

Package: ELmethodVar (via r-universe)

May 18, 2026

Version 0.1

Date 2022-06-25

Title Empirical Likelihood Inference of Variance Components in Linear Mixed-Effects Models

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Depends R (>= 3.5.0)

Description This package provides empirical likelihood-based methods for the inference of variance components in linear mixed-effects models.

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URL <https://github.com/jingru-zhang/ELmethod>

Repository <https://jingru-zhang.r-universe.dev>

Date/Publication 2025-10-22 12:40:10 UTC

RemoteUrl <https://github.com/jingru-zhang/elmethod>

RemoteRef HEAD

RemoteSha 01dd3287421b17abc719d3152f7de2a7e9eba616

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beta.all	<i>A Matrix Representing Fixed Effects</i>
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Description

This is a p by T matrix. Each column is the fixed effects at time t.

ELmethodVar	<i>Empirical Likelihood Inference of Variance Components in Linear Mixed-Effects Models</i>
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Description

This package provides empirical likelihood-based methods for the inference of variance components in linear mixed-effects models.

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References

Zhang J., Guo W., Carpenter J.S., Leroux A., Merikangas K.R., Martin N.G., Hickie I.B., Shou H., and Li H. (2022). Empirical likelihood tests for variance components in linear mixed-effects models.

See Also

[ELvar GELvar](#)

ELvar	<i>Empirical Likelihood Inference of a Local Variance Component</i>
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Description

This function provides an empirical likelihood method for the inference of a local variance component in linear mixed-effects models.

Usage

```
ELvar(X, Y, Philist, theta0=0, beta=NA, other=FALSE)
```

Arguments

X	design matrix for all observations, in which each row represents a p-dimensional covariates.
Y	response vector.
Philist	list of design matrices of variance components. Its i-th element is an n_i by $n_i \times d$ matrix that combines design matrices of variance components by columns for the i-th subject.
theta0	value of the first variance component under the null. Its default value is 0.
beta	fixed effects. Its default value is NA (unknown fixed effects).
other	logical; if TRUE, the function gives auxiliary terms. Its default value is FALSE.

Value

stat	value of the test statistic.
pvalue	approximated p-value based on asymptotic theory.
Zi, Di, Mi, nv1sq	auxiliary terms if other=TRUE.

References

Zhang J., Guo W., Carpenter J.S., Leroux A., Merikangas K.R., Martin N.G., Hickie I.B., Shou H., and Li H. (2022). Empirical likelihood tests for variance components in linear mixed-effects models.

See Also

[GELvar](#)

Examples

```
# Datasets "exampleNE0" and "exampleNE1" contain normal distributed longitudinal data.
# Datasets "exampleTE0" and "exampleTE1" contain t distributed longitudinal data.
# The first variance components in the datasets "exampleNE0" and "exampleTE0" are zero.
# The first variance components in the datasets "exampleNE1" and "exampleTE1" are nonzero at the 24, 25, 26, 27 time points.

# X is an N by p matrix with N being the number of all observations and p being the dimension of covariates.
# Y.all is an N by T matrix with T being the number of time points.
# Philist is an n list of design matrices of variance components with n being the number of subjects. Its $i$th element is a  $n_i$  by  $n_i \times d$  matrix.
# beta.all is a p by T matrix. Each column is the fixed effects at time t.
# thetastar is a d by T matrix. Each column is the variance components at time t.

data(exampleNE0)
t = 1 # consider the local problem at time t
re = ELvar(X,Y.all[,t],Philist,theta0=0) # with unknown fixed effects
re = ELvar(X,Y.all[,t],Philist,theta0=0,beta=beta.all[,t]) # with known fixed effects.
```

GELvar

*Empirical Likelihood Inference of Variance Components over an Interval***Description**

This function provides an empirical likelihood method for the inference of variance components over an interval in linear mixed-effects models.

Usage

```
GELvar(X, Y.all, Philist, theta0=0, beta.all=NA, permnum=1e3)
```

Arguments

X	design matrix for all observations, in which each row represents a p-dimensional covariates.
Y.all	response matrix, in which each column is the response vector at time t.
Philist	list of design matrices of variance components. Its i-th element is an n_i by $d \cdot n_i$ matrix that combines design matrices of variance components by columns for the i-th subject, where n_i is the number of repeated measures for the i-th subject and d is the number of variance components.
theta0	value of the first variance component under the null. Its default value is 0.
beta.all	fixed effects. Each column is the fixed effects at time t. Its default value is NA (unknown fixed effects).
permnum	number of perturbation. Its default value is 1000.

Value

stat.global	value of the test statistic over an interval.
pvalue.global	approximated p-value over an interval based on the perturbation.

References

Zhang J., Guo W., Carpenter J.S., Leroux A., Merikangas K.R., Martin N.G., Hickie I.B., Shou H., and Li H. (2022). Empirical likelihood tests for variance components in linear mixed-effects models.

See Also

[ELvar](#)

Examples

```

# Datasets "exampleNE0" and "exampleNE1" contain normal distributed longitudinal data.
# Datasets "exampleTE0" and "exampleTE1" contain t distributed longitudinal data.
# The first variance components in the datasets "exampleNE0" and "exampleTE0" are zero.
# The first variance components in the datasets "exampleNE1" and "exampleTE1" are nonzero at the 24, 25, 26, 27 time points.

# X is an N by p matrix with N being the number of all observations and p being the dimension of covariates.
# Y.all is an N by T matrix with T being the number of time points.
# Philist is an n list of design matrices of variance components with n being the number of subjects. Its $i$th element is a ni by d matrix.
# beta.all is a p by T matrix. Each column is the fixed effects at time t.
# thetastar is a d by T matrix. Each column is the variance components at time t.

data(exampleNE0)
re = GELvar(X,Y.all,Philist,theta0=0)

```

multiELvar

Empirical Likelihood Inference of Variance Components at multiple time points

Description

This function provides an empirical likelihood method for the inference of variance components at multiple time points in linear mixed-effects models.

Usage

```
multiELvar(X,Y.all,Philist,theta0=0,beta.all=NA,other=FALSE)
```

Arguments

X	design matrix for all observations, in which each row represents a p-dimensional covariates.
Y.all	response matrix, in which each column is the response vector at time t.
Philist	list of design matrices of variance components. Its i-th element is an ni by d*ni matrix that combines design matrices of variance components by columns for the i-th subject, where ni is the number of repeated measures for the i-th subject and d is the number of variance components.
theta0	value of the first variance component under the null. Its default value is 0.
beta.all	fixed effects. Each column is the fixed effects at time t. Its default value is NA (unknown fixed effects).
other	logical; if TRUE, the function gives auxiliary terms. Its default value is FALSE.

Value

stat.all vector of test statistics at multiple time points.

pvalue.all vector of approximated p-value at multiple time points based on asymptotic theory.

Z.all, D.all, M.all, nv1sq.all
auxiliary terms if other=TRUE.

References

Zhang J., Guo W., Carpenter J.S., Leroux A., Merikangas K.R., Martin N.G., Hickie I.B., Shou H., and Li H. (2022). Empirical likelihood tests for variance components in linear mixed-effects models.

See Also

[GELvar](#)

Examples

```
# Datasets "exampleNE0" and "exampleNE1" contain normal distributed longitudinal data.
# Datasets "exampleTE0" and "exampleTE1" contain t distributed longitudinal data.
# The first variance components in the datasets "exampleNE0" and "exampleTE0" are zero.
# The first variance components in the datasets "exampleNE1" and "exampleTE1" are nonzero at the 24, 25, 26, 27 time points.

# X is an N by p matrix with N being the number of all observations and p being the dimension of covariates.
# Y.all is an N by T matrix with T being the number of time points.
# Philist is an n list of design matrices of variance components with n being the number of subjects. Its $i$th element is a ni by d*ni matrix that combines design matrices of variance components by columns for the i-th subject, where ni is the number of repeated measures for the i-th subject and d is the number of variance components.
# beta.all is a p by T matrix. Each column is the fixed effects at time t.
# thetastar is a d by T matrix. Each column is the variance components at time t.

data(exampleNE0)
re = multiELvar(X,Y.all,Philist,theta0=0)
```

Philist

Design Matrices of Variance Components

Description

This is a list of design matrices of variance components. Its i -th element is an n_i by $d \cdot n_i$ matrix that combines design matrices of variance components by columns for the i -th subject, where n_i is the number of repeated measures for the i -th subject and d is the number of variance components.

thetastar	<i>A Matrix Representing True Variance Components</i>
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Description

This is a d by T matrix, where d is the number of variance components and T is the number of time points. Each column is the true variance components at time t .

X	<i>Design matrix for all observations</i>
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Description

This is an N by p matrix with N being the number of all observations and p being the dimension of covariates. Each row represents a p -dimensional covariates.

$Y.all$	<i>Response matrix</i>
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Description

This is an N by T matrix with N being the number of all observations and T being the number of time points. Each column is the response vector at time t .

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