

# Shrinkage Estimation of a Univariate Normal Mean

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It is well-known that there is no Stein phenomenon in dimensions one and two; cf. Stein (1956). In a linear regression setting, we study estimation of the mean of a new response given the corresponding new explanatory variables and a training sample. When the explanatory variables are held fixed, an estimator based on the James-Stein estimator performs poorly when compared to the maximum likelihood estimator in terms of worst-case risk. But on average (with respect to the new explanatory variables), this univariate James-Stein-based estimator dominates the maximum likelihood estimator, irrespective of the unknown parameters. We give an explicit finite-sample analysis of this phenomenon and find, in particular, that shrinkage estimation has certain attractive properties, even when the goal is estimation of a univariate normal mean.