On an Expression of Generalized Information Criterion

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Abstract

Choosing a model selection criterion for model search when there present many candidate models can be a controversy. This is not a surprise as different criteria are derived with different objectives in mind. However, it is generally agreed that the Bayesian Information Criterion (BIC) and its generalized version, the Generalized Information Criterion (GIC) possess the consistency property as opposed to others such as the Akaike Information Criterion (AIC). In this paper, we suggest a particular expression of the GIC as replacing $\log N$ in the penalty term of the BIC with $(\log N)^r$, $r > 0$. Justifications from the Bayes Factor point of view are provided. The strong consistency property of the proposed criterion is established. Our consistency results include the consistency of selecting the closest model when the true model is not presented and the consistency of selecting the true model with the smallest model dimension when there are more than one true models are presented. In applications of linear regression models where it has been reported that the BIC results in underfitting while the AIC causes overfitting, we suggest a choice of $r = 0.5$. Discussions of the choice and simulation studies are provided.