

Package ‘glmmSel’

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Type Package

Title Generalised Linear Mixed Model Selection

Version 1.0.3

Description Provides tools for fitting sparse generalised linear mixed models with l0 regularisation. Selects fixed and random effects under the hierarchy constraint that fixed effects must precede random effects. Uses coordinate descent and local search algorithms to rapidly deliver near-optimal estimates. Gaussian and binomial response families are currently supported. For more details see Thompson, Wand, and Wang (2025) <[doi:10.48550/arXiv.2506.20425](https://doi.org/10.48550/arXiv.2506.20425)>.

URL <https://github.com/ryan-thompson/glmmSel>

BugReports <https://github.com/ryan-thompson/glmmSel/issues>

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coef.cv.glmmse1	<i>Coefficient function for cv.glmmse1 object</i>
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Description

Extract cluster coefficients for a cross-validated value of the regularisation parameter.

Usage

```
## S3 method for class 'cv.glmmse1'
coef(object, lambda = "lambda.min", ...)
```

Arguments

object	an object of class cv.glmmse1
lambda	a value of the regularisation parameter
...	any other arguments

Value

An array of coefficients.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

coef.glmmse1	<i>Coefficient function for glmmse1 object</i>
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Description

Extracts coefficients for a specified value of the regularisation parameter.

Usage

```
## S3 method for class 'glmmse1'  
coef(object, lambda = NULL, ...)
```

Arguments

object	an object of class glmmse1
lambda	a value of the regularisation parameter
...	any other arguments

Value

An array of coefficients.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

cv.glmmse1	<i>Cross-validated generalised linear mixed model selection</i>
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Description

Fits the regularisation path for a sparse generalised linear mixed model and then cross-validates this path.

Usage

```
cv.glmmse1(  
  x,  
  y,  
  cluster,  
  family = c("gaussian", "binomial"),  
  lambda = NULL,  
  nfold = 10,  
  folds = NULL,  
  cv.loss = NULL,  
  interpolate = TRUE,  
  ...  
)
```

Arguments

x	a predictor matrix
y	a response vector
cluster	a vector of length <code>nrow(x)</code> with the <code>j</code> th element identifying the cluster that the <code>j</code> th observation belongs to
family	the likelihood family to use; 'gaussian' for a continuous response or 'binomial' for a binary response
lambda	the regularisation parameter for the overlapping penalty on the fixed and random slopes
nfold	the number of cross-validation folds
folds	an optional vector of length <code>nrow(x)</code> with the <code>j</code> th entry identifying the fold that the <code>j</code> th observation belongs to
cv.loss	an optional cross-validation loss-function to use; should accept a vector of predicted values and a vector of actual values
interpolate	a logical indicating whether to interpolate the lambda sequence for the cross-validation fits
...	any other arguments for <code>glmmsel()</code>

Value

An object of class `cv.glmmsel`; a list with the following components:

cv.mean	a vector of cross-validation means
cv.sd	a vector of cross-validation standard errors
lambda	a vector of cross-validated regularisation parameters
lambda.min	the value of lambda minimising <code>cv.mean</code>
fit	the fit from running <code>glmmsel()</code> on the full data

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

References

Thompson, R., Wand, M. P., and Wang, J. J. J. (2025). 'Scalable subset selection in linear mixed models'. arXiv: [2506.20425](https://arxiv.org/abs/2506.20425).

Examples

```
# Generate data
set.seed(1234)
n <- 100
m <- 4
p <- 10
s <- 5
x <- matrix(rnorm(n * p), n, p)
```

```
beta <- c(rep(1, s), rep(0, p - s))
u <- cbind(matrix(rnorm(m * s), m, s), matrix(0, m, p - s))
cluster <- sample(1:m, n, replace = TRUE)
xb <- rowSums(x * sweep(u, 2, beta, '+')[cluster, ])
y <- rnorm(n, xb)

# Fit sparse linear mixed model
fit <- cv.glmmSel(x, y, cluster)
plot(fit)
fixef(fit)
ranef(fit)
coef(fit)
predict(fit, x[1:3, ], cluster[1:3])
```

fixef

Fixed effects function

Description

Generic function for extracting fixed effects from model objects.

Usage

```
fixef(object, ...)
```

Arguments

object	a model object
...	any other arguments

Value

Depends on the specific method implementation.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

fixef.cv.glmmse1	<i>Fixed effects function for cv.glmmse1 object</i>
------------------	---

Description

Extract fixed effects for a cross-validated value of the regularisation parameter.

Usage

```
## S3 method for class 'cv.glmmse1'
fixef(object, lambda = "lambda.min", ...)
```

Arguments

object	an object of class cv.glmmse1
lambda	a value of the regularisation parameter
...	any other arguments

Value

A matrix of fixed effects.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

fixef.glmmse1	<i>Fixed effects function for glmmse1 object</i>
---------------	--

Description

Extracts fixed effects for a specified value of the regularisation parameter.

Usage

```
## S3 method for class 'glmmse1'
fixef(object, lambda = NULL, ...)
```

Arguments

object	an object of class glmmse1
lambda	a value of the regularisation parameter
...	any other arguments

Value

A matrix of fixed effects.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

glmmse1

Generalised linear mixed model selection

Description

Fits the regularisation path for a sparse generalised linear mixed model (GLMM).

Usage

```
glmmse1(  
  x,  
  y,  
  cluster,  
  family = c("gaussian", "binomial"),  
  local.search = FALSE,  
  max.nnz = 100,  
  nlambda = 100,  
  lambda.step = 0.99,  
  lambda = NULL,  
  alpha = 0.8,  
  intercept = TRUE,  
  random.intercept = TRUE,  
  standardise = TRUE,  
  eps = 1e-04,  
  max.cd.iter = 10000,  
  max.ls.iter = 100,  
  max.bls.iter = 30,  
  t.init = 1,  
  t.scale = 0.5,  
  max.pql.iter = 100,  
  active.set = TRUE,  
  active.set.count = 3,  
  sort = TRUE,  
  screen = 100,  
  warn = TRUE  
)
```

Arguments

<code>x</code>	a predictor matrix
<code>y</code>	a response vector
<code>cluster</code>	a vector of length <code>nrow(x)</code> with the <code>j</code> th element identifying the cluster that the <code>j</code> th observation belongs to
<code>family</code>	the likelihood family to use; 'gaussian' for a continuous response or 'binomial' for a binary response
<code>local.search</code>	a logical indicating whether to perform local search after coordinate descent; typically leads to higher quality solutions
<code>max.nnz</code>	the maximum number of predictors ever allowed to be active
<code>nlambda</code>	the number of regularisation parameters to evaluate when <code>lambda</code> is computed automatically
<code>lambda.step</code>	the step size taken when computing <code>lambda</code> from the data; should be a value strictly between 0 and 1; larger values typically lead to a finer grid of subset sizes
<code>lambda</code>	an optional vector of regularisation parameters
<code>alpha</code>	the hierarchical parameter
<code>intercept</code>	a logical indicating whether to include a fixed intercept
<code>random.intercept</code>	a logical indicating whether to include a random intercept; applies only when <code>intercept = TRUE</code>
<code>standardise</code>	a logical indicating whether to scale the data to have unit root mean square; all parameters are returned on the original scale of the data
<code>eps</code>	the convergence tolerance; convergence is declared when the relative maximum difference in consecutive parameter values is less than <code>eps</code>
<code>max.cd.iter</code>	the maximum number of coordinate descent iterations allowed
<code>max.ls.iter</code>	the maximum number of local search iterations allowed
<code>max.bls.iter</code>	the maximum number of backtracking line search iterations allowed
<code>t.init</code>	the initial value of the gradient step size during backtracking line search
<code>t.scale</code>	the scaling parameter of the gradient step size during backtracking line search
<code>max.pql.iter</code>	the maximum number of penalised quasi-likelihood iterations allowed
<code>active.set</code>	a logical indicating whether to use active set updates; typically lowers the run time
<code>active.set.count</code>	the number of consecutive coordinate descent iterations in which a subset should appear before running active set updates
<code>sort</code>	a logical indicating whether to sort the coordinates before running coordinate descent; typically leads to higher quality solutions
<code>screen</code>	the number of predictors to keep after gradient screening; smaller values typically lower the run time
<code>warn</code>	a logical indicating whether to print a warning if the algorithms fail to converge

Value

An object of class `glmmSel`; a list with the following components:

<code>beta0</code>	a vector of fixed intercepts
<code>gamma0</code>	a vector of random intercept variances
<code>beta</code>	a matrix of fixed slopes
<code>gamma</code>	a matrix of random slope variances
<code>u</code>	an array of random coefficient predictions
<code>sigma2</code>	a vector of residual variances
<code>loss</code>	a vector of loss function values
<code>cd.iter</code>	a vector indicating the number of coordinate descent iterations for convergence
<code>ls.iter</code>	a vector indicating the number of local search iterations for convergence
<code>pql.iter</code>	a vector indicating the number of penalised quasi-likelihood iterations for convergence
<code>nnz</code>	a vector of the number of nonzeros
<code>lambda</code>	a vector of regularisation parameters used for the fit
<code>family</code>	the likelihood family used
<code>clusters</code>	a vector of cluster identifiers
<code>alpha</code>	the value of the hierarchical parameter used for the fit
<code>intercept</code>	whether a fixed intercept is included in the model
<code>random.intercept</code>	whether a random intercept is included in the model

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

References

Thompson, R., Wand, M. P., and Wang, J. J. J. (2025). 'Scalable subset selection in linear mixed models'. arXiv: [2506.20425](https://arxiv.org/abs/2506.20425).

Examples

```
# Generate data
set.seed(1234)
n <- 100
m <- 4
p <- 10
s <- 5
x <- matrix(rnorm(n * p), n, p)
beta <- c(rep(1, s), rep(0, p - s))
u <- cbind(matrix(rnorm(m * s), m, s), matrix(0, m, p - s))
cluster <- sample(1:m, n, replace = TRUE)
xb <- rowSums(x * sweep(u, 2, beta, '+')[cluster, ])
```

```

y <- rnorm(n, xb)

# Fit sparse linear mixed model
fit <- glmmsel(x, y, cluster)
plot(fit)
fixef(fit, lambda = 10)
ranef(fit, lambda = 10)
coef(fit, lambda = 10)
predict(fit, x[1:3, ], cluster[1:3], lambda = 10)

```

plot.cv.glmmsel

Plot function for cv.glmmsel object

Description

Plot the cross-validation loss as a function of the regularisation parameter.

Usage

```

## S3 method for class 'cv.glmmsel'
plot(x, ...)

```

Arguments

x	an object of class cv.glmmsel
...	any other arguments

Value

A plot of the cross-validation results.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

plot.glmmsel

Plot function for glmmsel object

Description

Plots the coefficients as a function of the regularisation parameter.

Usage

```

## S3 method for class 'glmmsel'
plot(x, cluster = NULL, ...)

```

Arguments

x an object of class `glmmsel`
cluster the cluster whose coefficients to plot
... any other arguments

Value

A plot of the coefficient profiles.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

`predict.cv.glmmsel` *Predict function for cv.glmmsel object*

Description

Generates predictions for new data using a cross-validated value of the regularisation parameter.

Usage

```
## S3 method for class 'cv.glmmsel'  
predict(object, x.new, cluster.new, lambda = "lambda.min", ...)
```

Arguments

object an object of class `cv.glmmsel`
x.new a matrix of new values for the predictors
cluster.new a vector identifying the clusters that the rows of `x.new` belong to
lambda a value of the regularisation parameter
... any other arguments

Value

A matrix of predictions.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

predict.glmmsel *Predict function for glmmsel object*

Description

Generates predictions for new data using a specified value of the regularisation parameter.

Usage

```
## S3 method for class 'glmmsel'  
predict(object, x.new, cluster.new, lambda = NULL, ...)
```

Arguments

object	an object of class glmmsel
x.new	a matrix of new values for the predictors
cluster.new	a vector identifying the clusters that the rows of x.new belong to
lambda	a value of the regularisation parameter
...	any other arguments

Value

A matrix of predictions.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

ranef *Random effects function*

Description

Generic function for extracting random effects from model objects.

Usage

```
ranef(object, ...)
```

Arguments

object	a model object
...	any other arguments

Value

Depends on the specific method implementation.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

ranef.cv.glmmse1	<i>Random effects function for cv.glmmse1 object</i>
------------------	--

Description

Extract random effects for a cross-validated value of the regularisation parameter.

Usage

```
## S3 method for class 'cv.glmmse1'
ranef(object, lambda = "lambda.min", ...)
```

Arguments

object	an object of class cv.glmmse1
lambda	a value of the regularisation parameter
...	any other arguments

Value

A matrix of random effects.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

ranef.glmmse1	<i>Random effects function for glmmse1 object</i>
---------------	---

Description

Extracts random effects for a specified value of the regularisation parameter.

Usage

```
## S3 method for class 'glmmse1'
ranef(object, lambda = NULL, ...)
```

Arguments

object	an object of class <code>glmmsel</code>
lambda	a value of the regularisation parameter
...	any other arguments

Value

A matrix of random effects.

Author(s)

Ryan Thompson <ryan.thompson-1@uts.edu.au>

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