

Package ‘ClusterBootstrap’

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Title Analyze Clustered Data with Generalized Linear Models using the Cluster Bootstrap

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Description The ClusterBootstrap package provides functionality for the analysis of clustered data using the cluster bootstrap.

Depends R (>= 3.0), stats, utils, graphics, parallel

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URL <https://github.com/mathijsdeen/ClusterBootstrap>

BugReport <https://github.com/mathijsdeen/ClusterBootstrap/issues>

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R topics documented:

| | |
|-------------------------------|----------|
| clusbootglm | 2 |
| clusbootmatrix | 3 |
| clusbootsample | 4 |
| coef.clusbootglm | 4 |
| confint.clusbootglm | 5 |
| opposites | 6 |
| plot.clusbootglm | 6 |
| summary.clusbootglm | 7 |
| Index | 8 |

clusbootglm

*Fit generalized linear models with the cluster bootstrap***Description**

Fit a generalized linear model with the cluster bootstrap for analysis of clustered data.

Usage

```
clusbootglm(model, data, clusterid, family = gaussian, B = 5000,
  confint.level = 0.95, no_cores = 1)
```

Arguments

| | |
|---------------|---|
| model | generalized linear model to be fitted with the cluster bootstrap. |
| data | dataframe that contains the data. |
| clusterid | variable in data that identifies the clusters. Should consist of whole numbers. |
| family | error distribution to be used in the model, e.g. gaussian or binomial. |
| B | number of bootstrap samples. |
| confint.level | level of confidence interval. |
| no_cores | number of CPU cores to be used. |

Details

Some useful methods for the obtained clusbootglm class object are [summary.clusbootglm](#), [coef.clusbootglm](#), [plot.clusbootglm](#), [clusbootmatrix](#) and [clusbootsample](#).

Value

clusbootglm produces an object of class "clusbootglm", containing the following relevant components:

| | |
|---------------------|---|
| coefficients | A matrix of B rows, containing the parameter estimates for all bootstrap samples. |
| bootstrap.matrix | n*B matrix, of which each column represents a bootstrap sample; each value in a column represents a unit of subjectid. |
| lm.coefs | Parameter estimates from a single (generalized) linear model. |
| boot.coefs | Mean values of the parameter estimates, derived from the bootstrap coefficients. |
| boot.sds | Standard deviations of cluster bootstrap parameter estimates. |
| ci.level | User defined confidence interval level. |
| percentile.interval | Confidence interval based on percentiles, given the user defined confidence interval level. |
| parametric.interval | Confidence interval based on lm.coefs and column standard deviations of coefficients, given the user defined confidence interval level. |
| BCa.interval | Confidence interval based on percentiles with bias correction and acceleration, given the user defined confidence interval level. |

`samples.with.NA.coef`

Cluster bootstrap sample numbers with at least one coefficient being NA.

`failed.bootstrap.samples`

For each of the coefficients, the number of failed bootstrap samples are given.

Author(s)

Mathijs Deen, Mark de Rooij

Examples

```
## Not run:
data(opposites)
clusbootglm(SCORE~Time*COG,data=opposites,clusterid=opposites$Subject)
## End(Not run)
```

`clusbootmatrix`

Extract matrix with bootstrap samples

Description

Obtain a matrix containing the clusterid values for the bootstrap samples in a `clusbootglm` object.

Usage

```
clusbootmatrix(object, whichsample = "all")
```

Arguments

| | |
|--------------------------|---|
| <code>object</code> | object of class <code>clusbootglm</code> , created with the <code>clusbootglm</code> function. |
| <code>whichsample</code> | input which bootstrap sample(s) should be returned. Choose "all" for the complete bootstrap matrix, "failed" for bootstrap samples that returned NAs, or a vector of values for specific bootstrap samples. |

Author(s)

Mathijs Deen

Examples

```
## Not run:
data(opposites)
cbglm.1 <- clusbootglm(SCORE~Time*COG,data=opposites,clusterid=opposites$Subject)
clusbootmatrix(cbglm.1, whichsample=c(1:5))
## End(Not run)
```

| | |
|----------------|---|
| clusbootsample | <i>Return data for specified bootstrap sample</i> |
|----------------|---|

Description

Returns the full data frame for a specified bootstrap sample in a clusbootglm object.

Usage

```
clusbootsample(object, samplenr)
```

Arguments

| | |
|----------|---|
| object | object of class clusbootglm, created with the clusbootglm function. |
| samplenr | sample number for which the data frame should be returned. |

Author(s)

Mark de Rooij, Mathijs Deen

Examples

```
## Not run:
data(opposites)
cbglm.1 <- clusbootglm(SCORE~Time*COG,data=opposites,clusterid=opposites$Subject)
clusbootsample(cbglm.1, samplenr=1)
## End(Not run)
```

| | |
|------------------|--|
| coef.clusbootglm | <i>Obtain coefficients from cluster bootstrap object</i> |
|------------------|--|

Description

Returns the coefficients of an object of class clusbootglm.

Usage

```
## S3 method for class 'clusbootglm'
coef(object, type = "bootstrap", ...)
```

Arguments

| | |
|--------|---|
| object | object of class clusbootglm. |
| type | type of coefficient (bootstrap or GLM). |
| ... | other arguments. |

Author(s)

Mathijs Deen

Examples

```
## Not run:
data(opposites)
cbglm.1 <- clusbootglm(SCORE~Time*COG,data=opposites,clusterid=opposites$Subject)
coef(cbglm.1, type="bootstrap")
## End(Not run)
```

confint.clusbootglm *Confidence intervals for cluster bootstrap model parameters*

Description

Computes confidence intervals for one or more parameters in a fitted GLM with the cluster bootstrap.

Usage

```
## S3 method for class 'clusbootglm'
confint(object, parm = "all", level = 0.95,
        type = "percentile", ...)
```

Arguments

| | |
|--------|--|
| object | object of class clusbootglm. |
| parm | a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. Defaults to all parameters. |
| level | the required confidence level |
| type | type of confidence level. Options are percentile, parametric and BCa. |
| ... | other arguments. |

Author(s)

Mathijs Deen

Examples

```
## Not run:
data(opposites)
cbglm.1 <- clusbootglm(SCORE~Time*COG,data=opposites,clusterid=opposites$Subject)
confint(cbglm.1,parm=c("Time","COG"), level=.90, type="BCa")
## End(Not run)
```

opposites

Opposites naming data

Description

The opposites dataframe consists of 144 observations within 36 individuals that completed an inventory that assesses their performance on a timed cognitive task called "opposites naming".

The dataset does not contain the empirical data within 35 individuals from the experiment by Willett (1988), but a simulation based on the multilevel model from Singer & Willett (2003) within 36 individuals.

Usage

```
opposites
```

Format

the following variables are available:

- Subject: subject indicator
- Time: a time variable, ranging 0-3
- COG: cognitive skill, measured once (at time=0)
- SCORE: score on opposites naming task

References

- Willett, J.B. (1988). Questions and answers in the measurement of change. In: E. Rothkopf (Ed.), *Review of research in education (1988-89)* (pp. 345-422). Washington, DC: American Educational Research Association.
- Singer, J.D., & Willett, J.B. (2003). *Applied longitudinal data analysis. Modeling change and event occurrence*. NY: Oxford University Press, Inc.

plot.clusbootglm

Plot estimates and confidence intervals of cluster bootstrap GLM

Description

Plots the estimates and their confidence intervals for an object of class clusbootglm.

Usage

```
## S3 method for class 'clusbootglm'
plot(x, interval.type = "percentile",
     show.intercept = FALSE, ...)
```

Arguments

| | |
|----------------|---|
| x | object of class clusbootglm. |
| interval.type | which confidence interval should be used. Choose par for parametric, per for percentile, or BCa for BCa interval. |
| show.intercept | plot estimate and confidence interval of the intercept. |
| ... | other arguments. |

Author(s)

Mathijs Deen

Examples

```
## Not run:
data(opposites)
cbglm.1 <- clusbootglm(SCORE~Time*COG,data=opposites,clusterid=opposites$Subject)
plot(cbglm.1,interval.type="BCa")
## End(Not run)
```

| | |
|---------------------|--|
| summary.clusbootglm | <i>Summarize output of cluster bootstrap GLM</i> |
|---------------------|--|

Description

Returns the summary of an object of class clusbootglm.

Usage

```
## S3 method for class 'clusbootglm'
summary(object, interval.type = "BCa", ...)
```

Arguments

| | |
|---------------|---|
| object | object of class clusbootglm. |
| interval.type | which confidence interval should be used. Options are parametric, percentile and BCa intervals. |
| ... | other arguments. |

Author(s)

Mathijs Deen

Examples

```
## Not run:
data(opposites)
cbglm.1 <- clusbootglm(SCORE~Time*COG,data=opposites,clusterid=opposites$Subject)
summary(cbglm.1, interval.type="percentile")
## End(Not run)
```

Index

`clusbootglm`, [2](#)
`clusbootmatrix`, [2](#), [3](#)
`clusbootsample`, [2](#), [4](#)
`coef.clusbootglm`, [2](#), [4](#)
`confint.clusbootglm`, [5](#)

`opposites`, [6](#)

`plot.clusbootglm`, [2](#), [6](#)

`summary.clusbootglm`, [2](#), [7](#)