Department of Electrical and Computer Engineering
UNIVERSITY OF WISCONSIN-MADISON

SEMINAR NOTICE

Thursday, April 12, 2018
4:00 – 5:00pm, RM 1610 EH

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Variational Formulations and Distributed Convex Optimization Methods for Modern Data Science Applications

Abstract: *The need to reason about uncertainty in large, complex, and multi-modal datasets has become increasingly common across modern scientific environments. The ability to transform samples from one distribution P to another distribution Q enables the solution to many problems in machine learning and has been actively pursued from theoretical, computational, and application perspectives. Performing such transformations, in general, still comprises computational difficulties, especially in high dimensions. Here, we consider the problem of computing such "measure transport maps" efficiently and at scale. Under the mild assumptions that P need not be known but can be sampled from, that the density of Q is known up to a proportionality constant, and that Q is log-concave, we provide a convex optimization problem pertaining to quadratically regularized relative entropy minimization. This criterion, inspired by variational formulations in non-equilibrium thermodynamics, allows for sequential construction of transport maps with exponential convergence in relative entropy. We show that the empirical risk minimization formulation with maps parametrized by polynomial chaos enables an ADMM algorithm, which can be implemented on GPUs, where all updates are parallelizable and only involve matrix algebra. We provide examples within the context of Bayesian inference, active learning, density estimation, and generative modeling associated with human physiologic monitoring and the MNIST dataset.*

Bio: *Todd P. Coleman received B.S. degrees in electrical engineering (summa cum laude), as well as computer engineering (summa cum laude) from the University of Michigan. He received M.S. and Ph.D. degrees from MIT in electrical engineering (minor in mathematics), and did postdoctoral studies at MIT in neuroscience. He is currently a Professor in the Department of Bioengineering at UCSD, where he directs the Neural Interaction Laboratory. Dr. Coleman's research is very multi-disciplinary, using tools from applied probability, physiology, and bioelectronics. His research spans from developing fundamental information theory and machine learning techniques to partnering with clinicians and solving important healthcare challenges. He has been selected as a National Academy of Engineering Gilbreth Lecturer, as a TEDMED speaker, and as a Fellow of the American Institute for Medical and Biological Engineering.*