Penalized Likelihood Approach to Variable Selection Using Cox's Regression in Nested Case–Control Studies

I-Shou Chang*, National Health Research Institutes, Taiwan
Cheihui Wang, National Tsing-Hua University, Taiwan
Chao A. Hsiung, National Health Research Institutes, Taiwan
Howard Pan, National Central University, Taiwan

Abstract

Nested case-control sampling is designed to reduce the costs of large cohort studies; several methods have been proposed to estimate the parameters of interest as efficiently as possible. We consider the problem of simultaneous variable selection and parameter estimation using Cox's proportional hazards model in a nested case-control study. We propose several penalized likelihood approaches, implement them by self-consistent iterative procedures and examine their performance in simulation studies. These approaches include least absolute shrinkage and selection operator (LASSO) and the procedure using smoothly clipped absolute deviation (SCAD) penalty. Cross-validation methods are employed to decide the amount of penalty for better performance. Our simulation studies indicate that both LASSO and SCAD perform quite satisfactorily; in addition, we show that these methods enjoy oracle property. We finally illustrate this method in a microarray study that look for genes whose methylation levels can be used as biomarkers for predicting the survival of lung adenocarcinoma patients.

Keywords: Cox model; LASSO; Nested case-control studies; Proportional hazards model; SCAD; Survival data.

* Presenting author