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A MONTE CARLO METHOD FOR AN OBJECTIVE BAYESIAN PROCEDURE

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Abstract. This paper describes a method for an objective selection of the optimal prior distribution, or for adjusting its hyper-parameter, among the competing priors for a variety of Bayesian models. In order to implement this method, the integration of very high dimensional functions is required to get the normalizing constants of the posterior and even of the prior distribution. The logarithm of the high dimensional integral is reduced to the one-dimensional integration of a certain function with respect to the scalar parameter over the range of the unit interval. Having decided the prior, the Bayes estimate or the posterior mean is used mainly here in addition to the posterior mode. All of these are based on the simulation of Gibbs distributions such as Metropolis' Monte Carlo algorithm. The improvement of the integration's accuracy is substantial in comparison with the conventional crude Monte Carlo integration. In the present method, we have essentially no practical restrictions in modeling the prior and the likelihood. Illustrative artificial data of the lattice system are given to show the practicability of the present procedure.

Key words and phrases: ABIC, Bayesian likelihood, posterior mean, ϕ- and ψ-statistic, Gibbs distribution, hyper-parameters, Metropolis' algorithm, normalizing factor, potential function, type II maximum likelihood method.