AbstractID: 6923 Title: Comparison between a deterministic and a stochastic optimizer in radiotherapy optimization

Two intrinsically different types of optimization algorithms – deterministic and stochastic algorithms have been extensively used in radiotherapy treatment planning optimization. However, they have never been systematically compared in regards to their performances in radiotherapy optimization. In our study we tried to evaluate the performance of the two algorithms as well as to obtain useful information about local/global optimal solutions to the radiotherapy optimization problem by comparing the optimal solutions obtained by the two algorithms that search through the solution space following different paths. A deterministic optimizer GAMS – CONOPT2 solver and a stochastic optimizer based on the fast simulated annealing algorithm were used in this study. Their general performance such as effectiveness in optimization, convergence speed, sensitivity dependence on initial guess, and convergence/optimization errors were compared. The two algorithms were tested with a quadratic and an exponential objective function either with or without hard dose constraints. The results show that the two algorithms generate similar optimal solutions in these cases. Small differences between the optimal solutions obtained from the two algorithms are found and analyzed. In future work, the tests of the two algorithms will be extended to include many other cases such as DVH constraints and radiobiological objective function like sigmoid shaped TCP/NTCP functions. This work serves to provide general guidelines about these two algorithms' performance in radiotherapy optimization.