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Doubly Geometry-Informed Variational Bayes

Increasingly complicated models in modern statistics have called for more efficient Bayesian estimation methods. This work develops a Variational Bayes algorithm that exploits both the information geometry of the manifold of probability distribution functions and the manifold structure of the variational parameters. The information geometry of the manifold of probability distributions results in the natural gradient which is the steepest ascent on this manifold. Utilising the manifold structure of the variational parameters leads to an efficient non-linear optimization technique that takes into account the constraint structure of the parameter space. The convergence of the proposed algorithm is theoretically guaranteed and its performance is tested on several challenging examples including deep neural networks.