AbstractID: 11429 Title: Using Iterative Methods to Reconstruct Images from Under-Sampled and Truncated Projection Data in CT

Purpose:
In this work, iterative method with total variation (TV) minimization was proposed to reconstruct cone beam CT (CBCT) image from under sampled and truncated projection data.

Method and Materials:
Respiratory motion is a significant source of error in CBCT image reconstruction for the thorax and upper abdomen. To reduce motion artifacts in reconstructed image, four-dimensional (4D) CT imaging has been studied. One category of 4D CT imaging is gated image reconstruction in which projection data acquired when free breathing were retrospective sorted into several subsets of projections that each corresponds to a certain breathing phase. The projection subsets are reconstructed into CBCT volume at different phases. Normally, CBCT scanning system acquires about 330 projections over half rotation. After sorting these 330 projections into 10 subsets, each subset is under sampled and only has 33 projections. Image reconstructed with this under sampled subset has severe streaking artifacts. In addition, the detector panel does not cover the extent of the body causing truncation of the projection data along axle and transaxle directions. The maximum likelihood expectation maximization was used with TV constraint and the results were compared with those of filtered backprojection (FBP) using computer simulations and patient data.

Results:
The MLEM-TV method produced a larger reconstructed region-of-interest (ROI) than that of FBP in computer simulation. Also, the images of the proposed method appear to have better noise removal and streaking artifact suppression induced by under-sampling in computer simulation and patient data. Signal to noise ratio (SNR) of three typical regions on a patient image of the FBP method are 5.4, 7.5 and 8, while those of MLEM-TV are 9.7, 20.2 and 24.8 respectively.

Conclusion:
Iterative method is feasible in CBCT imaging and has an advantage over FBP method when the projection data are under sampled and truncated.