STANFORD UNIVERSITY

DEPARTMENT OF STATISTICS

DEPARTMENTAL SEMINAR

4:15 p.m., Tuesday, February 15, 2000
Sequoia Hall Rm. 200
(Cookies at 3:45 in 1st Floor Lounge)

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Curvelets and Statistical Linear Inverse Problems

The problem of recovering an input signal from noisy and linearly distorted data arises in many different areas of scientific investigation; e.g., noisy Radon inversion (tomography) is a problem of special interest and considerable practical relevance in medical imaging. We will argue that traditional methods for solving inverse problems – damping of the singular value decomposition (SVD) or cognate methods – behave poorly when the object to recover has edges.

We apply a new system of representation, namely, *the curvelets* in this setting. Curvelets provide near-optimal representations of otherwise smooth objects with discontinuities along smooth C^2 edges. Inspired by some recent work on nonlinear estimation, we construct a curvelet-based biorthogonal decomposition of the Radon operator and build estimators based on the shrinkage (or thresholding) of the noisy curvelet coefficients. We prove that the shrinkage can be tuned so that the estimator will attain, within logarithmic factors, the optimal estimation rate. In comparison, linear procedures – SVD included – obtain markedly suboptimal rates of convergence, as do 'wavelet-like' shrinkage methods.