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The Lasso, correlated design, and improved oracle inequalities

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We study high-dimensional linear models and the ℓ_1 -penalized least squares estimator, also known as the Lasso estimator. In literature, oracle inequalities have been derived under restricted eigenvalue or compatibility conditions. In this paper, we complement this with entropy conditions which allow one to improve the dual norm bound, and demonstrate how this leads to new oracle inequalities. The new oracle inequalities show that a smaller choice for the tuning parameter and a trade-off between ℓ_1 -norms and small compatibility constants are possible. This implies, in particular for correlated design, improved bounds for the prediction error of the Lasso estimator as compared to the methods based on restricted eigenvalue or compatibility conditions only.

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