Package ‘merDeriv’

July 10, 2019

Title  Case-Wise and Cluster-Wise Derivatives for Mixed Effects Models
Version  0.1-7
Description  Compute case-wise and cluster-wise derivative for mixed effects models with respect to fixed effects parameter, random effect (co)variances, and residual variance.
Depends  R (>= 3.2.3), lme4 (>= 1.1-10), stats, methods, nonnest2, sandwich, lavaan
Imports  utils, Matrix
License  GPL (>= 2)
LazyData  yes
URL  http://semtools.r-forge.r-project.org
NeedsCompilation  no
Maintainer  Ting Wang <twb8d@mail.missouri.edu>
Author  Ting Wang [aut, cre], Edgar Merkle [aut] (<https://orcid.org/0000-0001-7158-0653>), Yves Rosseel [ctb]
Repository  CRAN
Date/Publication  2019-07-10 14:10:02 UTC

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### Description

This function calculates the bread component of the Huber-White sandwich estimator (variance-covariance matrix multiplied by the number of clusters) for a generalized linear mixed effects model of class `glmerMod`.

#### Usage

```r
## S3 method for class 'glmerMod'
bread(x, ...)
```

#### Arguments

- `x`: An object of class `glmerMod`.
- `...`: additional arguments, including `full` (`full = FALSE; see details`).

#### Value

A \( p \times p \) "bread" matrix for the Huber-White sandwich estimator (variance-covariance matrix based on observed Fisher information multiplied by the number of clusters), where \( p \) represents the number of parameters. If `full = FALSE`, returns the variance-covariance matrix of only fixed effect parameters. If `full = TRUE`, returns the variance-covariance matrix for all fitted parameters (including fixed effect parameters, random effect (co)variances, and residual variance).

#### References


#### Examples

```r
## Not run:
# The cbpp example
data(finance, package="smdata")

lme4fit <- glmer(corr ~ jmeth + (1 | item), data = finance,
                 family = binomial, nAGQ = 20)

# bread component for all parameters
bread(lme4fit, full = TRUE)

## End(Not run)
```
Extract Bread Component for Huber-White Sandwich Estimator of Linear Mixed Effects Models

Description

This function calculates the bread component of the Huber-White sandwich estimator (variance-covariance matrix multiplied by the number of clusters) for a linear mixed effects model of class `lmerMod`.

Usage

```r
## S3 method for class 'lmerMod'
bread(x, ...) # not run:
```

Arguments

- `x`: An object of class `lmerMod`.
- `...`: Additional arguments, including `full` and `information` (`full = FALSE` and `information = "expected"` are default; see details).

Value

A $p \times p$ "bread" matrix for the Huber-White sandwich estimator (variance-covariance matrix multiplied by the number of clusters), where $p$ represents the number of parameters. If `full = FALSE`, returns the variance-covariance matrix of only fixed effect parameters. If `full = TRUE`, returns the variance-covariance matrix for all fitted parameters (including fixed effect parameters, random effect (co)variances, and residual variance. If `information = "expected"`, the variance-covariance matrix is based on the inversion of Fisher information matrix. If `information = "observed"`, the variance-covariance matrix is based on the observed Fisher information, which is the negative of Hessian matrix.

References


Examples

```r
## Not run:
# The sleepstudy example
lme4fit <- lmer(Reaction ~ Days + (Days|Subject), sleepstudy, REML = FALSE)

# bread component for all parameters
```
estfun.glmerMod

Extract Cluster-wise Derivatives for Generalized Linear Mixed Effects Models

Description
A function for extracting the cluster-wise derivatives of a generalized linear mixed effects models fitted via \texttt{lme4}. This function returns the cluster-wise scores, evaluated at the ML estimates.

Usage

\begin{verbatim}
## S3 method for class 'glmerMod'
estfun(x, ...)
\end{verbatim}

Arguments

- \texttt{x} An object of class \texttt{glmerMod}.
- \texttt{...} Additional arguments.

Value
A \(g\) by \(p\) score matrix, corresponding to \(g\) clusters and \(p\) parameters. For models with multiple clustering variables (three-level models, crossed random effects), an error is thrown.

References

Examples

\begin{verbatim}
## Not run:
data(finance, package="smdata")

lme4fit <- glmer(corr ~ jmeth + (1 | item), data = finance,
                 family = binomial, nAGQ = 20)

# clusterwise scores
estfun(lme4fit)
\end{verbatim}

## End(Not run)
**estfun.lmerMod**

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**estfun.lmerMod**  
*Extract Case-wise and Cluster-wise Derivatives for Linear Mixed Effects Models*

**Description**

A function for extracting the case-wise and cluster-wise derivatives of a linear mixed effects models fitted via **lme4**. This function returns the case-wise and cluster-wise scores, evaluated at the ML estimates.

**Usage**

```r
## S3 method for class 'lmerMod'
estfun(x, ...)
```

**Arguments**

- `x`  
  An object of class **lmerMod**.

- `...`  
  additional arguments, including `level` (`level = 2` is default; see details).

**Value**

If `level = 2`, a `g` by `p` score matrix, corresponding to `g` clusters and `p` parameters. If `level = 1`, a `n` by `p` score matrix, corresponding to `n` observations and `p` parameters. For models with multiple clustering variables (three-level models, crossed random effects), an error is thrown if `level = 2`.

**References**


**Examples**

```r
## Not run:
# The sleepstudy example
lme4fit <- lmer(Reaction ~ Days + (Days|Subject), sleepstudy, REML = FALSE)

# casewise scores
estfun(lme4fit, level = 1)

# clusterwise scores
estfun(lme4fit, level = 2)

## End(Not run)
```
Extract Cluster-wise Log Likelihoods for Generalized Linear Mixed Effects Models

Description

A function for extracting the cluster-wise log likelihoods of a generalized linear mixed effects model fitted via \texttt{lme4}. This function returns the cluster-wise log likelihoods, evaluated at the ML estimates.

Usage

\begin{verbatim}
## S3 method for class 'glmerMod'
llcont(x, ...)  
\end{verbatim}

Arguments

- \texttt{x}: An object of class \texttt{glmerMod}.
- \texttt{...}: Additional arguments.

Value

A vector of log-likelihoods whose length is the number of clusters.

References


Examples

\begin{verbatim}
## Not run:
data(finance, package="smdata")

lme4fit <- glmer(corr ~ jmeth + (1 | item), data = finance,  
                 family = binomial, nAGQ = 20)

# clusterwise log likelihood
llcont(lme4fit)

## End(Not run)
\end{verbatim}
llcont.lmerMod  

Extract Case-wise Log Likelihoods for Linear Mixed Effects Models

Description

A function for extracting the case-wise log likelihoods of a linear mixed effects model fitted via \texttt{lme4}. This function returns the case-wise log likelihoods, evaluated at the ML estimates.

Usage

```r
## S3 method for class 'lmerMod'
llcont(x, ...)  
```

Arguments

- `x` An object of class \texttt{lmerMod}.
- `...` additional arguments, including \code{level} (\code{level = 2} is default; see details).

Value

If \code{level = 2}, a vector of log-likelihoods whose length is the number of clusters. If \code{level = 1}, a vector of length \( n \), containing log-likelihoods for all \( n \) observations.

References


Examples

```r
## Not run:
# The sleepstudy example
lme4fit <- lmer(Reaction ~ Days + (Days|Subject), sleepstudy, REML = FALSE)

# clusterwise log likelihood
llcont(lme4fit)

## End(Not run)
```
Extract Variance-Covariance Matrix of all Parameters for Generalized Linear Mixed Effects Models

Description

This function calculates the variance-covariance matrix for all parameters (fixed and random effect) in a generalized linear mixed effects model of class \texttt{glmerMod}.

Usage

```r
## S3 method for class 'glmerMod'
vcov(object, ...)  
```

Arguments

- \texttt{object}
  - An object of class \texttt{glmerMod}.
- \texttt{...}
  - additional arguments, including \texttt{full} (\texttt{full = FALSE} is default; see details).

Value

A $p \times p$ variance-covariance matrix, where $p$ represents the number of parameters. If \texttt{full = FALSE}, returns the variance-covariance matrix of only fixed effect parameters. If \texttt{full = TRUE}, returns the variance-covariance matrix for all fitted parameters (including fixed effect parameters and random effect (co)variances). The variance-covariance matrix is based on the negative of Hessian matrix, which is extracted from \texttt{lme4}.

References


Examples

```r
## Not run:  
# The cbpp example  
data(finance, package="smdata")  

lme4fit <- glmer(corr ~ jmeth + (1 | item), data = finance,  
                 family = binomial, nAGQ = 20)  

# variance covariance matrix for all parameters  
vcov(lme4fit, full = TRUE)  

## End(Not run)
```
Extract Variance-Covariance Matrix of all Parameters for Linear Mixed Effects Models

Description

This function calculates the variance-covariance matrix for all parameters (fixed, random effect, and residual) in a linear mixed effects model of class \texttt{lmerMod}.

Usage

```r
## S3 method for class 'lmerMod'
vcov(object, ...)  
```

Arguments

- **object**: An object of class \texttt{lmerMod}.
- **...**: additional arguments, including \texttt{full} and \texttt{information} (\texttt{full = FALSE} and \texttt{information = "expected"} are default; see details).

Value

A \(p \times p\) variance-covariance matrix, where \(p\) represents the number of parameters. If \texttt{full = FALSE}, returns the variance-covariance matrix of only fixed effect parameters. If \texttt{full = TRUE}, returns the variance-covariance matrix for all fitted parameters (including fixed effect parameters, random effect (co)variances, and residual variance. If \texttt{information = "expected"}, the variance-covariance matrix is based on the inversion of Fisher information matrix. If \texttt{information = "observed"}, the variance-covariance matrix is based on the observed Fisher information, which is the negative of Hessian matrix.

References


Examples

```r
## Not run: 
# The sleepstudy example
lme4fit <- lmer(Reaction ~ Days + (Days|Subject), sleepstudy, REML = FALSE)

# variance covariance matrix for all parameters
vcov(lme4fit, full = TRUE)

## End(Not run)
```
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