Multidisciplinary Simulation, Estimation, and Assimilation Systems

Seminar Series

Dr. J. Nathan Kutz

Robert Bolles and Yasuko Endo Professor, Chair Applied Mathematics

Adjunct Professor of Electrical Engineering and Physics, University of Washington

Spatiotemporal Encoding/Decoding of Nonlinear Dynamics Using Compressive Sensing and Machine Learning

Abstract: Many high-dimensional complex systems often exhibit dynamics that evolve on a slow-manifold and/or a low-dimensional attractor. Thus we propose a data-driven modeling strategy that encodes/decodes the dynamical evolution using compressive (sparse) sensing (CS) in conjunction with machine learning (ML) strategies. L^2 based dimensionality reduction methods such as the proper orthogonal decomposition are used for constructing the machine-learned modal libraries (*encoding*) and sparse sensing is used to identify and reconstruct the low-dimensional manifolds (*decoding*). This technique provides an objective and general framework for characterizing the underlying dynamics, stability and bifurcations of complex systems. The integration of ML and CS techniques also provide an ideal basis for applying control algorithms to the underlying low-dimensional dynamical systems. The algorithm works equally well with experimental data and/or in an equation-free context, for instance by using dynamic mode decomposition or equation-free modeling in place of POD-type reductions.

Wednesday, June 19, 2013

11:00AM; Rm. 5-314

Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139

Host: Pierre F.J. Lermusiaux
http://mseas.mit.edu