Sparsity and Inverse problems

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Abstract

Adding an ℓ^1-constraint or penalization in order to promote sparsity is a well-established custom among statisticians. In finite dimensions, it has been proved recently that, for certain types of matrices A, the inverse problem of recovering sparse vectors x from (noisy versions of) their images Ax can be solved in a stable manner, even if A has a large null space, by means of such ℓ^1-constraints or penalizations. This special class of operators cannot be generalized to spaces that are infinitely-dimensional. Yet even in separable infinite-dimensional Hilbert spaces, ℓ^1-penalization turns out to provide a regularization procedure for ill-posed or ill-conditioned linear inverse problems. After introducing the general framework, the talk will discuss various algorithms that can be used for such ℓ^1-constrained or penalized inverse problems, and point to several applications.