A New Bayesian Information Complexity and Model Selection Criteria

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Abstract

This paper studies information complexity (ICOMP) criterion of Bozdogan (1990, 1994, 2000) within a Bayesian framework in maximizing a posterior expected utility. We consider the Kullback-Leibler (KL) (1951) distance between the posterior and the prior densities for a model and use this as one of our utilities U_1. We define another utility U_2 to be the complexity of the estimated inverse-Fisher information Matrix (IFIM) of the model. We combine these two utilities in constructing the log of the posterior expected utility and in deriving a new Bayesian Information Complexity (*Bayesian ICOMP*) criterion. Further, we introduce another new *Bayesian Model Selection (BMS) criterion* of Bozdogan and Ueno (2000) by using a different asymptotic approximation of the *posterior distribution* of a model for a given finite sample of *n* observations. These two new criteria can be applied to both *Frequentist* and *Bayesian* approaches to model selection using maximum likelihood estimation. The derivation of *Bayesian ICOMP* and *BMS* can be achieved under both correctly and misspecified models. In general, we do not need to assume that the true distribution belongs to the specified parametric family of probability density functions (p.d.f.'s) as in classic Akaike's (1973) *AIC*. We illustrate the practical utility and the importance of these new model selection criteria by providing a real as well as several Monte Carlo simulation examples in subset selection of variables in multiple regression analysis under the colinearity of variables to choose the *"best"* subset model; and in Bayesian factor analysis in choosing the number of factors. Other applications are also discussed.

References

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