

AbstractID: 4931 Title: Exploitation of Data Redundancy in a Reduced Fan-beam Scan

Purpose: We aim to devise new weighting schemes to improve the signal-to-noise ratio (SNR) in images reconstructed from data acquired in reduced fan-beam scans by fully utilizing the redundant information.

Method and Materials: Recently, we have developed a backprojection-filtration (BPF) algorithm, which can reconstruct ROI-images from the transversely truncated data in a reduced-scan with a scanning angular range less than that in a short-scan. However, the measured data in a practical reduced scan contain some redundant information. In this work, we devised two weighting schemes to appropriately incorporate the redundant data. Applying the weighting schemes to the BPF algorithm, we derived two new algorithms, derivative of weighted BPF (WD-BPF) and weighted-derivative BPF (DW-BPF) algorithms. Both of these two algorithms can be used to improve the SNR in reconstructed images.

Results: The ROI-images are reconstructed from the truncated projection data in a short-scan and a reduced-scan, respectively. For the reduced-scan, some shading artifacts appear in the images reconstructed by use of the WD-BPF algorithm. This is caused by the numerical error in the derivative of the discontinuous weighting function. In contrast, artifact-free images can be obtained by use of the DW-BPF algorithm. For the short-scan, both algorithms can obtain artifact-free images, because the weighting function is smooth. The results in the noise study show that image noise obtained by use of WD-BPF and DW-BPF algorithms are similar within the ROI.

Conclusion: We propose two weighting schemes for handling the data redundancy in reduced-scan fan-beam CT. Our results demonstrate that the proposed two algorithms can utilize the redundant data to improve the signal-noise ratio. Moreover, the noise properties of these two algorithms are similar to each other.