AbstractID: 3780 Title: A novel volume subdivision-based algorithm to register respiration phase-correlated lung CT images

Purpose: To develop a deformable image registration algorithm that will allow for temporal interpolation of phase-correlated 3D CT data sets and test it on lung CT images.

Method and Materials: We have developed a new deformable image registration algorithm that starts with a global rigid-body matching between two (volumetric) images, progressively subdivides one image, and refines the spatial matching locally for each of the subvolumes. When subvolumes reach a user-defined size, the algorithm interpolates all local solutions to generate a smooth deformation field. The above algorithm was applied to two lung CT image sets, each with three frames corresponding to end-inhalation (IN), mid-exhalation (MID) and end-exhalation (EX). These images were acquired in conjunction with a spirometer and using a spiral CT scanner. In each case, the IN image was registered to the MID image and the MID image to the EX image. An interactive multi-planar reformatting tool was used to evaluate the result of image registration quantitatively. For quantitative evaluation, reduction in root-mean squared (RMS) error was computed for each image pair before and after image registration.

Results: Visual inspection indicated an improved matching of anatomical features following registration. For the four image registrations performed (two for each case), the RMS error reduced from 13.8 to 7.2, 19.9 to 12.7, 13.5 to 8.0, and 12.2 to 7.0, indicating improved spatial matching following image registration.

Conclusions: We have developed a new deformable image registration and shown its application to gated lung CT images. The algorithm effectively aligned phase-correlated CT images. Full development of this deformable registration capability will allow tumor trajectory mapping and dose registration.

Conflict of Interest (if applicable): N/A