Purpose: To develop and evaluate a tool that can improve the accuracy of contour transfer between different image modalities under challenging conditions of low image contrast and large image deformation, comparing to a few commonly used methods, for radiation treatment planning.

Methods: The software tool includes the following steps and functionalities: (1) accepting input of images of different modalities, (2) converting existing contours on reference images (e.g., MRI) into delineated volumes and adjusting the intensity within the volumes to match target images (e.g., CT) intensity distribution for enhanced similarity metric, (3) registering reference and target images using appropriate deformable registration algorithms (e.g., B-spline, demons) and generate deformed contours, (4) mapping the deformed volumes on target images, calculating mean, variance, and center of mass as the initialization parameters for consecutive fuzzy connectedness (FC) image segmentation on target images, (5) generate affinity map from FC segmentation, (6) achieving final contours by modifying the deformed contours using the affinity map with a gradient distance weighting algorithm. The tool was tested with the CT and MR images of four pancreatic cancer patients acquired at the same respiration phase to minimize motion distortion. Dice’s Coefficient was calculated against direct delineation on target image. Contours generated by various methods, including rigid transfer, auto-segmentation, deformable only transfer and proposed method, were compared.

Results: Fuzzy connected image segmentation needs careful parameter initialization and user involvement. Automatic contour transfer by multi-modality deformable registration leads up to 10% of accuracy improvement over the rigid transfer. Two extra proposed steps of adjusting intensity distribution and modifying the deformed contour with affinity map improve the transfer accuracy further to 14% averagely.

Conclusions: Deformable image registration aided by contrast adjustment and fuzzy connectedness segmentation improves the contour transfer accuracy between multi-modality images, particularly with large deformation and low image contrast.