Department of Statistics

DISSERTATION PROPOSAL

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Convergence Rate of Variational Inference and Its Application to a General Model

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ABSTRACT

The first part of my study is to derive the convergence rates of variational posterior distributions for nonparametric and high-dimensional inference. We formulate general conditions on prior, likelihood, and variational class that characterize the convergence rates. Under similar "prior mass and testing" conditions considered in the literature, the rate is found to be the sum of two terms. The first term stands for the convergence rate of the true posterior distribution, and the second term is contributed by the variational approximation error. For a class of priors that admit the structure of a mixture of product measures, we propose a novel prior mass condition, under which the variational approximation error of the generalized meanfield class is dominated by convergence rate of the true posterior. We demonstrate the applicability of our general results for various models, prior distributions, and variational classes by deriving convergence rates of the corresponding variational posteriors. The second part of my study is to propose a proper prior and an algorithm for a general linear structured model. We showed that by putting proper 1-norm prior and apply variational algorithm, the variational posterior will have a nearly minimax rate subject to a logarithm term due to practical computational issue.
