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Purpose:

1)compare congruency of phase 50 with EE breath-hold scan 2)demonstrate improvement of the demons image registration algorithm with hierarchical regularization component.

Method and Materials:

We consider 10 cases with motion exceeding 0.5 cm. The tumor was contoured on phase 50. Image registration provided the transfer of a contour to EE scan. Contour comparison is afforded by the same DICOM-coordinates. Dice coefficient and centroids' shift between scans gauge tumor congruence. Multiresolution image registration is based on the fluid version of the demons algorithm. Algorithm is improved by the hierarchical regularization component. SSD is used to compare image fusions. Deformation maps are compared and described with maximal and mean magnitude of the deformation vector and its standard deviation. Number of iteration reveals the speed up of performance.

Results:

The tumor volumes ranged from 2.27cc to 37.21cc on phase 50. Transferred to EE differed on average by 7%. Tumor centroids shifts ranged upto 5 mm along the lateral, upto 7mm along ventro-dorsal and upto 7 mm along the superior-inferior axis. The ipsilateral lung volume between the scans differed upto 15%. The Dice coefficient did not exceed 0.7. Adaptive regularization accelerates convergence and improves on all scoring criteria.

Conclusion:

Data indicate incongruency between phase 50 and EE breath-hold scan, which precludes the latter in any emulation or substitution for phase 50 scan. Possible reasons are: relatively small tumor sizes, motion above 0.5cm and different air intake in both scans. Hierarchical application of the deformation field regularization provides more robust performance and heuristically can be seen as an adaptation to scale-size changes during iterations.