Statistics SEMINAR

ABSTRACT:

Deducing the state or structure of a system from partial, noisy measurements is a fundamental task throughout the sciences and engineering. The resulting inverse problems are often ill-posed because there are fewer measurements available than the ambient dimension of the model to be estimated. In practice, however, many interesting signals or models contain few degrees of freedom relative to their ambient dimension: a small number of genes may constitute the signature of a disease, very few parameters may specify the correlation structure of a time series, or a sparse collection of geometric constraints may determine a molecular configuration. Discovering, leveraging, or recognizing such low-dimensional structure plays an important role in making estimation problems well-posed.

In this talk, I will propose a unified approach to transform notions of simplicity and latent low-dimensionality into convex penalty functions. This approach builds on the success of generalizing compressed sensing to matrix completion, and greatly extends the catalog of objects and structures that can be recovered from partial information. I will focus on a suite of data analysis algorithms designed to decompose general signals into sums of atoms from a simple---but not necessarily discrete---set. These algorithms are derived in a convex optimization framework that encompasses previous methods based on $l1$-norm minimization and nuclear norm minimization for recovering sparse vectors and low-rank matrices. I will provide sharp estimates of the number of generic measurements required for exact and robust recovery of a variety of structured models. These estimates are based on computing certain Gaussian statistics related to the latent model geometry. I will detail several example applications and describe how to scale the corresponding inference algorithms to very large data sets.

TITLE:
The Convex Geometry of Inverse Problems

SPEAKER:
Professor Ben Recht
Department of Computer Science
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TIME & PLACE:
Wednesday, September 7, 2011
Room 140 Bardeen
4pm

THE UNIVERSITY *of* WISCONSIN
MADISON

Cookies & Coffee @ 3:30p in Rm 1210 MSC