Medical Imaging

MRI Water-Fat Separation with Full Dynamic Range Using In-Phase Images

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WARF: P120173US01

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing an image reconstruction method for performing fat-water separation with the ability to measure a full dynamic range of fat fraction values.

Overview

Chemical shift-based multi-echo water-fat separation methods have seen increased use in routine magnetic resonance imaging (MRI) clinical applications. These methods involve collecting multiple echoes with different water-fat phase shifts so that water and fat signals can be separated and displayed distinctly in an MR image. This distinction between water and fat is important for improved image quality and clarity, and improved images result in more accurate interpretation by the clinician.

Fat and water signals can be “swapped” by imaging algorithms due to shifts in the magnetic field during patient imaging. Multiple echoes may be required for qualitative water-fat separation. Recently developed algorithms can simultaneously estimate and calculate water and fat images with necessary corrections, but not with 100 percent effectiveness. Improved methods for water-fat separation and fat quantification that are free from ambiguities and insensitive to magnetic field inhomogeneities are needed.

The Invention

UW–Madison researchers have developed an image reconstruction method for accurate water-fat separation that fits in-phase echo signals to a signal model that characterizes the fat spectrum as having multiple resonance peaks. Signal contributions of water and fat are separated by fitting only those echo signals having water and the main fat spectral peak in-phase with each other to a signal model of the fat spectrum. An image can be produced with the desired amount of signal contributions from water and fat by using the separated signal contributions.

This method simplifies the separation problem by separating the combined water and main fat peak from the secondary fat peaks, the latter of which make up less than thirty percent of the signal. Using known relationships between the remaining water peak and main fat peak, the signal contributions from these two peaks can be reliably separated for ambiguity-free fat quantification.

Applications

- Fat-water qualitative and quantitative diagnostic imaging

Key Benefits

- Eliminates water-fat swapping during image reconstruction

Additional Information

For More Information About the Inventors

- Scott Reeder
- Diego Hernando Arribas

Related Technologies

- For more information about a method to improve MRI images of multiple chemical species including fat-water separation, see WARF reference number P100217US01.

Tech Fields

- Medical Imaging : MRI

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