Package 'rqlm'

December 31, 2023

Type Package

Title Bias Correction and Improved Robust Variance Estimation for the Modified Poisson and Least-Squares Regression Analyses

Version 2.1-1

Date 2023-12-31

Maintainer Hisashi Noma <noma@ism.ac.jp>

Description Modified Poisson and least-squares regression analyses have been standard multivariate analysis methods to estimate risk ratio and risk difference in clinical and epidemiological studies. However, the ordinary robust variance estimator possibly has serious bias under small or moderate sample size situations. Also, the risk ratio estimator has bias under small sample settings. This package provides computational tools of their bias correction and improved robust variance estimators (Noma, 2024+). Bias-corrected risk ratio estimator and improved confidence intervals are available for these regression methods.

Depends R (>= 3.5.0)

Imports stats, gee, geesmv, brglm2, matrixcalc

License GPL-3

Encoding UTF-8

LazyData true

R topics documented:

`rqlm-package` *The 'rqlm' package.*

Description

Modified Poisson and least-squares regression analyses have been standard multivariate analysis methods to estimate risk ratio and risk difference in clinical and epidemiological studies. However, the ordinary robust variance estimator possibly has serious bias under small or moderate sample size situations. Also, the risk ratio estimator has bias under small sample settings. This package provides computational tools of their bias correction and improved robust variance estimators (Noma, 2024+). Bias-corrected risk ratio estimator and improved confidence intervals are available for these regression methods.

References

Cheung, Y. B. (2007). A modified least-squares regression approach to the estimation of risk difference. *American Journal of Epidemiology* **166**, 1337-1344.

Noma, H. (2024+). Bias correction and improved confidence intervals of the modified Poisson and least-squares regression analyses for binary outcomes. To appear.

Pan, W. and Wall, M. M. (2002). Small-sample adjustments in using the sandwich variance estimator in generalized estimating equations. *Statistics in Medicine* **21**, 1429-1441.

Zou, G. (2004). A modified poisson regression approach to prospective studies with binary data. *American Journal of Epidemiology* **159**, 702-706.

`exdata` *A simulated example dataset*

Description

A simulated cohort data with binomial outcome.

- `y`: Dichotomous outcome variable.
- `x1`: Continous covariate.
- `x2`: Continous covariate.
- `x3`: Continous covariate.

Usage

```
data(exdata)
```

Format

A simulated cohort data with binomial outcome.

References

Noma, H. (2024+). Improved robust variance estimators and confidence intervals for modified Poisson and least-squares regressions. To appear.

`rqlm` *Modified Poisson and least-squares regression analyses with improved robust variance estimators*

Description

Modified Poisson and least-squares regression analyses have been standard multivariate analysis methods to estimate risk ratio and risk difference in clinical and epidemiological studies. However, the ordinary robust variance estimator possibly has serious bias under small or moderate sample size situations. Also, the risk ratio estimator has bias under small sample settings. The `rqlm` function provides computational tools for their bias correction and improved robust variance estimators (Noma, 2024+). Bias-corrected risk ratio estimator and improved confidence intervals are available for these regression methods.

Usage

```
rqlm(formula, data, family=gaussian, bias.correct=FALSE, method="Wang-Long",
 eform=FALSE, digits=4)
```

Arguments

`formula`	An object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted.
`data`	A data frame, list or environment (or object coercible by as.data.frame to a data frame) containing the variables in the model.
`family`	A description of the error distribution and link function to be used in the model. `gaussian`: Modified least-squares regression. `poisson`: Modified Poisson regression.
`bias.correct`	A logical value that specify whether bias correction is performed (default: FALSE); only for the case `family=poisson`.
`method`	The method to be used in calculating robust variance estimator. `Standard`: Ordinary robust variance estimator. `Fay-Graubard`: Fay-Graubard-type improved robust variance estimator. `Gosho`: Gosho-type improved robust variance estimator. `Kauermann-Carroll`: Kauermann-Carroll-type improved robust variance estimator. `Morel`: Morel-type improved robust variance estimator. `Mancl-DeRouen`: Mancl-DeRouen-type improved robust variance estimator. `Mackinnon`: Mackinnon-type improved robust variance estimator. `Pan`: Pan-type improved robust variance estimator. `Wang-Long`: Wang-Long-type improved robust variance estimator.
`eform`	A logical value that specify whether the outcome should be transformed by exponential function (default: FALSE)
`digits`	Number of decimal places in the output (default: 4).

Value

Results of the modified Poisson and least-squares regression analyses.

- `coef`: Coefficient estimates; transformed to the exponential scale if `eform==TRUE`.
- `SE`: Standard error estimates.

- `CL`: Lower limits of 95% confidence intervals.
- `CU`: Upper limits of 95% confidence intervals.
- `P-value`: P-values for the coefficient tests.

References

Cheung, Y. B. (2007). A modified least-squares regression approach to the estimation of risk difference. *American Journal of Epidemiology* **166**, 1337-1344.

Fay, M. P. and Graubard, B. I. (2001). Small-sample adjustments for Wald-type tests using sandwich estimators. *Biometrics* **57**, 1198-1206.

Gosho, M., Sato, Y. and Takeuchi, H. (2014). Robust covariance estimator for small-sample adjustment in the generalized estimating equations: A simulation study. *Science Journal of Applied Mathematics and Statistics* **2**, 20-25.

Kauermann, G. and Carroll, R. J. (2001). A note on the efficiency of sandwich covariance matrix estimation. *Journal of the American Statistical Association* **96**, 1387-1398.

Morel, J. G., Bokossa, M. C., and Neerchal, N. K. (2003). Small sample correction for the variance of GEE estimators. *Biometrical Journal* **45**, 395-409.

MacKinnon, J. G. (1985). Some heteroskedasticity-consistent covariance matrix estimators with improved finite sample properties. *Journal of Econometrics* **29**, 305-325.

Mancl, L. A. and DeRouen, T. A. (2001). A covariance estimator for GEE with improved small-sample properties. *Biometrics* **57**, 126-134.

Noma, H. (2024+). Bias correction and improved confidence intervals of the modified Poisson and least-squares regression analyses for binary outcomes. To appear.

Pan, W. (2001). On the robust variance estimator in Generalized Estimating Equations. *Biometrika* **88**, 901-906.

Pan, W. and Wall, M. M. (2002). Small-sample adjustments in using the sandwich variance estimator in generalized estimating equations. *Statistics in Medicine* **21**, 1429-1441.

Wang, M. and Long, Q. (2011). Modified robust variance estimator for generalized estimating equations with improved small-sample performance. *Statistics in Medicine* **30**, 1278-1291.

Zou, G. (2004). A modified poisson regression approach to prospective studies with binary data. *American Journal of Epidemiology* **159**, 702-706.

Examples

```
data(exdata)

rqlm(y ~ x1 + x2 + x3, data=exdata, family=poisson, method="Standard", eform=TRUE)
rqlm(y ~ x1 + x2 + x3, data=exdata, family=poisson, method="Wang-Long", eform=TRUE)

rqlm(y ~ x1 + x2 + x3, data=exdata, family=poisson, bias.correct=TRUE, method="Wang-Long",
 eform=TRUE)

rqlm(y ~ x1 + x2 + x3, data=exdata, family=poisson, bias.correct=TRUE, method="Wang-Long",
 eform=TRUE, digits=3)

rqlm(y ~ x1 + x2 + x3, data=exdata, family=gaussian, method="Standard")
rqlm(y ~ x1 + x2 + x3, data=exdata, family=gaussian, method="Wang-Long")
```

Index