

AbstractID: 11188 Title: Study of automatic patient positioning system based on the correlation of two edge images in proton therapy

Purpose: To clinically evaluate the accuracy of an automatic patient positioning system based on the image correlation of two edge images in radiotherapy.

Method and Materials: Ninety-six head & neck images from eight patients undergoing proton therapy were compared with a digitally reconstructed radiograph (DRR) of planning CT. Two edge images, a reference image and a test image, were extracted by applying a Canny edge detector algorithm to a DRR and a 2D x-ray image, respectively, of each patient before positioning. The value for patient positioning was determined using an optimization algorithm based on an image correlation factor, which recognizes shifts between two edge images by translating and rotating the test image with respect to the reference image.

Results: In a simulation using a humanoid phantom, performed to verify the effectiveness of the proposed method, no registration errors were observed for given ranges of rotation, pitch and translation in the x, y and z directions. For real patients, however, there were discrepancies between the automatic positioning method and manual positioning by physicians or technicians. Using edged head coronal- and sagittal-view images, the average differences in registration between these two methods for the x, y and z directions were 0.10 cm, 0.09 cm and 0.11 cm, respectively, whereas the maximum discrepancies were 0.34 cm, 0.38 cm, and 0.50 cm, respectively. For rotation and pitch, the average registration errors were 0.96° and 1.25° , respectively, and the maximum errors were 3.6° and 2.3° , respectively.

Conclusion: The proposed automatic patient positioning system based on edge image comparison was relatively accurate for head & neck patients. However, image deformation during treatment may render the automatic method less accurate, since the test image may differ significantly from the reference image.