

A Fast Iterative Interior Point Method for the design of Spiral Magnetic Resonance Image Reconstruction Resampling Kernels

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Abstract

After formulating the design problem for Resampling Kernels used in Magnetic Resonance Spiral Image Reconstruction, we show that an iterative Gauss-Seidel-type interior-point optimization method is suitable (fast and light-weight) for embedded uses. In contrast to previous practice, we directly optimize a computationally efficient, piecewise-linear kernel rather than an analytic function (Kaiser-Bessel). We also optimize our kernels for worst-case (infinity-norm) signal aliasing, rather than the usual proxy energy function (2-norm) minimization. In numerical simulations of undesirable near-frequency systematic noise the new kernel significantly outperforms a conventional Kaiser-Bessel-based solution.

Keywords: magnetic resonance imaging, spiral imaging, regridding, non-uniform Fourier transform, interior point method