Package 'lmeVarComp'

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Type Package

Title Testing for a Subset of Variance Components in Linear Mixed Models

Version 1.1

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Imports stats

Depends R (>= 3.0.0)

Description Test zero variance components in linear mixed models and test additivity in nonparametric regression using the restricted likelihood ratio test and the generalized F-test. Details can be found at Zhang et al (2016) <doi:10.1002/cjs.11295>.

License GPL (>= 2)

ByteCompile yes

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R topics documented:

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Description

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Details

The DESCRIPTION file:

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Version:	1.1
Date:	2018-04-13
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Author:	Yichi Zhang [aut, cre]
Maintainer:	Yichi Zhang <yzhang52@ncsu.edu>
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test.additivity         Testing Additivity in Nonparametric Regression
test.varcomp            Testing Zero Variance Components in Linear
                        Mixed Models
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The main functions are:

- `rlr.test` for testing zero variance components in linear mixed models.
- `test.additivity` for testing additivity in nonparametric regression.
- `test.varcomp` for testing zero variance components in balanced ANOVA models.

Author(s)

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References

Zhang, Y., Staicu, A.-M., and Maity, A. (2016). Testing for additivity in non-parametric regression. Canadian Journal of Statistics, 44: 445-462. doi: 10.1002/cjs.11295

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mnls *Minimum Norm Least Squares*

Description

`mnls` computes the minimum norm solution to the least squares problem.

Usage

```
mnls(x, y, rcond = 1e-10)
```

Arguments

`x`	design matrix of dimension `n` by `p`.
`y`	response vector of length `n`, or response matrix of dimension `n` by `q`.
`rcond`	reciprocal condition number to determine the effective rank of `x`.

Details

The underlying C code calls the LAPACK routine DGELSY.

Value

The least squares solution, as a `p` by `q` matrix. It has an attribute called `rank`, which is the effective rank of `x`.

Author(s)

Yichi Zhang

Examples

```
x <- matrix(rnorm(500L), 100L, 5L)
x <- cbind(x, x[, 1L] + x[, 2L], x[, 1L] - x[, 3L])
b <- -3L : 3L
y <- c(x %*% b)
mnls(x, y)  # different to b
```

`rlr.test` *Restricted Likelihood Ratio Test and Generalized F-test for Zero Variance Components*

Description

`rlr.test` tests whether certain variance components are zeros using restricted likelihood ratio test and generalized F-test.

Usage

```
rlr.test(Y, X, Z, Sigma, m0, nsim = 5000L, seed = 130623L)
```

Arguments

`Y`	response vector of length `n`
`X`	fixed effects design matrix of dimension `n` by `p`
`Z`	a list of random effects design matrices. Each matrix should have `n` rows.
`Sigma`	a list of random effects correlation structures. Each matrix should be symmetric and positive definite, and match the dimension of the corresponding random effects design matrix.
`m0`	an integer indicating the number of nuisance variance components. Should be between `0` and `length(Z) - 1`. The first `m0` variance components will be treated as nuisance.
`nsim`	number of simulations from the null distribution. If zero, REML estimates are computed but tests are not performed.
`seed`	a seed to be set before simulating from the null distribution.

Value

A list containing the following components:

`RLRT`	a vector of the test statistic and the p-value of restricted likelihood ratio test.
`GFT`	a vector of the test statistic and the p-value of generalized F-test.
`H0.estimate`	REML estimate of variance components (including the error term) under the null hypothesis.
`H1.estimate`	REML estimate of variance components (including the error term) under the alternative hypothesis.

Author(s)

Yichi Zhang

References

Zhang, Y., Staicu, A.-M., and Maity, A. (2016). Testing for additivity in non-parametric regression. Canadian Journal of Statistics, 44: 445-462. doi: 10.1002/cjs.11295

Examples

```
# two-way random effects ANOVA
n1 <- 5L
n2 <- 6L
n0 <- 4L
n <- n1 * n2 * n0
X <- cbind(rep(1, n))
A <- gl(n1, n2 * n0)
Z1 <- model.matrix(~ -1 + A, contrasts.arg = contr.treatment)
B <- rep(gl(n2, n0), n1)
Z2 <- model.matrix(~ -1 + B, contrasts.arg = contr.treatment)
Z3 <- model.matrix(~ -1 + B : A, contrasts.arg = contr.treatment)
set.seed(1L)
Y <- (X %*% 1
  + Z1 %*% rnorm(ncol(Z1), 0, 0.7)
  + Z2 %*% rnorm(ncol(Z2), 0, 0.3)
  + Z3 %*% rnorm(ncol(Z3), 0, 0.5)
  + rnorm(n, 0, 1))
Z <- list(Z1, Z2, Z3)
Sigma <- lapply(Z, function(z) diag(ncol(z)))
# tests interaction effects
rlr.test(Y, X, Z, Sigma, 2L, 2000L, 2L)
# tests overall effects
rlr.test(Y, X, Z, Sigma, 1L, 2000L, 3L)
```

`test.additivity` *Testing Additivity in Nonparametric Regression*

Description

`test.additivity` tests for additive model in nonparametric regression using mixed model representation and variance components testing.

Usage

```
test.additivity(x, y, type = "RLR",
  nbasis = 10L, kernel = c("gaussian", "polynomial", "spline"),
  nsim = 5000L, seed = 130623L)
```

Arguments

x	design matrix. Each column should be scaled to have range within `[0,1]`.
y	response vector.

type	RLR for restricted likelihood ratio test and generalized F-test
nbasis	number of basis functions in additive modeling.
kernel	reproducing kernel for non-additive modeling.
nsim	number of simulations from the null distribution.
seed	a seed to be set before simulating from the null distribution.

Value

A vector of test statistic and p-value.

Author(s)

Yichi Zhang

References

Zhang, Y., Staicu, A.-M., and Maity, A. (2016). Testing for additivity in non-parametric regression. Canadian Journal of Statistics, 44: 445-462. doi: 10.1002/cjs.11295

See Also

rlr.test

Examples

```
set.seed(20L)
x <- matrix(runif(200L), 100L, 2L)
y <- 4 * x[, 1L] * x[, 2L] + rnorm(100L)
test.additivity(x, y)
```

---

test.varcomp *Testing Zero Variance Components in Linear Mixed Models*

Description

test.varcomp tests whether certain variance components are zeros. This function provides a formula interface to the rlr.test function.

Usage

```
test.varcomp(fixed, random, test, data = NULL, Sigma = NULL,
  type = "RLR", nsim = 5000L, seed = 130623L,
  keep.matrices = FALSE)
```

Arguments

fixed	a two-sided formula specifying the response and the fixed effects.
random	a one-sided formula specifying the random effects (not including the error term).
test	an integer vector of the indices of random effects to be tested.
data	an optional data frame, list or environment containing the variables in the model.
Sigma	an optional list of symmetric and positive definite matrices specifying the correlation structures of random effects. If NULL, default to identity matrices.
type	RLR for restricted likelihood ratio test and generalized F-test
nsim	number of simulations from the null distribution.
seed	a seed to be set before simulating from the null distribution.
keep.matrices	whether the design matrices for fixed effects and random effects, as well as the response vector, will be returned.

Value

A list containing the following components:

RLRT	A vector of the test statistic and the p-value of restricted likelihood ratio test.
GFT	A vector of the test statistic and the p-value of generalized F-test.
Y	If keep.matrices is TRUE, the response.
X	If keep.matrices is TRUE, the fixed effects design matrix.
Z	If keep.matrices is TRUE, a list of the random effects design matrices.
Sigma	If keep.matrices is TRUE, a list of the random effects correlation structures.

Author(s)

Yichi Zhang

References

Zhang, Y., Staicu, A.-M., and Maity, A. (2016). Testing for additivity in non-parametric regression. Canadian Journal of Statistics, 44: 445-462. doi: 10.1002/cjs.11295

See Also

rlr.test

Examples

```
n1 <- 5L
n2 <- 6L
n0 <- 4L
A <- gl(n1, n2 * n0)
B <- rep(gl(n2, n0), n1)
set.seed(1L)
Y <- 1 + rnorm(n1, 0, 0.7)[A] + rnorm(n2, 0, 0.3)[B] +
```

```
  rnorm(n1 * n2, 0, 0.5)[A : B] + rnorm(n1 * n2 * n0, 0, 1)
test.varcomp(Y ~ 1, ~ -1 + A + B + A:B, test = c(2L, 3L),
  nsim = 2000L, seed = 2L)
```

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