Improved Techniques for Quantitative MRI

Technology #19-0061

Background
Quantification of tissue properties, such as the T1 and T2 relaxation times, in the human body through quantitative magnetic resonance imaging, is desired for clinical applications and research areas. Compared to qualitative imaging techniques, quantitative imaging can provide more accurate and unbiased information of a patient and make it easier to objectively compare different examinations in longitudinal studies. However, one of the major barriers of translating conventional quantitative imaging techniques to clinical applications is the prohibitively long time for data acquisition. Such time delay can render these techniques unsuitable for certain patients and hinder derivative techniques dependent on the data acquisition.

Technology Overview
Researchers in the Department of Radiology and the Biomedical Research Imaging Center at the University of North Carolina at Chapel Hill have developed a system to improve and increase the speed of quantitative imaging techniques using magnetic
resonance fingerprinting (MRF). The first aspect of the system is a MRF technique that allows for accurate quantification with a faster scan time by sampling fewer data points. This MRF technique utilizes a deep learning model for spatially-constrained tissue quantification that learns by analyzing signals at neighboring points in the image to determine the tissue properties at a central point. The second aspect of the system is a 3D MRF technique that utilizes parallel imaging and deep learning to simultaneously quantify T1 and T2 relaxation times. Parallel imaging reduces data acquisition time for high-resolution images, while deep learning allows for extraction of additional features from the MRF signal to improve tissue characterization. Collectively, these techniques decrease image acquisition time by using only a fraction of the time points compared to conventional methods, while improving characterization of tissue properties.

**Benefits**
Shorter time for data acquisition, allowing quantitative imaging to be achieved in a more clinically relevant manner.
Improved accuracy and quantification of tissue mapping.
Training strategy for model improves performance.

**Related Publications:**
• **High-resolution 3D MR Fingerprinting using parallel imaging and deep learning**

• **Deep Learning for Fast and Spatially-Constrained Tissue Quantification from Highly-Accelerated Data in Magnetic Resonance Fingerprinting**

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