Fast Linearized Bregman Iteration for Compressive Sensing and Sparse Denoising

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Abstract

We propose and analyze a fast, efficient and simple method for solving the problem:

$$\min(\|u\|_1 : Au = f,\ u \in R^n).$$

This method was first described in [J. Darbon and S. Osher, 2007], with more details in [W. Yin et. al. 2007] and rigorous theory given in [J. Cai et. al. 2008]. The motivation was compressive sensing, which now has a vast and exciting history, started with pioneering research by D. Donaho, E. Candes and T. Tao. Our method introduces an improvement called "kicking" on top of the original algorithm in [W. Yin et. al. 2007] and also applies to the problem of denoising of undersampled signals. The use of Bregman iterations for denoising of images began in [S. Osher et. al. 2004] and led to improved results for total variation based methods. Here we apply it to denoise signals, especially essentially sparse signals, which might even be undersampled.