Seminar Series

INDUSTRIAL ENGINEERING

An Algorithm for Selecting High-Quality Coplanar or Non-Coplanar Beam Orientations for IMRT Treatments

Tuesday, October 23, 2012

12:30-1:20pm – Bell 2267

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In beam orientation optimization, a small number of beam positions must be selected that allow for both a high treatment plan quality and efficient deliverability, creating a large-scale combinatorial optimization problem. Our goal is to develop an efficient and effective method for selecting high-quality coplanar or non-coplanar beam orientations for IMRT treatments that explicitly incorporates the effect of this selection on the quality of the resulting optimal dose distribution. To this end, we propose a greedy heuristic for solving a model that integrates beam selection with the so-called fluence map optimization problem (which optimizes the dose distribution given a fixed set of beams). The algorithm iteratively adds beams to the model according to a dynamically updated attractiveness measure for each remaining candidate beam. We consider measures that are based explicitly on the optimal dose distribution corresponding to the currently selected set of beams. Several specific attractiveness measures are proposed that use either first-order or both first and second-order information. Performance of the algorithm was assessed on clinical data.

Troy Long's research is focused on treatment planning for radiation therapy. He has worked on lexicographic optimization for IMRT with an emphasis on sensitivity analysis. Currently he is working on beam orientation optimization for IMRT, as well as other low-cardinality optimization problems in radiation therapy treatment planning. He is a third-year PhD student at the University of Michigan and is interested in optimization, modeling, and algorithms with healthcare applications.

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