INFORMATION CRITERION FOR FIRTH-TYPE PENALIZED PARTIAL LIKELIHOOD IN COX REGRESSION

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The phenomenon of monotone likelihood is observed in the fitting process of a Cox model if the likelihood converges to a finite value while at least one parameter estimate diverges to ±infinity. Heinze and Schemper (2001) proposed a solution for this problem: they applied Firth's penalized partial likelihood (which is proposed to remove asymptotic bias in the maximum likelihood estimator), and proposed a maximum penalized likelihood estimator, a profile likelihood confidence interval, and a likelihood ratio test. However, the model selection criteria for Firth's penalized partial likelihood have not been studied. Moreover, the SAS PHREG Procedure gives –2log(maximum penalized partial likelihood) + 2p where p is the number of model parameters, but this quantity is not adequate for model selection, because the penalized log partial likelihood is not an estimator for the expected log partial likelihood.

Therefore, we propose an information criterion based on AIC, and evaluate its performance in numerical simulations.

References

1. Heinze G, Schemper M. A solution to the problem of monotone likelihood in Cox regression. *Biometrics* 2001; **57**: 114–119.