AbstractID: 1599 Title: A Multi-frame Optical Flow Approach for Automated Breathing Motion Tracking in 4D Computed Tomography

We are developing a 4D-CT process to provide breathing motion information (trajectories) for radiation therapy treatment planning of lung cancer. Potential applications include optimization of intensity-modulated beams in the presence of breathing motion and intra-fraction target volume margin determination for conformal therapy. The images are acquired using a multi-slice CT scanner while the patient undergoes simultaneous quantitative spirometry. At each couch position, the CT scanner is operated in ciné mode and acquires up to 15 scans of twelve 1.5 mm thick slices. Each CT scan is associated with the measured tidal volume for retrospective reconstruction of 3D CT scans at arbitrary tidal volumes. Typical 4D-CT scan datasets contain almost 10^9 voxels, so automated methods will be required to produce the motion trajectories. This talk describes our implementation of the automated registration if internal organ motion during free breathing. A modified least-squares based optical flow algorithm tracks specific features of interest by modifying the eigenvalues of the image intensity gradient matrix. Temporal constraints along the breathing cycle are invoked by utilizing multiple breathing frames instead of performing pairwise registration. Good correlations between the measured motion and spirometry-based tidal volume are observed and evidence of internal hysteresis is also detected.

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