

Purpose:

Deformable dose registration is a burgeoning use for deformable registration algorithms. By applying the deformation matrix generated from an anatomic registration to the dose matrix, it may be possible to sum patient doses across multiple treatment fractions. In certain clinical situations, such as HDR brachytherapy, obtaining a good registration is difficult. Improving the performance in such cases may be possible using only the anatomy of interest. Using the physician drawn contours to mask off areas outside the organs of interest can provide better registration results. With an improved registration, the doses can be added across fractions more accurately.

Methods:

Using a research version of the program ABAS (CMS Elekta Software, Maryland Heights, MO), a deformable registration was performed on image sets of a multi-fraction brachytherapy treatment. The quality of registration was examined by using the Dice Similarity Coefficient (DSC) values for bladder and rectum contours. A routine was written to automatically mask scans using bony anatomy and physician drawn contours. Registrations performed using the full patient CT scan were compared to registrations performed with a masked CT.

Results:

The focus of this study was the DSC values for bladder and rectum. Comparing these values for registrations performed with normal CT scans and masked CT scans demonstrates that masking can provide a much better registration. Patients with bladder DSC values of 0.38-0.74 improved to 0.94-0.99 with the masking technique. DSC values of 0.9 are commonly seen in cases of patients with well-contrasted bladder and rectal anatomy.

Conclusions:

Using a masking approach for deformable registration can greatly improve the registration results for HDR brachytherapy patients. Masking can be done automatically in seconds using physician drawn contours. Focusing a registration on the anatomical areas that are the most relevant to treatment may provide a superior deformable dose registration.