Abstract

Radiation therapy is a non-invasive treatment modality for cancer patients. Radiation therapy treatment planning for cancer patients provides many challenging optimization problems. Various variables of a treatment plan need to be optimized so that the resulting plan can kill all cancerous cells while minimizing damage on the patient’s normal tissues. Intensity modulated proton therapy (IMPT) has recently emerged as one of the most advanced radiation therapy modalities, and is being adopted by more and more cancer treatment facilities in the U.S. and the World. However, optimization methods that are specifically designed for IMPT treatment planning have not been well studied. Unlike conventional photon-based radiation therapies such as 3D conformal radiation therapy (3DCRT) and intensity modulated radiation therapy (IMRT), IMPT is highly sensitive to uncertainties and its optimization involves very large data sets. In addition, the biological effects of protons are greater in tissues. In this talk, we introduce three challenging optimization problems in robust IMPT and demonstrate how uncertainty incorporated models and high performance computing help selecting treatment variables including beam angles, proton energy levels, and intensity profiles. Furthermore, optimization models considering proton biological effects are discussed.
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Biography

Dr. Lim is the Chairman of Industrial Engineering and Hari and Anjali faculty fellow at the University of Houston. His research interests are in robust optimization, large-scale optimization models and computational algorithms, Operations Research applications in homeland security and healthcare systems. He was the recipient of the Pierskalla Best Paper award (INFORMS) for his pioneering work on Gamma Knife radiotherapy optimization for brain cancer patients while collaborating with researchers at U of Maryland School of Medicine, Baltimore, MD. As a well-published researcher in these areas, he has led numerous multi-institutional research projects of over $10M that have been funded by various federal, state, international, local agencies and industry partners. His current research projects include maritime security, emergency evacuation planning and management, radiation treatment planning, and CPU-based high performance computing. Dr. Lim was the chair of Bonder Scholarship committee for healthcare society of INFORMS, a past program chair for 2012 ISERC conference (FL) and serves as a member of INFORMS Chapter/Fora, a program Co-Chair of 2013 ISERC doctoral colloquium, an invited sessions chair for INFORMS 2015 conference, and a program chair for 2017 INFORMS annual conference. Dr. Lim received both his M.S. and Ph.D. degrees in industrial engineering from University of Wisconsin – Madison.