AbstractID: 3567 Title: Automatic seed detection in MVCT images for prostate radiotherapy

Purpose:
In radiotherapy treatment of prostate, a common approach to prostate localization for each treatment fraction is to insert several seeds into the prostate as a marker. The seeds are visually identified and aligned by the radiation therapist prior to treatment. Manual seed identification and registration is a time-consuming process, and the precision of the seed localization is on the order of voxels. We developed an algorithm that can detect the seeds automatically and achieve sub-voxel precision.

Method and Materials:
The CT number of the MVCT images was calibrated by matching their histogram to the reference KVCT image histogram. An edge-preserving image smoothing filter was applied to MVCT images of prostate. This filter can effectively remove the noise while preserving the edge of organs and seeds. After the noise was reduced, the images were scanned and a connected-threshold method was used to label isolated high-CT-number regions. These regions include seeds and bone structures. A seed classifier was designed based on the size and the mean CT-number of the region. The position of the seed was determined with sub-voxel accuracy by calculating the mass center of the seed assuming the CT-number corresponding to the mass density. The entire process is fully-automatic.

Results:
The algorithm was tested on 39 MVCT images, each containing three seeds. It achieved over 90% success rate in the detection of all three seeds without false-positive. When we restrict our search range within a box that encases the prostate, we achieve 100% success rate.

Conclusion:
We have demonstrated a fully-automatic, high-precision seeds detection algorithm that works very well in MVCT prostate images. The performance can be further improved if the MVCT image quality is better, or if we confine the seeds searching area to the prostate location.