AbstractID: 12707 Title: Automatic deformable registration of Head & Neck CT and MVCBCT images for dose-guided radiotherapy

Purpose: To integrate deformable registration into the dose-guided radiotherapy (DGRT) workflow and use it for automatic adaptation of contours as well as correlating dose distributions for accumulating delivered doses.

Method and Materials: In our previously presented DGRT prototype MVCBCT images can be used for treatment dose recalculation and dose differences can be analyzed for individual fractions. We present the integration of a deformable registration framework into the prototype. Each MVCBCT can now be registered with its original planning CT. Different registration algorithms were integrated and studied, ranging from rigid registration to deformable methods, e.g. diffusive, curvature-based and elastic registration. Prior to registration the MVCB is pre-processed. To minimize artifacts at the MVCB boundaries it is stitched with the original planning CT which helps smoothing the deformation field outside the FOV of the MVCBCT. Resulting deformation vector fields are stored and can afterwards be used for warping the planning contours to the treatment datasets or for accumulation of treatment doses.

Results: A stable cord warping algorithm parameterization was found which was working for all treatment images for all 6 patients tested so far. Computation time for registration is below one minute. Due to low image quality we limited our first analysis to adaptation of spinal cord planning contours. Accuracy was validated against manual contouring results for the MVCB data. Tanimoto coefficient and Hausdorff distance are in the range of variability of manually drawn contours. The dose accumulation framework works though clinical validation is rather complex as no ground truth data is available.

Conclusion: Contour adaptation and dose accumulation was developed and feasibility of the methods was shown. The whole framework can be reused with other treatment imaging modalities, though algorithm configurations may need to be re-optimized. As a next step tools for verifying correctness of accumulated doses need to be developed.