AbstractID: 8431 Title: Exploring the spatial trade-off in treatment planning

Purpose:
To include spatial information during multi-criteria treatment planning. Particularly, to study whether constrained optimization on the voxel level allows to deliberately trade-off the dose delivered to one region of a volume of interest (VOI) with respect to other clinical goals.

Method and Materials:
We extended a stepwise optimization method for robotic radiosurgery to interactively modify dose constraints on a voxel level. The optimization problem is solved using linear programming, and every term in the objective function is matched by a corresponding constraint. Clinical goals are addressed separately and maintained using the constraints. A trade-off among the clinical goals is then explored by a series of optimization steps. For visualization, VOIs are represented by a 3D grid of spheres, where each sphere represents a voxel and can be selected in a 3D scene. Constraints on the dose in the selected voxels can be considered independently for subsequent optimization steps. The method was applied to a prostate case, where we studied trade-offs with respect to the maximum dose in the rectum.

Results:
Relaxing the upper dose bound on a set of voxels in the prostate lobes by 150 cGy allowed to reduce the maximum rectum dose by 100 cGy. Likewise, a relaxation of the lower dose bound on a few voxels on the prostate surface by 100 cGy allowed to further reduce the maximum dose in th rectum by 157 cGy.

Conclusion:
Spatial information is not available from cumulative statistics typically used as criteria for treatment planning. Our results indicate that it is possible to include spatial information in interactive multi-criteria optimization. The proposed method can be used when clinical goals can be expressed with respect to a subregion of a VOI.

Conflict of Interest (only if applicable):
Research partially sponsored by Accuray Inc.