

Purpose: To present a tensorial based method for evaluation of tumor deformation

Method and Materials: Image registration provides a displacement field for each voxel and as such provides also a deformation field. The Jacobian of the deformation field reveals the volume changes. However even with Jacobian =1, a voxel might deform. We use the Green-St Venan strain tensor to quantify the tumor deformation. The tensor is obtained with the in-house implemented elastic image registration. The Gaussian Pyramid of registered CT volumes allows for speedup of the registration as well as for addressing larger displacement. We use retrospectively ten cases of lung cancer patients for whom a pre-treatment 4 DCT was obtained. The use of the tensor allows for factoring out rotation and translation. This in turn allows for the measurement of the pure deformation.

Results: Only three GTVs were observed to deform between phase 50 and phase 0. The relative maximal shape change as quantified by the average ratio of the tensorial ellipsoid radii was 30%. The average tumor motion for the cases was 1.6 cm.

Conclusion: The method allows for improved measurement of intra fractional tumor deformation as contrasted with methods based on contour or volume comparison. It can be adopted to the measurement of the inter fractional changes in tumor shape and size if relevant CT scans are available.

Conflict of Interest (only if applicable): None