Preconditioning for consistency in sparse inference

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Preconditioning is a technique from numerical linear algebra that can accelerate algorithms to solve systems of equations. In this pa per, we demonstrate how preconditioning can circumvent three stringent assumptions for various types of consistency in sparse linear regression. Given X and Y, that satisfy the standard regression equation, this paper demonstrates that even if the design matrix X does not satisfy the irrepresentable condition, the restricted eigenvalue condition, or the restricted isometry property, the design matrix FX often does, where F is a preconditioning matrix defined in this paper. By computing the Lasso on (FX,FY), instead of on (X, Y), the necessary assumptions on X become much less stringent. Crucially, left multiplying the regression equation by F does not change β, the vector of unknown coefficients.