

AbstractID: 1613 Title: An Adaptive Control Method for Acquiring Improved Four-Dimensional Thoracic CT Scans

Four-dimensional computed tomography (4DCT) acquisition methods that explicitly account for respiratory motion have been recently developed in both academic and commercial settings. 4DCT is generally acquired either by sinogram or image sorting based on a post-acquisition procedure using external respiration signals. The patient's ability to maintain reproducible respiratory signals is the limiting factor during 4DCT, as respiratory variations cause artifacts in the 4DCT scan. Methods of breathing coaching, e.g. audiovisual biofeedback, can improve respiration reproducibility, however significant variations remain. To reduce 4DCT artifacts and their subsequent deleterious effects during radiotherapy planning and delivery, a method for improved 4DCT image acquisition has been proposed that relies on adaptive control during data acquisition. The respiration signal and CT data acquisition are linked, such that 'bad' data from erratic breathing cycles that cause artifacts are not acquired by pausing CT acquisition until steady state respiration is resumed. A proof-of-principal application of the adaptive control method to an existing respiration signal acquired during 4DCT demonstrates the potential of this method to reduce artifacts currently found in 4DCT scans. Though 4DCT methods accounting for respiratory motion are being developed in radiation oncology departments, there is potentially a significant widespread role of 4DCT in diagnostic radiology for pulmonary function tests. Limiting the widespread application of 4DCT is the utility of current passive acquisition techniques to account for the variations in patient's respiratory signals. Active 4DCT acquisition processes, such as the adaptive control method, will potentially allow the general use of 4DCT.

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