Bayesian Sufficient Dimension Reduction via Modeling Joint Distributions

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Abstract: This work develops a novel method to estimate the central subspace in the sufficient dimension reduction problem. By modeling the joint distribution of the projected predictive variables and the response variable, we can assess the likelihood of a specific projection subspace and the corresponding joint distribution, thus estimate both simultaneously. The main difficulty of this approach is that the parameter space is extremely large. Therefore, the Markov chain converges slowly. We develop an efficient sampling method for this model and enable the computation time comparable with other iterative methods. This joint modeling approach is capable of detecting complicated relationships between predictors and the response. And we can do posterior inference rather than just point estimations in the Bayesian framework. These advantages are confirmed in simulation studies.