Package 'lmmfit'

July 2, 2014

Type Package

Title Goodness-of-fit-measures for linear mixed models with one-level-grouping

Version 1.0

Date 2011-04-28

Author Aleksandra Maj

Maintainer Aleksandra Maj <am248424@students.mimuw.edu.pl>

Depends nlme, MASS

Description Package lmmfit contains three functions evaluating some goodness-of-fit-measures for linear mixed models with one-level-grouping fitted using lme() from package nlme.

License GPL-2

Repository CRAN

Date/Publication 2011-08-08 15:46:10

NeedsCompilation no

R topics documented:

`lmmfit-package` *Goodness-of-fit measures for linear mixed models with one-level-grouping*

Description

Package contains four different functions for evaluating goodness-of-fit measures for linear mixed models with one-level-grouping, such as concordance correlation coefficient (CCC), R^2 based on Wald's statistic and R^2 based on likelihood ratio and ordinary R^2. It also contains two functions for evaluating some criterions, which can be helpful in selecting linear mixed models: predicted residual sum of squares (PRESS) and general information criterion (GIC). There are also a few step-function for linear mixed models with one-level-grouping, which can be useful for selecting the best correlation structures for given/known fixed and random effects. They find the model through minimiznig GIC criterion or maximizing measures of fit listed above.

Details

Package:	lmmfit
Type:	Package
Version:	1.0
Date:	2011-04-28
License:	GPL-2

Author(s)

Aleksandra Maj

Maintainer: Aleksandra Maj <am248424@students.mimuw.edu.pl>

References

Gurka M., Selecting the best linear mixed model under REML, The American Statistician, 60(1), 19-26, 2006.

Magee L., R2 measures based on Wald and likelihood ratio joint significance tests, The American Statistician 44, 250-253, 1990.

Vonesh E.F., Chinchili V.M., Pu K., Goodness-of-fit in generalized nonlinear mixed-effect models, Biometrics, 52, 1996.

See Also

`lme`

Examples

```
fm1 <- lme(distance ~ age + Sex, data = Orthodont, random = ~ 1)
  lmmR2W(fm1)
  lmmCCC(fm1)
  lmmR2LR(fm1)
  GIC(fm1)
  structStep(fm1)
  structStepR2(fm1)
```

GIC *General Information Criterion (GIC) for linear mixed model*

Description

Function GIC() evaluates General Information Criterion (GIC) for linear mixed models. The function is usable only for models evaluated by lme() function from nlme package.

Usage

```
GIC(model, k, type)
```

Arguments

model	object - one-level-grouped linear mixed model fitted with lme().
k	numeric or "PRESS" - if numeric: penalty for number of model parameters, if "PRESS": PRESS coefficient for the model is evaluated
type	character - type for PRESS: "marginal" (default) or "conditional"

Details

k can be any of real numeric, but if k = 2 (default) GIC is equivalent of AIC, if k = log(nrow(data)) GIC is equivalent of BIC. If k is "PRESS", then PRESS coefficient for the model is evalauted. This option is useful in structStep().

Value

GIC() returns general information criterion for mixed model (numeric) or PRESS coefficient for the model (numeric).

Author(s)

Aleksandra Maj

See Also

lmmPRESS, lmmR2LR, lmmCCC, lmmR2W, lmmR2

Examples

```
fm1 <- lme(distance ~ age, data = Orthodont, random = pdDiag(~age))
GIC(fm1)
GIC(fm1, k = log(nrow(getData(fm1))))
GIC(fm1, k = "PRESS")
```

`lmmCCC` *Concordance correlation coefficient for linear mixed models with one-level-grouping*

Description

Function lmmCCC() evaluates concordance correlation coefficient (CCC) for linear mixed models with one-level-grouping. The function is usable only for models evaluated by lme() function from nlme package. Two types of CCC are available: marginal (default) and conditional.

Usage

```
lmmCCC(model, type = "marginal", adjust = "none")
```

Arguments

`model`	a one-level-grouping linear mixed model fitted with lme()
`type`	character defining type of fitted values. There are two types available: "marginal" (default) and "conditional".
`adjust`	character defining adjustment for number of model parameters. Three types available: "none" (default, no adjustment), "fixed" (adjustment for number of fixed effects) and "both" (adjustment for number of fixed effects and number of correlation structures parameters).

Details

The CCC can be used as a measure of goodness-of-fit of linear mixed model with one-level-grouping.

Value

lmmCCC() returns concordance correlation coefficient for linear mixed model with one-level-grouping, this value lies between -1 and 1.

Author(s)

Aleksandra Maj

References

Gurka M., Selecting the best linear mixed model under REML, The American Statistician, 60(1), 19-26, 2006.

Magee L., R2 measures based on Wald and likelihood ratio joint significance tests, The American Statistician 44, 250-253, 1990.

Vonesh E.F., Chinchili V.M., Pu K., Goodness-of-fit in generalized nonlinear mixed-effect models, Biometrics, 52, 1996.

See Also

lmmR2W, lmmR2LR, lmmR2

Examples

```
fm1 <- lme(distance ~ age + Sex, data = Orthodont, random = ~ 1)
lmmCCC(fm1)
lmmCCC(fm1, type = "conditional")
```

---

lmmPRESS *Predicted Residual Sum of Squares for linear mixed models with one-level-grouping*

Description

Function lmmPRESS() evaluates predicted residual sum of squares (PRESS) for linear mixed models with one-level-grouping. The function is usable only for models evaluated by lme() function from nlme package. Two types of PRESS are available: marginal (default) and conditional.

Usage

```
lmmPRESS(model, type = "marginal")
```

Arguments

model	object - one-level-grouped linear mixed model fitted with lme().
type	character defining type of fitted values. There are two types available: "marginal" (default) and "conditional".

Details

PRESS is evaluated using leave-one-out-group method. In order not to evaluate model too many times, the model hat matrix is used. For linear mixed model this matrix is: H = X(X'V^-1X)^(-1)X'V^-1, where X is fixed effects model matrix and V is correlation matrix of model.

Value

Numeric.

Author(s)

Aleksandra Maj

References

Gurka M., Selecting the best linear mixed model under REML, The American Statistician, 60(1), 19-26, 2006.

Vonesh E.F., Chinchili V.M., Pu K., Goodness-of-fit in generalized nonlinear mixed-effect models, Biometrics, 52, 1996.

Liu H., Weiss R.E., Jennrich I., Wenger N.S., PRESS model selection in repeated measures data, Elsevier, 1999.

See Also

lmmCCC, lmmR2LR, lmmR2W, lmmR2

Examples

```
fm1 <- lme(distance ~ age, data = Orthodont) # random is ~ age
lmmPRESS(fm1)
lmmPRESS(fm1, type = "conditional")
```

---

lmmR2 *R squared coefficient for linear mixed models with one-level-grouping*

Description

Function lmmR2() can be evaluated only for models class lme, because it uses methods for this class.

Usage

```
lmmR2(model, type = "marginal", adjust = "none")
```

Arguments

model	object - one-level-grouped linear mixed model fitted with lme().
type	character defining type of fitted values. There are two types available: "marginal" (default) and "conditional".
adjust	character defining adjustment for number of model parameters. Three types available: "none" (default, no adjustment), "fixed" (adjustment for number of fixed effects) and "both" (adjustment for number of fixed effects and number of correlation structures parameters).

Details

R2(adjust = "fixed") = 1 - k*(1 - R2), where k = nrow(data)/(nrow(data) - rank(X)).

R2(adjust = "both") = 1 - k*(1 - R2), where k = nrow(data)/(nrow(data) - (rank(X) + length(theta))), where theta is a vector of parameters of correlation structures of model.

Value

Numeric, between 0 and 1.

Author(s)

Aleksandra Maj

References

Gurka M., Selecting the best linear mixed model under REML, The American Statistician, 60(1), 19-26, 2006.

Vonesh E.F., Chinchili V.M., Pu K., Goodness-of-fit in generalized nonlinear mixed-effect models, Biometrics, 52, 1996.

See Also

lmmCCC, lmmR2LR, lmmR2W

Examples

```
fm1 <- lme(distance ~ age + Sex, data = Orthodont, random = ~ 1)
 lmmR2(fm1)
 lmmR2(fm1, type = "conditional")
 lmmR2(fm1, type = "conditional", adjust = "both")
```

---

lmmR2LR *R squared coefficient based on likelihood ratio for mixed models*

Description

Function lmmR2LR() can be evaluated only for models class lme, because it uses methods for this class.

Usage

```
lmmR2LR(model, type = "marginal", adjust = "none")
```

Arguments

model	object - one-level-grouped linear mixed model fitted with lme().
type	changing this parameter won't change anything. It is only used for structStepR2.
adjust	changing this parameter won't change anything. It is only used for structStepR2.

Details

The R squared coefficient based on likelihood ratio (of the model and the Intercept-model) can be used as a measure of goodness-of-fit of mixed model.

Value

lmmR2LR() returns R squared coefficient based on likelihood ratio (of the model and the Intercept-model) for mixed model, this value lies between 0 and 1.

Author(s)

Aleksandra Maj

References

Magee L., R2 measures based on Wald and likelihood ratio joint significance tests, The American Statistician 44, 250-253, 1990.

Vonesh E.F., Chinchili V.M., Pu K., Goodness-of-fit in generalized nonlinear mixed-effect models, Biometrics, 52, 1996.

See Also

lmmCCC, lmmR2W, lmmR2

Examples

```
fm1 <- lme(distance ~ age + Sex, data = Orthodont, random = ~ 1)
lmmR2LR(fm1)
```

---

lmmR2W *R squared coefficient based on Wald's statistics for linear mixed models with one-level-grouping*

Description

Function lmmR2W() evaluates an R squared coefficient based on Wald's statistics for linear mixed models with one-level-grouping. The function is usable only for models evaluated by lme() function from nlme package. Two types of R squared coefficients based on Wald's statistics are available: marginal (default) and conditional.

Usage

```
lmmR2W(model, type = "marginal", adjust = "none")
```

Arguments

model	a one-level-grouping linear mixed model fitted with lme()
type	character defining type of fitted values. There are two types available: "marginal" (default) and "conditional".
adjust	changing this parameter won't change anything. It is only used for structStepR2.

Details

The R squared coefficient based on Wald's statistics can be used as a measure of goodness-of-fit of linear mixed model with one-level-grouping.

Value

lmmR2W() returns R squared coefficient based on Wald's statistics for linear mixed model with one-level-grouping, this value lies between 0 and 1.

Author(s)

Aleksandra Maj

References

Gurka M., Selecting the best linear mixed model under REML, The American Statistician, 60(1), 19-26, 2006.

Magee L., R2 measures based on Wald and likelihood ratio joint significance tests, The American Statistician 44, 250-253, 1990.

Vonesh E.F., Chinchili V.M., Pu K., Goodness-of-fit in generalized nonlinear mixed-effect models, Biometrics, 52, 1996.

See Also

lmmCCC, lmmR2LR, lmmR2

Examples

```
fm1 <- lme(distance ~ age + Sex, data = Orthodont, random = ~ 1)
lmmR2W(fm1)
lmmR2W(fm1, type = "conditional")
```

`structStep` *Selecting the best structures for random factors of linear mixed model with one-level-grouping using GIC (General Information Criterion) or PRESS coefficient*

Description

Function structStep() selects the best structures (for random effects and for model errors for linear mixed model with one-level-grouping using GIC or PRESS coefficient) from:

random effects available structures: pdIdent, pdDiag, pdCompSymm, pdSymm, pdLogChol, pdNatural,

model errors available structures: NULL, corCompSymm, corARMA(p,q), corAR1.

Usage

```
structStep(model, k = 2, p = 1, q = 1, structChange = "both", trace = TRUE, type = "marginal")
```

Arguments

`model`	object - one-level-grouped linear mixed model fitted with lme().
`k`	numeric - penalty for number of model parameters (parameter for GIC() function). For example: if k = 2 (default) model will be selected by AIC, if k = log(nrow(data)) model will be selected by BIC. Or character "PRESS", then criterion for minimization is PRESS coefficient
`p`	integer - parameter for ARMA(p,q) correlation structure, default 1.
`q`	integer - parameter for ARMA(p,q) correlation structure, default 1.
`structChange`	character - specifies way to choose models. If "both" (default) both: random errors and random effects structures are selected, if "correlation" only correlation of random errors is chosen, if "random" only random effects structure is selected.
`trace`	logical - if TRUE all fitted models will be printed, if FALSE nothing is printed
`type`	character - type for PRESS residuals: "marginal" (default) or "conditional"

Details

ARMA(p,q) correlation structure is default to ARMA(1,1) it can be changed, the best change may be if you know something about structure of your data.

Returned model is selected by minimizing the given criterion.

Value

Model of class lme().

Author(s)

Aleksandra Maj

See Also

GIC, lmmPRESS

Examples

```
fm1 <- lme(distance ~ age, data = Orthodont, random = pdDiag(~age))
out <- structStep(fm1)
summary(out)
```

---

structStepR2 *Selecting the best structures for random factors of linear mixed model with one-level-grouping using R^2 measures of goodness-of-fit*

Description

Function structStepR2() selects the best structures (for random effects and for model errors for linear mixed model with one-level-grouping using R^2 measures of goodness-of-fit) from:

random effects available structures: pdIdent, pdDiag, pdCompSymm, pdSymm, pdLogChol, pdNatural,

model errors available structures: NULL, corCompSymm, corARMA(p,q), corAR1.

Available R^2 measures of goodness-of-fit: lmmCCC, lmmR2, lmmR2W, lmmR2LR.

Usage

```
structStepR2(model, crit = lmmCCC, type = "marginal", adjust = "none", p = 1, q = 1, structChange = "bo
```

Arguments

model	object - one-level-grouped linear mixed model fitted with lme().
crit	function - one of: lmmCCC, lmmR2, lmmR2W, lmmR2LR.
type	character - defining type of fitted values. There are two types available: "marginal" (default) and "conditional".
adjust	character defining adjustment for number of model parameters. Three types available: "none" (default, no adjustment), "fixed" (adjustment for number of fixed effects) and "both" (adjustment for number of fixed effects and number of correlation structures parameters). Available only for: lmmCCC, lmmR2.
p	integer - parameter for ARMA(p,q) correlation structure, default 1.
q	integer - parameter for ARMA(p,q) correlation structure, default 1.
structChange	character - specifies way to choose models. If "both" (default) both: random errors and random effects structures are selected, if "correlation" only correlation of random errors is chosen, if "random" only random effects structure is selected.
trace	logical - if TRUE all fitted models will be printed, if FALSE nothing is printed

Details

ARMA(p,q) correlation structure is default to ARMA(1,1) it can be changed, the best change may be if you know something about structure of your data.

Returned model is selected by maximizing the given criterion.

Value

Model of class lme().

Author(s)

Aleksandra Maj

See Also

lmmR2W, lmmR2LR, lmmR2, lmmCCC, structStep

Examples

```
fm1 <- lme(distance ~ age, data = Orthodont, random = pdDiag(~age))
out <- structStep(fm1)
summary(out)
```

Index