

## A 3-D Image Registration Toolkit for Radiation Therapy Treatment Planning

Image registration offers a substantial improvement for the target volume definition in radiation therapy. For improved target volume definition, a new 3D image registration toolkit was developed and incorporated into our treatment planning system. This toolkit offers both automatic and manual image registrations. Although automatic image registration speeds up the process, in certain clinical cases, it is inadequate due to the nature of the information contained in different modalities of images. Applications of manual image registration will be presented here. The user applies rigid body transformations, namely translation and rotation, to correlate image data sets in 3-D. Once a match between the two data sets is accomplished, the transformation matrix then is applied to display both data sets side-by-side in the same coordinate system. Target volume and critical organs can be contoured in either data set. While contouring in one modality, the corresponding point is displayed on the second one. In fact, the user can interchange modality during contouring a structure. This allows the user to define the target volume based on both modalities. Currently we employ image registration to define lung lesions from PET and CT. PET- transmission images are registered with CT images, since the lung outline is well defined in both. The CT-PET- transmission transformation matrix is then applied to display PET- emission images with the corresponding CT, which allows us to determine the extent of the tumor or to visualize other unknown sites on CT images.