AbstractID: 8938 Title: Reconstruction of missing data on kilovoltage and megavoltage cone-beam CT images for adaptive radiation therapy

Purpose: Kilovoltage (kV) or megavoltage (MV) cone-beam CT (CBCT) technique become popular nowadays for patient setup verification and dose recalculation aiming image-guided radiation therapy. In case of kV CBCT, field-of-view (FOV) is large enough to cover whole thoracic or pelvic region at detector off-set mode while length of image set is limited and MV CBCT, vice versa. In this study, we dealt with missing data issue; compensation of missing part with kV CT images used for treatment planning.
Method and Materials: First, obtained kV or MV CBCT images were registered with the planning kV CT images respectively. For kV CBCT, CT slices beyond the obtained volume were filled with planning CT data. For MV CBCT, overlapped regions in the kV CT images with the MV CBCT images after registration were substituted with the MV CBCT data. To reduce statistical discrepancies of pixel numbers between CBCT images and kV CT images and to minimize dose recalculation error, pixel number mapping and spatial filtering were employed. Varian Clinac iX and Siemens Primus linacs were used for CBCT image acquisition. Image registration and dose recalculation were implemented using Pinnacle3 ver 8.0d. Proposed algorithm were tested for chest and pelvic regions of a humanoid phantom and patients. Isodose comparison and gamma index were adopted as evaluation criteria.
Results: Dose calculation result with the reconstructed CT image set agreed with calculation done with kV CT meaningfully within 2% on a phantom but error was up to 5% for clinical cases. Discrepancies were mainly due to anatomic changes and incomplete match of boundaries at the interface of two image set.
Conclusion: The reconstruction algorithm showed a possibility of adaptive radiation therapy using CBCT images but image quality of CBCT data needs to be improved more.

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