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10h00
UT3 Paul Sabatier, IRIT, Auditorium J. Herbrand

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Reconstruction d'images ultrasonores déconvoluées à partir de données

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Mots-clés : traitement du signal et de l'image, amélioration de la résolution, problèmes inverses, échantillonnage compressé, déconvolution, optimisation numérique

Résumé : The interest of compressive sampling in ultrasound imaging has been recently extensively evaluated by several research teams. Following the different application setups, it has been shown that the RF data may be reconstructed from a small number of measurements and/or using a reduced number of ultrasound pulse emissions. Nevertheless, RF image spatial resolution, contrast and signal to noise ratio are affected by the limited bandwidth of the imaging transducer and the physical phenomenon related to Ultrasound wave propagation. To overcome these limitations, we first propose a novel framework for Ultrasound imaging, named compressive deconvolution, to combine the compressive sampling and deconvolution. Exploiting a unified formulation of the direct acquisition model, combining random projections and 2D convolution with a spatially invariant point spread function, the benefit of this framework is the joint data volume reduction and image quality improvement.

An optimization method based on the Alternating Direction Method of Multipliers is then proposed to invert the linear model, including two regularization terms expressing the sparsity of the RF images in a given basis and the generalized Gaussian statistical assumption on tissue reflectivity functions. It is improved afterwards by the method based on the Simultaneous Direction Method of Multipliers. Both algorithms are evaluated on simulated and in vivo data. With regularization techniques, a novel approach based on Alternating Minimization is finally developed to jointly estimate the tissue reflectivity function and the point spread function. A preliminary investigation is made on simulated data.