Ph.D. Thesis Defense Presentation

Large Scale Optimization Models and Algorithms in Healthcare Delivery

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Abstract

Many problems in healthcare delivery are very complex to solve. The primary goal of this dissertation work is to show the efficient use of optimization techniques (modelling and solution algorithms) to solve these highly complex non-convex problems. Two challenging problems are presented in this work. The first application is the blood donation tailoring problem to identify donation types and collect blood products. The contribution of this work was to include blood product type, donation type and blood type, simultaneously, that has not been well addressed in the literature. The second application is to optimize treatment plans in radiation treatment planning for cancer patients. The first part of this second application is to optimally determine the amount of radiation dose to kill tumor cells while minimizing damage to the surrounding healthy organs. Computationally efficient constrained optimization algorithms have been identified and explored. The second part is to optimally select beam angles in radiation treatment planning. This is a combinatorial optimization problem that is known to be NP-hard. Two new approaches have been studied: (1) a modified clique problem to generate a starting solution, followed by a local neighborhood search, and (2) a modified very-large scale neighborhood search algorithm. Details about the techniques and comparison results will be presented in my talk.