Accelerated Perfusion & Parametric Mapping

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Highlights

- Cardiac perfusion and parametric mapping techniques have a lot of clinical potential, but they need fast data acquisition to be used in clinical studies
- The compressibility of perfusion and parametric mapping data sets enables the application of k-t methods and compressed sensing

Introduction

First-pass cardiac perfusion MRI is a promising and much-studied modality for noninvasive assessment of coronary artery disease [1]. However, robust implementation for routine clinical use can be technically challenging. In particular, the pulse sequence must be carefully designed to balance conflicting requirements, such as spatial resolution, temporal resolution, contrast-to-noise ratio, and spatial coverage.

Quantitative mapping of MRI contrast parameters in the heart, such as longitudinal (T_1) and transverse (T_2) relaxation times, may offer potentially more sensitive and specific information than conventional MRI, e.g. detection of myocardial necrosis and edema [2]. However, parametric mapping requires the acquisition of a series of images, which results in long scan times that impose tradeoffs with spatial resolution.

This talk will review the main methods for accelerated cardiac perfusion and parametric mapping. Besides parallel imaging, the presentation will focus on recent methods that exploit the compressibility of perfusion and parametric mapping to accelerate data acquisition.

Accelerated Cardiac Perfusion

Parallel imaging techniques for dynamic MRI, such as TSENSE and TGRAPPA, can be used to acquire three to four slices per heartbeat, with adequate spatial and temporal resolution for clinical interpretation. To extend the slice coverage and/or increase spatial and temporal resolution, more advanced techniques are needed to obtain higher acceleration factors. The extensive spatial and temporal correlations in the cardiac perfusion data sets result in sparse representations that can be used to increase the acceleration rate. The application of k-t BLAST/SENSE [3] and compressed sensing [4] to cardiac perfusion will be discussed.

Accelerated Cardiac Parametric Mapping

The spatial and temporal correlations in the series of images acquired to estimate T1 or T2 maps can also be exploited to accelerate data acquisition. Moreover, the availability of a well-defined model enables sparser representations. The application of compressed sensing [5] and model-based reconstruction to T1 and T2 mapping will be discussed.

References

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