MARS via LASSO

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Abstract:

MARS is a popular method for nonparametric regression introduced by Friedman in 1991. MARS fits simple nonlinear and non-additive functions to regression data. We propose and study a natural LASSO variant of the MARS method. Our method is based on least squares estimation over a convex class of functions obtained by considering infinite-dimensional linear combinations of functions in the MARS basis and imposing a variation based complexity constraint. We show that our estimator can be computed via finite-dimensional convex optimization and that it is naturally connected to nonparametric function estimation techniques based on smoothness constraints. Under a simple design assumption, we prove that our estimator achieves a rate of convergence that depends only logarithmically on dimension and thus avoids the usual curse of dimensionality to some extent. We implement our method with a cross-validation scheme for the selection of the involved tuning parameter and show that it has favorable performance compared to the usual MARS method in simulation and real data settings.