AbstractID: 9007 Title: Scatter Correction for Cone-Beam CT in Radiation Therapy

Purpose: Cone-beam CT (CBCT) is being increasingly used in radiation therapy. However, as compared to conventional CT, the degraded image quality of CBCT hampers its applications. Due to the large volume of x-ray illumination in CBCT, scatter is considered as one of the fundamental limitations of CBCT image quality. Many scatter correction algorithms have been developed, while drawbacks still exist. Here, we propose a new scatter correction method which is particularly useful in radiation therapy.

Methods and Materials: Since the same patient is scanned repetitively during one radiation treatment course, we measure the scatter distributions in one scan, and use the measured scatter distributions to estimate and correct scatter in the following scans. A partially blocked CBCT is used in the scatter measurement scan. The x-ray beam blocker has a strip pattern, such that the whole-field scatter distribution can be estimated from the detected signals in the shadow region and the patient rigid transformation can be determined from the reconstructed image using the illuminated detector projection data. From the derived patient transformation, the measured scatter is then modified and used for scatter correction in the following regular CBCT scans.

Results: The proposed method has been evaluated using Monte Carlo simulations and physical experiments on an anthropomorphic chest phantom. The results show a significant suppression of scatter artifacts using the proposed method. Using the reconstruction in a narrow collimator geometry as a reference, the comparison also shows that the proposed method reduces reconstruction error from 13.2% to 0.8%.

Conclusions: This work indicates that much improved CBCT image quality is achievable using the proposed scatter correction method in radiation therapy. Our method is very attractive in applications where high CBCT reconstruction accuracy is critical, for example, dose calculation in adaptive radiation therapy.

Conflicts of Interest: There are no potential conflicts of interest.