AbstractID: 8504 Title: Genetic optimizers and control of DMLC IMRT delivery to moving body anatomy

Genetic optimizers and control of DMLC IMRT delivery to moving body anatomy.

Purpose: A new treatment delivery method based on the control of the leaf-velocity and intensity-dose-rate for moving and deforming body anatomy during hypo fractionation and intensity modulated radiation therapy (IMRT) is presented. Since the organ motions are unavoidable, a proactive approach to utilize the organ motions is taken to lower the dose to sensitive structures without compromising the dose delivered to the target.

Method: Diverse criteria for quality of treatment can be utilized, some increasing the efficiency of treatment and minimizing overall radiation exposure while other decreasing cumulative dose distribution over organs at risk to minimize treatment toxicity. The solution strategies can lead to complex optimization processes, many supporting diverse landscapes of multiple local minima. Among few possible procedures leading to achieving global solutions, or satisfactory local solutions, we explore explicitly dynamical pathways that breed offspring control parameters that efficiently conform to optimal solutions. These so called genetic operations, such as reproduction, suppression, mutation, and the mating crossover lead to efficient solutions of our multi-parameter dynamic treatment optimization problems.

Results: By using the velocity of the leaves and the intensity dose rate as the control parameters in optimization we find a strategy that the dose delivered to the organ at risk can be reduced to 50% compare to the delivery based on static anatomy assumption.

Conclusion: We present strategies based on controlling the velocity of multi-leafs and intensity rate of beams that allow to redistribute beneficially the irradiation to the target and to organs at risk over subsequent phases of the body motion.