AbstractID: 12915 Title: Arc Modulated Radiation Therapy Based on Linear Models

Purpose: The challenge for implementing promising Arc Modulated Radiation Therapy (AMRT) is its effectiveness of treatment planning tools to find optimal multileaf collimator (MLC) sequence and the fluence map. This study provides a new approach to the above challenge using linear models.

Method and Materials: AMRT is implemented with a three-step procedure. First, fluence maps for 36 fixed-gantry beams are generated using a linear-model based IMRT optimization algorithm. Second, the 2D fluence maps are decomposed into 1D fluence profiles, sorted according to each leaf pairs. These sorted fluence maps are referred to as Rotational Fluence Maps (RFMs). Third, a mixed integer linear model constructs the leaf motions of an arc delivery that reproduce the RFMs previously derived. The MLC sequence takes into account the starting and ending leaf positions in between the neighboring apertures, such that the MLC segments of the entire treatment plan are deliverable in a continuous arc.

Results: Patient studies with a prostate case and a neck-and-neck show that the AMRT can reproduce the 36-beam IMRT plan using 1 arc and 3 arcs with negligible dosimetrical variance. Furthermore, the HN AMRT plan is compared with the nine-beam IMRT plan that had been used for the patient treatment in the clinic (generated using the Varian Eclipse Treatment planning system). Consider the nine-beam IMRT plan as the gold standard, the AMRT plan shows comparable target coverage and ORA sparing. Hence, the AMRT plan can be considered a clinically acceptable IMRT plan.

Conclusions: A new inverse AMRT planning technique using linear models was developed for effective planning of IMRT treatment.

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