SEMINAR ANNOUNCEMENT

Invited Speaker: Marta Gonzalez

Date: Monday, February 27, 2017

Time: 10:45 – noon

Location: Rice Hall, Room 242

Host: Jon Goodall

Title: Data Science for Energy Efficiency of Cities

Abstract

I will cover the use of large data sets as a byproduct of human activity and how they can be used to help us to characterize energy demand to plan for the better usage of our resources.

In the first part, I address the congestion of roads. Billions of spatiotemporal call detail records (CDRs) collected from mobile devices create new opportunities to quantify and solve problems of congestion. However, there is a need for tools to map the new data meaningful onto the existing transportation infrastructure. First, I present the TimeGeo mobility framework to mine billions of calls and learn location transition probabilities of phone users. These transition probabilities are then up-scaled with demographic data to estimate origin-destination (OD) flows of residents between any two intersections of a city. I demonstrate that the percentage of time lost in congestion is a function of the proportion of vehicular travel demand to road infrastructure capacity, and can be studied in the framework of non-equilibrium phase transitions. This framework allows us to compare the feasibility of smart routing applications in five diverse cities.

In the second part, I evaluate the benefit of various electricity tariffs based on the profiles of electric consumption. We model energy consumption at urban scale from records of energy bills and smart meters’ data. The method entails the interplay between behavioral variables of residential energy consumption and the differences in economic benefits with the adoption of solar panels with and without batteries. Further, I study the coupling between power and transportation infrastructures through electric vehicles (EVs) charging. I couple estimates of EVs mobility with charging session data for the San Francisco Bay Area. I present various charging schemes and the impact of their arrival times, proposing a shifting of the charging activity to shave peak power load. Substantial savings are achievable based on our recommendations.

About the speaker:

Marta C. Gonzalez is Professor of Civil and Environmental Engineering; Director, Human Mobility and Networks Lab. She left Venezuela where she grew up to pursue a PhD in Computational Physics in Stuttgart Universitaet, as a selected fellow of the DAAD, the German agency for students’ exchange. Next, she moved to the U.S. to do a postdoc in the Barabasi Lab and initiated the study of patterns of human mobility with a complex systems’ perspective. She is currently Associate Professor of Civil and Environmental Engineering at MIT, joint with the Operations Research Center and the Center for Advanced Urbanism. With support from several companies, cities and foundations from around the world, her research team develops computational models to analyze digital traces of device-mediated interaction and to explore the use of urban infrastructures in relation to energy and mobility. Recent research uses billions of mobile phone records to understand the emergence of traffic gridlocks and the integration of electric vehicles in the power grid, records of smart meter data to compare policy of solar energy adoption, and credit card transactions to identify habits in spending behavior. Her research has been published in leading journals, including Science, PNAS, Nature and Physical Review Letters.