AbstractID: 10814 Title: Noise Suppression in Scatter Correction for Cone-Beam CT

Purpose:

Scatter correction is crucial to the quality of reconstructed images in X-ray cone-beam computed tomography (CBCT). Most of existing scatter correction methods assume smooth scatter distributions. The high-frequency scatter noise remains in the projection images even after a perfect scatter correction. To circumvent the problem and truly gain from scatter correction, an effective scatter noise suppression method must be in place.

Method and Materials:

We analyze the noise properties in the projections after scatter correction, and propose to use a penalized weighted least-squares (PWLS) algorithm to reduce the noise in the reconstructed images. The method aims to estimate the ideal linear integrals by minimizing a PWLS objective function which models the first and second moments of the projection data.

Results:

Experimental results on an evaluation phantom (Catphan@600) show that the proposed algorithm further reduces the reconstruction error in a scatter corrected image from 10.6% to 1.7%, and increases the CNR by a factor of 3.6. Significant image quality improvement is also shown in the results on an anthropomorphic phantom, in which the global noise level is reduced and the local streaking artifacts around bones are suppressed.

Conclusion:

In this paper, using a clinical CBCT system and a measurement-based scatter correction, we show that a scatter correction alone does not provide satisfactory image quality and the loss of the contrast-to-noise ratio (CNR) of the scatter corrected image may overwrite the benefit of scatter removal. A statistics-based PWLS is proposed to reduce the image noise after scatter correction and the algorithm performance is demonstrated using experiments.