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Nonconvex compressive sensing: getting the most from very little information.

In this talk we'll look at the exciting, recent results showing that most images and other signals can be reconstructed from many fewer data than previously thought possible, using simple, efficient algorithms. A consequence has been the explosive growth of the new field known as compressive sensing, so called because the results show how a small number of measurements of a signal can be regarded as tantamount to a compression of that signal. The many potential applications include reducing exposure time in medical imaging, inferring the state of infrastructure networks from measurements taken at a limited number of nodes, and reducing the data storage/transmission/processing burden on deployed sensor systems.

We'll see how substituting a nonconvex objective function (such as the ℓ^p quasinorm, with $p < 1$) into the convex optimization problem typically used in this field has the effect of reducing still further the number of measurements needed to reconstruct a signal. A very surprising result is that simple algorithms, designed only for finding one of the many local minima of the optimization problem, typically find the global minimum. In this talk we'll look at examples, algorithms, and theory. (Received September 20, 2009)