

Regularization Methods for Linear Inverse Problems with Sparse Constraint

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In this talk, we consider the linear inverse problems of recovering a sparse vector from noisy measurement data. Two different class of regularization methods are proposed: iterative regularization method and variational regularization method. For iterative regularization method, we showed that ADMM method is a regularization method, which explained why ADMM works well for the image deblurring problem. For the variational regularization method, we provided an algorithm of primal-dual active set type for a class of convex/nonconvex sparsity-promoting penalties. A novel necessary optimality condition for the global minimizer using the associated thresholding operator is derived. Upon introducing the dual variable, the active set can be determined from the primal and dual variables. This relation lends itself to an iterative algorithm of active set type which at each step involves updating the primal variable only on the active set and then updating the dual variable explicitly. This approach can also extend to the group sparse model. Numerical examples are given to validate the theoretical results.