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On Lipschitzness of the solution mapping for LASSO programs

Compressed sensing theory explains why LASSO programs recover structured high-dimensional signals with minimax order-optimal error. Yet, the optimal choice of the program's tuning parameter is often unknown in practice. It has not been fully clarified how variation of the governing parameter impacts recovery error in compressed sensing, which is otherwise provably stable and robust. We present a novel upper bound on the Lipschitz constant for the solution mapping of the unconstrained LASSO with respect to its tuning parameter, using tools from variational analysis. We show how this bound behaves in the setting of subgaussian measurement matrices with gaussian noise and contrast it against recent asymptotic results for parameter sensitivity in constrained LASSO and basis pursuit. In particular, we demonstrate that informed selection of a LASSO program can avoid sensitivity issues.