AbstractID: 7055 Title: An Automatic 3D set-up error estimator for radiotherapy using Mutual Information

We have investigated a fully automatic set-up error estimation method that aligns DRRs (Digitally Reconstructed Radiographs) from a 3D planning CT image onto 2D radiographs that are acquired in a treatment room. We have chosen a MI (Mutual Information)-based image registration method to overcome the gray scale differences between the DRRs and the radiographs. The MI-based estimator is fully automatic since it is based on the image intensity values without segmentation. To test this method, an anthropomorphic chest phantom was scanned at 1 mm slice thickness. The phantom was then positioned on a linear accelerator with controlled offsets, and a series of radiographs were acquired using an active matrix flat panel imager. MI-based alignment was performed, as well as a verification of the controlled offsets through alignment of multiple fiducial markers placed at the periphery of the imaged fields. The fiducials were not present in the image regions used for MI-based registration. The average differences between the proposed method and the fiducial marker-based verification were smaller than 1mm for translations and 0.8 degree for rotations. The empirical standard deviations of estimates from the proposed method were smaller than 0.3 mm and 0.07 degree for the translation parameters and the rotation parameters, respectively.

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