AbstractID: 10592 Title: Incorporating prior knowledge into the segment optimization in segment-modulated arc therapy

Purpose: Recently, various stochastic algorithms have been applied to the segment modulated arc therapy (SMART) inverse planning. Most, if not all, algorithms are brute force trial-and-error search in nature without inclusion of *a priori* knowledge for segment position and shape. The purpose of this work is to provide an effective way to speed up the SMART planning process by incorporating dosimetric knowledge of the system into the segment shaping. **Methods**: The SMART inverse planning was performed in two steps. First, the maximum intensity map (MIM) was evaluated for each beam. The intensity of MIM is defined as the maximum intensity without violating the threshold dose of the organ-at-risks (OARs) located on the path of the beamlet. Based on MIM, a probabilistic map (MP) model was properly established which describes the probability for a beamlet to be open (=1) or close (=0). A rule of thumb is that a beamlet traversing sensitive OARs (which is *bad*) tends to have smaller chance to open and vice versa. Second, a SMART inverse planning was performed based on simulated annealing method. In each step, MP serves as a likelihood function for the trial change of a segment. With this likelihood, a bad segment tends to be rejected without spending valuable CPU-time to calculate the dose distribution and vice versa. **Results:** The proposed method was tested on a prostate case. A comparison of a prostate SMART planning with and without prior knowledge indicated that the computational efficiency was increased by a factor of ~4. Besides, it is observed better sparing of OARs is also achieved by using MIM-guidance. **Conclusion:** MIM information provides useful priors for the selection of potentially good segment shape and position and greatly facilitates the search for a set of optimal segments for SMART.