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MRI Signal Separation using Iterative Calibration (20130079, Dr. Kamil Ugurbil)

Technology No. 20130079

IP Status: Issued US Patent; **Application #:** 14/171,310

K-space Data Reduces Streak Artifacts

A reconstruction algorithm improves separation of signals to generate images in multiband MRI, reducing artifacts that could hinder clinical acceptance due to readability issues. The method iteratively calibrates a reconstruction kernel for use in MRI, reconstructing images from k-space data acquired using accelerated MRI techniques, such as simultaneous multi-slice acquisitions using multi-band radio frequency (RF) excitation and undersampled phase encoding. The initial reconstruction kernel generated from the reference k-space data is used to produce an initial image for each of the multiple slice locations by applying the initial reconstruction kernel to the acquired k-space data. The average phase of each slice location is then calculated from these images and used to shift the phase values of the reference k-space data for generating a reconstruction kernel that is tailored to the acquired k-space data. The technique is implemented as a software algorithm either sold as an add-on package or bundled with new scanners.

SNR Artifact Issues

Multiband MRI techniques offer many benefits in accelerated image acquisition, but in pulse sequences with both low and high signal-to-noise (SNR), streaking artifacts from high SNR signals onto low SNR signals due to aliasing degrade image quality. These artifacts negatively impact readability and therefore the potential for quantitative imaging. This technology updates the ratio between calibration data, required for signal separation of the multiband technique, and thereby addresses streaking image artifacts problems in low SNR sequences (such as those used in diffusion imaging for stroke, and potentially for cancer). Current calibration relies on measurements taken only once and at a different time than the signals that needs to be separated. Fluctuations due to cardiac and respiratory changes limit the temporal stability of the unaliased MRI signals. This new technique updates the phase of slices used for calibration, thus ensuring an appropriate fit with the measured signals and increasing volumetric consistency for dynamic imaging.

BENEFITS AND FEATURES:

- Reduces artifacts that degrade readability
- Expands potential applications of multiband
- May allow scans previously not possible
- Add-on software or sold with new scanners
- May increase patient throughput
- Improved image fidelity and diagnostic capabilities

APPLICATIONS:

- MRI scanners; most likely high-field systems (1.5T, 3T and 7T)
- Clinical 1.5T and 3T scanners
- MRI applications
- Brain imaging
- Diffusion imaging for stroke or potentially cancer

Phase of Development - Pilot scale demonstrated

Researchers

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