Title:

1. Human Activity Analysis using Smart Meters

2. Social Media Nested Epidemic Simulation via Online Semi-supervised Deep Learning

Speaker:

Chang-Tien Lu

Professor of Computer Science and Associate Director of the Discovery Analytics Center at Virginia Tech

Abstract:

Human Activity Analysis using Smart Meters：

Activity analysis disaggregates utility consumption from smart meters into specific usage that associates with human activities. It can not only help residents better manage their consumption for sustainable lifestyle, but also allow utility managers to devise conservation programs. Existing research efforts on disaggregating consumption focus on analyzing consumption features with high sample rates between 1Hz ~ 1MHz. However, many smart meter deployments support sample rates at most 1/900Hz, which challenges activity analysis with occurrences of parallel activities and lack of detailed consumption features. In this talk, I will present an unsupervised statistical framework for disaggregation on coarse granular water meter readings based on hidden Markov models. This framework explicitly formulates appliance characteristics and activity correlations, and has been deployed to serve over 300 pilot households in Dubuque, Iowa. The effectiveness of our approach will be demonstrated using both simulation and real world data. I will also discuss some interesting consumption patterns identified, positive behavior changes observed, and overall outcome studies.

Social Media Nested Epidemic Simulation via Online Semi-supervised Deep Learning：

Infectious disease epidemics such as influenza and Ebola pose a serious threat to global public health. It is crucial to characterize the disease and the evolution of the ongoing epidemic efficiently and accurately. Computational epidemiology can model the disease progress and underlying contact network, but suffers from the lack of real-time and fine-grained surveillance data. Social media, on the other hand, provides timely and detailed disease surveillance, but is insensible to the underlying contact network and disease model. In this talk, I will present a novel semi-supervised deep learning framework that integrates the strengths of computational epidemiology and social media mining techniques. Specifically, this framework learns the social media users' health states and intervention actions in real time, which are regularized by the underlying disease model and contact network. Conversely, the learned knowledge from social media can be fed into computational epidemic model to improve the efficiency and accuracy of disease diffusion modeling. I will describe an online optimization algorithm to substantialize the above interactive learning process iteratively to achieve a consistent stage of the integration, and demonstrate that our approach can effectively characterize the spatiotemporal disease diffusion, outperforming competing methods by a substantial margin on multiple metrics.

Bio:

Chang-Tien Lu is a Professor of Computer Science and Associate Director of the Discovery Analytics Center at Virginia Tech. He received his Ph.D. from the University of Minnesota at Twin Cities in 2001. He served as Program Chair of the 18th IEEE International Conference on Tools with Artificial Intelligence in 2006, and General Chair of the 17th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems in 2009 and the International Symposium on Spatial and Temporal Databases in 2017. He also served as Secretary (2008-2011) and Vice Chair (2011-2014) of the ACM Special Interest Group on Spatial Information (ACM SIGSPATIAL). His research interests include spatial databases, data mining, urban computing, and intelligent transportation systems. He has published over 140 articles in top rated journals and conference proceedings. His research has been supported by NSF, NIH, DoD, IARPA, VDOT, and DCDOT. He is an ACM Distinguished Scientist and Virginia Tech College of Engineering faculty fellow.