

AbstractID: 5319 Title: A Simple Method to Calibrate Stereo-Vision System In Image-Guided Radiotherapy

Purpose: To calibrate a 3D stereovision system (or 3D camera in short) with complex planning and treatment systems to implement a 3D image-guided radiotherapy system.

Method and Materials: A calibration template with a printed grid is used to correlate the treatment machine coordinate system to the 3D camera image coordinate system. The calibration template is carefully placed on the top of the treatment machine table and precisely aligned with the corresponding machine axes. A 3D surface image of the template is captured by a 3D camera mounted on the ceiling of treatment room. Nine points of the 3D surface image are manually digitized and used to calibrate two coordinate systems. Two algorithm, analytical method and multi-points registration method are conducted to find the transformation parameters. The analytical method only needs 3 points to find a rigid transformation between two coordinate systems. Triggered by least-squares approximation, the multi-points method uses 9 points to find an optimum rigid transformation between two coordinate systems.

Results: Results from a set of experiments demonstrated that both methods can provide acceptable accuracy (<1-mm) for the image-guided radiotherapy. Ideally, all points of the template surface transformed from the calibration should be in the O-XY plane but due to image noise and calibration uncertainty, large error (up to 2 mm) can be introduced by the analytical method. In contrast, for the same template image, the multiple-point registration approach provided image transformation with the maximum error in the template plane less than 1.0 mm under the noisy circumstance.

Conclusions: Both methods can be used for accurate image system calibration. However, the multiple-point registration method yields more reliable results than that of the analytical method. Both methods are simple and the calibration can be conducted weekly with the QA of radiotherapy systems.