AbstractID: 9112 Title: Removing artifacts from 4DCT volumes acquired in Cine mode using B-spline non-rigid registrations

Purpose:
To remove artefacts that occur between adjacent couch positions in 4DCT volumes acquired in Cine mode.

Method and Materials:
A separate B-spline non-rigid registration is performed between an artefact free reference volume and the data from each individual couch position in the 4DCT volume. The registration is performed using an extended control point grid that covers all of the couch positions and is common to all of the registrations. Therefore the result of each registration defines a transformation over all couch positions but was only constrained by data from one couch position. The registration results from all couch position are then combined into a single B-spline transformation. The control point displacements in the combined transformation are a weighted average of the displacements in the individual registrations. The weight for each registration is different for each row in the control point grid, and depends on the contribution that the control points make to the transformation in the region of the couch position that was registered. The combined transformation is continuous across all the couch positions, and when used to deform the reference volume will produce an artefact free prediction of the anatomy in the same respiratory state as the original 4DCT volume.

Results:
This method has been applied to 4DCT data from five patients that were subject to artefacts between couch positions. In all cases our method produced volumes that resembled the original 4DCT data but were free of artefacts between adjacent couch positions.

Conclusion:
We have presented a novel method based on B-spline non-rigid registration that can remove the artefacts that occur between adjacent couch positions in 4DCT volumes acquired in Cine model, and have successfully demonstrated this method on data from five patients.