AbstractID: 1136 Title: Automatic Portal Image Based Patient Positioning for Radiotherapy

One of the objectives of external beam radiation therapy is to reproduce the patient setup for each fraction of the treatment process. We evaluated automatic registration of stereo portal images with digitally reconstructed radiographs (DRRs) generated from the pre-treatment CT dataset. Algorithms were developed to automatically determine the patient setup adjustment required to assure that the dose distribution delivered is as prescribed during treatment planning. Both geometric and radiometric calibrations were performed to generate high quality DRRs that can be compared against digital portal images acquired with 1-2 cGy prior to the treatment dose delivery. To gain computational efficiency a graphic processing unit (GPU) was used to generate the DRRs in approximately 20 ms. The optimization procedure involves comparing the generated DRRs with the acquired portal images. The optimization constituted a search algorithm through a six dimensional parameter space; 4 couch adjustments (vertical, lateral, transverse and rotation) and 2 setup parameters accounting for the patient tilt and roll. Comparative studies were performed on various similarity measures and optimization procedures. It was found, in a series of Rando phantom studies, that a simple similarity measure such as Local Normalized Correlation (LNC) achieves better than 1 mm repositioning accuracy. The optimization typically required several minutes; however software and hardware modification will significantly reduce this time. The plan is to correct patient setup errors by having the output from the optimization algorithm transferred automatically to the record and verify system for modification of the treatment couch co-ordinates prior to treatment dose delivery.