Package 'firthb'

December 28, 2023

Type Package

Title Firth-type penalized estimation of the modified Poisson and linear regressions for multivariate analyses of risk ratio and risk difference

Version 2.2-1

Date 2023-12-27

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Description The modified Poisson and linear regression analyses have been standard methods for multivariate analyses of binary outcome data in estimating risk ratio and risk difference. Uno, Noma and Gosho (2024+) <forthcoming> show these multivariate analyses possibly provide biased and/or imprecise estimates under small and sparse data situations (i.e., the "separation" condition). This package provides computational tools of the Firth-type penalized estimating methods for the modified Poisson and linear regressions proposed by Uno, Noma and Gosho (2024+) <forthcoming>. Also, a bias-corrected sandwich variance estimator under small sample settings is available.

Depends R (>= 3.5.0)

Imports stats, MASS

License GPL-3

Encoding UTF-8

LazyData true

R topics documented:

`firthb-package` *The 'firthb' package.*

Description

Firth-type penalized estimation of the modified Poisson and linear regressions for multivariate analyses of risk ratio and risk difference.

References

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

Firth, D. (1993). Bias reduction of maximum likelihood estimates. *Biometrika* **80**, 27-38.

Uno, S., Noma, H. and Gosho, M. (2024+). Firth-type penalized methods of the modified Poisson and least-squares regression analyses in estimating risk ratio and risk difference. Forthcoming.

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

`firthb` *Firth-type penalized estimation of the modified Poisson and linear regressions*

Description

Firth-type penalized estimation of the modified Poisson and linear regressions.

Usage

```
firthb(formula, data, measure)
```

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.
`measure`	Type of effect measure: `RR` (risk ratio) or `RD` (risk difference)

Value

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

- `glm+robust SE`: Ordinary analyses by modified Poisson and least-squares regressions.
- `firth+robust SE`: Firth-type penalized analyses using ordinary robust standard error estimates.
- `firth+improved robust SE`: Firth-type penalized analyses using Uno's improved robust standard error estimates.

Also, individual outputs are

- `EstimatedRR`: Regression coefficient estimates for risk ratio (if measure: `RR`).
- `EstimatedRD`: Regression coefficient estimates for risk difference (if measure: `RD`).
- `Low95pctCI`: Lower limits of the 95
- `Upp95pctCI`: Upper limits of the 95

References

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

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Uno, S., Noma, H. and Gosho, M. (2024+). Firth-type penalized methods of the modified Poisson and least-squares regression analyses in estimating risk ratio and risk difference. Forthcoming.

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Examples

```
data(titanic)

firthb(Death ~ is_female + class_1 + class_2 + Age, data=titanic, measure="RR")
firthb(Death ~ is_female + class_1 + class_2 + Age, data=titanic, measure="RD")
```

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titanic *Survival outcomes for Titanic passengers*

Description

- `PassengerId`: Passenger ID
- `Survived`: Passenger survival indicator
- `Pclass`: Passenger class
- `Name`: Name
- `Sex`: Sex
- `Age`: Age
- `SibSp`: Number of siblings/spouses aboard
- `Parch`: Number of parents/children aboard
- `Ticket`: Ticket number
- `Fare`: Passenger fare
- `Cabin`: Cabin
- `Embarked`: Port of embarkation
- `is_female`: Dummy variable of sex
- `class_1`: Dummy variable of Pclass
- `class_2`: Dummy variable of Pclass
- `class_3`: Dummy variable of Pclass
- `Death`: 1-`Survived`

Usage

```
data(titanic)
```

Format

A data frame with 130 rows and 17 variables

References

https://www.kaggle.com/c/titanic/data

Index