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Robust and generalized nonparametric regression

Wavelet thresholding is an effective technique to take advantage of sparsity in the wavelet domain in many nonparametric function estimation problems. Much of the theory and methodology is focused on the case of additive Gaussian noise. In such a setting many wavelet thresholding methods have been developed and shown to be highly adaptive.

In this talk we consider robust nonparametric regression, where the noise distribution is unknown and possibly heavy-tailed, and generalized nonparametric regression in exponential families which include, for example, Poisson regression, binomial regression, and Gamma regression. We take a unified approach of using a transformation to convert each of these problems into a standard homoskedastic Gaussian regression problem. Then in principle any good nonparametric Gaussian regression procedure can be applied to the transformed data. We use a wavelet block thresholding procedure to illustrate our method and show that the resulting estimators are adaptively rate-optimal over a range of Besov Spaces. The procedure is easily implementable.

A key technical step is the development of a quantile coupling theorem that is used to connect our problem with a more familiar Gaussian setting.