AbstractID: 4860 Title: An image-intensity modification method to deal with non-correspondence problem in deformable image registration of the gaseous rectum

Purpose: The goal of this study is to develop an image intensity modification method together with the intensity based deformable registration algorithm for auto-segmentation of the rectum on daily CT images. In CT-guided prostate cancer radiotherapy, the planning CT image may contain an empty rectum while there may exist bowel gases in the rectum on any given treatment day (daily CT). The intensity based image registration algorithms alone were insufficient to produce the correct spatial transformations for all objects, especially for the rectum since there was no one-to-one correspondence in the gaseous region.

Material and Methods: In this study, we proposed a diffusion-based deformable image registration algorithm combined with an automatic intensity modification method that introduces artificial gas pockets in the planning CT based on prior knowledge of the previously contoured rectum. This will allow for the establishment of correspondence between the two CT images. A multi-grid method was used for solving the nonlinear partial differential equation for the displacement field, and this displacement field was used to map the manual rectum contours from the planning CT to the daily CT. 30 CT images with the largest bowel gas fillings from 15 prostate cancer patients were chosen to test the algorithm.

Results: The intensity modification technique is demonstrated to be effective in correctly delineating the daily rectum. Compared with the deformable image registration method without rectum image modification, the average volume overlap index was improved from 50.6% to 71.2%. This was visually verified by overlaying the segmented contours onto the daily CT images.

Conclusion: We developed an effective auto-segmentation technique for rectum using a deformable image registration algorithm combined with an image intensity modification method. The approach is fully automatic and capable of handling the special non-correspondence problem in CT images of prostate cancer patients.