CENTER FOR
HEALTHCARE ENGINEERING & PATIENT SAFETY
UNIVERSITY OF MICHIGAN

Providing Better Healthcare Through Systems Engineering: Seminars and Discussions

Data-driven Greedy Policies and Information-Relaxation Bounds for Ambulance Location and Deployment

Lavanya Marla, PhD

Monday November 11 at 4:30PM in 1123 LBME

We present an efficient data-driven computational solution and bounding approach for static allocation of an ambulance fleet and its dynamic redeployment, where the goal is to position (or re-position) ambulances to bases to maximize the system's service level. Central to our approach is a discrete-event simulator to evaluate the impact of ambulance deployments to logs of emergency requests. We first model ambulance allocation as an approximately-submodular-maximization problem, and devise a simple and efficient greedy algorithm that produces both static allocations and dynamic repositioning policies. In parallel, we find data-driven information-relaxation bounds for both static and dynamic cases. We build even tighter information-relaxation bounds by penalizing the previous relaxations. Our approach allows the computation of tight bounds without incurring the curse of dimensionality common to such approaches. Our bounding methods help inform policymakers about the viability of proposed fleet sizes and policies being adopted by the contracted EMS agencies. Our computational experiments on an Asian city's EMS demonstrate the tractability and efficiency of our greedy algorithm and our bounding methods.

The first part of this work is with Ramayya Krishnan and Yisong Yue, and the latter part with Achal Bassamboo.

Lavanya Marla is an Assistant Professor in Industrial and Enterprise Systems Engineering at the University of Illinois at Urbana-Champaign. Prior to her current position, she was a Systems Scientist with the Heinz College at Carnegie Mellon University; and earned her PhD in Transportation Systems from MIT and Bachelors degree from IIT Madras. Her research interests are in robust and dynamic decision-making under uncertainty and game theoretic analysis for large-scale transportation and logistics systems; combining tools from data-driven optimization, statistics, simulation and machine learning. Her research is funded by an integrative National Science Foundation grant, a Department of Homeland Security cyber-security grant, the Department of Transportation, the US-India Educational Foundation, the INFORMS Transportation and Logistics Society and aviation companies. Her work has received an Honorable mention for the Anna Valicek award from AGIFORS, a best presentation award from AGIFORS, a KDD Startup Research award, and a Top-10 cited paper recognition from Transportation Research – Part A.

1123 LBME is room 1123 in the Ann & Robert H. Lurie Biomedical Engineering Building (LBME). The street address is 1101 Beal Avenue. A map and directions are available at: https://bme.umich.edu/about/maps-directions/.

This seminar series is presented by the U-M Center for Healthcare Engineering and Patient Safety (CHEPS): Our mission is to improve the safety and quality of healthcare delivery through a multi-disciplinary, systems-engineering approach.

For additional information and to be added to the weekly e-mail for the series, please contact genehkim@umich.edu.