AbstractID: 13936 Title: Scatter Correction for On-board Cone-beam CT in Radiation Therapy Using Planning MDCT Images

Purpose: The applications of cone-beam CT (CBCT) imaging in radiation therapy are greatly hampered by the poor image quality mainly due to scatter artifacts. The current use of CBCT is only limited to treatment setup, and an optimal scatter correction solution still remains unclear. Here, we propose a new scatter correction method for CBCT based on the current workflow of radiation therapy. **Methods and Materials**: With much smaller inherent scatter signals, diagnostic multi-detector CT (MDCT) provides more accurate CT images and is routinely used for radiation treatment planning. Using the MDCT image as the "free" prior information, we first estimate the primary projections in the CBCT scan via forward projection on MDCT data. Since the deviation between patient geometries in the CBCT and the registered MDCT data only leads to high-frequency primary projection differences and scatter has dominant low-frequency components, CBCT scatter signals are accurately estimated by low-pass filtering and effectively corrected for after subtraction. The proposed method is evaluated using two phantom studies on tabletop systems. **Results**: On the Catphan©600 phantom, the reconstruction error is reduced from 348 HU to 4 HU around the phantom center. In the selected regions of interest, the average image contrast is increased by a factor of 3.3. This contrast increase improves low-contrast detectability, as seen in the pelvis phantom study. Besides a significant improvement of image quality, a 25 HU object, which is otherwise buried in the scatter artifacts, can be clearly identified after the proposed scatter correction. Compared to the kernel-based method, our approach shows an improved performance. **Conclusions**: Effective scatter correction is achieved on CBCT using our MDCT-based approach. The increased accuracy of CBCT imaging substantially facilitates CBCT-based clinical applications, such as tumor delineation and dose calculation. As such, the proposed method will be very attractive in current radiation therapy.