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Divergence Based Priors for Objective Bayesian Model Selection

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One of the main difficulties for objective Bayesian model selection is that usual objective priors can not be used, since they are improper. They can be used for parameters occurring in all of the models and having the same meaning across models, but otherwie *proper* priors have to be used. This is true in particular for the 'extra' parameter(s) in the alternative hypothesis.

There are several methods to derive objective but proper prior for model selection. One of the most popular is Jeffrey's proposal, later generalized by Zellner and Siow, for the Normal Linear models context. Less known is that Jeffreys pointed some ideas to extend this prior to general scenarios, perhaps because it was not really pursued, and Jeffrey's first attempt was not very succesful.

In this talk we follow Jeffrey's hint and develop (objective) proper prior distributions for hypothesis testing and model selection based on measures of divergence between the competing models; we call them *divergence based* (DB) priors . DB priors have simple form and are shown to have desirable properties, like information (finite sample) consistency; often, they are similar to other existing proposals like the intrinsic priors; moreover, in normal linear models scenarios, they exactly reproduce Jeffreys-Zellner-Siow priors. Most importantly, in challenging scenarios such as irregular models and mixture models, the DB priors are well defined and very reasonable, while alternative proposals are not. We derive approximations to the DB priors as well as MCMC and asymptotic expressions for the associated Bayes factors, which also reveals interesting connections with other proposals (like the unit information priors). The paper is available at http://ftp.stat.duke.edu/WorkingPapers/06-23.pdf