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An Adaptive Selection Criterion for Spline Smoothing

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Abstract

In nonparametric regression, smoothing splines are a popular method for curve fitting, in which selection of the smoothing parameter is crucial. In the past, there are many scholars who proposed various criteria for selecting the smoothing parameter, such as Mallows' C_p , generalized maximum likelihood (GML), and the extended exponential (EE) criterion. Although C_p has been shown to be asymptotically optimal under the squared error loss (Li 1986), Kou and Efron (2002) utilized a geometric approach to show that C_p has a higher variability than GML and EE for small to moderately large sample sizes. On the other hand, GML and EE are more stable than C_p , but they do not possess the same asymptotic optimality as C_p . Therefore, an adaptive selection criterion would be proposed which is superior and more stable than C_p for small to moderately large sample sizes, and possesses the same asymptotic optimality as C_p .

Key words : Effective degrees of freedom; Generalized degrees of freedom; Nonlinear estimate; Selection variability; Stein's unbiased risk estimate