Docket #: S16-403

Algebraic reconstruction method for off-resonance and eddy-current correction in functional and diffusion weighted magnetic resonance imaging

Stanford researchers have designed a method to perform an off-resonance corrected MRI reconstruction by modeling the off-resonance terms as part of the image encoding process. By acquiring two sets of images with inverted readout polarity, the underlying geometric distortion map can be derived.

This method allows for a joint reconstruction of acquisitions with opposing readout polarity and thereby improves the conditioning of the reconstruction (inversion) process. This method also allows for an iteration between image domain methods and k-space based methods.

Existing methods correct for geometric distortions in the image domain after the reconstruction from the MR-signal is completed. The new method accounts for the distortions during the reconstruction step (k-space based).

Applications

- In diffusion weighted MRI, this method allows correction of static geometric distortions and dynamic components due to eddy currents.
- In functional MRI, this method enables dynamic distortion correction in combination with prospective motion correction.

Advantages

- In a setting with multiple receiver coils, the additional encoding due to internal gradients can be partially compensated.
- The g-factor penalty (conditioning of reconstruction process) in parallel imaging is reduced by a joint reduction of interleaved acquisitions with inverted polarity.
- Formulating the off-resonance correction in k-space (in contrast to existing methods in the image domain) allows for an independent test for how close the assumed off-resonance map is to the true off-resonance map. This allows for an iterative procedure to improve the initial guess.

Patents

- Published Application: 20190162807
- Issued: 10,429,476 (USA)

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