Package 'nlmeU'

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Version 0.71.7

Title Functions and Data Supporting 'Linear Mixed-Effects Models: A
Step-by-Step Approach'

Description Provides functions and datasets to support the book
by Galecki and Burzykowski (2013),
'Linear Mixed-Effects Models: A Step-by-Step Approach',
Springer. Includes functions for power calculations,
log-likelihood contributions, and data simulation
for linear mixed-effects models.

Imports nlme, stats

Suggests reshape, WWGbook, lattice, ellipse, roxygen2, testthat

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License GPL-2

URL https://github.com/agalecki/nlmeU

Depends R (>= 3.5.0)

NeedsCompilation no

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nlmeU-package   *nlmeU: Datasets and Utility Functions Enhancing Functionality of*
                         'nlme' Package

Description

Provides functions and datasets to support the book by Galecki and Burzykowski (2013), "Linear
Mixed-Effects Models Using R: A Step-by-Step Approach", Springer. Package includes functions
for power calculations, log-likelihood contributions, and data simulation for linear mixed-effects
models.

Details

This package provides datasets and utility functions to complement the nlme package, includ-
ing functions like logLik1, Pwr, and simulateY. It also includes datasets such as armd, armd0,
armd.wide, fcat, prt.fiber, prt, prt.subjects, and SIIdata.

Author(s)

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See Also

Useful links:

  • https://github.com/agalecki/nlmeU

---

armd   *armd Data (867 x 8)*

Description

Data from Age-Related Macular Degeneration (ARMD) clinical trial

Usage

```
armd
```

Format

A data frame with 867 rows and 8 columns:

subject A factor with 234 levels: 1, 2, 3, 4, 6, ..., 240

treat.f A factor with 2 levels: Placebo, Active

visual0 An integer vector with values ranging from 20 to 85

miss.pat A factor with 8 levels: ----, ---X, --X-, --XX, -XX-, ..., X-XX

time.f A factor with 4 levels: 4wks, 12wks, 24wks, 52wks

time A numeric vector with values 4, 12, 24, 52

visual An integer vector with values ranging from 3 to 85

tp A numeric vector with values 1, 2, 3, 4 corresponding to time points 4, 12, 24, 52, respectively

Details

The ARMD data arise from a randomized multi-center clinical trial comparing an experimental treatment (interferon-alpha) versus placebo for patients diagnosed with ARMD.

Source

Pharmacological Therapy for Macular Degeneration Study Group (1997). Interferon alpha-IIA is ineffective for patients with choroidal neovascularization secondary to age-related macular degeneration. Results of a prospective randomized placebo-controlled clinical trial. Archives of Ophthalmology, 115, 865-872.

See Also

armd0, armd.wide

Examples

```
library(nlmeU)
data(armd)
summary(armd)
```

---

armd.wide	*armd.wide Data (240 x 10)*

Description

Data from Age-Related Macular Degeneration (ARMD) clinical trial

Usage

```
armd.wide
```

Format

A data frame with 240 rows and 10 columns:

subject A factor with 240 levels: 1, 2, 3, 4, 5, ..., 240

lesion An integer vector with values 1, 2, 3, 4

line0 An integer vector with values ranging from 5 to 17

visual0 An integer vector with values of visual acuity measured at baseline ranging from 20 to 85

visual4 An integer vector with values of visual acuity measured at 4 weeks ranging from 12 to 84

visual12 An integer vector with values of visual acuity measured at 12 weeks ranging from 3 to 85

visual24 An integer vector with values of visual acuity measured at 24 weeks ranging from 5 to 85

visual52 An integer vector with values of visual acuity measured at 52 weeks from 4 to 85

treat.f A factor with 2 levels: Placebo, Active

miss.pat A factor with 9 levels: ----, ---X, --X-, --XX, -XX-, ..., XXXX

Details

The ARMD data arise from a randomized multi-center clinical trial comparing an experimental treatment (interferon-alpha) versus placebo for patients diagnosed with ARMD.

Source

Pharmacological Therapy for Macular Degeneration Study Group (1997). Interferon alpha-IIA is ineffective for patients with choroidal neovascularization secondary to age-related macular degeneration. Results of a prospective randomized placebo-controlled clinical trial. Archives of Ophthalmology, 115, 865-872.

See Also

armd, armd0

Examples

```
data(armd.wide, package = "nlmeU")
summary(armd.wide)
```

---

armd0 *armd0 Data (1107 x 8)*

Description

Data from Age-Related Macular Degeneration (ARMD) clinical trial

Usage

```
armd0
```

Format

A data frame with 1107 rows and 8 columns:

subject A factor with 240 levels: 1, 2, 3, 4, 5, ...

treat.f A factor with 2 levels: `Placebo`, `Active`

visual0 An integer vector with values from 20 to 85

miss.pat A factor with 9 levels: `----`, `---X`, `--X-`, `--XX`, `-XX-`, ...

time.f A factor with 5 levels: `Baseline`, `4wks`, `12wks`, `24wks`, `52wks`

time A numeric vector with values from 0 to 52

visual An integer vector with values from 3 to 85

tp A numeric vector with values from 0 to 4

Details

The ARMD data arise from a randomized multi-center clinical trial comparing an experimental treatment (interferon-alpha) versus placebo for patients diagnosed with ARMD.

Source

Pharmacological Therapy for Macular Degeneration Study Group (1997). Interferon alpha-IIA is ineffective for patients with choroidal neovascularization secondary to age-related macular degeneration. Results of a prospective randomized placebo-controlled clinical trial. Archives of Ophthalmology, 115, 865-872.

See Also

[armd](#), [armd.wide](#)

Examples

```
data(armd0, package = "nlmeU")
summary(armd0)
```

---

fcat	*fcat Data (4851 x 3)*

Description

Data from Flemish Community Attainment-Targets (FCAT) Study

Usage

```
fcat
```

Format

A data frame with 4851 rows and 3 columns:

target A factor with 9 levels: `T1(4)`, `T2(6)`, `T3(8)`, `T4(5)`, `T5(9)`, ..., `T9(5)`

id A factor with 539 levels: 1, 2, 3, 4, 5, ..., 539

scorec An integer vector with values from 0 to 9

Details

An educational study, in which elementary school graduates were evaluated with respect to reading comprehension in Dutch. Pupils from randomly selected schools were assessed for a set of nine attainment targets. The dataset is an example of grouped data, for which the grouping factors are crossed.

Source

Janssen, R., Tuerlinckx, F., Meulders, M., & De Boeck, P. (2000). A hierarchical IRT model for criterion-referenced measurement. Journal of Educational and Behavioral Statistics, 25(3), 285.

Examples

```
data(fcat, package = "nlmeU")
summary(fcat)
```

---

logLik1 *Calculates contribution of one subject to the log-likelihood*

Description

This function is generic; method functions can be written to handle specific classes of objects.

Usage

```
logLik1(modfit, dt1, dtInit)
```

Arguments

modfit	an object representing a model fitted to data using maximum likelihood estimation.
dt1	a data frame with data for one subject, for whom the log-likelihood function is to be evaluated.
dtInit	an optional auxiliary data frame.

Details

Calculates contribution of one subject to the log-likelihood

This function is generic; method functions can be written to handle specific classes of objects.

Value

Numeric scalar value representing the contribution of a given subject to the overall log-likelihood returned by logLik.

Author(s)

Andrzej Galecki and Tomasz Burzykowski

References

Galecki, A., & Burzykowski, T. (2013). *Linear Mixed-Effects Models: A Step-by-Step Approach*. Springer.

Examples

```
library(nlme)
logLik(fm1 <- lme(distance ~ age, data = Orthodont)) # random is ~ age
dt1 <- subset(Orthodont, Subject == "M01")
logLik1(fm1, dt1)
```

---

logLik1.lme   *Calculates contribution of one subject to the log-likelihood for an* lme
                               object

Description

This is a method for the [logLik1](#) generic function.

Usage

```
## S3 method for class 'lme'
logLik1(modfit, dt1, dtInit)
```

Arguments

modfit	an [lme](#) object representing a model fitted using maximum likelihood.
dt1	a data frame with data for one subject, for whom the log-likelihood function is to be evaluated.
dtInit	an optional auxiliary data frame.

Details

Calculates the profile likelihood (with beta profiled out) for one subject. Data with one level of grouping only. The correlation component in modelStruct is not implemented.

Value

Numeric scalar value representing the contribution of a given subject to the overall log-likelihood returned by [logLik](#) applied to an [lme](#) object defined by the modfit argument.

Author(s)

Andrzej Galecki and Tomasz Burzykowski

Examples

```
library(nlme)
data(armd, package = "nlmeU")
lm3.form <- visual ~ visual0 + time + treat.f
fm16.5ml <- lme(lm3.form,
                random = list(subject = pdDiag(~time)),
                weights = varPower(form = ~time),
                data = armd, method = "ML") # M16.5
df1 <- subset(armd, subject = "1")           # Panel R20.7
logLik1(fm16.5ml, df1)
```

---

missPat	*Extract pattern of missing data*

Description

This function compactly presents the pattern of missing data in a given vector, matrix, or data frame.

Usage

```
missPat(..., symbols = c("X", "-"), collapse = "", missData = FALSE)
```

Arguments

...	one or more vectors, matrices, or data frames, compatible for column-wise binding.
symbols	vector containing two single characters used to indicate NA and non-NA values. By default, c("X", "-").
collapse	an optional character string used in the internal call to paste() to separate results. By default, "".
missData	logical. If TRUE, a data frame with the pattern of missing values is saved in the missData attribute of the returned vector. By default, FALSE.

Value

Character vector with as many elements as the length of vector(s) or number of rows in matrices/data frames in .... Attribute cnames contains names of vectors/columns/variables. Optional attribute missData contains a data frame with the missing pattern.

Author(s)

Andrzej Galecki and Tomasz Burzykowski

See Also

armd.wide

Examples

```
## Not run:
  data(armd.wide, package = "nlmeU")
  dtf <- armd.wide[ , c("visual12", "visual24", "visual52")]
  missPat(dtf, symbols = c("?", "+"))

## End(Not run)
```

---

print.Pwr   *Print method for Pwr objects*

Description

Prints the results of power calculations for objects of class `Pwr.lme`.

Usage

```
## S3 method for class 'Pwr'
print(x, verbose = attr(x, "verbose"), ...)
```

Arguments

x	an object of class `Pwr.lme`.
verbose	logical. If `TRUE`, additional information is printed. By default, uses the `verbose` attribute of `x`.
...	additional arguments passed to the method.

Value

Prints the power calculation results and returns `NULL` invisibly.

Author(s)

Andrzej Galecki and Tomasz Burzykowski

---

prt   *prt Data (2471 x 9)*

Description

Data from a Progressive Resistance Randomized Trial.

Usage

```
prt
```

Format

A data frame with 2471 rows and 9 columns:

id A factor with 63 levels: 5, 10, 15, 20, 25, ..., 520 (subject id)

prt.f A factor with 2 levels: High, Low, i.e., training (intervention) intensity

age.f A factor with 2 levels: Young, Old (stratifying variable)

sex.f A factor with 2 levels: Female, Male (stratifying variable)

bmi A numeric vector with values of BMI at baseline ranging from 18.36 to 32.29

iso.fo A numeric vector with values of isometric force ranging from 0.16 to 2.565

spec.fo A numeric vector with values of specific force ranging from 80.5 to 290

occ.f A factor with 2 levels: Pre, Pos, i.e., pre- and post-intervention

fiber.f A factor with 2 levels: Type 1, Type 2, i.e., Type 1 and Type 2 muscle fiber

Details

Data frame `prt` was obtained by merging `prt.subjects` and `prt.fiber`.

Source

Claflin, D.R., Larkin, L.M., Cederna, P.S., Horowitz, J.F., Alexander, N.B., Cole, N.M., Galecki, A.T., Chen, S., Nyquist, L.V., Carlson, B.M., Faulkner, J.A., & Ashton-Miller, J.A. (2011). Effects of high- and low-velocity resistance training on the contractile properties of skeletal muscle fibers from young and older humans. Journal of Applied Physiology, 111, 1021-1030.

See Also

[prt.fiber](#), [prt.subjects](#)

Examples

```
data(prt, package = "nlmeU")
summary(prt)
```

---

prt.fiber	*prt.fiber Data (2471 x 5)*

Description

Data from a Progressive Resistance Randomized Trial.

Usage

```
prt.fiber
```

Format

A data frame with 2471 rows and 5 columns:

id A factor with 63 levels: `5, 10, 15, 20, 25, ..., 520`

iso.fo A numeric vector with values of isometric force ranging from 0.16 to 2.565

spec.fo A numeric vector with values of specific force ranging from 80.5 to 290

occ.f A factor with 2 levels: `Pre, Pos`, i.e., pre- and post-intervention

fiber.f A factor with 2 levels: `Type 1, Type 2`, i.e., Type 1 and Type 2 muscle fiber

Details

PRT trial was aimed for devising evidence-based methods for improving and measuring the mobility and muscle power of elderly men and women.

Source

Claflin, D.R., Larkin, L.M., Cederna, P.S., Horowitz, J.F., Alexander, N.B., Cole, N.M., Galecki, A.T., Chen, S., Nyquist, L.V., Carlson, B.M., Faulkner, J.A., & Ashton-Miller, J.A. (2011). Effects of high- and low-velocity resistance training on the contractile properties of skeletal muscle fibers from young and older humans. Journal of Applied Physiology, 111, 1021-1030.

See Also

`prt`, `prt.subjects`

Examples

```
data(prt.fiber, package = "nlmeU")
summary(prt.fiber)
```

---

  prt.subjects   *prt.subjects Data (63 x 5)*

Description

Data from a Progressive Resistance Randomized Trial.

Usage

```
prt.subjects
```

Format

A data frame with 63 rows and 5 columns:

id A factor with 63 levels: 5, 10, 15, 20, 25, ...

prt.f A factor with 2 levels: High, Low

age.f A factor with 2 levels: Young, Old

sex.f A factor with 2 levels: Female, Male

bmi A numeric vector with values from 18.4 to 32.3

Details

The working hypothesis was that a 12-week program of PRT would increase: (a) the power output of the overall musculature associated with movements of the ankles, knees, and hips; (b) the cross-sectional area and the force and power of permeabilized single fibers obtained from the vastus lateralis muscle; and (c) the ability of young and elderly men and women to safely arrest standardized falls. The training consisted of repeated leg extensions by shortening contractions of the leg extensor muscles against a resistance that was increased as the subject trained using a specially designed apparatus.

Source

Claflin, D.R., Larkin, L.M., Cederna, P.S., Horowitz, J.F., Alexander, N.B., Cole, N.M., Galecki, A.T., Chen, S., Nyquist, L.V., Carlson, B.M., Faulkner, J.A., & Ashton-Miller, J.A. (2011). Effects of high- and low-velocity resistance training on the contractile properties of skeletal muscle fibers from young and older humans. Journal of Applied Physiology, 111, 1021-1030.

Examples

```
data(prt.subjects, package = "nlmeU")
summary(prt.subjects)
```

Pwr *Calculates power based on a model fit*

Description

This function is generic; method functions can be written to handle specific classes of objects.

Usage

```
Pwr(object, ...)
```

Arguments

object	an object containing the results returned by a model fitting function (e.g., lme).
...	some methods for this generic function may require additional arguments.

Value

Numeric scalar value.

Author(s)

Andrzej Galecki and Tomasz Burzykowski

References

Galecki, A., & Burzykowski, T. (2013). *Linear Mixed-Effects Models: A Step-by-Step Approach*. Springer.

See Also

[Pwr.lme](#)

Examples

```
## Not run:
  library(nlme)
  fm1 <- lme(distance ~ age, data = Orthodont)
  Pwr(fm1)

## End(Not run)
```

Pwr.lme   *Performs power calculations for an* lme *object*

Description

This is a method for the [Pwr](#) generic function. It works for the example given in Galecki and Burzykowski (2013) but may require additional testing, especially for post-hoc power analysis.

Usage

```
## S3 method for class 'lme'
Pwr(
  object,
  ...,
  type = c("sequential", "marginal"),
  Terms,
  L,
  verbose = FALSE,
  ddf = numeric(0),
  alpha = 0.05,
  altB = NULL,
  tol = 1e-10
)
```

Arguments

`object`	an [lme](lme) object containing a model fit, which provides information needed for power calculations.
`...`	some additional arguments may be required.
`type`	an optional character string specifying the type of sum of squares to be used in F-tests needed for power calculations. Syntax is the same as for anova.lme in the `nlme` package.
`Terms`	an optional integer or character vector specifying which terms in the model should be jointly tested to be zero using a Wald F-test. See anova.lme in the `nlme` package for details.
`L`	an optional numeric vector or array specifying linear combinations of the coefficients in the model that should be tested to be zero. See anova.lme in the `nlme` package for details.
`verbose`	logical. If `TRUE`, additional information is provided. See anova.lme in the `nlme` package for details.
`ddf`	numeric scalar value. Redefines the default number of denominator degrees of freedom.
`alpha`	numeric scalar value. By default, `0.05`.
`altB`	matrix or vector containing alternative values for beta parameters.
`tol`	numeric scalar value for numerical tolerance.

Value

A data frame inheriting from class `Pwr.lme`.

Author(s)

Andrzej Galecki and Tomasz Burzykowski

References

Galecki, A., & Burzykowski, T. (2013). *Linear Mixed-Effects Models: A Step-by-Step Approach*. Springer.

See Also

anova.lme

---

runScript   *Execute scripts from Galecki and Burzykowski (2013)*

Description

Executes scripts from the book by Galecki and Burzykowski (2013). If called without arguments, it prints a list of available scripts.

Usage

```
runScript(
  script = NA,
  package = "nlmeU",
  subdir = "scriptsR4.5.1",
  echo = TRUE
)
```

Arguments

script   character string containing the name of the script to be executed. By default, NA.

package   character string containing the package name. By default, "nlmeU".

subdir   subdirectory containing scripts. By default, "scriptsR2.15.0".

echo   logical. If TRUE, the script is executed with output printed. Used by source().
              By default, TRUE.

Value

The script is executed, and results are printed. If script is NA, a list of available scripts is printed.

Author(s)

Andrzej Galecki and Tomasz Burzykowski

References

Galecki, A., & Burzykowski, T. (2013). *Linear Mixed-Effects Models: A Step-by-Step Approach*. Springer.

Examples

```
runScript()
```

SIIdata	*SIIdata Data (1190 x 12)*

Description

Data from Study of Instructional Improvement Project

Usage

```
SIIdata
```

Format

A data frame with 1190 rows and 12 columns:

sex A factor with 2 levels: M, F, i.e., males and females, respectively

minority A factor with 2 levels: Mnrt=No, Mnrt=Yes. An indicator variable for the minority status

mathkind An integer vector with values from 290 to 629. This is pupil's math score in the spring of the kindergarten year

mathgain An integer vector with values from -110 to 253. Number represents pupil's gain in the math achievement score from the spring of kindergarten to the spring of first grade

ses A numeric vector with values from -1.61 to 3.21. Value represents socioeconomic status

yearstea A numeric vector with values from 0 to 40. It is number of years of teacher's experience in teaching in the first grade

mathknow A numeric vector with values from -2.5 to 2.61. Number represents teacher's knowledge of the first-grade math contents (higher values indicate a higher knowledge of the contents)

housepov A numeric vector containing proportion of households in the neighborhood of the school below the poverty level with values ranging from 0.012 to 0.564

mathprep A numeric vector with values from 1 to 6. Contains the number of preparatory courses on the first-grade math contents and methods followed by the teacher

classid A factor with 312 levels: 1, 2, 3, 4, 5, ..., 312. Classroom's id

schoolid A factor with 107 levels: 1, 2, 3, 4, 5, ..., 107. School's id

childid A factor with 1190 levels: 1, 2, 3, 4, 5, ..., 1190. Pupil's id

Details

The SII Project was carried out to assess the math achievement scores of first- and third-grade pupils in randomly selected classrooms from a national US sample of elementary schools (Hill et al, 2005). Data were also analyzed in West et al, 2007. The outcome of interest is mathgain variable. Data were created based on classroom data from WWGbook package.

Source

Hill, H., Rowan, B., and Ball, D. (2005). Effect of teachers' mathematical knowledge for teaching on student achievement. American Educational Research Journal, 42, 371-406. West, B. T., Welch, K. B., and Galecki, A. T. (2007). Linear Mixed Models: A Practical Guide Using Statistical Software. Chapman and Hall/CRC.

Examples

```
data(SIIdata, package = "nlmeU")
summary(SIIdata)
```

---

simulateY   *Simulates values of the dependent variable based on a model fit*

Description

This function is generic; method functions can be written to handle specific classes of objects.

Usage

```
simulateY(object, nsim = 1, seed = NULL, ..., verbose = FALSE, sigma)
```

Arguments

object	an object with a model fit for which the dependent variable is to be simulated.
nsim	number of simulations. By default, nsim = 1.
seed	integer scalar used to initiate the random number generator.
...	some methods for this generic function may require additional arguments.
verbose	logical. If TRUE, basic information about arguments is provided. By default set to FALSE.
sigma	numeric scalar. Allows simulations employing an alternative value of the scale parameter.

Value

Numeric matrix with the number of columns determined by the nsim argument.

Author(s)

Andrzej Galecki and Tomasz Burzykowski

Examples

```
## Not run:
  library(nlme)
  fm1 <- lme(distance ~ age, data = Orthodont)
  simulateY(fm1)

## End(Not run)
```

---

simulateY.lme   *Simulates values for an* lme *object*

Description

This is a method for the [simulateY](#) generic function.

Usage

```
## S3 method for class 'lme'
simulateY(
  object,
  nsim = 1,
  seed = as.integer(runif(1, 0, .Machine$integer.max)),
  ...,
  verbose = FALSE,
  sigma
)
```

Arguments

object	an [lme](#) object with a model fit for which the dependent variable is to be simulated.
nsim	number of simulations. By default, nsim = 1.
seed	integer scalar used to initiate the random number generator.
...	some methods for this generic function may require additional arguments.
verbose	logical. If TRUE, basic information about arguments is provided. By default set to FALSE.
sigma	numeric scalar. Allows simulations employing an alternative value of the scale parameter.

Details

Simulates values of the dependent variable for a fitted [lme](#) model. Data with one level of grouping only.

Value

Numeric matrix with the number of columns determined by the nsim argument.

Author(s)

Andrzej Galecki and Tomasz Burzykowski

Examples

```
## Not run:
  library(nlme)
  fm1 <- lme(distance ~ age, data = Orthodont)
  simulateY(fm1)

## End(Not run)
```

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