AbstractID: 13514 Title: Compressed Sensing with a First-Order Method for Low-Dose Cone-Beam CT Reconstruction

Purpose: This work considers the problem of reconstructing cone-beam computed tomography (CBCT) images from a set of under-sampled and potentially noisy projection measurements.

Materials and Methods: We cast the reconstruction as a compressed sensing problem based on ℓ_1 norm minimization constrained by statistically weighted least-squares of CBCT projection data. For accurate modeling, the noise characteristics of CBCT projection data are used to determine the relative importance of each projection measurement. To solve the compressed sensing problem, we employ a method minimizing total-variation norm satisfying a pre-specified level of measurement consistency using a first-order method developed by Nesterov.

Results: The method converges fastly to the optimal solution without excessive memory requirement, thanks to the method of iterative forward and back projections. The performance of the proposed algorithm is demonstrated through a series of anthropomorphic phantom studies. It is found that high quality CBCT image can be reconstructed from under-sampled and potentially noisy projection data by using the proposed method. Both sparse sampling and decreasing x-ray tube current (*i.e.*, noisy projection data), lead to reduction of radiation dose in CBCT imaging.

Conclusions: It is demonstrated that compressed sensing outperforms the traditional algorithm when dealing with sparse, and potentially noisy, CBCT projection views and relatively high noise due to low tube current.