EFFECT OF DIFFERENT INTERPOLATION METHODS ON THE ACCURACY OF THE RECONSTRUCTION OF SPIRAL K-SPACE TRAJECTORIES IN MRI

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Introduction: Reconstruction of magnetic resonance images from k-space non-cartesian data is a problem usually solved by using convolution interpolation. This conventional re-gridding algorithm convolves the non-uniform samples with a small-width window, and samples the result onto a rectilinear grid before final Fourier transformation [1]. This method requires the calculation of a density compensation function and the reconstruction accuracy varies according to the density weighting and the convolution kernel used [2]. In this work we have implemented direct re-gridding reconstructions using three different interpolation methods (linear, inverse distance and krigging), and compared their performance with that of the usual convolution interpolation algorithm.

Methods: Raw data were exported to a standard PC workstation (2.40 GHz, 4 GB 64-bit OS). The four reconstruction algorithms were implemented in the IDL program language. For the convolution interpolation algorithm, a Kaiser-Bessel convolution kernel was chosen and Voronoi areas were calculated for density compensation. No density compensation was needed for direct interpolation algorithms. Experiments were performed on a 7T Bruker Biospec 70/20 scanner (Gmax=671.716 mT/m, slew ratemax=5417.070 T/m/s) using a linear coil resonator. Phantom images were acquired using the shortest TE achievable, 1.64ms. A 4.5 x 4.5 cm FOV was chosen, corresponding to a 70x70 matrix size. Acquisition bandwidth was 454.5 KHz. Peak-valley ratio and slope measurements were obtained to evaluate image contrast and resolution.

Results: Figure 1 compares reconstructed images and intensity profiles. All of them show high quality reconstructions. Table 1 compares the contrast, resolution and computing time achieved with the different methods. Direct interpolation show lower edge slope but higher contrast and lower computing time than conventional reconstruction.

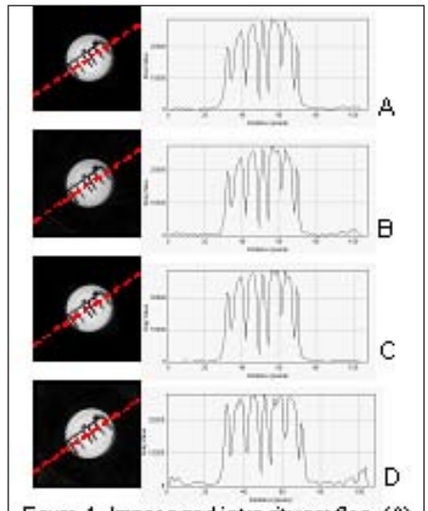

Figure 1. Images and intensity profiles. (A) linear interpolation. (B) distance inverse interpolation. (C) krigring interpolation. (D) convolution interpolation.

	90-10% slope	Mean peak-valley ratio	Computing time (ms)
Linear interpolation	2878.62	0.664	16
Inverse distance interpolation	2779.37	0.661	339.7
Kriging interpolation	3286.85	0.678	461.5
Convolution interpolation	3846.66	0.638	605.5

Table 1. Contrast measurements

Conclusions: Direct interpolation methods show an image quality nearly identical to the conventional reconstruction and a lower computational time. Comparing with conventional interpolation, Krigring interpolation offers a good contrast and lower computing time. Linear interpolation offers the fastest reconstruction with still reasonable contrast results.

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