

AbstractID: 3865 Title: Validation of CT-Assisted Targeting (CAT) software for soft tissue and bony target localization

Purpose:

To evaluate the performance of an automatic CT-to-CT image registration algorithm for both soft tissue and bony targets.

Method and Materials:

CT-Assisted Targeting (CAT) software was developed for on-line CT-guided radiotherapy using a CT-on-rails system. The algorithm was tested in two phantom studies and cross-compared with other radiotherapy imaging techniques available in the same room. A BAT phantom (North American Scientific, Chatsworth) was intentionally shifted and imaged each time by (1) an electronic portal imaging device, (2) ultrasound, and (3) the CT-on-rails. A Rando pelvic phantom with imbedded gold markers for target localization using the ACCULOC™ software (Northwest Medical Physics Equipment) was also used. To test the software in patient images, 15 prostate cancer patients receiving 3 CT scans per week over 8 week's treatment were selected. The prostate was chosen as the soft tissue target and a bony structure in the pelvic region (excluding the femoral heads) was used as the bony alignment target. A total of 366 treatment-day CT images were registered using the CAT software and verified by a single observer.

Results:

The phantom studies demonstrated that the CAT software can achieve sub-millimeter accuracy in detecting the intended shifts and were generally agreed well with other established imaging modalities in this controlled phantom study. The CAT software also performed well in patient's CT images. The failure rate, as defined by greater than 3 mm differences between the automatic detected positions and the final positions adjusted by the human observer, was only 2.1 % for soft tissue target registration and 1.6% for bony target registration in 366 CT images. The automatic registration takes less than 12 seconds.

Conclusion:

We have designed a highly robust, accurate, and fast computer algorithm for CT-to-CT image registration. The software provides a quick and reliable application for CT-guided radiotherapy.