AbstractID: 9343 Title: Experimental demonstration of simultaneous high spatial and high temporal resolution using Prior Image Constrained Compressed Sensing (PICCS) for gated CT reconstruction

Purpose: Recently an extension to compressed sensing theory has been proposed in which a prior image is used to constrain the reconstruction process. This new algorithm may be applied to gated CT acquisitions where a fully sampled 'blurred' image is used as the prior image to constrain images reconstructed at each phase. Our hypothesis is that the PICCS algorithm can accurately track moving objects throughout a given cyclic motion profile. The purpose of this study is to experimentally verify this hypothesis.

Materials and Methods:

The PICCS algorithm was implemented on a clinical C-arm system (GE Innova 4100). A phantom was constructed using human bones to simulate a realistic background of ribs and vertebrae. A 3 mm plastic rod was scanned along a one dimensional motion profile. The motion profile had a period of 0.8sec with a resting phase of 0.2 sec, and an amplitude of 8 mm.
420 cone-beam projections were acquired using a 14 second data acquisition time over 210 degrees. PICCS reconstructed was applied to the gated data such that 25 phases were reconstructed.

Results:

The center of mass of the moving rod was calculated based on the reconstructed images and agrees well with the programmed motion profile for all points in the simulated motion profile. Intensity plots are given comparing the gated PICCS reconstruction to the standard filtered backprojection algorithm. The PICCS reconstruction results also faithfully depict the width of the moving objects. When the width of the gating window in the PICCS algorithm is increased the width of the reconstructed moving object increases.

Conclusions:

This study demonstrates that for moving objects PICCS has the ability to reconstruct images with simultaneous high spatial resolution and temporal resolution via gated reconstruction. PICCS has the potential to improve reconstruction for gated acquisitions such as cardiac and lung imaging.