AbstractID: 13497 Title: An automated scoring method to quantitatively evaluate imaging artifacts in 4D-CT images

Purpose: To develop an automated scoring method based on normalized cross correlation to evaluate imaging artifacts due to respiratory motion in four-dimensional-computed tomography (4D-CT) images. **Method and Materials:** Imaging artifacts in 4D CT have been extensively documented in the literature. Manual analysis of the magnitude of the artifacts is subjective and time consuming and there has no automated methods been reported for the objective quantification of the artifacts. We have developed an automated method to score the 4D-CT images based on the calculation of the normalized cross-correlation coefficients (NCC) between adjacent image slices at couch transitions (edge slices). We used three scoring criteria to evaluate the imaging artifacts: the minimum of the NCC (score #1), the average NCC (score #2), and the mean of the difference between the NCC of edge slices and the mean NCC of the edge slices with their respective neighboring slices within the same couch position (score #3). Our method was tested using a commercially available 4D motion phantom and subsequently applied to the 4D-CT scans of 30 lung cancer patients. **Results:** Our method is able to detect imaging artifacts in the reconstructed respiratory phases of the 4D-CT scans that are verified visually. In particular, score #1correlates well with the maximum magnitudes of two types of artifacts that were measured manually by an unbiased observer. In contrast, scores #2 and #3 showed no correlations. **Conclusions:** Our automated scoring method based on normalized cross correlation is suitable to quantitatively evaluate imaging artifacts. Score #1 appears to be the most reliable measure to quantitate artifacts and has been verified visually. Used in conjunction with score #1, score #2 can be an indicator of the overall goodness of the image quality while score #3 indicates the ‘badness’ of edge slices as compared with their respective neighboring slices.