Industrial and Systems Engineering Seminar

Personalized Treatment Design: Application to Cervical Cancer

Wednesday, October 16

2:45 PM – Refreshments before the Seminar

3:00 PM – Graduate Seminar

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Professor

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Cervical cancer has a high mortality rate (approximately 35 percent) in the United States and is difficult to treat successfully. One promising treatment is high-dose-rate brachytherapy, which entails delivering high-dose radiation to the tumor via the temporary implantation of radioactive seeds. This treatment promises to be particularly effective in eradicating tumors, while preserving the organs. Yet, major obstacles to successful treatment remain, especially (1) determining the best seed type, spatial configuration of seeds, and seed dwelling time, and (2) improving the probability that the treatment will eliminate all malignant cells. We developed an advanced planning model to simultaneously address both of these issues. To permit taking advantage of the best available information, our model works with inputs from positron emission tomography. We begin with a multi-objective, nonlinear, mixed-integer programming model that is initially intractable. To solve the model, we introduce an original branch-and-cut and local-search approach that couples new polyhedral cuts with matrix reduction and intelligent geometric heuristics. The result has been accurate solutions, which are obtained rapidly. Clinical trials at Rush University Medical Center have demonstrated superior medical outcomes. These analytical techniques are applicable not only to cervical cancer, but also to other types of cancer, including breast, lung, and prostate cancer.

Bio: Dr. Lee works in the area of mathematical programming and large-scale computational algorithms with a primary emphasis on medical/healthcare decision analysis and logistics operations management.She tackles challenging problems in health systems and biomedicine through systems modeling, algorithm and software design, and decision theory analysis. Specific research areas include health risk prediction, early disease prediction and diagnosis, optimal treatment strategies and drug delivery, healthcare outcome analysis and treatment prediction, public health and medical preparedness, large-scale healthcare/medical decision analysis and quality improvement. **www2.isye.gatech.edu/~evakylee**