EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

Managing Hurricane Evacuation with Stochastic Dynamic Networks

ABSTRACT - This talk will focus on evacuation strategies when the underlying road network is dynamic and stochastic. It is dynamic in the sense travel times are changing over time and it is stochastic in the sense the underlying dynamics are uncertain but may be modeled with probability distributions using prediction data of an on-coming hurricane. Even though many practical guidelines have been developed by emergency management agencies, and many models have been developed by researchers, little of these explicitly consider the availability of predictive data and hence on proactive evacuation management strategies.

Short-notice disasters such as hurricanes involve uncertainties in many facets, from the time of its occurrence to its impacts' magnitude. These uncertainties and corresponding impacts during a storm event can quickly cascade. Hence, failure to incorporate these uncertainties can affect the effectiveness of the emergency responses. After a brief motivation and introduction, this talk will (a) first discuss a data-driven simulation model to that illustrates the cascading impacts of the a storm (winds, precipitation and storm surges) on evacuation demand from unsafe origins to safe destinations and impacts on physical networks, (b) develop models of stochastic dynamic networks and attendant algorithms for evacuation strategies, and (c) show some results of a case study based on data of Hurricane Irma in Florida in 2017. The simulation model provides means to represent uncertainty in storm's movement and possible levels of impact intensities including prediction of travel demand. Coupled with an underlying stochastic network infrastructure, the model/algorithms suggest routes and schedules to minimize the total flow time, or the makespan, of the evacuation process. Lastly, the case study compares the performance of our strategy with a system that plans for evacuation assuming a potential storm scenario.

Dr. Pitu B. Mirchandani
Professor
Dept. of Computing, Informatics, Decision Systems Engineering,
Arizona State University
AVNET Chair for Supply Chain Networks

SPEAKER BIO – Dr. Mirchandani [UCLA, BS/MS in Engineering; MIT, SM (Aero and Astro) and ScD in Operations Research] is a Professor of Computing, Informatics, Decision Systems Engineering and the AVNET Chair for Supply Chain Networks. He is the Director of the Advanced Traffic and Logistics Algorithms and Systems Laboratory (ATLAS), the Chief Scientist of the DHS Center for Accelerating Operations Efficiency, and a Senior Scientist at ASU's Global Institute of Sustainability. Mirchandani has extensive background in Optimization (including network optimization, AI, and complexity guaranteed heuristics), Predictive Analytics (including applied statistics, estimation methods and machine learning) and Stochastic Control. He has used his expertise to develop concepts of Dynamic Stochastic Networks and their management and control, and is interested in developing models and systems for making strategic/tactical/operational decisions in stochastic networked environments, with applications typically related to transportation and logistics. He is a Fellow of INFORMS and Fellow of IEEE.

USC Viterbi
School of Engineering
Daniel J. Epstein Department of Industrial and Systems Engineering

TUESDAY, NOVEMBER 3, 2020
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