

## RECENT ADVANCES IN ITERATIVE SHRINKAGE/THRESHOLDING

Mário A. T. Figueiredo and José M. Bioucas-Dias

Instituto de Telecomunicações  
Instituto Superior Técnico  
1096-001 Lisboa, PORTUGAL

Iterative shrinkage/thresholding (IST) algorithms are an important component of the computational toolbox used in image restoration/reconstruction problems under non-quadratic regularization (e.g., total-variation, wavelet-based). IST algorithms are typically used to address unconstrained minimization formulations, where the objective function includes a linear-quadratic data term (corresponding to a linear observation operator followed by additive Gaussian noise) and a sparsity-inducing regularizer (typically the  $p$ -th power of an  $\ell_p$  norm). In the first part of this talk, we will briefly review the several ways in which IST algorithms can be derived (expectation-maximization [1], majorization-minimization [2], forward-backward splitting [3], separable approximation [4]) as well as several convergence results. We will then present some recent advances : (a) new ways to derive fast IST-like algorithms for deconvolution, (b) new IST-type algorithms for non-Gaussian noise (namely Gamma and Poisson, which are common in remote sensing and medical imaging).

### References

- [1] M. Figueiredo and R. Nowak, An EM algorithm for wavelet-based image restoration, *IEEE Trans. Image Processing*, **12**, pp. 906–916, 2003.
- [2] I. Daubechies, M. Defrise, and C. De Mol, An iterative thresholding algorithm for linear inverse problems with a sparsity constraint, *Comm. Pure and Applied Mathematics*, **LVII**, pp. 1413–1457, 2004.
- [3] P. Combettes and V. Wajs, Signal recovery by proximal forward-backward splitting, *SIAM J. Multiscale Mod. & Simul.*, **4**, pp. 1168–1200, 2005.
- [4] S. Wright, R. Nowak, and M. Figueiredo, Sparse reconstruction by separable approximation, *IEEE Trans. Signal Processing*, 2009 (to appear).