

AbstractID: 9564 Title: A new leaf-sequencing algorithm using difference matrices reduces aperture number in IMRT

Leaf-sequencing in the Corvus (NOMOS, PA) planning system takes place after the optimization of the treatment plan. The Corvus leaf-sequencing algorithm generates a large number of apertures, which can result in significant treatment delivery time. We have developed, implemented, and tested on clinical data a new approach for a model of the intensity map decomposition problem that is solved in order to obtain leaf-sequencing. Specifically, we focus on minimizing the number of apertures in the decomposition, because for certain linacs the setup and transition times between apertures can dominate the actual radiation delivery time (beam-on time). The fast heuristic that we present utilizes the concept of difference matrices, which, roughly speaking, show differences between successive entries in a given matrix. These difference matrices provide an excellent mechanism for identifying and guiding the creation and extraction of "flat" regions of constant value in matrices. Such regions can then be exploited in the generation of shape matrices. Results for this heuristic for difficult head-and-neck and prostate clinical cases are described and contrasted with corresponding decompositions produced by the Corvus treatment planning system and by an approach based on a method of Boland, Hamacher and Lenzen that generates minimum beam-on time plans. Relative to these other approaches, our method shows improvements in segment counts of approximately 70%, 55% and 30% for the 5, 10 and 100 intensity level cases, respectively. We are currently further refining this heuristic and incorporating it within the Nested Partitions framework for global optimization.