AbstractID: 11386 Title: The Effect of Surface Rendering On Anatomical Structures Arising From Deformable Image Registration

Purpose: Volume rendering is important in deformable image registration (DIR) and hyperdimensional imaging (>3D). Interpolation and the use of finite volume element grids to describe the image and 3D surface/volume datasets can cause partial occupancy when structures are mapped by deformation vectors. The choice of surface rendering technique directly impacts the agreement between manually and automatically delineated structures. The purpose of this study was to investigate the effect different surface rendering algorithms have for CT imaging sets mapped by DIR.
Method and Materials: 4DCT clinical lung imaging was used in this study. A single expert user with secondary confirmation contoured the GTV, right lung, and left lung on the FBCT as well as on all ten phases of the 4DCT. The Juggler DIR algorithm was used to calculate the deformation vectors between the free breathing CT and each phase of the 4DCT. The deformation vectors were then applied to the contours of the FBCT, and different surface rendering techniques were applied (including thresholding and [Christiansen's mosaic method) to reconstruct the volume. Reconstructed structures were compared with manually delineated structures and agreement was evaluated based on volume, center-of-mass position, similarity index, and 3D distance maps.
Results: We found the center-of-mass for all organs over all phases to be invariant to rendering technique. Percent volume difference varied greatly depending on the technique and organ, ranging from -23% to +56% for the gtv to -3.75% to +13.58% for the left lung volume.
Conclusion: TH50% and SR1 gave the best results**,** but significant differences can arise between DIR-generated structures and manually delineated structures depending on the rendering technique used. We suggest rigorous QA before implementation of such a system prior clinical use.