

Bayesian model choice as a classification problem

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The marginal likelihood (also called the evidence) plays a central role in Bayesian model selection. It is defined as the integral over the parameter space of the likelihood times the prior density. We show that this integration problem can be rewritten as a classification problem. We consider the two cases where the calculation of the likelihood is tractable or not. When the likelihood function is available in closed form, we adapt the noise-contrastive estimation method introduced by Gutmann and Hyvarinen (2012). The calculating of the integrated likelihood is reduced to the estimation of the intercept of a well-chosen logistic regression model. When the likelihood function is intractable we highlights the effectiveness of the Approximate Bayesian Computation with Random Forests strategy introduce by Pudlo et al. (2016).

Gutmann, M. and Hyvarinen, A. (2012) Noise-Contrastive Estimation of Unnormalized Statistical Models, with Applications to Natural Image Statistics. *Journal of Machine Learning Research* 13, 307-361

Pudlo, P., Marin, J.-M., Estoup, A., Cornuet, J.-M., Gautier, M. and Robert, C.P. (2016) Reliable ABC model choice via random forests. *Bioinformatics*, 32, 6, 859–866