Improving the efficiency of deconvolution algorithms for sound source localization

The localization of sound sources with delay-and-sum (DAS) beamforming is limited by a poor spatial resolution - particularly at low frequencies. Various methods based on deconvolution are examined to improve the resolution of the beamforming map, which can be modeled by a convolution of the unknown acoustic source distribution and the beamformer's response to a point source, i.e., point-spread function. A significant limitation of deconvolution is, however, an additional computational effort compared to beamforming. In this paper, computationally efficient deconvolution algorithms are examined with computer simulations and experimental data. Specifically, the deconvolution problem is solved with a fast gradient projection method called Fast Iterative Shrinkage-Thresholding Algorithm (FISTA), and compared with a Fourier-based non-negative least squares algorithm. The results indicate that FISTA tends to provide an improved spatial resolution and is up to 30% faster and more robust to noise. In the spirit of reproducible research, the source code is available online.