

Development and evaluation of high spatiotemporal resolution dynamic contrast-enhanced breast MRI

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Breast cancer is the second most common type of cancer in women and the second most common cause of cancer death in women. Magnetic resonance imaging (MRI) is now commonly used in breast imaging due to its high sensitivity. Current clinical breast MRI protocols require high spatial resolution in order to assess lesion morphology. Since spatial resolution and temporal resolution are competing demands in MRI, this high spatial resolution currently comes at the expense of temporal resolution, making assessment of lesion kinetics difficult.

With recent advances in MRI, higher temporal resolution can be achieved while maintaining acceptably high spatial resolution. A recently published data acquisition scheme, Differential Subsampling with Cartesian Ordering (DISCO), allows for high spatiotemporal imaging. This method combines pseudorandom undersampling, view sharing for image reconstruction, and two-point Dixon fat-water separation. The goal of this thesis is to evaluate some of the characteristics of DISCO for application in breast MRI with high temporal resolution while maintaining clinically acceptable spatial resolution.

The pseudorandom undersampling and view sharing may affect the assessment of lesion morphology and kinetics. These effects are demonstrated in a digital phantom study and a patient study. Additionally, implementation of two-point Dixon at 3.0 T with high spatial resolution is challenging. An alternative fat suppression option was investigated. This thesis presents initial work demonstrating the feasibility of using DISCO clinically in DCE breast MRI with high spatial resolution and high temporal resolution.