

Package ‘GCEstim’

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Type Package

Title Regression Coefficients Estimation Using the Generalized Cross Entropy

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Description Estimation and inference using the Generalized Maximum Entropy (GME) and Generalized Cross Entropy (GCE) framework, a flexible method for solving ill-posed inverse problems and parameter estimation under uncertainty (Golan, Judge, and Miller (1996, ISBN:978-0471145925) ``Maximum Entropy Econometrics: Robust Estimation with Limited Data"). The package includes routines for generalized cross entropy estimation of linear models including the implementation of a GME-GCE two steps approach. Diagnostic tools, and options to incorporate prior information through support and prior distributions are available (Macedo, Cabral, Afreixo, Macedo and Angelelli (2025) <[doi:10.1007/978-3-031-97589-9_21](https://doi.org/10.1007/978-3-031-97589-9_21)>). In particular, support spaces can be defined by the user or be internally computed based on the ridge trace or on the distribution of standardized regression coefficients. Different optimization methods for the objective function can be used. An adaptation of the normalized entropy aggregation (Macedo and Costa (2019) <[doi:10.1007/978-3-030-26036-1_2](https://doi.org/10.1007/978-3-030-26036-1_2)> ``Normalized entropy aggregation for inhomogeneous large-scale data") and a two-stage maximum entropy approach for time series regression (Macedo (2022) <[doi:10.1080/03610918.2022.2057540](https://doi.org/10.1080/03610918.2022.2057540)>) are also available. Suitable for applications in econometrics, health, signal processing, and other fields requiring robust estimation under data constraints.

License GPL-3

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Suggests knitr, rmarkdown, kableExtra

VignetteBuilder knitr

URL <https://github.com/jorgevazcabral/GCEstim>

BugReports <https://github.com/jorgevazcabral/GCEstim/issues>

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NeedsCompilation no

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| | |
|------------|--------------------------|
| accmeasure | <i>Accuracy measures</i> |
|------------|--------------------------|

Description

Function that allows to calculate different types of errors for point predictions:

1. MAE - Mean Absolute Error,
2. MAD - Mean Absolute Deviation,
3. MSE - Mean Squared Error,
4. RMSE - Root Mean Squared Error,
5. MAPE - Mean Absolute Percentage Error,
6. sMAPE - symmetric Mean Absolute Percentage Error,
7. MASE - Mean Absolute Scaled Error (Hyndman & Koehler, 2006)

Usage

```
accmeasure(
  y_pred,
  y_true,
  which = c("RMSE", "MSE", "MAPE", "sMAPE", "MAE", "MAD", "MASE")
)
```

Arguments

| | |
|--------|---|
| y_pred | fitted values. |
| y_true | observed values. |
| which | one of c("RMSE", "MAPE", "sMAPE", "MAE", "MAD", "MASE") |

Value

The value of the chosen error is returned.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

References

Hyndman, R. J., & Koehler, A. B. (2006) *Another look at measures of forecast accuracy*. International Journal of Forecasting, 22(4), 679–688. doi:[10.1016/j.ijforecast.2006.03.001](https://doi.org/10.1016/j.ijforecast.2006.03.001)

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

accmeasure(fitted(res_gce_package), dataGCE$y, which = "MSE")
```

case.names.lmgce

Case Names of `lmgce` Fitted Models

Description

Simple utility returning case names.

Usage

```
## S3 method for class 'lmgce'
case.names(object, ...)
```

Arguments

`object` Fitted [lmgce](#) model object.
`...` Additional arguments (not used).

Value

A character vector containing the names or labels of the cases (observations) in the [lmgce](#) model object.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

case.names(res_gce_package)
```

| | |
|------------|--|
| changestep | <i>Change the step from lmgce object</i> |
|------------|--|

Description

Changes the number of GCE reestimations of a [lmgce](#) object

Usage

```
changestep(object, twosteps.n, verbose = 0)
```

Arguments

`object` fitted [lmgce](#) object.
`twosteps.n` An integer that defines the number of GCE reestimations to be used.
`verbose` An integer to control how verbose the output is. For a value of 0 no messages or output are shown and for a value of 3 all messages are shown. The default is `verbose = 0`.

Value

An `lmgce` object with the specified number of GCE reestimations

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        twosteps.n = 10,
        seed = 230676)

res_gce_package_change_step <- changestep(res_gce_package, 5)

summary(res_gce_package)

summary(res_gce_package_change_step)
```

changesupport

Change the support from `lmgce` object

Description

Changes the support spaces of a `lmgce` object

Usage

```
changesupport(object, support, verbose = 0)
```

Arguments

| | |
|----------------------|--|
| <code>object</code> | fitted <code>lmgce</code> object. |
| <code>support</code> | One of <code>c("min", "lse", "elbow")</code> or a chosen support from <code>object\$support.ok</code> . |
| <code>verbose</code> | An integer to control how verbose the output is. For a value of 0 no messages or output are shown and for a value of 3 all messages are shown. The default is <code>verbose = 0</code> . |

Value

An `lmgce` object with the specified support spaces

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```

res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

res_gce_package_change <- changesupport(res_gce_package, "min")

summary(res_gce_package)

summary(res_gce_package_change)

```

| | |
|---------------|--|
| coef.cv.lmgce | <i>Extract cv.lmgce Coefficients</i> |
|---------------|--|

Description

Extract coefficients from a [cv.lmgce](#) object

Usage

```

## S3 method for class 'cv.lmgce'
coef(object, ...)

```

Arguments

| | |
|--------|---|
| object | Fitted cv.lmgce model object. |
| ... | Additional arguments (not used). |

Value

Returns the coefficients from a [cv.lmgce](#) object. The coefficients are obtained from the [lmgce](#) object with best performance. These coefficients are stored in `object$best$coefficients`.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res.cv.lmgce <-
  cv.lmgce(y ~ .,
           data = dataGCE)

coef(res.cv.lmgce)
```

| | |
|------------|--|
| coef.lmgce | <i>Extract lmgce Model Coefficients</i> |
|------------|--|

Description

Extract coefficients from a **lmgce** object

Usage

```
## S3 method for class 'lmgce'
coef(object, ...)
```

Arguments

| | |
|--------|-----------------------------------|
| object | Fitted lmgce model object. |
| ... | Additional arguments (not used). |

Value

Returns the coefficients from a **lmgce** object

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

coef(res_gce_package)
```

| | |
|---------------|--------------------------------------|
| coef.neagging | Extract neagging Coefficients |
|---------------|--------------------------------------|

Description

Extract coefficients from a **neagging** object

Usage

```
## S3 method for class 'neagging'  
coef(object, which = which.min(object$error)[[1]], ...)
```

Arguments

| | |
|--------|--|
| object | Fitted neagging model object. |
| which | Number of aggregated models. The coefficients returned are by default the ones that produced the lowest in sample error. |
| ... | Additional arguments. |

Value

Returns the coefficients from a **neagging** object

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-  
  lmgce(y ~ .,  
        data = dataGCE,  
        boot.B = 50,  
        seed = 230676)  
  
res_neagging <- neagging(res_gce_package)  
coef(res_neagging)  
coef(res_neagging, which = ncol(res_neagging$matrix))
```

| | |
|------------|---|
| coef.ridge | Extract <code>ridge</code> Model Coefficients |
|------------|---|

Description

Extract coefficients from a `ridge` object

Usage

```
## S3 method for class 'ridge'  
coef(object, which = "min.error", ...)
```

Arguments

| | |
|--------|--|
| object | Fitted <code>ridge</code> model object. |
| which | One of c("min.error", "max.abs"). If which = "min.error", the default, the coefficients that produced the lowest error cross-validation error (cv = TRUE), or in sample error are returned (cv = FALSE). If which = "max.abs" then the maximum absolute coefficients are returned. |
| ... | Additional arguments (not used). |

Value

Returns the coefficients from a `ridge` object

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res.ridge <-  
  ridge(  
    formula = y ~ X001 + X002 + X003 + X004 + X005,  
    data = dataGCE)  
  
coef(res.ridge)
```

| | |
|----------------|--|
| coef.tsbootgce | Extract tsbootgce Model Coefficients |
|----------------|--|

Description

Extract coefficients from a [tsbootgce](#) object

Usage

```
## S3 method for class 'tsbootgce'  
coef(object, which = NULL, seed = object$seed, ...)
```

Arguments

| | |
|--------|--|
| object | Fitted tsbootgce model object. |
| which | The default is which = NULL and returns the coefficients defined in the argument coef.method from the tsbootgce object. Can be set as "mode" or "median" and the mode and median coefficients will be computed, respectively (see hdr). |
| seed | A single value, interpreted as an integer, for reproducibility or NULL for randomness. The default is seed = object\$seed. |
| ... | Additional arguments. |

Value

Returns the coefficients from a tsbootgce object

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res.tsbootgce <-  
  tsbootgce(  
    formula = C02 ~ 1 + L(GDP, 1) + L(EPC, 1) + L(EU, 1),  
    data = moz_ts)  
  
coef(res.tsbootgce)
```

coefficients.cv.lmgce *Extract [cv.lmgce](#) Coefficients*

Description

Extract coefficients from a [cv.lmgce](#) object

Usage

```
## S3 method for class 'cv.lmgce'  
coefficients(object, ...)
```

Arguments

| | |
|--------|---|
| object | Fitted cv.lmgce model object. |
| ... | Additional arguments (not used). |

Value

Returns the coefficients from a [cv.lmgce](#) object. The coefficients are obtained from the [lmgce](#) object with best performance. These coefficients are stored in `object$best$coefficients`.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res.cv.lmgce <-  
  cv.lmgce(y ~ .,  
           data = dataGCE)  
  
coefficients(res.cv.lmgce)
```

coefficients.lmgce *Extract [lmgce](#) Model Coefficients*

Description

Extract coefficients from a [lmgce](#) object

Usage

```
## S3 method for class 'lmgce'  
coefficients(object, ...)
```

Arguments

object Fitted [lmgce](#) model object.
 ... Additional arguments (not used).

Value

Returns the coefficients from a [lmgce](#) object

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        seed = 230676)

coefficients(res_gce_package)
```

coefficients.neagging *Extract [neagging](#) Coefficients*

Description

Extract coefficients from a [neagging](#) object

Usage

```
## S3 method for class 'neagging'
coefficients(object, which = which.min(object$error)[[1]], ...)
```

Arguments

object Fitted [neagging](#) model object.
 which Number of aggregated models. The coefficients returned are by default the ones that produced the lowest in sample error.
 ... Additional arguments.

Value

Returns the coefficients from a [neagging](#) object

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

res_neagging <- neagging(res_gce_package)
coefficients(res_neagging)
coefficients(res_neagging, which = ncol(res_neagging$matrix))
```

coefficients.ridgetrace

Extract [ridgetrace](#) Model Coefficients

Description

Extract coefficients from a [ridgetrace](#) object

Usage

```
## S3 method for class 'ridgetrace'
coefficients(object, which = "min.error", ...)
```

Arguments

| | |
|--------|--|
| object | Fitted ridgetrace model object. |
| which | One of c("min.error", "max.abs"). If which = "min.error", the default, the coefficients that produced the lowest error cross-validation error (cv = TRUE), or in sample error are returned (cv = FALSE). If which = "max.abs" then the maximum absolute coefficients are returned. |
| ... | Additional arguments. |

Value

Returns the coefficients from a [ridgetrace](#) object

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res.ridgetrace <-
  ridgetrace(
    formula = y ~ X001 + X002 + X003 + X004 + X005,
    data = dataGCE)

coefficients(res.ridgetrace)
```

coefficients.tsbootgce

Extract [tsbootgce](#) Model Coefficients

Description

Extract coefficients from a [tsbootgce](#) object

Usage

```
## S3 method for class 'tsbootgce'
coefficients(object, which = NULL, seed = object$seed, ...)
```

Arguments

| | |
|--------|--|
| object | Fitted tsbootgce model object. |
| which | The default is which = NULL and returns the coefficients defined in the argument coef.method from the tsbootgce object. Can be set as "mode" or "median" and the mode and median coefficients will be computed, respectively (see hdr). |
| seed | A single value, interpreted as an integer, for reproducibility or NULL for randomness. The default is seed = object\$seed. |
| ... | Additional arguments. |

Value

Returns the coefficients from a tsbootgce object

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res.tsbootgce <-
  tsbootgce(
    formula = CO2 ~ 1 + L(GDP, 1) + L(EPC, 1) + L(EU, 1),
    data = moz_ts)

coefficients(res.tsbootgce)
```

| | |
|---------------|---|
| confint.lmgce | <i>Confidence Intervals for lmgce Model Parameters and Normalized Entropy</i> |
|---------------|---|

Description

Computes confidence intervals for one or more parameters or Normalized Entropy in a [lmgce](#) fitted model.

Usage

```
## S3 method for class 'lmgce'
confint(
  object,
  parm,
  level = 0.95,
  which = c("estimates", "NormEnt"),
  method = {
    if (which == "estimates") {
      c("z", "percentile", "basic")
    }
    else {
      c("percentile", "basic")
    }
  },
  boot.B = ifelse(object$boot.B == 0, 100, object$boot.B),
  boot.method = object$boot.method,
  ...
)
```

Arguments

| | |
|--------|---|
| object | Fitted lmgce model object. |
| parm | a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. If missing, all parameters are considered. |

| | |
|-------------|---|
| level | the confidence level required. The default is level = 0.95. |
| which | One of c("estimates", "NormEnt"). The default is which = "estimates". |
| method | method used to compute the interval. One of c("z", "percentile", "basic"). The default is method = "z" and is only valid for the parameters. |
| boot.B | A single positive integer greater or equal to 10 for the number of bootstrap replicates for the computation of the bootstrap confidence interval(s), to be used when method = c("percentile", "basic") and when object was created with boot.B = 0. The default is boot.B = 100 when the object has no previous sampling information and boot.B = object\$boot.B otherwise, which corresponds to the boot.B given to lmgce when the object was created. |
| boot.method | Method used for bootstrapping. One of c("residuals", "cases", "wild") which corresponds to resampling on residuals, on individual cases or on residuals multiplied by a N(0,1) variable, respectively. The default is boot.method = object\$boot.method. |
| ... | additional arguments. |

Value

A matrix (or vector) with columns giving lower and upper confidence limits for each parameter. These will be labelled as (1-level)/2 and 1 - (1-level)/2 in percentage (by default 2.5 percent and 97.5 percent).

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

confint(res_gce_package, method = "percentile")

confint(res_gce_package, which = "NormEnt", level = 0.99)

confint(res_gce_package, parm = c("X005"), level = 0.99)
```

| | |
|-------------------|---|
| confint.tsbootgce | <i>Confidence Intervals for tsbootgce Model Parameters and Normalized Entropy</i> |
|-------------------|---|

Description

Computes confidence intervals for one or more parameters or Normalized Entropy in a [tsbootgce](#) fitted model.

Usage

```
## S3 method for class 'tsbootgce'
confint(
  object,
  parm,
  level = 0.95,
  which = c("estimates", "NormEnt"),
  method = c("hdr", "percentile", "basic"),
  seed = object$seed,
  ...
)
```

Arguments

| | |
|--------|---|
| object | Fitted tsbootgce model object. |
| parm | a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. If missing, all parameters are considered. |
| level | the confidence level required. The default is level = 0.95. |
| which | One of c("estimates", "NormEnt"). The default is which = "estimates". |
| method | method used to compute the interval. One of c("hdr", "percentile", "basic"). The default is method = "hdr" (see hdr). |
| seed | A single value, interpreted as an integer, for reproducibility or NULL for randomness. The default is seed = object\$seed. |
| ... | additional arguments. |

Value

A matrix (or vector) with columns giving lower and upper confidence limits for each parameter. Generally, these will be labelled as (1-level)/2 and 1 - (1-level)/2 in percentage (by default 2.5 percent and 97.5 percent).

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res.tsbootgce <-
  tsbootgce(
    formula = CO2 ~ 1 + L(GDP, 1) + L(EPC, 1) + L(EU, 1),
    data = moz_ts)

confint(res.tsbootgce, method = "percentile")

confint(res.tsbootgce, which = "NormEnt", level = 0.99)

confint(res.tsbootgce, parm = c("L(GDP, 1)"), level = 0.99)
```

cv.lmgce

Cross-validation for lmgce

Description

Performs k-fold cross-validation for some of the [lmgce](#) parameters.

Usage

```
cv.lmgce(
  formula,
  data,
  subset,
  na.action,
  offset,
  contrasts = NULL,
  model = TRUE,
  x = FALSE,
  y = FALSE,
  cv = TRUE,
  cv.nfolds = 5,
  errormeasure = c("RMSE", "MSE", "MAE", "MAPE", "SMAPE", "MASE"),
  errormeasure.which = {
    if (isTRUE(cv))
      c("1se", "min", "elbow")

    else c("min", "elbow")
  },
  support.method = c("standardized", "ridge"),
  support.method.penalize.intercept = TRUE,
  support.signal = NULL,
  support.signal.vector = NULL,
  support.signal.vector.min = 0.3,
```

```

support.signal.vector.max = 20,
support.signal.vector.n = 20,
support.signal.points = c(3, 5, 7, 9),
support.noise = NULL,
support.noise.points = c(3, 5, 7, 9),
weight = c(0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9),
twosteps.n = 1,
method = c("dual.lbfgsb3c", "dual.BFGS", "dual", "primal.solnl", "primal.solnp",
  "dual.CG", "dual.L-BFGS-B", "dual.Rcgmin", "dual.bobyqa", "dual.newuoa",
  "dual.nlm", "dual.nlm", "dual.lbfgs", "dual.optimParallel"),
caseGLM = c("D", "M", "NM"),
boot.B = 0,
boot.method = c("residuals", "cases", "wild"),
seed = 230676,
OLS = TRUE,
verbose = 0,
coef = NULL
)

```

Arguments

| | |
|-----------|--|
| formula | An object of class formula (or one that can be coerced to that class): a symbolic description of the model to be fitted. |
| data | A data frame (or object coercible by as.data.frame to a data frame) containing the variables in the model. |
| subset | an optional vector specifying a subset of observations to be used in the fitting process. |
| na.action | a function which indicates what should happen when the data contain NAs. The default is set by the na.action setting of options , and is na.fail if that is unset. The ‘factory-fresh’ default is na.omit . Another possible value is NULL, no action. Value na.exclude can be useful. |
| offset | this can be used to specify an a priori known component to be included in the linear predictor during fitting. This should be NULL or a numeric vector or matrix of extents matching those of the response. One or more offset terms can be included in the formula instead or as well, and if more than one are specified their sum is used. See model.offset . |
| contrasts | An optional list. See the contrasts.arg of model.matrix.default . |
| model | Boolean value. if TRUE, the model frame used is returned. The default is model = TRUE. |
| x | Boolean value. if TRUE, the model matrix used is returned. The default is x = FALSE. |
| y | Boolean value. if TRUE, the response used is returned. The default is y = FALSE. |
| cv | Boolean value. If TRUE the error, errormeasure , will be computed using cross-validation. If FALSE the error will be computed in sample. The default is cv = TRUE. |

| | |
|--|---|
| <code>cv.nfolds</code> | number of folds used for cross-validation when <code>cv = TRUE</code> . The default is <code>cv.nfolds = 5</code> and the smallest value allowable is <code>cv.nfolds = 3</code> . |
| <code>errormeasure</code> | Loss function (error) to be used for the selection of the support spaces. One of <code>c("RMSE", "MSE", "MAE", "MAPE", "sMAPE", "MASE")</code> . The default is <code>errormeasure = "RMSE"</code> . |
| <code>errormeasure.which</code> | Which value of <code>errormeasure</code> to be used for selecting a support space upper limit from <code>support.signal.vector</code> . One of <code>c("min", "1se", "elbow")</code> where <code>"min"</code> corresponds to the support spaces that produced the lowest error, <code>"1se"</code> corresponds to the support spaces such that error is within 1 standard error of the CV error for <code>"min"</code> and <code>"elbow"</code> corresponds to the elbow point of the error curve (the point that maximizes the distance between each observation, i.e., the pair composed by the upper limit of the support space and the error, and the line between the first and last observations, i.e., the lowest and the highest upper limits of the support space respectively. See find_curve_elbow). The default is <code>errormeasure.which = "1se"</code> . |
| <code>support.method</code> | One of <code>c("standardized", "ridge")</code> . If <code>support.method = "standardized"</code> , the default, standardized coefficients are used to define the signal support spaces. If <code>support.method = "ridge"</code> the signal support spaces are defined by the ridge trace. |
| <code>support.method.penalize.intercept</code> | Boolean value. if <code>TRUE</code> , the default, the intercept will be penalized. To be used when <code>support.method = "ridge"</code> . |
| <code>support.signal</code> | <code>NULL</code> or fixed positive upper limit (<code>L</code>) for the support spaces (<code>-L, L</code>) on standardized data (when <code>support.method = "standardized"</code>); <code>NULL</code> or fixed positive factor to be multiplied by the maximum absolute value of the ridge trace for each coefficient (when <code>support.method = "ridge"</code>); a pair (<code>LL, UL</code>) or a matrix (<code>(k+1) x 2</code>) for the support spaces on original data. The default is <code>support.signal = NULL</code> . |
| <code>support.signal.vector</code> | <code>NULL</code> or a vector of positive values when <code>support.signal = NULL</code> . If <code>support.signal.vector = NULL</code> , the default, a vector <code>c(support.signal.vector.min, ..., support.signal.vector.max)</code> of dimension <code>support.signal.vector.n</code> and logarithmically equally spaced will be generated. Each value represents the upper limits for the standardized support spaces, when <code>support.method = "standardized"</code> or the factor to be multiplied by the maximum absolute value of the ridge trace for each coefficient, when <code>support.method = "ridge"</code> . |
| <code>support.signal.vector.min</code> | A positive value for the lowest limit of the <code>support.signal.vector</code> when <code>support.signal = NULL</code> and <code>support.signal.vector = NULL</code> . The default is <code>support.signal.vector.min = 0.3</code> . |
| <code>support.signal.vector.max</code> | A positive value for the highest limit of the <code>support.signal.vector</code> when <code>support.signal = NULL</code> and <code>support.signal.vector = NULL</code> . The default is <code>support.signal.vector.max = 20</code> . |
| <code>support.signal.vector.n</code> | A positive integer for the number of support spaces to be used when <code>support.signal</code> |

| | |
|------------------------------------|--|
| | = NULL and <code>support.signal.vector</code> = NULL. The default is <code>support.signal.vector.n</code> = 20. |
| <code>support.signal.points</code> | A vector of positive integers defining the number of points for the signal support to be tested. The default is <code>support.signal.points</code> = <code>c(3, 5, 7, 9)</code> . |
| <code>support.noise</code> | An interval, preferably centered around zero, given in the form <code>c(LL, UL)</code> . If <code>support.noise</code> = NULL, the default, then a vector <code>c(-L, L)</code> is computed using the empirical three-sigma rule Pukelsheim (1994). |
| <code>support.noise.points</code> | A vector of positive integers defining the number of points for the noise support to be tested. The default is <code>support.noise.points</code> = <code>c(3, 5, 7, 9)</code> . |
| <code>weight</code> | a vector of values between zero and one representing the prediction-precision loss trade-off. The default is <code>weight</code> = <code>c(0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9)</code> . |
| <code>twosteps.n</code> | Number of GCE reestimations using a previously estimated vector of signal probabilities. |
| <code>method</code> | Use "primal.solnl" (GCE using Sequential Quadratic Programming (SQP) method; see solnl) or "primal.solnp" (GCE using the augmented Lagrange multiplier method with an SQP interior algorithm; see solnp) for primal form of the optimization problem and "dual" (GME), "dual.CG" (GCE using a conjugate gradients method; see optim), "dual.BFGS" (GCE using Broyden-Fletcher-Goldfarb-Shanno quasi-Newton method; see optim), "dual.L-BFGS-B" (GCE using a box-constrained optimization with limited-memory modification of the BFGS quasi-Newton method; see optim), <code>dual.Rcgmin</code> (GCE using an update of the conjugate gradient algorithm; see optimx), <code>dual.bobyqa</code> (GCE using a derivative-free optimization by quadratic approximation; see optimx and bobyqa), <code>dual.newuoa</code> (GCE using a derivative-free optimization by quadratic approximation; see optimx and newuoa), <code>dual.nlminb</code> (GCE; see optimx and nlminb), <code>dual.nlm</code> (GCE; see optimx and nlm), <code>dual.lbfgs</code> (GCE using the Limited-memory Broyden-Fletcher-Goldfarb-Shanno; see lbfgs), <code>dual.lbfgsb3c</code> (GCE using L-BFSC-B implemented in Fortran code and with an Rcpp interface; see lbfgsb3c) or <code>dual.optimParallel</code> (GCE using parallel version of the L-BFGS-B; see optimParallel) for dual form. The default is <code>method</code> = "dual.BFGS". |
| <code>caseGLM</code> | special cases of the generic general linear model. One of <code>c("D", "M", "NM")</code> , where "D" stands for data, "M" for moment and "NM" for normed-moment. The default is <code>caseGLM</code> = "D". |
| <code>boot.B</code> | A single positive integer greater or equal to 10 for the number of bootstrap replicates to be used for the computation of the bootstrap confidence interval(s). Zero value will generate no replicate. The default is <code>boot.B</code> = 0. |
| <code>boot.method</code> | Method to be use for bootstrapping. One of <code>c("residuals", "cases", "wild")</code> which corresponds to resampling on residuals, on individual cases or on residuals multiplied by a $N(0,1)$ variable, respectively. The default is <code>boot.method</code> = "residuals". |
| <code>seed</code> | A single value, interpreted as an integer, for reproducibility or NULL for randomness. The default is <code>seed</code> = 230676. |

| | |
|---------|--|
| OLS | Boolean value. if TRUE, the default, OLS estimation is performed. |
| verbose | An integer to control how verbose the output is. For a value of 0 no messages or output are shown and for a value of 3 all messages are shown. The default is verbose = 0. |
| coef | A vector of the true coefficients, when available. |

Details

The `cv.lmgce` function fits several linear regression models via generalized cross according to the defined arguments. In particular, `support.signal.points`, `support.noise.points` and `weight` can be defined as vectors.

Value

`cv.lmgce` returns an object of [class](#) `cv.lmgce`.

An object of [class](#) `cv.lmgce` is a list containing at least the following components:

| | |
|----------------------------|---|
| results | a $C \times 8$ data.frame, where C is the number of combinations of the arguments <code>support.signal.points</code> , <code>support.noise.points</code> and <code>weight</code> . Contains information about the arguments, error, convergence of the optimization method and time of computation. |
| best | a lm object obtained with the combination of arguments that produced the lowest cross-validation error. |
| support.signal.points | a vector of the <code>support.signal.points</code> tested. |
| support.signal.points.best | the value of <code>support.signal.points</code> that produced the lowest cross-validation error. |
| support.noise.points | a vector of the <code>support.noise.points</code> tested. |
| support.noise.points.best | the value of <code>support.noise.points</code> that produced the lowest cross-validation error. |
| weight | a vector of the <code>weight</code> tested. |
| weight.best | the value of <code>weight</code> that produced the lowest cross-validation error. |

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

References

- Golan, A., Judge, G. G. and Miller, D. (1996) *Maximum entropy econometrics : robust estimation with limited data*. Wiley.
- Golan, A. (2008). *Information and Entropy Econometrics — A Review and Synthesis*. Foundations and Trends® in Econometrics, 2(1–2), 1–145. doi:10.1561/08000000004
- Golan, A. (2017) *Foundations of Info-Metrics: Modeling, Inference, and Imperfect Information*

(Vol. 1). Oxford University Press. doi:10.1093/oso/9780199349524.001.0001
 Pukelsheim, F. (1994) *The Three Sigma Rule*. The American Statistician, 48(2), 88–91. doi:10.2307/2684253

See Also

See the generic functions `plot.cv.lmgce`, `print.cv.lmgce` and `coef.cv.lmgce`.

Examples

```
res.cv.lmgce <-
  cv.lmgce(y ~ .,
           data = dataGCE)

res.cv.lmgce
```

dataGCE

Simulated data set generated with fngendata

Description

Simulated data, used to demonstrate the functions of GCEstim. The seed used is the different from the one used to generate dataGCE.test but the remaining parameters are the same.

Usage

```
dataGCE
```

Format

A data.frame containing:

X001 A N(0,1) independent variable.

X002 A N(0,1) independent variable.

X003 A N(0,1) independent variable.

X004 A N(0,1) independent variable.

X005 A N(0,1) independent variable.

y A Dependent variable: $y = 1 + 3 * X003 + 6 * X004 + 9 * X005 + \text{error}$; the error follows a normal distribution with mean equal to zero and variance such that the signal to noise ratio is equal to 5.

Examples

```
data(dataGCE)
```

```
plot(dataGCE)
```

| | |
|--------------|--|
| dataGCE.test | <i>Simulated data set generated with fngendata</i> |
|--------------|--|

Description

Simulated data, used to demonstrate the functions of GCEstim. The seed used is the different from the one used to generate dataGCE but the remaining parameters are the same.

Usage

```
dataGCE.test
```

Format

A data.frame containing:

X001 A N(0,1) independent variable.

X002 A N(0,1) independent variable.

X003 A N(0,1) independent variable.

X004 A N(0,1) independent variable.

X005 A N(0,1) independent variable.

y A Dependent variable: $y = 1 + 3 * X003 + 6 * X004 + 9 * X005 + \text{error}$; the error follows a normal distribution with mean equal to zero and variance such that the signal to noise ratio is equal to 5.

Examples

```
data(dataGCE.test)
```

```
plot(dataGCE.test)
```

| | |
|---------------|--|
| dataincRidGME | <i>Simulated data set generated with fngendata</i> |
|---------------|--|

Description

Simulated data, used to demonstrate the functions of GCEstim.

Usage

```
dataincRidGME
```

Format

A data.frame containing:

X001 A N(0,1) independent variable.

X002 A N(0,1) independent variable.

X003 A N(0,1) independent variable.

X004 A N(0,1) independent variable.

X005 A N(0,1) independent variable.

X006 A N(0,1) independent variable.

y A Dependent variable: $y = 2.5 - 8 * X004 + 19 * X005 - 13 * X006 + \text{error}$; the error follows a normal distribution with mean equal to zero and variance such that the signal to noise ratio is equal to 1.

Examples

```
data(dataincRidGME)
```

```
plot(dataincRidGME)
```

| | |
|--------------------|--|
| dataincRidGME.test | <i>Simulated data set generated with fngendata</i> |
|--------------------|--|

Description

Simulated data, used to demonstrate the functions of GCEstim.

Usage

```
dataincRidGME.test
```

Format

A data.frame containing:

X001 A N(0,1) independent variable.

X002 A N(0,1) independent variable.

X003 A N(0,1) independent variable.

X004 A N(0,1) independent variable.

X005 A N(0,1) independent variable.

X006 A N(0,1) independent variable.

y A Dependent variable: $y = 2.5 - 8 * X004 + 19 * X005 - 13 * X006 + \text{error}$; the error follows a normal distribution with mean equal to zero and variance such that the signal to noise ratio is equal to 1.

Examples

```
data(dataincRidGME.test)

plot(dataincRidGME.test)
```

| | |
|-------------------|------------------------------------|
| df.residual.lmgce | <i>Residual Degrees-of-Freedom</i> |
|-------------------|------------------------------------|

Description

Returns the residual degrees-of-freedom extracted from a fitted model [lmgce](#) object.

Usage

```
## S3 method for class 'lmgce'
df.residual(object, ...)
```

Arguments

| | |
|--------|--|
| object | Fitted lmgce model object. |
| ... | additional arguments. |

Value

The value of the residual degrees-of-freedom extracted from a [lmgce](#) object.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

df.residual(res_gce_package)
```

| | |
|---------|---------------------------|
| ER.test | <i>Entropy Ratio test</i> |
|---------|---------------------------|

Description

The Entropy Ratio test - which corresponds to the likelihood ratio, or empirical ratio, test - measures the entropy discrepancy between the constrained and the unconstrained models.

Usage

```
ER.test(object)
```

Arguments

object fitted [lmgce](#) object.

Value

A matrix with the X-squared statistics, degrees of freedom and p-value for each parameter.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

ER.test(res_gce_package)
```

| | |
|--------------|--|
| fitted.lmgce | <i>Calculate lmgce Fitted Values</i> |
|--------------|--|

Description

The fitted values for the linear model represented by a [lmgce](#) object are extracted.

Usage

```
## S3 method for class 'lmgce'
fitted(object, ...)
```

Arguments

object Fitted [lmge](#) model object.
... additional arguments.

Value

Returns a vector with the fitted values for the linear model represented by a [lmge](#) object.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-  
  lmge(y ~ .,  
        data = dataGCE,  
        boot.B = 50,  
        seed = 230676)  
  
fitted(res_gce_package)
```

| | |
|---------------------|--|
| fitted.values.lmgce | Calculate lmge Fitted Values |
|---------------------|--|

Description

The fitted values for the linear model represented by a [lmge](#) object are extracted.

Usage

```
## S3 method for class 'lmge'  
fitted.values(object, ...)
```

Arguments

object Fitted [lmge](#) model object.
... additional arguments.

Value

Returns a vector with the fitted values for the linear model represented by a [lmge](#) object.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

fitted.values(res_gce_package)
```

fngendata

*Data generating function***Description**

Generates data

Usage

```
fngendata(
  n,
  bin.k = 0,
  bin.prob = NULL,
  cont.k = 5,
  y.gen.bin.k = 0,
  y.gen.bin.beta = NULL,
  y.gen.bin.prob = NULL,
  y.gen.cont.beta = c(2, 4, 6, 8, 10),
  y.gen.cont.mod.k = 0,
  y.gen.cont.mod.beta = matrix(c(-2, 2), 1, 2, byrow = TRUE),
  y.gen.bin.mod.prob = c(0.5),
  y.gen.cont.sp.k = 0,
  y.gen.cont.sp.groups = 2,
  y.gen.cont.sp.rho = 0.2,
  y.gen.cont.sp.dif = 1,
  intercept.beta = 0,
  Xgenerator.method = "simstudy",
  corMatrix = 100,
  rho = NULL,
  constr = NULL,
  condnumber = 1,
  mu = 0,
  muvect = NULL,
  sd = 1,
  sdvect = NULL,
  error.dist = "normal",
  error.dist.mean = 0,
```

```

    error.dist.sd = 1,
    error.dist.snr = NULL,
    error.dist.df = 2,
    dataframe = TRUE,
    seed = NULL
)

```

Arguments

| | |
|-----------------------------------|--|
| <code>n</code> | Number of individuals. |
| <code>bin.k</code> | Number of binary variables not used for generating <code>y</code> . |
| <code>bin.prob</code> | A vector of probabilities with length equal to <code>bin.k</code> . |
| <code>cont.k</code> | Number of continuous variables not used for generating <code>y</code> . |
| <code>y.gen.bin.k</code> | Number of binary variables used for generating <code>y</code> . |
| <code>y.gen.bin.beta</code> | A vector of coefficients with length equal to <code>bin.k</code> used to generate <code>y</code> . |
| <code>y.gen.bin.prob</code> | A vector of probabilities with length equal to <code>y.gen.bin.k</code> . |
| <code>y.gen.cont.beta</code> | A vector of coefficients with length equal to <code>cont.k</code> used to generate <code>y</code> . |
| <code>y.gen.cont.mod.k</code> | Experimental |
| <code>y.gen.cont.mod.beta</code> | Experimental |
| <code>y.gen.bin.mod.prob</code> | Experimental |
| <code>y.gen.cont.sp.k</code> | Experimental |
| <code>y.gen.cont.sp.groups</code> | Experimental |
| <code>y.gen.cont.sp.rho</code> | Experimental |
| <code>y.gen.cont.sp.dif</code> | Experimental |
| <code>intercept.beta</code> | Value for the constant used to generate <code>y</code> . |
| <code>Xgenerator.method</code> | Method used to generate X data ("simstudy" or "svd"). |
| <code>corMatrix</code> | A positive number for <code>alphad</code> (see rcorrmatrix), NULL or a correlation matrix to be used when <code>Xgenerator</code> is "simstudy". |
| <code>rho</code> | Correlation coefficient, $-1 \leq \rho \leq 1$. Use when <code>Xgenerator</code> is "simstudy" and <code>corMatrix</code> is NULL. |
| <code>corstr</code> | correlation structure ("ind", "cs" or "ar1") (see genCorData) to be used when <code>Xgenerator</code> is "simstudy" and <code>corMatrix</code> is NULL. |
| <code>condnumber</code> | A value for the condition number of the X matrix to be used when <code>Xgenerator</code> is "svd". |

| | |
|------------------------------|---|
| <code>mu</code> | The mean of the variables. To be used when all variables have the same mean. |
| <code>muvect</code> | A vector of means. To be used when variables have different means. The length of <code>muvect</code> must be <code>k</code> . |
| <code>sd</code> | Standard deviation of the variables. To be used when all variables have the same standard deviation. |
| <code>sdvect</code> | A vector of standard deviations. To be used when variables have different standard deviations. The length of <code>sdvect</code> must be <code>k</code> . |
| <code>error.dist</code> | Distribution of the error. "normal" for normal distribution or "t" for t-student distribution. |
| <code>error.dist.mean</code> | Mean value used when <code>error.dist</code> is "normal". |
| <code>error.dist.sd</code> | Standard deviation value used when <code>error.dist</code> is "normal". |
| <code>error.dist.snr</code> | Signal to noise ratio. If not NULL, the value of <code>error.dist.sd</code> will be ignored and it will be determined accordingly. |
| <code>error.dist.df</code> | Degrees of freedom used when <code>error.dist</code> is "t". |
| <code>dataframe</code> | Logical. If TRUE, the default, returns a <code>data.frame</code> else returns a list. |
| <code>seed</code> | A seed for reproducibility. |

Value

A `data.frame` or a list composed of a matrix of independent variables values (X), a vector of the dependent variable values (y), a vector of coefficient values (coefficients), a vector of non-zero coefficients (`y.coefficients`), and a vector of the error values (`epsilon`).

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
dataGCEstim <- fngendata(
  n = 100, cont.k = 2,
  y.gen.cont.beta = c(3, 6, 9),
  intercept.beta = 1,
  Xgenerator.method = "svd", condnumber = 50,
  mu = 0, sd = 1,
  error.dist = "normal", error.dist.mean = 0, error.dist.snr = 5,
  dataframe = TRUE, seed = 230676)

summary(dataGCEstim)
```

| | |
|---------------|--|
| formula.lmgce | <i>Extract Model Formula from lmgce object</i> |
|---------------|--|

Description

Returns the model used to fit `lmgce` object.

Usage

```
## S3 method for class 'lmgce'
formula(x, ...)
```

Arguments

| | |
|------------------|-----------------------------------|
| <code>x</code> | fitted <code>lmgce</code> object. |
| <code>...</code> | additional arguments. |

Value

An object of class `formula` representing the model formula.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

formula(res_gce_package)
```

| | |
|-------|---|
| lmgce | <i>Generalized Cross entropy estimation</i> |
|-------|---|

Description

This generic function fits a linear regression model via generalized cross entropy. Initial support spaces can be provided or computed.

Usage

```
lmgce(
  formula,
  data,
  subset,
  na.action,
  offset,
  contrasts = NULL,
  model = TRUE,
  x = FALSE,
  y = FALSE,
  cv = TRUE,
  cv.nfolds = 5,
  errormeasure = c("RMSE", "MSE", "MAE", "MAPE", "sMAPE", "MASE"),
  errormeasure.which = {
    if (isTRUE(cv))
      c("1se", "min", "elbow")

    else c("min", "elbow")
  },
  support.method = c("standardized", "ridge"),
  support.method.penalize.intercept = TRUE,
  support.signal = NULL,
  support.signal.vector = NULL,
  support.signal.vector.min = 0.3,
  support.signal.vector.max = 20,
  support.signal.vector.n = 20,
  support.signal.points = c(1/5, 1/5, 1/5, 1/5, 1/5),
  support.noise = NULL,
  support.noise.points = c(1/3, 1/3, 1/3),
  weight = 0.5,
  twosteps.n = 1,
  method = c("dual.BFGS", "dual.lbfgsb3c", "dual", "primal.solnl", "primal.solnp",
    "dual.CG", "dual.L-BFGS-B", "dual.Rcgmin", "dual.bobyqa", "dual.newuoa",
    "dual.nlminb", "dual.nlm", "dual.lbfgs", "dual.optimParallel"),
  caseGLM = c("D", "M", "NM"),
  boot.B = 0,
  boot.method = c("residuals", "cases", "wild"),
  seed = 230676,
  OLS = TRUE,
  verbose = 0
)
```

Arguments

| | |
|---------|--|
| formula | An object of class formula (or one that can be coerced to that class): a symbolic description of the model to be fitted. |
| data | A data frame (or object coercible by as.data.frame to a data frame) containing |

| | |
|--|---|
| | the variables in the model. |
| <code>subset</code> | an optional vector specifying a subset of observations to be used in the fitting process. |
| <code>na.action</code> | a function which indicates what should happen when the data contain NAs. The default is set by the <code>na.action</code> setting of <code>options</code> , and is <code>na.fail</code> if that is unset. The ‘factory-fresh’ default is <code>na.omit</code> . Another possible value is <code>NULL</code> , no action. Value <code>na.exclude</code> can be useful. |
| <code>offset</code> | this can be used to specify an a priori known component to be included in the linear predictor during fitting. This should be <code>NULL</code> or a numeric vector or matrix of extents matching those of the response. One or more <code>offset</code> terms can be included in the formula instead or as well, and if more than one are specified their sum is used. See <code>model.offset</code> . |
| <code>contrasts</code> | An optional list. See the <code>contrasts.arg</code> of <code>model.matrix.default</code> . |
| <code>model</code> | Boolean value. if <code>TRUE</code> , the model frame used is returned. The default is <code>model = TRUE</code> . |
| <code>x</code> | Boolean value. if <code>TRUE</code> , the model matrix used is returned. The default is <code>x = FALSE</code> . |
| <code>y</code> | Boolean value. if <code>TRUE</code> , the response used is returned. The default is <code>y = FALSE</code> . |
| <code>cv</code> | Boolean value. If <code>TRUE</code> the error, <code>errormeasure</code> , will be computed using cross-validation. If <code>FALSE</code> the error will be computed in sample. The default is <code>cv = TRUE</code> . |
| <code>cv.nfolds</code> | number of folds used for cross-validation when <code>cv = TRUE</code> . The default is <code>cv.nfolds = 5</code> and the smallest value allowable is <code>cv.nfolds = 3</code> . |
| <code>errormeasure</code> | Loss function (error) to be used for the selection of the support spaces. One of <code>c("RMSE", "MSE", "MAE", "MAPE", "sMAPE", "MASE")</code> . The default is <code>errormeasure = "RMSE"</code> . |
| <code>errormeasure.which</code> | Which value of <code>errormeasure</code> to be used for selecting a support space upper limit from <code>support.signal.vector</code> . One of <code>c("min", "1se", "elbow")</code> where <code>"min"</code> corresponds to the support spaces that produced the lowest error, <code>"1se"</code> corresponds to the support spaces such that error is within 1 standard error of the CV error for <code>"min"</code> and <code>"elbow"</code> corresponds to the elbow point of the error curve (the point that maximizes the distance between each observation, i.e, the pair composed by the upper limit of the support space and the error, and the line between the first and last observations, i.e., the lowest and the highest upper limits of the support space respectively. See <code>find_curve_elbow</code>). The default is <code>errormeasure.which = "1se"</code> . |
| <code>support.method</code> | One of <code>c("standardized", "ridge")</code> . If <code>support.method = "standardized"</code> , the default, standardized coefficients are used to define the signal support spaces. If <code>support.method = "ridge"</code> the signal support spaces are defined by the ridge trace. |
| <code>support.method.penalize.intercept</code> | Boolean value. if <code>TRUE</code> , the default, the intercept will be penalized. To be used when <code>support.method = "ridge"</code> . |

| | |
|--|---|
| <code>support.signal</code> | NULL or fixed positive upper limit (L) for the support spaces (-L,L) on standardized data (when <code>support.method = "standardized"</code>); NULL or fixed positive factor to be multiplied by the maximum absolute value of the ridge trace for each coefficient (when <code>support.method = "ridge"</code>); a pair (LL,UL) or a matrix ((k+1) x 2) for the support spaces on original data. The default is <code>support.signal = NULL</code> . |
| <code>support.signal.vector</code> | NULL or a vector of positive values when <code>support.signal = NULL</code> . If <code>support.signal.vector = NULL</code> , the default, a vector <code>c(support.signal.vector.min, ..., support.signal.vector.max)</code> of dimension <code>support.signal.vector.n</code> and logarithmically equally spaced will be generated. Each value represents the upper limits for the standardized support spaces, when <code>support.method = "standardized"</code> or the factor to be multiplied by the maximum absolute value of the ridge trace for each coefficient, when <code>support.method = "ridge"</code> . |
| <code>support.signal.vector.min</code> | A positive value for the lowest limit of the <code>support.signal.vector</code> when <code>support.signal = NULL</code> and <code>support.signal.vector = NULL</code> . The default is <code>support.signal.vector.min = 0.3</code> . |
| <code>support.signal.vector.max</code> | A positive value for the highest limit of the <code>support.signal.vector</code> when <code>support.signal = NULL</code> and <code>support.signal.vector = NULL</code> . The default is <code>support.signal.vector.max = 20</code> . |
| <code>support.signal.vector.n</code> | A positive integer for the number of support spaces to be used when <code>support.signal = NULL</code> and <code>support.signal.vector = NULL</code> . The default is <code>support.signal.vector.n = 20</code> . |
| <code>support.signal.points</code> | A positive integer, a vector or a matrix. Prior weights for the signal. If not a positive integer then the sum of weights by row must be equal to 1. The default is <code>support.signal.points = c(1 / 5, 1 / 5, 1 / 5, 1 / 5, 1 / 5)</code> . |
| <code>support.noise</code> | An interval, preferably centered around zero, given in the form <code>c(LL,UL)</code> . If <code>support.noise = NULL</code> , the default, then a vector <code>c(-L,L)</code> is computed using the empirical three-sigma rule Pukelsheim (1994). |
| <code>support.noise.points</code> | A positive integer, a vector or a matrix. Prior weights for the noise. If not a positive integer then the sum of weights by row must be equal to 1. The default is <code>support.noise.points = c(1 / 3, 1 / 3, 1 / 3)</code> . |
| <code>weight</code> | a value between zero and one representing the prediction-precision loss trade-off. If <code>weight = 0.5</code> , the default, equal weight is placed on the signal and noise entropies. A higher than 0.5 value places more weight on the noise entropy whereas a lower than 0.5 value places more weight on the signal entropy. |
| <code>twosteps.n</code> | Number of GCE reestimations using a previously estimated vector of signal probabilities. |
| <code>method</code> | Use <code>"primal.solnl"</code> (GCE using Sequential Quadratic Programming (SQP) method; see solnl) or <code>"primal.solnp"</code> (GCE using the augmented Lagrange multiplier method with an SQP interior algorithm; see solnp) for primal form of the optimization problem and <code>"dual"</code> (GME), <code>"dual.CG"</code> (GCE using a |

| | |
|-------------|---|
| | conjugate gradients method; see optim), "dual.BFGS" (GCE using Broyden-Fletcher-Goldfarb-Shanno quasi-Newton method; see optim), "dual.L-BFGS-B" (GCE using a box-constrained optimization with limited-memory modification of the BFGS quasi-Newton method; see optim), dual.Rcgmin (GCE using an update of the conjugate gradient algorithm; see optimx), dual.bobyqa (GCE using a derivative-free optimization by quadratic approximation; see optimx and bobyqa), dual.newuoa (GCE using a derivative-free optimization by quadratic approximation; see optimx and newuoa), dual.nlminb (GCE; see optimx and nlminb), dual.nlm (GCE; see optimx and nlm), dual.lbfgs (GCE using the Limited-memory Broyden-Fletcher-Goldfarb-Shanno; see lbfgs), dual.lbfgsb3c (GCE using L-BFSC-B implemented in Fortran code and with an Rcpp interface; see lbfgsb3c) or dual.optimParallel (GCE using parallel version of the L-BFGS-B; see optimParallel) for dual form. The default is method = "dual.BFGS". |
| caseGLM | special cases of the generic general linear model. One of c("D", "M", "NM"), where "D" stands for data, "M" for moment and "NM" for normed-moment The default is caseGLM = "D". |
| boot.B | A single positive integer greater or equal to 10 for the number of bootstrap replicates to be used for the computation of the bootstrap confidence interval(s). Zero value will generate no replicate. The default is boot.B = 0. |
| boot.method | Method to be use for bootstrapping. One of c("residuals", "cases", "wild") which corresponds to resampling on residuals, on individual cases or on residuals multiplied by a N(0,1) variable, respectively. The default is boot.method = "residuals". |
| seed | A single value, interpreted as an integer, for reproducibility or NULL for randomness. The default is seed = 230676. |
| OLS | Boolean value. if TRUE, the default, OLS estimation is performed. |
| verbose | An integer to control how verbose the output is. For a value of 0 no messages or output are shown and for a value of 3 all messages are shown. The default is verbose = 0. |

Details

The `lmgce` function fits a linear regression model via generalized cross entropy. Models for `lmgce` are specified symbolically. A typical model has the form `response ~ terms` where `response` is the (numeric) response vector and `terms` is a series of terms which specifies a linear predictor for response. `lmgce` calls the lower level functions `lmgce.validate`, `lmgce.assign.ci`, `lmgce.assign.noci`, `lmgce.sscv`, `lmgce.ss`, `lmgce.cv` and `lmgce.fit`.

Value

`lmgce` returns an object of `class` `lmgce`. The function `summary.lmgce` is used to obtain and print a summary of the results. The generic accessory functions `coef.lmgce`, `fitted.values.lmgce`, `residuals.lmgce` and `df.residual.lmgce`, extract various useful features of the value returned by object of class `lmgce`.

An object of `class` `lmgce` is a list containing at least the following components:

| | |
|------------------------------------|--|
| <code>coefficients</code> | a named vector of coefficients. |
| <code>residuals</code> | the residuals, that is response minus fitted values. |
| <code>fitted.values</code> | the fitted mean values. |
| <code>df.residual</code> | the residual degrees of freedom. |
| <code>call</code> | the matched call. |
| <code>terms</code> | the terms object used. |
| <code>contrast</code> | (only where relevant) the contrasts used. |
| <code>xlevels</code> | (only where relevant) a record of the levels of the factors used in fitting. |
| <code>offset</code> | the offset used (missing if none were used). |
| <code>y</code> | if requested (the default), the response used. |
| <code>x</code> | if requested (the default), the model matrix used. |
| <code>model</code> | if requested (the default), the model frame used. |
| <code>na.action</code> | (where relevant) information returned by model.frame on the special handling of NAs. |
| <code>boot.B</code> | number of bootstrap replicates used. |
| <code>boot.method</code> | method used for bootstrapping. |
| <code>caseGLM</code> | case of the generic general linear model used. |
| <code>convergence</code> | an integer code. 0 indicates successful optimization completion. Other numbers indicate different errors. See optim , optimx , solnl , solnp , lbfgs and lbfgsb3c). |
| <code>error</code> | loss function (error) used for the selection of the support spaces. |
| <code>error.measure</code> | in sample error for the selected support space. |
| <code>error.measure.cv.mean</code> | cross-validation mean error for the selected support space. |
| <code>error.measure.cv.sd</code> | standard deviation of the cross-validation error for the selected support space. |
| <code>error.which</code> | which criterion/standardized/factor support was used |
| <code>support.signal.1se</code> | upper limit of the standardized support space or factor that produced the error within one standard error from the minimum error. |
| <code>support.signal.elbow</code> | upper limit of the standardized support space or factor that produced the error correspondent to the elbow of the error curve. |
| <code>support.signal.min</code> | upper limit of the standardized support space or factor that produced the minimum error. |
| <code>p0</code> | vector of prior weights used for the signal. |
| <code>p</code> | estimated probabilities associated with the signal. |
| <code>w0</code> | vector of prior weights used for the noise. |
| <code>w</code> | estimated probabilities associated with the noise. |

| | |
|-----------------------------|---|
| <code>lambda</code> | estimated Lagrange multipliers. |
| <code>nep</code> | normalized entropy of the signal of the model. |
| <code>nep.cv.mean</code> | cross-validation normalized entropy of the signal of the model. |
| <code>nep.cv.sd</code> | standard deviation of the cross-validation normalized entropy of the signal of the model. |
| <code>nepk</code> | normalized entropy of the signal of each coefficient. |
| <code>results</code> | results from the different support spaces with or without cross-validation, and from bootstrap replicates, namely number of attempts (if the number of attempts is greater than three times the number of bootstrap replicates the bootstrapping process stops), coefficients and normalized entropies (<code>nep</code> - model, and <code>nepk</code> - coefficients), when applicable; results from OLS estimation if <code>OLS = TRUE</code> ; results from GCE reestimation if <code>twosteps.n</code> is greater than 0. |
| <code>support</code> | vector of given positive upper limits for the support spaces on standardized data or factors, when <code>support.signal = NULL</code> or <code>support.signal = L</code> , or "interval" otherwise. |
| <code>support.matrix</code> | matrix with the support spaces used for estimation on original data. |
| <code>support.method</code> | method chosen for the support's limits |
| <code>support.ok</code> | vector of successful positive upper limits for the support spaces on standardized data (<code>support.method = "standardized"</code>) or factors (<code>support.method = "ridge"</code>), when <code>support.signal = NULL</code> or <code>support.signal = L</code> , or "interval" otherwise. |
| <code>support.stdUL</code> | when applicable, the upper limit of the standardized support chosen, when <code>support.method = "standardized"</code> or the factor used when <code>support.method = "ridge"</code> . |
| <code>vcov</code> | variance-covariance matrix of the coefficients. |

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

References

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See Also

[summary.lmgce](#) for more detailed summaries. The generic functions [plot.lmgce](#), [print.lmgce](#), [coef.lmgce](#) and [confint.lmgce](#).

Examples

```
res_gce_package <-  
  lmgce(y ~ .,  
        data = dataGCE,  
        boot.B = 50,  
        seed = 230676)
```

```
res_gce_package
```

lmgceAddin

An add-in to easily generate the code for a [lmgce](#) analysis

Description

Select data and choose the arguments to be used. The execution of the code is also possible within the addin.

Usage

```
lmgceAddin()
```

Details

An addin for [lmgce](#)

Value

The code to be use in the [lmgce](#) analysis.

Examples

```
lmgceAddin()
```

| | |
|----------|---|
| lmgceAPP | lmgce Shiny application |
|----------|---|

Description

A Shiny application to execute [lmgce](#)

Usage

```
lmgceAPP()
```

Value

NULL. This function is called for its side effect (launching the app).

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

| | |
|--------------------|---|
| model.matrix.lmgce | Extract design matrix from lmgce object |
|--------------------|---|

Description

Returns the design matrix used to fit [lmgce](#) object.

Usage

```
## S3 method for class 'lmgce'  
model.matrix(object, ...)
```

Arguments

| | |
|--------|--------------------------------------|
| object | fitted lmgce object. |
| ... | additional arguments. |

Value

A numeric matrix with one row for each observation and one column for each parameter in the model.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        x = TRUE,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

model.matrix(res_gce_package)
```

 moz_ts

Worldbank time series data for Mozambique

Description

Mozambique's CO2, GDP, EPC e EU time series (1991-2014) from <https://databank.worldbank.org/> (Downloaded in 2024/12/03).

Usage

```
moz_ts
```

Format

A ts object containing:

year Year to which data refers

CO2 CO2 emissions (metric tons per capita); Data from: IDA Results Measurement System, Tier I Database – WDI;

EPC Electric power consumption (kWh per capita). Data from database: Jobs;

EU Energy use (kg of oil equivalent per capita). Data from database: World Development Indicators;

GDP Gross domestic product per capita (current US\$); Data from: World Development Indicators.

Examples

```
data(moz_ts)
```

```
plot(moz_ts)
```

| | |
|----------|---|
| neagging | <i>Normalized Entropy Aggregation for Inhomogeneous Large-Scale Data - Neagging</i> |
|----------|---|

Description

Computes the estimates for the Normalized Entropy Aggregation

Usage

```
neagging(
  object,
  boot.B = ifelse(object$boot.B == 0, 100, object$boot.B),
  boot.method = object$boot.method,
  error = object$error
)
```

Arguments

| | |
|--------------------------|--|
| <code>object</code> | Fitted lmgce or tsbootgce model object. |
| <code>boot.B</code> | To use with a lmgce object. A single positive integer greater or equal to 10 for the number of bootstrap replicates for the computation of the Normalized Entropy Aggregation estimate(s), to be used when <code>object</code> was created with <code>boot.B = 0</code> . The default is <code>boot.B = 100</code> when the object has no previous sampling information and <code>boot.B = object\$boot.B</code> otherwise, which corresponds to the <code>boot.B</code> given to lmgce when the object was created. |
| <code>boot.method</code> | To use with a lmgce object. Method used for bootstrapping. One of <code>c("residuals", "cases", "wild")</code> which corresponds to resampling on residuals, on individual cases or on residuals multiplied by a $N(0,1)$ variable, respectively. The default is <code>boot.method = object\$boot.method</code> . |
| <code>error</code> | Loss function (error) to be used for the selection of the support spaces. One of <code>c("RMSE", "MSE", "MAE", "MAPE", "sMAPE", "MASE")</code> . The default is <code>boot.method = object\$error</code> . |

Value

An object of [class](#) `neagging` is a list containing at least the following components:

| | |
|----------------------------------|---|
| <code>matrix</code> | a matrix where each column contains sequentially the aggregated estimates. |
| <code>error</code> | a named vector with the in sample error for each aggregated set of estimates. |
| <code>error.object</code> | the in sample error of the object. |
| <code>coefficients</code> | the aggregated coefficients that produced the lowest in sample error. |
| <code>coefficients.object</code> | the coefficients of the object. |

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

References

da Conceição Costa, M. and Macedo, P. (2019). *Normalized Entropy Aggregation for Inhomogeneous Large-Scale Data*. In O. Valenzuela, F. Rojas, H. Pomares, & I. Rojas (Eds.), *Theory and Applications of Time Series Analysis* (pp. 19–29). Springer International Publishing. doi:[10.1007/9783030260361_2](https://doi.org/10.1007/9783030260361_2)

See Also

The generic functions [plot.neagging](#) and [coef.neagging](#).

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

neagging(res_gce_package, boot.method = "cases")

res.tsbootgce <-
  tsbootgce(
    formula = C02 ~ 1 + L(GDP, 1) + L(EPC, 1) + L(EU, 1),
    data = moz_ts)

neagging(res.tsbootgce)
```

nobs.lmgce

Extract the Number of Observations from a [lmgce](#) model fit

Description

Extract the number of ‘observations’ from a [lmgce](#) model fit.

Usage

```
## S3 method for class 'lmgce'
nobs(object, ...)
```

Arguments

```
object      Fitted lmgce model object.
...         additional arguments.
```

Value

An integer scalar representing the number of observations (rows) used in fitting the [lmgce](#) model object.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)
```

```
nobs(res_gce_package)
```

NormEnt

Normalized Entropy

Description

Returns the normalized entropy of the model or the normalized entropy of the predictors.

Usage

```
NormEnt(object, model = TRUE, parm)
```

Arguments

| | |
|--------|--|
| object | fitted lmgce or tsbootgce object. |
| model | Boolean value. if model = TRUE, the model's normalized entropy is returned. If model = FALSE the normalized entropy of each estimate is returned. The default is model = TRUE. |
| parm | a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. If missing, all parameters are considered. |

Value

the value of the normalized entropy of the model or parameters.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

NormEnt(res_gce_package)
```

plot.cv.lmgce

Plot Diagnostics for a [cv.lmgce](#) Object

Description

One plot (selectable by which) is currently available to evaluate a [cv.lmgce](#) object. The plot depicts the error change with the combination of different arguments of [cv.lmgce](#).

Usage

```
## S3 method for class 'cv.lmgce'
plot(x, which = 1, ncol = 1, scales = "free", ...)
```

Arguments

| | |
|--------|---|
| x | Fitted <code>cv.lmgce</code> model object. |
| which | A subset of the numbers 1:1. |
| ncol | Number of columns of the plot (see facet_wrap). |
| scales | One of <code>c("free", "fixed")</code> (see facet_wrap). |
| ... | additional arguments. |

Value

A ggplot object.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

See Also

[cv.lmgce](#)

Examples

```
res.cv.lmgce <-
  cv.lmgce(y ~ .,
           data = dataGCE)

plot(res.cv.lmgce)
```

plot.lmgce

*Plot Diagnostics for a lmgce Object***Description**

Seven plots (selectable by which) are currently available to evaluate a `lmgce` object: a plot of the Estimates and confidence intervals; four plots of supports against Prediction Error, Estimates, Normalized Entropy and Precision Error; two plots of GCE reestimation against Prediction and Precision Errors. Note that plots regarding Precision Error are only produced if the argument `coef` is not NULL.

Usage

```
## S3 method for class 'lmgce'
plot(
  x,
  type = c("ggplot2", "plotly"),
  which = 1:7,
  ci.level = 0.95,
  ci.method = c("z", "percentile", "basic"),
  boot.B = ifelse(x$boot.B == 0, 100, x$boot.B),
  boot.method = x$boot.method,
  coef = NULL,
  OLS = TRUE,
  NormEnt = TRUE,
  caption = list(paste0("Estimates (", ci.method[1], " ", ci.level * 100, "% CI)",
    "Prediction Error vs supports", "Estimates vs supports",
    "Normalized Entropy vs supports", "Precision Error vs supports",
    "Prediction Error vs GCE reestimation", "Precision Error vs GCE reestimation"),
  ...
)
```

Arguments

| | |
|--------------------|--|
| <code>x</code> | Fitted <code>lmgce</code> model object. |
| <code>type</code> | One of <code>c("ggplot2", "plotly")</code> . "ggplot2" is used by default. |
| <code>which</code> | A subset of the numbers 1:7. |

| | |
|--------------------------|--|
| <code>ci.level</code> | the confidence level (0,1) required to compute the confidence interval. |
| <code>ci.method</code> | the method used to compute the confidence interval. One of <code>c("z", "percentile", "basic")</code> . The default is <code>method = "z"</code> . |
| <code>boot.B</code> | A single positive integer greater or equal to 10 for the number of bootstrap replicates for the computation of the bootstrap confidence interval(s), to be used when <code>method = c("percentile", "basic")</code> and when object was created with <code>boot.B = 0</code> . The default is <code>boot.B = 100</code> when the object has no previous sampling information and <code>boot.B = object\$boot.B</code> otherwise, which corresponds to the <code>boot.B</code> given to <code>lmgce</code> when the object was created. |
| <code>boot.method</code> | Method used for bootstrapping. One of <code>c("residuals", "cases", "wild")</code> which corresponds to resampling on residuals, on individual cases or on residuals multiplied by a $N(0,1)$ variable, respectively. The default is <code>boot.method = object\$boot.method</code> . |
| <code>coef</code> | A vector of true coefficients to be used when <code>which = c(5, 7)</code> . |
| <code>OLS</code> | Boolean value. if TRUE, the default, plots the OLS results. |
| <code>NormEnt</code> | Boolean value. if TRUE, the default, plots the normalized entropy. |
| <code>caption</code> | Captions to appear above the plots; character vector or list of valid graphics annotations, see as.graphicsAnnot , of length 7, the j-th entry corresponding to <code>which[j]</code> . Can be set to <code>""</code> or NA to suppress all captions. |
| <code>...</code> | additional arguments. |

Value

A named list of ggplot or plotly objects, each representing a separate plot.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

See Also

[lmgce](#)

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

plot(res_gce_package)
```


Description

Two plots (selectable by which) are currently available to evaluate a [neagging](#) object: plots of the estimates and in sample error against the number of bootstrap samples aggregated.

Usage

```
## S3 method for class 'neagging'  
plot(x, which = 1, ...)
```

Arguments

| | |
|-------|-------------------------------|
| x | Fitted neagging model object. |
| which | Numbers 1 or 2. |
| ... | additional arguments. |

Value

A ggplot object.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

See Also

[lmgce](#), [tsbootgce](#) and [neagging](#)

Examples

```
res_gce_package <-  
  lmgce(y ~ .,  
        data = dataGCE,  
        boot.B = 50,  
        seed = 230676)  
  
res_neagging <- neagging(res_gce_package)  
  
plot(res_neagging)
```

| | |
|-----------------|---|
| plot.ridgetrace | <i>Plot Diagnostics for a ridgetrace Object</i> |
|-----------------|---|

Description

Plot Diagnostics for a [ridgetrace](#) Object

Usage

```
## S3 method for class 'ridgetrace'
plot(x, coef = NULL, ...)
```

Arguments

| | |
|------|---|
| x | Fitted ridgetrace model object. |
| coef | A vector of true coefficients if available. |
| ... | additional arguments. |

Value

Supports are returned.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>
 res.ridgetrace <- ridgetrace(formula = y ~ X001 + X002 + X003 + X004 + X005, data = dataGCE)
 plot(res.ridgetrace)

| | |
|----------------|--|
| plot.tsbootgce | <i>Plot Diagnostics for a tsbootgce object</i> |
|----------------|--|

Description

Three plots (selectable by which) are currently available to evaluate a [tsbootgce](#) object.

Usage

```
## S3 method for class 'tsbootgce'
plot(
  x,
  which = c(1, 2),
  group = TRUE,
  group.ncol = NULL,
  group.nrow = NULL,
```

```

    ci.levels = c(0.9, 0.95, 0.99),
    ci.method = c("hdr", "basic", "percentile"),
    seed = object$seed,
    lambda = 1,
    col = NULL,
    plot.lines = TRUE,
    legend.position = "bottom",
    ...
)

```

Arguments

| | |
|------------------------------|---|
| <code>x</code> | Fitted tsbootgce object. |
| <code>which</code> | Integers from 1 to 3. The default is <code>which = c(1, 2)</code> . |
| <code>group</code> | Boolean value. If <code>group = TRUE</code> , the default, plots are grouped in one image. |
| <code>group.ncol</code> | Number of columns (see ggarrange). The default is <code>group.ncol = NULL</code> . |
| <code>group.nrow</code> | Number of rows. (see ggarrange). The default is <code>group.nrow = NULL</code> . |
| <code>ci.levels</code> | the confidence levels (maximum of 4) required to compute the confidence interval. The default is <code>ci.levels = c(0.90, 0.95, 0.99)</code> . |
| <code>ci.method</code> | One of <code>c("hdr", "basic", "percentile")</code> . The default is <code>ci.method = "hdr"</code> (see hdr). |
| <code>seed</code> | A single value, interpreted as an integer, for reproducibility or <code>NULL</code> for randomness. The default is <code>seed = object\$seed</code> . |
| <code>lambda</code> | Box-Cox transformation parameter. Value between 0 and 1. The default is <code>lambda = 1</code> (see hdr). |
| <code>col</code> | Vector of colors for regions. The default is <code>col = NULL</code> . |
| <code>plot.lines</code> | Boolean. The default is <code>plot.lines = TRUE</code> . |
| <code>legend.position</code> | The default is <code>legend.position = "bottom"</code> . |
| <code>...</code> | additional arguments. |

Value

A ggplot object.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

See Also

[tsbootgce](#)

Examples

```
res.tsbootgce <-
  tsbootgce(
    formula = CO2 ~ 1 + L(GDP, 1) + L(EPC, 1) + L(EU, 1),
    data = moz_ts)

plot(res.tsbootgce, which = 2, group = TRUE)
```

| | |
|---------------|---|
| predict.lmgce | <i>Predict method for lmgce Linear Model Fits</i> |
|---------------|---|

Description

Predicted values based on a fitted model [lmgce](#) object.

Usage

```
## S3 method for class 'lmgce'
predict(
  object,
  newdata,
  interval = c("none", "confidence"),
  type = c("response", "terms"),
  level = 0.95,
  terms = NULL,
  na.action = na.pass,
  ...
)
```

Arguments

| | |
|-----------|--|
| object | Fitted lmgce model object. |
| newdata | An optional data frame in which to look for variables with which to predict. If omitted, the fitted values are used. |
| interval | One of c("none", "confidence"). Type of interval calculation. Can be abbreviated. |
| type | One of c("response", "terms"). Type of prediction (response or model term). Can be abbreviated. |
| level | Tolerance/confidence level (0,1). |
| terms | if type = "terms", which terms (default is all terms), a character vector. |
| na.action | function determining what should be done with missing values in newdata. The default is to predict NA. |
| ... | additional arguments. |

Value

predict.lmgce produces a vector of predictions.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

predict(res_gce_package, dataGCE.test)
```

| | |
|----------------|--|
| print.cv.lmgce | <i>Print cv.lmgce object</i> |
|----------------|--|

Description

Print [cv.lmgce](#) object

Usage

```
## S3 method for class 'cv.lmgce'
print(x, digits = max(3L, getOption("digits") - 3L), ...)
```

Arguments

| | |
|--------|---|
| x | fitted cv.lmgce object. |
| digits | significant digits in printout. |
| ... | additional print arguments. |

Value

A small summary of a cv.lmgce object is returned.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res.cv.lmgce <-
  cv.lmgce(y ~ .,
           data = dataGCE)

res.cv.lmgce
```

| | |
|-------------|--------------------------------------|
| print.lmgce | Print a lmgce object |
|-------------|--------------------------------------|

Description

Concise summary of a [lmgce](#) object

Usage

```
## S3 method for class 'lmgce'
print(x, digits = max(3L, getOption("digits") - 3L), ...)
```

Arguments

| | |
|--------|--------------------------------------|
| x | fitted lmgce object. |
| digits | significant digits in printout. |
| ... | additional print arguments. |

Value

A small summary of a [lmgce](#) object is returned.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

res_gce_package
```

| | |
|------------------|---|
| print.ridgetrace | Print a ridgetrace object |
|------------------|---|

Description

Concise summary of a [ridgetrace](#) object

Usage

```
## S3 method for class 'ridgetrace'  
print(x, digits = max(3L, getOption("digits") - 3L), ...)
```

Arguments

| | |
|--------|---|
| x | fitted ridgetrace object. |
| digits | significant digits in printout. |
| ... | additional print arguments. |

Value

A small summary of a [ridgetrace](#) object is returned.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res.ridgetrace <-  
  ridgetrace(  
    formula = y ~ X001 + X002 + X003 + X004 + X005,  
    data = dataGCE)  
  
res.ridgetrace
```

| | |
|---------------------|---|
| print.summary.lmgce | Print Summary of lmgce Model Fits |
|---------------------|---|

Description

print.summary method for class [lmgce](#).

Usage

```
## S3 method for class 'summary.lmgce'
print(
  x,
  digits = max(3L, getOption("digits") - 3L),
  symbolic.cor = x$symbolic.cor,
  signif.stars = getOption("show.signif.stars"),
  ...
)
```

Arguments

| | |
|---------------------------|--|
| <code>x</code> | an object of class <code>summary.lmgce</code> , usually, a result of a call to <code>summary.lmgce</code> . |
| <code>digits</code> | The number of significant digits to use when printing. |
| <code>symbolic.cor</code> | Boolean value. if TRUE, print the correlations in a symbolic form (see <code>symnum</code>) rather than as numbers. |
| <code>signif.stars</code> | Boolean value. if TRUE, ‘significance stars’ are printed for each coefficient. |
| <code>...</code> | Further arguments passed to or from other methods. |

Value

The function `print.summary.lmgce` prints the information in a `summary.lmgce` object.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

summary(res_gce_package)

summary(res_gce_package, ci.level = 0.90, ci.method = "basic")
```

| | |
|-----------------|-------------------------------------|
| print.tsbootgce | Print <code>tsbootgce</code> object |
|-----------------|-------------------------------------|

Description

Print `tsbootgce` object

Usage

```
## S3 method for class 'tsbootgce'  
print(x, digits = max(3L, getOption("digits") - 3L), ...)
```

Arguments

| | |
|---------------------|------------------------------------|
| <code>x</code> | fitted <code>lm</code> gce object. |
| <code>digits</code> | significant digits in printout. |
| <code>...</code> | additional print arguments. |

Value

A small summary of a `tsbootgce` object is returned.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res.tsbootgce <-  
  tsbootgce(  
    formula = C02 ~ 1 + L(GDP, 1) + L(EPC, 1) + L(EU, 1),  
    data = moz_ts)  
  
res.tsbootgce
```

`resid.lmgce`*Extract `lmgce` Model Residuals*

Description

`resid` is a function which extracts model residuals from `lmgce` objects.

Usage

```
## S3 method for class 'lmgce'  
resid(object, ...)
```

Arguments

| | |
|---------------------|---|
| <code>object</code> | Fitted <code>lmgce</code> model object. |
| <code>...</code> | additional arguments. |

Value

Returns the residuals from a `lmgce` object

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-  
  lmgce(y ~ .,  
        data = dataGCE,  
        boot.B = 50,  
        seed = 230676)  
  
resid(res_gce_package)
```

`residuals.lmgce`*Extract `lmgce` Model Residuals*

Description

`residuals` is a function which extracts model residuals from `lmgce` objects. The abbreviated form `resid` is an alias for `residuals`.

Usage

```
## S3 method for class 'lmgce'
residuals(object, ...)
```

Arguments

```
object      Fitted lmgce model object.
...         additional arguments.
```

Value

Returns the residuals from a lmgce object

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

residuals(res_gce_package)
```

| | |
|-----------------|-------------------------------|
| res_gce_package | <i>Example 'lmgce' object</i> |
|-----------------|-------------------------------|

Description

An example of an object of class 'lmgce' used for demonstration.

Usage

```
res_gce_package
```

Format

An object of class "lmgce".

Source

generated by the package.

| | |
|------------|---|
| ridgetrace | <i>Function to obtain the ridge trace and choose the support limits given a formula</i> |
|------------|---|

Description

Function to obtain the ridge trace and choose the support limits given a formula

Usage

```
ridgetrace(
  formula,
  data,
  subset,
  na.action,
  offset,
  contrasts = NULL,
  lambda = NULL,
  lambda.min = 0.001,
  lambda.max = 1,
  lambda.n = 100,
  penalize.intercept = TRUE,
  errormeasure = c("RMSE", "MSE", "MAE", "MAPE", "sMAPE", "MASE"),
  cv = TRUE,
  cv.nfolds = 5,
  seed = 230676
)
```

Arguments

| | |
|-----------|--|
| formula | An object of class formula (or one that can be coerced to that class): a symbolic description of the model to be fitted. |
| data | A data frame (or object coercible by as.data.frame to a data frame) containing the variables in the model. |
| subset | an optional vector specifying a subset of observations to be used in the fitting process. |
| na.action | a function which indicates what should happen when the data contain NAs. The default is set by the na.action setting of options , and is na.fail if that is unset. The ‘factory-fresh’ default is na.omit . Another possible value is NULL, no action. Value na.exclude can be useful. |
| offset | this can be used to specify an a priori known component to be included in the linear predictor during fitting. This should be NULL or a numeric vector or matrix of extents matching those of the response. One or more offset terms can be included in the formula instead or as well, and if more than one are specified their sum is used. See model.offset . |

| | |
|--------------------|--|
| contrasts | An optional list. See the contrasts.arg of model.matrix.default . |
| lambda | The default is lambda = NULL and a lambda sequence will be computed based on lambda.n, lambda.min and lambda.max. Supplying a lambda sequence overrides this. |
| lambda.min | Minimum value for the lambda sequence. |
| lambda.max | Maximum value for the lambda sequence. |
| lambda.n | The number of lambda values. The default is lambda.n = 100. |
| penalize.intercept | Boolean value. if TRUE, the default, the intercept will be penalized. |
| errormeasure | Loss function (error) to be used for the selection of the support spaces. One of c("RMSE", "MSE", "MAE", "MAPE", "sMAPE", "MASE"). The default is errormeasure = "RMSE". |
| cv | Boolean value. If TRUE the error, errormeasure, will be computed using cross-validation. If FALSE the error will be computed in sample. The default is cv = TRUE. |
| cv.nfolds | number of folds used for cross-validation when cv = TRUE. The default is cv.nfolds = 5. |
| seed | A single value, interpreted as an integer, for reproducibility or NULL for randomness. The default is seed = 230676. |

Value

An object of [class](#) ridgetrace is a list containing at least the following components:

| | |
|------------------|--|
| lambda | the lambda sequence used |
| max.abs.coef | a named vector of coefficients (maximum absolute coefficients) |
| max.abs.residual | the maximum absolute residual |
| coef.lambda | a data.frame with the coefficients for each lambda tested |
| error.lambda | a vector with the in sample error |
| error.lambda.cv | a data.frame with cross-validation errors |
| call | the matched call |

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res.ridgetrace <-
  ridgetrace(
    formula = y ~ X001 + X002 + X003 + X004 + X005,
    data = dataGCE)

res.ridgetrace
```

| | |
|---------------|--------------------------------|
| scalebackcoef | <i>Scale coefficients back</i> |
|---------------|--------------------------------|

Description

Given a vector of scaled (standardized) regression coefficients the function returns the unscaled (in the original scale) regression coefficients

Usage

```
scalebackcoef(X.scaled, y.scaled, betas.scaled, intercept = TRUE)
```

Arguments

| | |
|--------------|---|
| X.scaled | A matrix scaled with scale . |
| y.scaled | A vector scaled with scale . |
| betas.scaled | A vector of given scaled coefficients. |
| intercept | logical indicating if intercept is to be calculated |

Value

Returns a vector of unscaled numeric regression coefficients.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

| | |
|---------------|--|
| summary.lmgce | <i>Summarise a linear regression model via generalized cross entropy fit</i> |
|---------------|--|

Description

summary method for class [lmgce](#). Function used to produce summary information from a fitted linear regression model via generalized cross entropy as represented by object of class [lmgce](#).

Usage

```
## S3 method for class 'lmgce'
summary(
  object,
  call = TRUE,
  correlation = FALSE,
  symbolic.cor = FALSE,
  ci.level = NULL,
  ci.method = c("z", "percentile", "basic"),
```

```

boot.B = ifelse(object$boot.B == 0, 100, object$boot.B),
boot.method = object$boot.method,
...
)

```

Arguments

| | |
|--------------|---|
| object | Fitted lmgce model object. |
| call | Boolean value. if TRUE, the call used is returned. The default is model = TRUE. |
| correlation | Boolean value. if TRUE, the correlation matrix of the estimated parameters is returned and printed. |
| symbolic.cor | Boolean value. if TRUE, print the correlations in a symbolic form (see symnum) rather than as numbers. |
| ci.level | the confidence level (0,1) required to compute the confidence interval. The default is ci.level = NULL which results in the omission of the confidence interval. |
| ci.method | method used to compute a confidence interval. One of c("z", "percentile", "basic"). The default is ci.method = "z". |
| boot.B | A single positive integer greater or equal to 10 for the number of bootstrap replicates for the computation of the bootstrap confidence interval(s), to be used when method = c("percentile", "basic") and when object was created with boot.B = 0. The default is boot.B = 100 when the object has no previous sampling information and boot.B = object\$boot.B otherwise, which corresponds to the boot.B given to lmgce when the object was created. |
| boot.method | Method used for bootstrapping. One of c("residuals", "cases", "wild") which corresponds to resampling on residuals, on individual cases or on residuals multiplied by a N(0,1) variable, respectively. The default is boot.method = object\$boot.method. |
| ... | additional arguments. |

Value

The function `summary.lmgce` computes and returns a list of summary statistics of the fitted [lmgce](#) linear model given in `object`, using the components (list elements) "call" and "terms" from its argument, plus

| | |
|--------------|--|
| residuals | the residuals, that is response minus fitted values. |
| coefficients | a $p \times 4$ matrix, where p is the number of non-aliased coefficients, with columns for the estimated coefficient, its standard error, z-statistic and corresponding (two-sided) p-value. Aliased coefficients are omitted. |
| support | a $p \times 3$ matrix with columns for the normalized entropy (NormEnt), and lower (LL) and upper (UL) limits for each of the $K + 1$ support spaces. |
| aliased | named logical vector showing if the original coefficients are aliased. |
| sigma | the square root of the estimated variance of the random error. |

| | |
|-----------------------|---|
| df | degrees of freedom, a 3-vector $(p, n - p)$ the first being the number of non-aliased coefficients, the last being the p minus the number of included individuals n . |
| r.squared | R^2 , the ‘fraction of variance explained by the model’ |
| adj.r.squared | the above R^2 statistic ‘adjusted’, penalizing for higher p . |
| cov.unscaled | a $p \times p$ matrix of covariances of the $\hat{\beta}$ |
| support.stdUL | when applicable, the upper limit of the standardized support chosen, when support.method = "standardized" or the factor used when support.method = "ridge". |
| support.method | method chosen for the support’s limits |
| nep | the normalized entropy of the model. |
| nep.cv.mean | the cross-validation normalized entropy of the model. |
| nep.cv.sd | the standard deviation of the cross-validation normalized entropy of the model. |
| error | the error measure chosen |
| error.which | which criterion/standardized/factor support was used |
| error.measure | the value of the error measure |
| error.measure.cv.mean | the cross-validation value of the error measure |
| error.measure.cv.sd | the standard deviation of the cross-validation value of the error measure |
| correlation | the correlation matrix corresponding to the above cov.unscaled, if correlation = TRUE is specified. |
| symbolic.cor | (only if correlation = TRUE) The value of the argument symbolic.cor. |
| na.action | from object, if present there. |

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmgce(y ~ .,
        data = dataGCE,
        boot.B = 50,
        seed = 230676)

sm_res_gce_package <- summary(res_gce_package)

str(sm_res_gce_package)

sm_res_gce_package$coefficients
```


tsbootgce

*Time series bootstrap Cross entropy estimation***Description**

This generic function fits a linear regression model using bootstrapped time series via generalized cross entropy.

Usage

```
tsbootgce(
  formula,
  data,
  subset,
  na.action,
  offset,
  contrasts = NULL,
  trim = 0.05,
  reps = 1000,
  start = NULL,
  end = NULL,
  coef.method = c("mode", "median"),
  cv = TRUE,
  cv.nfolds = 5,
  errormeasure = c("RMSE", "MSE", "MAE", "MAPE", "sMAPE", "MASE"),
  errormeasure.which = {
    if (isTRUE(cv))
      c("1se", "min", "elbow")

    else c("min", "elbow")
  },
  support.method = c("standardized", "ridge"),
  support.method.penalize.intercept = TRUE,
  support.signal = NULL,
  support.signal.vector = NULL,
  support.signal.vector.min = 0.3,
  support.signal.vector.max = 20,
  support.signal.vector.n = 20,
  support.signal.points = c(1/5, 1/5, 1/5, 1/5, 1/5),
  support.noise = NULL,
  support.noise.points = c(1/3, 1/3, 1/3),
  weight = 0.5,
  twosteps.n = 1,
  method = c("dual.BFGS", "dual.lbfgsb3c", "dual", "primal.solnl", "primal.solnp",
    "dual.CG", "dual.L-BFGS-B", "dual.Rcgmin", "dual.bobyqa", "dual.newuoa",
    "dual.nlm", "dual.nlmnb", "dual.nlm", "dual.lbfgs", "dual.optimParallel"),
  caseGLM = c("D", "M", "NM"),
```

```

boot.B = 0,
boot.method = c("residuals", "cases", "wild"),
seed = 230676,
OLS = TRUE,
verbose = 0
)

```

Arguments

| | |
|--------------------|--|
| formula | a "formula" describing the linear model to be fit. For details see lm and dynlm . |
| data | A data.frame (or object coercible by as.data.frame to a data frame) or time series object (e.g., ts or zoo), containing the variables in the model. |
| subset | an optional vector specifying a subset of observations to be used in the fitting process. |
| na.action | a function which indicates what should happen when the data contain NAs. The default is set by the na.action setting of options , and is na.fail if that is unset. The 'factory-fresh' default is na.omit . Another possible value is NULL, no action. Value na.exclude can be useful. |
| offset | this can be used to specify an a priori known component to be included in the linear predictor during fitting. This should be NULL or a numeric vector or matrix of extents matching those of the response. One or more offset terms can be included in the formula instead or as well, and if more than one are specified their sum is used. See model.offset . |
| contrasts | An optional list. See the contrasts.arg of model.matrix.default . |
| trim | The trimming proportion (see meboot). The default is trim = 0.05. |
| reps | The number of replicates to generate (see meboot). The default is reps = 1000. |
| start | The time of the first observation. Either a single number or a vector of two numbers (the second of which is an integer), which specify a natural time unit and a (1-based) number of samples into the time unit (see ts). |
| end | The time of the last observation, specified in the same way as start (see ts). |
| coef.method | Method used to estimate the coefficients. One of c("mode", "median"). for "mode" see hdr |
| cv | Boolean value. If TRUE the error, errormeasure , will be computed using cross-validation. If FALSE the error will be computed in sample. The default is cv = TRUE. |
| cv.nfolds | number of folds used for cross-validation when cv = TRUE. The default is cv.nfolds = 5 and the smallest value allowable is cv.nfolds = 3. |
| errormeasure | Loss function (error) to be used for the selection of the support spaces. One of c("RMSE", "MSE", "MAE", "MAPE", "sMAPE", "MASE"). The default is errormeasure = "RMSE". |
| errormeasure.which | Which value of errormeasure to be used for selecting a support space upper limit from support.signal.vector. One of c("min", "1se", "elbow") where "min" corresponds to the support spaces that produced the lowest error, |

"1se" corresponds to the support spaces such that error is within 1 standard error of the CV error for "min" and "elbow" corresponds to the elbow point of the error curve (the point that maximizes the distance between each observation, i.e., the pair composed by the upper limit of the support space and the error, and the line between the first and last observations, i.e., the lowest and the highest upper limits of the support space respectively. See [find_curve_elbow](#)). The default is `errormeasure.which = "1se"`.

- `support.method` One of `c("standardized", "ridge")`. If `support.method = "standardized"`, the default, standardized coefficients are used to define the signal support spaces. If `support.method = "ridge"` the signal support spaces are defined by the ridge trace.
- `support.method.penalize.intercept` Boolean value. if TRUE, the default, the intercept will be penalized. To be used when `support.method = "ridge"`.
- `support.signal` NULL or fixed positive upper limit (L) for the support spaces (-L,L) on standardized data (when `support.method = "standardized"`); NULL or fixed positive factor to be multiplied by the maximum absolute value of the ridge trace for each coefficient (when `support.method = "ridge"`); a pair (LL,UL) or a matrix $((k+1) \times 2)$ for the support spaces on original data. The default is `support.signal = NULL`.
- `support.signal.vector` NULL or a vector of positive values when `support.signal = NULL`. If `support.signal.vector = NULL`, the default, a vector `c(support.signal.vector.min, ..., support.signal.vector.max)` of dimension `support.signal.vector.n` and logarithmically equally spaced will be generated. Each value represents the upper limits for the standardized support spaces, when `support.method = "standardized"` or the factor to be multiplied by the maximum absolute value of the ridge trace for each coefficient, when `support.method = "ridge"`.
- `support.signal.vector.min` A positive value for the lowest limit of the `support.signal.vector` when `support.signal = NULL` and `support.signal.vector = NULL`. The default is `support.signal.vector.min = 0.3`.
- `support.signal.vector.max` A positive value for the highest limit of the `support.signal.vector` when `support.signal = NULL` and `support.signal.vector = NULL`. The default is `support.signal.vector.max = 20`.
- `support.signal.vector.n` A positive integer for the number of support spaces to be used when `support.signal = NULL` and `support.signal.vector = NULL`. The default is `support.signal.vector.n = 20`.
- `support.signal.points` A positive integer, a vector or a matrix. Prior weights for the signal. If not a positive integer then the sum of weights by row must be equal to 1. The default is `support.signal.points = c(1 / 5, 1 / 5, 1 / 5, 1 / 5, 1 / 5)`.
- `support.noise` An interval, preferably centered around zero, given in the form `c(LL,UL)`. If `support.noise = NULL`, the default, then a vector `c(-L,L)` is computed using the empirical three-sigma rule Pukelsheim (1994).

| | |
|-----------------------------------|---|
| <code>support.noise.points</code> | A positive integer, a vector or a matrix. Prior weights for the noise. If not a positive integer then the sum of weights by row must be equal to 1. The default is <code>support.noise.points = c(1 / 3, 1 / 3, 1 / 3)</code> . |
| <code>weight</code> | a value between zero and one representing the prediction-precision loss trade-off. If <code>weight = 0.5</code> , the default, equal weight is placed on the signal and noise entropies. A higher than 0.5 value places more weight on the noise entropy whereas a lower than 0.5 value places more weight on the signal entropy. |
| <code>twosteps.n</code> | Number of GCE reestimations using a previously estimated vector of signal probabilities. |
| <code>method</code> | Use "primal.solnl" (GCE using Sequential Quadratic Programming (SQP) method; see solnl) or "primal.solnp" (GCE using the augmented Lagrange multiplier method with an SQP interior algorithm; see solnp) for primal form of the optimization problem and "dual" (GME), "dual.CG" (GCE using a conjugate gradients method; see optim), "dual.BFGS" (GCE using Broyden-Fletcher-Goldfarb-Shanno quasi-Newton method; see optim), "dual.L-BFGS-B" (GCE using a box-constrained optimization with limited-memory modification of the BFGS quasi-Newton method; see optim), <code>dual.Rcgmin</code> (GCE using an update of the conjugate gradient algorithm; see optimx), <code>dual.bobyqa</code> (GCE using a derivative-free optimization by quadratic approximation; see optimx and bobyqa), <code>dual.newuoa</code> (GCE using a derivative-free optimization by quadratic approximation; see optimx and newuoa), <code>dual.nlminb</code> (GCE; see optimx and nlminb), <code>dual.nlm</code> (GCE; see optimx and nlm), <code>dual.lbfgs</code> (GCE using the Limited-memory Broyden-Fletcher-Goldfarb-Shanno; see lbfgs), <code>dual.lbfgsb3c</code> (GCE using L-BFSC-B implemented in Fortran code and with an Rcpp interface; see lbfgsb3c) or <code>dual.optimParallel</code> (GCE using parallel version of the L-BFGS-B; see optimParallel) for dual form. The default is <code>method = "dual.BFGS"</code> . |
| <code>caseGLM</code> | special cases of the generic general linear model. One of <code>c("D", "M", "NM")</code> , where "D" stands for data, "M" for moment and "NM" for normed-moment. The default is <code>caseGLM = "D"</code> . |
| <code>boot.B</code> | A single positive integer greater or equal to 10 for the number of bootstrap replicates to be used for the computation of the bootstrap confidence interval(s). Zero value will generate no replicate. The default is <code>boot.B = 0</code> . |
| <code>boot.method</code> | Method to be use for bootstrapping. One of <code>c("residuals", "cases", "wild")</code> which corresponds to resampling on residuals, on individual cases or on residuals multiplied by a $N(0,1)$ variable, respectively. The default is <code>boot.method = "residuals"</code> . |
| <code>seed</code> | A single value, interpreted as an integer, for reproducibility or NULL for randomness. The default is <code>seed = 230676</code> . |
| <code>OLS</code> | Boolean value. if TRUE, the default, OLS estimation is performed. |
| <code>verbose</code> | An integer to control how verbose the output is. For a value of 0 no messages or output are shown and for a value of 3 all messages are shown. The default is <code>verbose = 0</code> . |

Details

The `tsbootgce` function fits several linear regression models via generalized cross entropy in replicas of time series obtained using `meboot`. Models for `tsbootgce` are specified symbolically (see `lm` and `dynlm`).

Value

`tsbootgce` returns an object of `class` `tsbootgce`. The generic accessory functions `coef.tsbootgce`, `confint.tsbootgce` and `plot.tsbootgce` extract various useful features of the value returned by object of class `tsbootgce`.

An object of `class` `tsbootgce` is a list containing at least the following components:

| | |
|----------------------------|---|
| <code>call</code> | the matched call. |
| <code>coefficients</code> | a named data frame of coefficients determined by <code>coef</code> .method. |
| <code>data.ts</code> | ts object. |
| <code>error</code> | loss function (error) used for the selection of the support spaces. |
| <code>error.measure</code> | in sample error for the selected support space. |
| <code>fitted.values</code> | the fitted mean values. |
| <code>frequency</code> | see <code>link[zoo]{zoo}</code> . |
| <code>index</code> | see <code>link[zoo]{zoo}</code> . |
| <code>lmgce</code> | <code>lmgce</code> object. |
| <code>meboot</code> | <code>meboot</code> replicates. |
| <code>model</code> | the model frame used. |
| <code>nep</code> | normalized entropy of the signal of the model. |
| <code>nepk</code> | normalized entropy of the signal of each coefficient. |
| <code>residuals</code> | the residuals, that is response minus fitted values. |
| <code>results</code> | a list containing the bootstrap results: "coef.matrix", a named data frame of all the coefficients; "nepk.matrix", a named data frame of all the normalized entropy values of each parameter; "nep.vector", a vector of all the normalized entropy values of the model. |
| <code>seed</code> | the seed used. |
| <code>terms</code> | the <code>terms</code> object used. |
| <code>x</code> | if requested (the default), the model matrix used. |
| <code>xlevels</code> | (only where relevant) a record of the levels of the factors used in fitting. |
| <code>y</code> | if requested (the default), the response used. |

Author(s)

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See Also

The generic functions [plot.tsbootgce](#), [print.tsbootgce](#), and [coef.tsbootgce](#).

Examples

```
res.tsbootgce <-
  tsbootgce(
    formula = C02 ~ 1 + L(GDP, 1) + L(EPC, 1) + L(EU, 1),
    data = moz_ts)

res.tsbootgce
```

| | |
|----------------------|---|
| variable.names.lmgce | Variable Names of lmgce Fitted Models |
|----------------------|---|

Description

Simple utility returning variable names.

Usage

```
## S3 method for class 'lmgce'
variable.names(object, ...)
```

Arguments

object Fitted [lmge](#) model object.
 ... additional arguments.

Value

A character vector containing the names of the variables in the [lmge](#) model object.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-
  lmge(y ~ .,
       data = dataGCE,
       boot.B = 50,
       seed = 230676)

variable.names(res_gce_package)
```

vcov.lmgce

Extract [lmge](#) Model's Variance-Covariance Matrix

Description

Returns the variance-covariance matrix of the main parameters of a [lmge](#) object

Usage

```
## S3 method for class 'lmge'
vcov(object, ...)
```

Arguments

object Fitted [lmge](#) model object.
 ... additional arguments.

Value

A matrix of the estimated covariances between the parameter estimates in the linear predictor of the [lmge](#) model.

Author(s)

Jorge Cabral, <jorgecabral@ua.pt>

Examples

```
res_gce_package <-  
  lmgce(y ~ .,  
        data = dataGCE,  
        boot.B = 50,  
        seed = 230676)  
  
vcov(res_gce_package)
```


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