

AbstractID: 14060 Title: 3-D Fiducial Localization with MV EPID Imaging During a RapidArc Therapy

Purpose:

Fiducials can be used to aid organ localization during RapidArc delivery. Specifically, the 3-D tumor position may be found through the tracking of fiducials during beam delivery. A promising technique is the detection of fiducials in 2-D EPID images, and then reconstruction of the 3-D position using limited views.

Methods and Materials:

The CIRS dynamic thorax phantom with a custom tumor model is used in the study. Two fiducials are placed on the surface of the tumor at clinically relevant distances apart from each other. Clinical RapidArc plans are delivered to the phantom based on a single 360° arc.

The fiducial detection algorithms are developed based on an image block matching filter and anisotropic diffusion techniques. A wavelet-based block matching filter is developed to suppress the noise and texture of images while preserving the edges of fiducials. Furthermore, the anisotropic diffusion technique removes redundant edges and trivial structures of the results of the previous filtering. Experiments show that the algorithms are robust to image contrast and aperture variations during the RapidArc delivery. With detected 2-D locations, 3-D spatial locations of fiducials are reconstructed using the inverse 3-D rotation matrix.

Results:

The position accuracy in 2D EPID is 0.77 ± 0.58 mm by comparing with the manual outlines. The 3D fiducial positions are reconstructed using the 2D EPID images. The displacement from the references in the 3D CBCT image is within one millimeter.

Conclusion:

Novel filtering and detection algorithms are developed to identify the fiducials in 2D EPID images. The results show that limited angles of full rotation can rigorously reconstruct the locations of each of fiducials in 3D to within one millimeter.

Conflict of Interest:

Varian Medical Systems, Inc.