AbstractID: 14057 Title: Rapid MR imaging for real-time target tracking using temporal sparsity

Purpose: Real-time MRI-guided radiotherapy is an exciting new modality and requires the development of new imaging schemes focused on the role of MRI in radiotherapy guidance rather than diagnosis. In this work, we investigated sparse k-space sampling schemes in order to reduce scan time for the purpose of real-time target tracking. **Method and Materials:** To compare different k-space sparse sampling schemes, an IRB-approved human subject examination of MR imaging was performed using a FIESTA sequence in a 1.5 T system (General Electric, Milwaukee, WI). The power spectrum of the difference between adjacent k-space image frames was calculated over each time series. Sparse sampling schemes were determined by specifying five different threshold levels for the superimposed power spectrum corresponding to all the frames in each time series. A blood vessel in the liver was segmented in the full-sampled time series and sparse-sampled time series. The root mean square (RMS) error of each degraded trajectory with respect to the full-sampled trajectory was computed. **Results:** For k-space sampling reduction schemes using temporal sparsity, the RMS error in the superior-inferior direction was 0.13, 0.27, 0.38, 0.38, and 0.57 mm for the 88%, 76%, 69%, 60% , and 54% sampling fraction, respectively. **Conclusions:** Sparse k-space sampling schemes for MR imaging scan time reduction have been investigated. This allows fast MR imaging, which can be applied to real-time target tracking for management and localization of tumor motion in radiotherapy. **Conflict of Interest:** This work was supported by the AAPM Research Seed Funding Initiative.