DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
UNIVERSITY OF SOUTHERN DENMARK, ODENSE

COMPUTER SCIENCE COLLOQUIUM

Travel Cost Inference from Sparse, Spatio-Temporally Correlated Time Series Using Markov Models

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IMADA's Seminar Room

Abstract:

The monitoring of a system can yield a set of measurements that can be modeled as a collection of time series. These time series are often sparse, due to missing measurements, and spatio-temporally correlated, meaning that spatially close time series exhibit temporal correlation. The analysis of such time series offers insight into the underlying system and enables prediction of system behavior. While the techniques presented in the paper apply more generally, we consider the case of transportation systems and aim to predict travel cost from GPS tracking data from probe vehicles. Specifi- cally, each road segment has an associated travel-cost time series, which is derived from GPS data.

We use spatio-temporal hidden Markov models (STHMM) to model correlations among different traffic time series. We pro- vide algorithms that are able to learn the parameters of an STHMM while contending with the sparsity, spatio-temporal correlation, and heterogeneity of the time series. Using the resulting STHMM, near future travel costs in the transportation network, e.g., travel time or greenhouse gas emissions, can be inferred, enabling a variety of routing services, e.g., eco-routing. Empirical studies with a sub- stantial GPS data set offer insight into the design properties of the proposed framework and algorithms, demonstrating the effective- ness and efficiency of travel cost inferencing.

In addition, I will give a brief overview of the REDUCTION project that motivates this work.

Host: Yongluan Zhou