USC Viterbi School of Engineering
Ming Hsieh Department of Electrical Engineering

Seminar Announcement

Traffic estimation for extreme congestion events

Monday November 30th
11 a.m. – 12 Noon
EEB132

Abstract: This talk will describe new approaches to monitor traffic for extreme congestion triggers ranging from incidents to city-scale disasters. While the field of traffic monitoring has advanced rapidly over the last several years due to falling sensing, communication, and computational costs, several holes remain which have high impact on operational efficiency and safety. This talk will describe potential solutions for monitoring extreme congestion events in terms of improved sensing technologies and better algorithms to extract information from the existing data streams.

First, we show the traffic state estimation problem can be linked to the traffic incident detection problem, resulting in a unified framework to solve both problems simultaneously. The joint problem is posed as a hybrid state estimation problem, and a multiple model particle filter is used to estimate the state while accommodating the nonlinearity and switching dynamics of the traffic flow model under incidents. Experiments on field data show the joint framework can improve both incident detection capabilities and post incident traffic state estimation.

Second, we will discuss estimation methods for the emerging problem quantifying the resilience of the city-scale traffic network to extreme events such as natural disasters using only GPS data readily available from taxis. The method works by estimating the hourly traffic state from the taxi data, then solving a low rank plus column sparse matrix decomposition problem on the traffic data matrix. Using a dataset of 697 million taxi trips in New York City, the analysis indicates that Hurricane Sandy impacted traffic conditions for more than five days and caused a peak delay of two minutes per mile. Practically, it identifies that the evacuation caused only minor disruptions, but significant delays were encountered during the post-disaster reentry process.

Bio: Daniel Work is an assistant professor in the Department of Civil and Environmental Engineering, the Department of Electrical and Computer Engineering (courtesy), and the Coordinated Science Laboratory at the University of Illinois at Urbana-Champaign. He earned a Bachelor of Science degree (2006) from the Ohio State University, and a Master of Science (2007) and Ph.D. (2010) from the University of California, Berkeley, each in civil engineering. Work was a guest researcher at Microsoft Research, Redmond in 2010 and a visiting researcher at Nokia Research Center, Palo Alto from 2008-2010 prior to joining the faculty at Illinois. His research interests are control, estimation, and optimization of transportation systems, mobile sensing, and inverse modeling & data assimilation. Prof. Work's honors and awards include the CAREER Award from the National Science Foundation (2014) The Faculty Fellow Award from the National Center for Super Computing Applications (2014), and the IEEE ITSS Best Dissertation Award (2011).

Host: Petros Ioannou