

AbstractID: 7026 Title: Elastic registration incorporating prior knowledge of segmentation and points mapping

Registration of images acquired at different times during the treatment allows the quantitative monitoring of disease progression and regression. The "rigid body" assumption simplifies the registration process, but the techniques that use this assumption have quite limited applicability because many organs deform substantially. Internal organ deformation throughout the course of radiation therapy is problematic for accurately evaluating the cumulative dose delivered. Elastic registration is a technique to account for internal organ deformation.

In this work, two preprocessing steps were incorporated into elastic registration, namely reference based segmentation and automatic feature tracking. Reference based segmentation is the localization of the organ boundary in the target image based on the contour information in the reference image. Feature tracking describes the automated detection of features in the reference image and the tracking of them in the target image. A biomechanical model is used to describe organ deformation. We assign each region (based on segmentation) specific biomechanics parameters. A linear elastic model is used to construct a set of partial differential equations (PDE). The boundary mapping from the segmentation process is used as the boundary conditions of the PDE system and feature correspondence is modeled as body force. The PDE solver utilizes finite element methods.

Elastic registration was applied to CT images of a prostate patient. The results show, that registration based on local elastic transformations is appropriate to describe the local deformations in the prostate and the rectum. Similarity measures such as mutual information improved significantly after the registration.