Going off the grid

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We often model signals from the physical world with continuous parameterizations. Unfortunately, continuous models pose problems for the tools of sparse approximation, and popular discrete approximations are fraught with theoretical and algorithmic issues. In this talk, I will propose a general, convex-optimization framework---called atomic-norm denoising----that obviates discretization and gridding by generalizing sparse approximation to continuous dictionaries.

As an extended example that highlights the salient features of the atomic-norm framework, I will highlight the problem of estimating the frequencies and phases of a mixture of complex exponentials from noisy, incomplete data. I will demonstrate that the atomic-norm denoising problem can be solved via semidefintie programming and is intimately related to standard relaxations of polynomial optimization. The proposed algorithm outperforms state-of-the-art spectral and sparse-approximation methods in both theory and practice. I will close with a discussion of additional applications of the atomic-norm framework including deconvolution, deblurring, and system identification.

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