Dear Editors,

We are submitting our research article “Oracle inequalities for hyper-parameter selection via split-sample validation with applications to penalized regression “ for consideration in the Annals of Statistics.

Our manuscript considers model-estimation procedures where the hyper-parameters are tuned using split-sample validation. Up to now, it is unknown how the generalization error of a model grows as the number of hyper-parameters increases. To address this open question, we establish finite-sample oracle inequalities and show that the error incurred from tuning hyper-parameters shrinks at nearly a parametric rate under sufficient regularity conditions. For semi- and non-parametric regression settings, this additional error is negligible compared to the error of the model-estimation procedure itself; for parametric regression settings, the error from adding a hyper-parameter is roughly on the same order as adding a parameter to the model itself.

We then specialize our oracle inequalities to characterize the performance of penalized regression methods as the number of penalty parameters increases. Again we show that the error rate from tuning penalty parameters shrinks at a near-parametric rate. Our results imply that regularization methods with many penalty parameters can produce effective models and that more exploration into such methods is warranted.

We believe our paper will be of interest to readers of Annals of Statistics. There is currently very little theoretical work on the performance of model-estimation procedures as the number of hyper-parameters grows, even though many new computational methods have been developed to tune hyper-parameters efficiently. Our paper addresses this gap in the literature.

Sincerely,

Jean Feng

Noah Simon