DBP3: Head and Neck Cancer

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NA-MIC CMRO Meeting
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• 3D Slicer user group meeting at AAPM/COMP
• Tuesday, Aug 2, 2011
Specific Aims

1. Develop an open computational workflow for adaptive radiotherapy. We will develop a practical workflow for adaptive therapy planning that enables the registration of successive CT scans, segmentation of the tumor and the critical structures in CT, mapping of prior radiation plans onto new images, and planning of additional radiation therapy. We hypothesize that a flexible framework or workflow will enable an adaptive plan to be generated, reviewed, and ready for use within hours of acquisition.

2. Validate the accuracy of image analysis algorithms for radiotherapy. We will investigate and quantify the accuracy of automatic image registration and segmentation algorithms to establish spatial correspondences across consecutive CT scans and to delineate structures for radiation planning. We will adapt and compare the algorithms within NA-MIC Kit, and work with the Computer Science Core to develop novel segmentation and registration methods tailored to adaptive radiotherapy planning.

3. Evaluate the dosimetric gain of adaptive radiotherapy. Using CT images acquired from patients before treatment and at the mid-point during treatment, we will perform dosimetric comparisons of traditional radiotherapy and adaptive radiotherapy. We hypothesize that adaptive radiotherapy will result in a clinical gain in the probability of tumor control and/or a reduction in complication rate, as predicted by radiation dose-response models.
Anatomic Change

Pre-treatment

Mid-treatment
Anatomic Change

Pre-treatment

Mid-treatment
Implications of Anatomic Change
Algorithms

• Polina Golland, Amelia Arbisser (MIT)
  • Atlas-based segmentation

• Allen Tannenbaum, Ivan Kolesov (GT)
  • Shape-based segmentation
Engineering Plan

• Support for adaptive radiotherapy in NA-MIC

• Four goals
  – DICOM-RT interchange
  – Structure and dose warping
  – Interactive deformable registration
  – Plan review
DICOM-RT Interchange

- RT Dose
  - Dose in Gray
- RT Structure Sets
  - Polyline contours of organs of interest
- RT Plan
  - Beam arrangements
Structure Set Manipulation

- Overlapping structures
- Individual control of visibility, style
- Names and colors grouped with structures
Structure and Dose Warping

• Evaluate registration algorithms for CT
• Workflow for structure and dose warping
Interactive Deformable Registration

• Landmark-based method
• Make local corrections to registration results
Plan Review

- Isodose display
- Dose volume histograms (DVH)
- Dose comparison tools