AbstractID: 6559 Title: Conventional CT to cone-beam CT image registration using combination of intensity- and landmark-based deformable image registration methods

Purpose: A hybrid deformable registration approach was proposed to combine the landmark-based compact support radial basis functions (CSRBFs) spline registration with the automatic intensity-based diffusion registration. The goal was to gain more local control of the region that cannot be handled properly with intensity-based automatic image registration for cone beam CT (CBCT) images with local image artifacts.

Method and Materials: The hybrid registration takes the advantage of both methods: the diffusion registration for automatic registration of the entire image and the CSRBFs spline method with limited landmark points to control the local deformation for special situations. For registration of CT image with the CBCT image of head and neck cancer patient, the air cavity and the image artifacts in CBCT image are the major concern of the local CSRBFs spline registration. The control points were usually selected on the boundary of those correspondence ambiguity regions in both images. Due to the limited range of the CSRBFs, the registration will not affect the area outside of the region where the landmark points were placed. The constraint of the topology preservation involved in this algorithm ensures that the transformations are reliable and accurate.

Results: we register CT image to CBCT images of head and neck cancer patients, and map the manual contours to daily CBCT image using three different registration approaches. The performances of the registration algorithms were evaluated by visually assessing the agreement of the structures with the deformed contours in the CBCT image. We found that the hybrid registration gave a better result.

Conclusion: The hybrid method can handle correspondence ambiguity problem in image registration cause by air cavity and image artifacts in CBCT images. It can also improve the registration accuracy without significantly increasing the registration time.

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