Robust Chemical Shift MRI Using Magnetization Transfer

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WARF: P160247US01

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method to significantly reduce errors in chemical species separation techniques.

Overview

Accurate fat-water separation is critical in diagnosing non-alcoholic fatty liver disease. Typically the separation is performed using specialized methods such as iterative decomposition with echo asymmetry and least-squares estimation applied to several images acquired with different echo times. While existing chemical species separation techniques, such as IDEAL, represent significant advancement, they can suffer inaccuracies arising from the competing sources of off-resonance (i.e., fat chemical shift and field inhomogeneity). Significant errors (e.g., swapped fat and water) may result.

To reduce errors, specialized image processing algorithms have been developed which assume field map smoothness. In practice these methods fail to perform robustly, especially in cases of field inhomogeneities such as near-metal imaging and tissue-air interfaces. Furthermore, these algorithms may be computationally intensive, which limits their implementation on modern scanners.

Still needed is a method for chemical species signal separation that is more reliable and reproducible because it can better control the impact of off-resonance effects on the resulting images and/or quantifications.

The Invention

A UW–Madison researcher has developed a method that significantly reduces fat-water separation errors using a fat-insensitive field map for calibration. The field map is generated by exploiting the magnetization transfer effect and its lack of influence on fat.

The new method acquires a static magnetic field map (B_0) before application of the IDEAL algorithm using a fast prescan with a special radiofrequency pulse and post processing, which reduces separation errors without prolonged or intensive computation.

Applications

- Acquisition software for clinical and preclinical imaging
  - Fat fraction and iron quantification in the presence of iron overload
  - Detection and tracking of superparamagnetic iron oxide particles

Key Benefits

- Improved separation of fat-water components in various anatomies
- Increased accuracy of fat fraction and iron overload quantification
- Improved fat/water imaging for very strong B_0 inhomogeneities (e.g., near-metal imaging)
- No sophisticated computational processing

- Faster calculation times

Stage of Development

Use of the magnetization transfer-based field map has been shown to improve fat-water separation compared to standard IDEAL.

Tech Fields

- Medical Imaging : MRI

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846