AbstractID: 9202 Title: Cardiac function measurements on an interventional C-arm system with isotropic spatial resolution and high temporal resolution using prior image constrained compressed sensing (PICCS)

Purpose:

To achieve three dimensional isotropic dynamic cardiac CT imaging with high temporal resolution for evaluation of cardiac function with a slowly rotating C-arm system. In this work we propose an acquisition and image reconstruction framework which enables simultaneously high spatial resolution and high temporal resolution.

Method and Materials:

A recently introduced extension to compressed sensing in which a prior image is used as a constraint in the reconstruction has enabled this application. This new algorithm is referred to as Prior Image Constrained Compressed Sensing (PICCS). An in-vivo animal experiment (e.g. a beagle model) was conducted using an interventional C-arm system. The imaging protocol was as follows: contrast was injected, the contrast equilibrated, breathing was suspended for ~14 seconds during which time 420 equally spaced projections were acquired. This data set was used to reconstruct a fully sampled blurred image volume using the conventional FDK algorithm (e.g. the prior image). Then the data set was retrospectively gated into 19 phases according to the recorded ECG signal (heart rate ~ 95bpm) and images were reconstructed with the PICCS algorithm.

Results:

Cardiac MR was used as the gold standard due to its high temporal resolution. The same short-axis slice was selected from the PICCS-CT data set and the MR data set. Manual contouring on the peak systolic and peak diastolic frames was performed to assess the ejection fraction contribution from this single plane. The calculated ejection fractions with PICCS-CT agreed well with the MR results.

Conclusion:

We have demonstrated the ability to use a slowly rotating interventional C-arm system in order to make measurements of cardiac function. The new technique provides high isotropic spatial resolution (~0.5 mm) along with high temporal resolution (~ 33 ms). The evaluation of cardiac function demonstrated agreement with single slice cardiac MR.