DEPARTMENT OF STATISTICS AND BIOSTATISTICS

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Sparse recovery from binary or saturated measurements

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3:20 – 4:20pm
Light refreshments will be served
110 Frelinghuysen Road

Abstract I will discuss some extensions of the compressive sensing theory to the case where the measurements are not linear. In particular, I will focus on three related topics: one-bit compressive sensing of dictionary-sparse signals, exponential decay of the recovery error from binary measurements, and sparse recovery from saturated measurements. In the first scenario, signals $f \in \mathbf{R}^n$ are acquired through the one-bit measurements $y = \mathrm{sgn}(Af) \in \mathbf{R}^m$ for some realization of a Gaussian matrix $A \in \mathbf{R}^{m \times n}$. Under the assumption that the analysis coefficient vector $D^\top f$ is effectively s-sparse for some tight frame $D \in \mathbf{R}^{n \times N}$, I will show how convex optimization and hard thresholding can be used to accurately recover (the direction of) f only from the knowledge of y when the oversampling factor $\lambda := m/(s\log(n/s))$ grows. In the second scenario, in which $D = I_n$, I will show that an adaptive choice of thresholds $\tau_1, \ldots, \tau_m$ in the binary measurements $y = \mathrm{sgn}(Af - \tau) \in \mathbf{R}^m$ can drastically improve the decay rate of the recovery error from polynomial to exponential in λ. In the third scenario, in which $D = I_n$ again, I will introduce a hybrid setting that bridges the standard and one-bit compressive sensing frameworks. Precisely, the measurements take the form $y = \mathcal{S}(Af)$, where the saturation function $\mathcal{S}$ acts as the identity if its input is below a certain level and saturates to this level otherwise. With a Gaussian measurement scheme and a recovery scheme based on ℓ_1-minimization, I will justify rigorously the intuition that sparse signals of small magnitude are exactly recoverable and that sparse signals of larger magnitude are accessible through more than just their directions.

.**Bio:** Simon Foucart works in computational approximation theory in high dimensions, seeking to make connections among classical approximation theory, sparse and structured recovery, scientific computing, and applications in engineering and bioinformatics. He holds a PhD from Cambridge, has recently won the Best Paper Award from the Journal of Complexity, and, after stints at Drexel and the University of Georgia, is currently an Associate Professor of Mathematics at Texas A&M University.