IE Decision Systems Engineering
Spring '22 Seminar Series

Exact Algorithms for Distributionally Risk-Receptive Programs and Camera View-Frame Placement Problems: Applications in Homeland Security

Friday, April 29th 2022, 12:00pm-1:00pm AZ Time
Room: **BYENG 209**
Zoom link: https://asu.zoom.us/j/8120740932

Abstract

For many security applications, it is critical to make strategic long-term planning decisions with uncertain input data parameters that also allow adjustments based on risk-appetite of a decision maker. In the first half of this talk, we consider a distributionally risk-receptive network interdiction problem (DRR-NIP) where a leader maximizes a follower's minimal expected objective value for the best-case probability distribution belonging to a given set of distributions (referred to as ambiguity set). The DRR-NIP is applicable for network vulnerability analysis where a network user seeks to identify vulnerabilities in the network against potential disruptions by an adversary who is receptive to risk for improving the expected objective values. We present exact and approximation algorithms for solving DRR-NIP with a general ambiguity set. We also provide conditions for which these approaches are finitely convergent, along with results of our extensive computational experiments.

In the second half of the talk, we introduce a combinatorial optimization problem pertinent to network-based telerobotic cameras that enable decision makers to interact with a remote physical environment using shared resources. Specifically, we consider a system of p networked robotic cameras that receives rectangular subregions as requests from multiple users for monitoring. Each subregion (or request) has an associated reward rate that depends on the importance level associated with monitoring that subregion. Our goal is to select the best view frame (pan, tilt, and zoom) for the cameras with discrete or continuous resolutions to maximize the total reward from the captured parts of the requested subregions. We develop exact and approximation algorithms for solving this NP-hard problem. These optimal or near-optimal solutions provide information to decision makers to conduct surveillance and reconnaissance in environments where it is tedious for humans to collect information. We also present results of our computational experiments conducted to evaluate the performance of these algorithms.

Bio

Manish Bansal is an Assistant Professor with Grado Department of Industrial and Systems Engineering at Virginia Tech. He did Bachelors in Electrical Engineering from National Institute of Technology in India, and M.S. (with thesis) and Ph.D. from Department of Industrial and Systems Engineering at Texas A&M University. Prior to joining Virginia Tech, he was a postdoctoral fellow in Department of Industrial Engineering and Management Sciences at Northwestern University. He has served as president and vice-president of INFORMS Junior Faculty Interest Group during 2020-2022. He is serving as secretary of Engineering Faculty Organization at Virginia Tech. His research is focused on the theory of mixed integer programming, stochastic and distributionally robust optimization, and location science along with their applications in homeland security, logistics, and telerobotics. Currently, his research team has 4 PhD students and has received multiple grants from National Science Foundation and Department of Defense.

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