Fundamental limits of computational super-resolution with sparse priors

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The problem of computational super-resolution is to recover the fine details of an unknown object from inaccurate measurements of inherently low resolution. It is an inverse problem of great theoretical and practical interest with diverse applications in optics, imaging, inverse scattering, signal processing, and data analysis.

In this talk I will discuss recent progress on establishing computational limits for the problem of super-resolution under sparsity constraints below the classical Rayleigh-Nyquist limit. Under the assumption that the signal can be modeled by a small number of point sources, we derive optimal recovery results, showing in particular that sub-Rayleigh accuracy is possible provided that the local signal complexity can be effectively controlled. I will also mention ongoing work on looking for optimal algorithms, and extending the theory to sparse deconvolution problems, higher dimensions and manifolds.