An algorithm for variable density sampling and constrained acquisition by blocks of measurements

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Reducing acquisition time is of fundamental importance in various imaging modalities. A typical example is Magnetic Resonance Imaging where faster acquisitions could drastically improve the patient comfort, the time and space resolution or reduce the (huge) acquisition costs. The concept of variable density sampling provides a nice framework to reduce the acquisition times. It was justified recently from a theoretical point of view in the compressed sensing (CS) literature. Unfortunately, the sampling schemes suggested by current CS theories are often of little relevance since they do not take the acquisition constraints into account. For instance, a typical constraint met in MRI is that measurements should be contiguous in the Fourier domain. In this talk, we will propose a numerical method to perform variable density sampling with block constraints. Our main contribution is to propose a new way to draw the blocks in order to imitate CS strategies based on isolated measurements. The basic idea is to minimize a tailored distance between a probability defined on the set of isolated measurements and a probability defined on a set of blocks of measurements. This problem turns out to be a convex problem in high dimension. Our second contribution is to define an efficient minimization algorithm based on Nesterov accelerated gradient descent in metric spaces. We study carefully the choice of the metrics and of the prox function. We will conclude the talk by giving some practical results. The results presented in this talk are available in [1].

Références

[1] Claire Boyer, Pierre Weiss, Jérémie Bigot, *An algorithm for variable density sampling with block-constrained acquisition*, Submitted to SIAM, 2013.

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