Scaling Up Bayesian Model Averaging

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Abstract

Bayesian model averaging (BMA) for the linear regression problem with $p$ correlated predictors requires calculations on the order of $2^p$, prohibiting enumeration of the model space for moderate to large $p$. With orthogonality of the columns of the design matrix, the number of calculations can be reduced to order $p$. In most real applications, the variables of interest are not orthogonal. One can, however, augment the original design matrix by adding rows, so that the resulting "complete" design matrix has mutually orthogonal columns. The introduction of the complete design and latent variables for the augmented responses, combined with Rao-Blackwellization, leads to an order $p$ implementation for BMA. As formulated, the solution for the augmented design matrix is not unique. We consider several strategies using ideas from experimental design to create the augmented design matrix.