

AbstractID: 10587 Title: Fully automated internal marker tracking algorithm for cine EPID images

Introduction: An electronic portal imaging device (EPID) in cine mode can be used for validating respiratory gating and stereotactic body radiation therapy (SBRT) by tracking implanted fiducials. Manual tracking methods are time and labor intensive, limiting the utility of the validation. We have developed a fully automated algorithm to quickly and accurately extract the markers in EPID images and reconstruct their 3D positions.

Materials and Methods: The markers were detected and recognized using an image processing algorithm based on the Laplacian of Gaussian (LoG) filter. To reduce false marker detection, a marker registration technique was applied using image intensity as well as the geometric spatial transformations between the reference marker positions produced from the projection of 3D CT images and the estimated marker positions. An average marker position in 3D was reconstructed by backprojecting, towards the source, the position of each marker on the 2D image.

Results: From phantom studies, spatial accuracies of <1 mm were achieved in both 2D and 3D marker locations. Using only the LoG algorithm, the marker detection success rate was 88.8%. However, adding the registration technique which utilizes prior CT information, the success rate was increased to 100%. In addition, we have examined the cases of 5 patients being treated under an SBRT protocol for hepatic metastases. The intrafractional tumor motion (3.1-11.3 mm) in the SI direction was measured using the 2D images. The interfractional patient setup errors (0.1-12.7 mm) in the SI, AP, and LR directions were obtained from the marker locations reconstructed in 3D and compared to the reference planning CT image.

Conclusions: The measured intrafractional tumor motion and the interfractional daily patient setup error can be used for off-line retrospective verification of SBRT.

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