James Nagy

Efficient Iterative Solvers for Nonlinear Least Squares Problems in Imaging Applications

Mathematics and Computer Science Department
Emory University
400 Dowman Drive
Suite W401
Atlanta
GA 30322
nagy@mathcs.emory.edu

In this talk we consider large-scale separable nonlinear least squares problems that arise in image processing applications. We use a Gauss-Newton method for the nonlinear solver, and LSQR for the associated linear systems. Two important issues need to be considered: how to incorporate regularization (the underlying continuous problem is ill-posed), and how to efficiently handle large scale linear solvers with the Jacobian matrix. This latter issue is essential to making it worth using a Gauss-Newton method. We discuss these issues in the context of a specific imaging application called multi-frame blind deconvolution. We show that the Jacobian, though dense, has an interesting structure that allows for very efficient matrix-vector multiplications, as well as for construction of effective preconditioners.