AbstractID: 10489 Title: Inverse consistency deformable image registration on partially matched images

Purpose:
For many RT applications, deformable image registrations (DIR) are often carried out between two images that only match partially. In addition, it is often desirable to use inverse consistency DIR to improve accuracy and to compute both the forward and backward deformation vector fields (DVF) simultaneously and consistently. Inverse consistency is especially important for adaptive radiotherapy applications because doses and structures need to be remapped between the planning image and the daily image using both forward and backward DVFs. Image mismatching (superior-inferior coverage difference, field-of-view (FOV) cutoff, etc) makes it difficult for inverse consistency DIR algorithms which normally need both images to have matched image content and dimensions. Therefore, we propose a method in this study to perform inverse consistency DIR for these image mismatch situations.

Method:
Our method is based on the inverse consistency optical flow algorithm (Yang, PMB, 2008). The idea of allowing image mismatching is to extend the image volumes and define the extension voxel (outside the original image volume) values as NaN (not-a-number). NaN values are transparent to all floating-point arithmetic computations in the DIR computation, including re-sampling, interpolation, etc. With the NaN voxels, registrations are carried out with one additional rule that a NaN voxel can match any voxel. In this way, the matched sections of the images are registered properly, and the mismatched sections of the images are registered to NaN voxels.

Results:
We demonstrate the proposed method with Tomotherapy MVCT images with FOV cutoff problems and smaller volumetric coverage. Our results suggest that the proposed method could significantly improve image registration accuracy, especially near or in the mismatched image regions.

Conclusion:
This proposed method makes it possible to obtain inverse consistent DVFs on partially matched images that are usually difficult to register otherwise.