AbstractID: 2928 Title: Determination of displacement binning points for four-dimensional CT image acquisition

Purpose:

Present methods of generating four-dimensional (4D) computed tomography (CT) image data sets that bin either projections or reconstructed images based on the phase of the respiratory cycle might display artifacts caused by irregularities in the respiratory cycle. Binning based solely on displacement has the potential for resolving these artifacts but yields three-dimensional image data sets that are unevenly spaced in time, making the application of the 4D data set to treatment planning more difficult. We propose a method for displacement-based binning that sets the binning points at displacement points corresponding to approximately equally-spaced phases.

Method and Materials:

The present approach extracts the file used to monitor the patient's respiratory cycle and identifies the points on the respiratory cycle corresponding to true end-inspiration. The time intervals between each set of end inspiration points were divided into a specified number of phases (typically 10) equally spaced in time. The displacements corresponding to these phase points were averaged among the respiratory cycles included in the image acquisition, and the times in each respiratory cycle corresponding to the mean values were recorded and sent to the reconstruction program. A MATLAB program was written to generate these times and applied to a typical respiratory cycle.

Results:

When evenly-spaced displacements were used for displacement binning, the mean time intervals among the 10 phases varied by as much as a factor of 5. The present methodology reduced the variation in mean time intervals among phases to approximately 20%.

Conclusion:

If binning for acquisition of 4D CT image data sets is to be based on displacement of the respiratory trace, then, to ensure approximately equally-spaced time intervals, the displacement for a specific phase averaged over all respiratory cycles should be used.

Conflict of Interest:

Supported in part by a Sponsored Research Agreement with Philips Medical Systems, Inc.