Exploiting Sparsity in Signal Acquisition, Separation and Processing

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Sparsity has become one of the latest buzz words in signal processing, statistics and machine learning. It provides a notion of parsimony often termed Ockham's razor. In signal processing this is realized through the use of sparse representations to describe signals that have an underlying simple structure and these have been employed to solve a number of important signal processing problems. For example, such models can be used to acquire signals from limited measurements, or to separate out mixtures of multiple signals.

At the heart of such problems often lies a simple linear system of equations $Ax=y$, but one where we have an infinity of potential solutions due to its underdetermined form. Sparsity based methods aim to find a good solution to such problems by seeking a sparse feasible or approximate solution. This raises the question of when these problems can be successfully inverted, both theoretically and in practice. Here the recently developed theory of compressed sensing been able to shed light on the solution to such problems and their links to notions of low distortion embedding of sparse signal sets.

This talk will review the main ideas behind sparse signal models and compressed sensing and highlight their application to source separation, subNyquist sampling, compressive imaging and beyond.