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Conditions for Consistency of a Log-likelihood- Based Information Criterion in High-Dimensional Multivariate Linear Regression Models under the Violation of Normality Assumption

In this paper, we clarify conditions to satisfy a consistency of an information criterion, which is defined by adding a penalty term to negative twofold maximum log- likelihood, in multivariate linear regression models with normality assumption, when the dimension of response variables and the sample size are large, and the normality assumption is violated. The conditions are derived from the high-dimensional asymptotic framework, such that the dimension of the response variables and the sample size are approaching ∞. The conditions indicates the consistency properties of AIC and bias-corrected $\mathrm{AIC}_{\mathrm{c}}$. Moreover, it turns out that BIC and consistent AIC (CAIC) are not always consistent model selection criteria when a high-dimensional asymptotic framework is used. The consistency property is also checked numerically by conducting a Monte Carlo simulation.