DCT, C]$ and \mathbf{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 received support

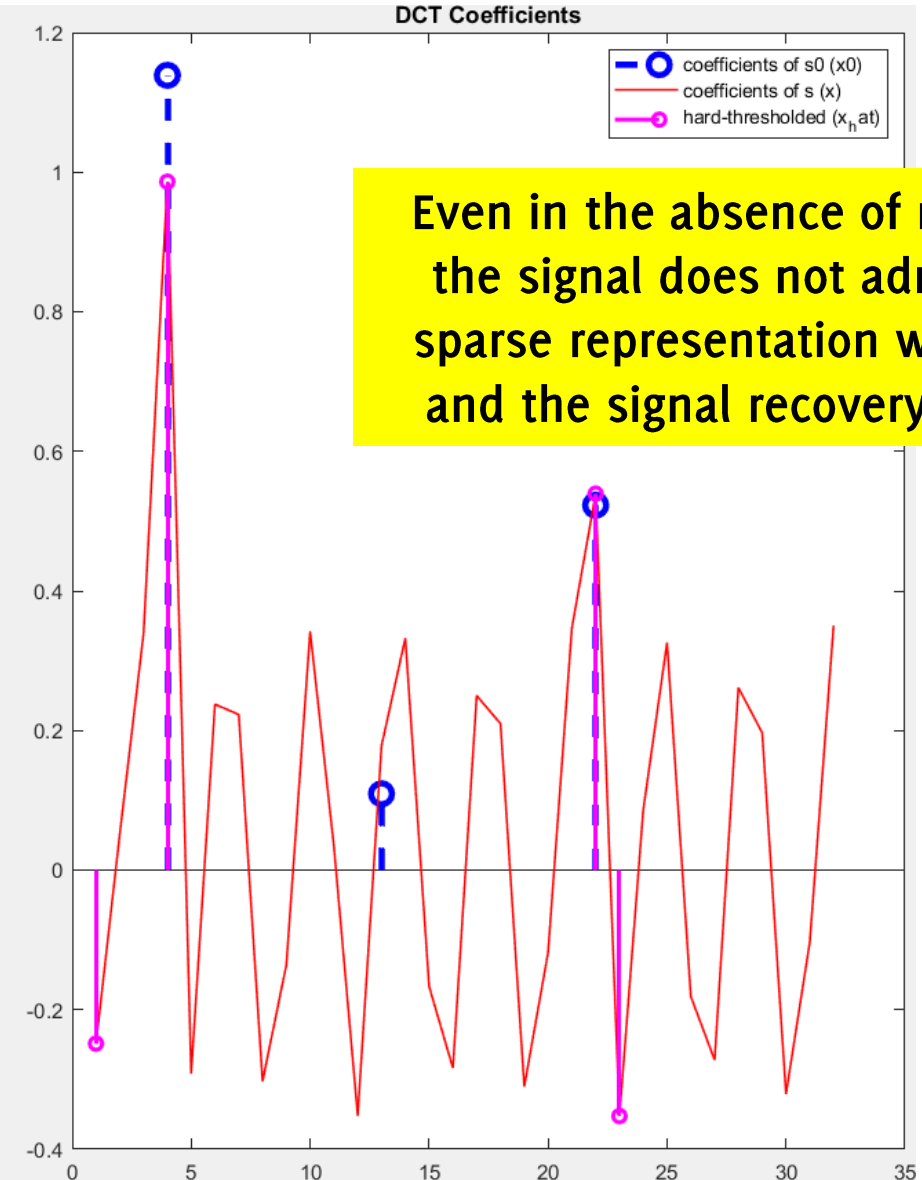
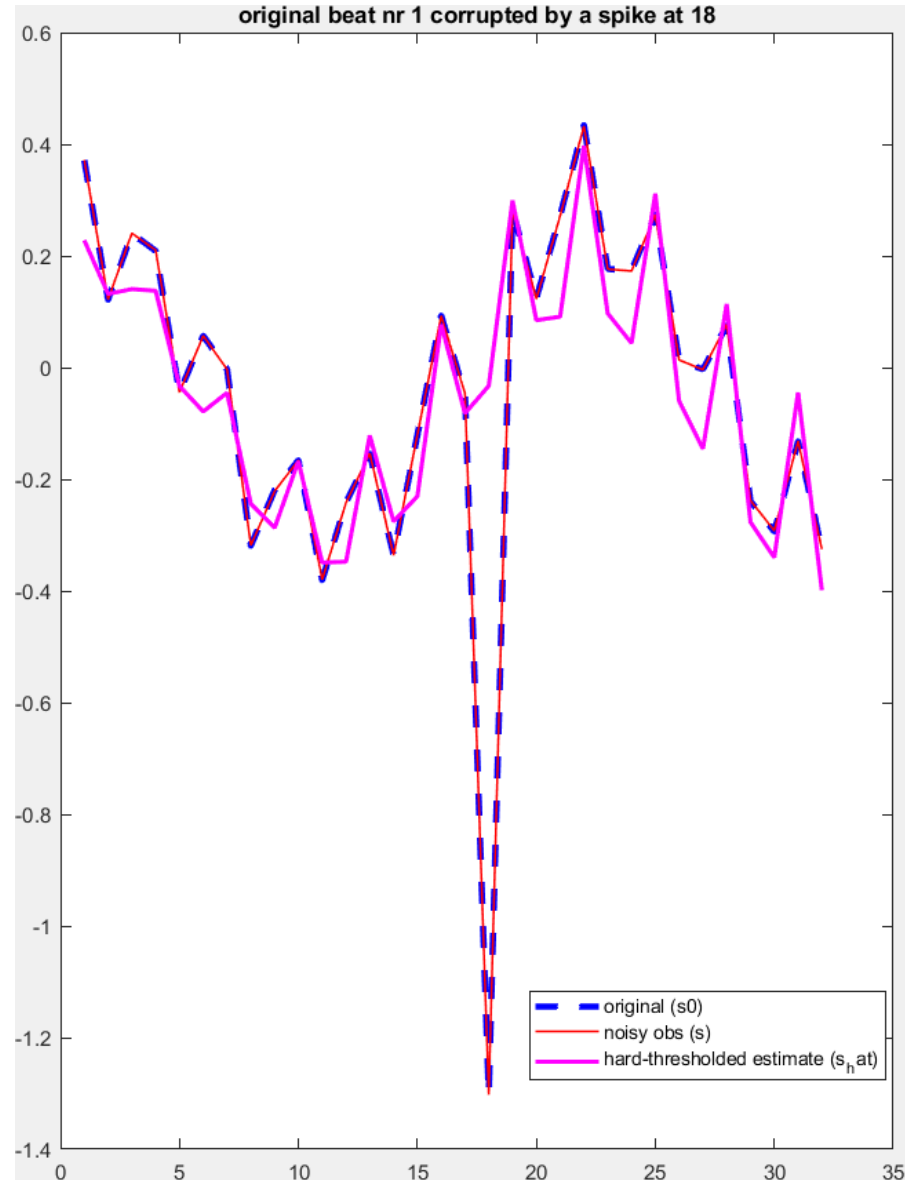
The Dictionary



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



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