

# A new estimator for Cox proportional hazard regression model in presence of collinearity

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## Abstract

This paper considers a new approach to estimate Cox proportional hazard regression model parameters in presence of collinearity between covariates.

Usually partial maximum likelihood estimator is used to estimate Cox proportional hazard regression model parameters. But when there exist collinearity partial maximum likelihood estimates can be effected seriously. Parameter estimates have large variances so they may be far from true values.

In 2007 Xue *et al.* generalized ridge regression approach to the Cox proportional hazard regression model. But especially when there exist severe collinearity this approach may not fully addresses the collinearity problem.

In this study we developed Liu-type estimator for Cox proportional hazard regression model and compared with ridge regression estimator in terms of mean squared error (MSE). Finally we evaluated its performance through simulation studies.

## Keywords

Cox regression model, Liu-type estimator, Partial maximum likelihood estimator, Multicollinearity.

## References

- Kaçiranlar, S. and Sakallioğlu, S. (2001). Combining the Liu estimator and the principal component regression estimator. *Comm. Statist. Theory Methods* 30, 2699–2705.
- Kleinbaum, D.G., Klein, M. (2005). Parametric survival models. In: Gail, M., Samet, J., Tsiatis, A., Wong, W. (Eds.), *Survival Analysis A Self-Learning Text* (pp. 257–329). Springer, USA.

- Lee, E.T. and Wang, J.W. (2003). Identification of prognostic factors related to survival time: Cox proportional hazard model. In: Balding, D.J., Bloomfield, P., Cressie, N.A.C., Fisher, N.I., Johnstone, I.M., Kadane, J.B., Ryan, L.M., Scott, D.W., Smith, A.F.M., Teugels, J.L. (Eds.), *Statistical Methods for Survival Data Analysis* (pp. 298–376). John Wiley & Sons, Canada.
- Liu, K. (2003). Using Liu type estimator to combat collinearity. *Comm. Statist. Theory Methods* 32(5), 1009–1020.
- Lustbader, E.D. (1986). Relative risk regression diagnosis. In: Moolgavkar, S.H., Prentice, R.L. (Eds.), *Modern Statistical Methods in Chronic Disease Epidemiology*, SIAM, Philadelphia.
- Montgomery, D.C., Peck, A.E., and Vining, G.G. (2001). Multicollinearity. In: Bloomfield, P., Cressie, N.A.C., Fisher, N.I., Johnstone, I.M., Kadane, J.B., Ryan, L.M., Scott, D.W., Silverman, B.W., Smith, A.F.M., Teugels, J.L., Barnett, V., Bradley, R.A., Hunter, J.S., Kendall, D.G. (Eds.), *Introduction to the Linear Regression Analysis* (pp. 325–382). John Wiley & Sons, Canada.
- Xue, X., Kim, M.Y., and Shore, R.E. (2007). Cox regression analysis in presence of collinearity: an application to assessment of health risk associated with occupational radiation exposure. *Lifetime Data Anal.* 13(3), 333–350.