AbstractID: 1442 Title: Clinical Knowledge-Based Inverse Treatment Planning

An important issue in inverse planning is how to formalize the clinical goals to objectively evaluate the figures of merit of different treatment plans. Despite of intense effort in modeling the clinical decision-making strategies, appropriate form of the objective function for IMRT planning remains illusive. The purpose of this work is to develop a biologically more sensible yet clinically practical inverse planning framework and to bridge the gap between the clinical decision-making and computational modeling. In this formalism, the dose-volume effects for both tumor and sensitive structures were incorporated into the objective function using the concept of effective volume in the voxel domain[1]. The penalty now depends not only on the dose deviation from the desired value but also the dose-volume status of the involved organs, making it possible to use the existing clinical knowledge to guide the plan optimization. An inverse planning module based on the proposed formalism was implemented and applied to two prostate and a head-neck cases. The study shows that the incorporation of clinical knowledge can greatly facilitate the inverse planning process and allows us to obtain IMRT plans that would otherwise be unattainable. For the same target coverage, we found that the critical structure sparing was substantially improved for all the cases. Conversely, the dose to the target can be escalated greatly (~10%) while maintaining the toxicity at the current level. Thus the new technique should have significant potential for enhancing the therapeutic ratio.

[1]Kutcher, et al. Int. J. Radiat., Biol., Phys. 16 (6), (1989).