Package 'miscTools'

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Title Miscellaneous Tools and Utilities

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Depends R (>= 2.14.0)

Imports digest

Suggests Ecdat (>= 0.1-5)

Description Miscellaneous small tools and utilities.
Many of them facilitate the work with matrices,
e.g. inserting rows or columns, creating symmetric matrices,
or checking for semidefiniteness.
Other tools facilitate the work with regression models,
e.g. extracting the standard errors,
obtaining the number of (estimated) parameters,
or calculating R-squared values.

License GPL (>= 2)

URL https://github.com/arne-henningsen/miscTools

BugReports https://github.com/arne-henningsen/miscTools/issues

NeedsCompilation no

Repository CRAN

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R topics documented:

`coefTable` *Coefficient Table*

Description

Generate Table for Coefficients, Std. Errors, t-values and P-values.

Usage

```
coefTable( coef, stdErr, df = NULL )
```

Arguments

`coef`	vector that contains the coefficients.
`stdErr`	vector that contains the standard errors of the coefficients.
`df`	degrees of freedom of the t-test used to calculate P-values.

Value

a matrix with 4 columns: coefficients, standard errors, t-values and P-values. If argument `df` is not provided, the last column (P-values) is filled with `NA`s.

Author(s)

Arne Henningsen

Examples

```
coefTable( rnorm( 10 ), 0.5 * abs( rnorm( 10 ) ), 20 )
```

colMedians *Medians of Columns*

Description

Compute the sample medians of the columns (non-rows) of a data.frame or array.

Usage

```
colMedians( x, na.rm = FALSE )
```

Arguments

x	a data.frame or array.
na.rm	a logical value indicating whether NA values should be stripped before the computation proceeds.

Value

A vector or array of the medians of each column (non-row) of x with dimension dim(x)[-1].

Author(s)

Arne Henningsen

See Also

rowMedians,median,colMeans.

Examples

```
data( "Electricity", package = "Ecdat" )
colMedians( Electricity )

a4 <- array( 1:120, dim = c(5,4,3,2),
   dimnames = list( c("a","b","c","d","e"), c("A","B","C","D"),
   c("x","y","z"), c("Y","Z") ) )
colMedians( a4 )
median( a4[ , "B", "x", "Z" ] )  # equal to
colMedians( a4 )[ "B", "x", "Z" ]
```

compPlot *Scatterplot to Compare two Variables*

Description

Plot a scatterplot to compare two variables.

Usage

```
compPlot( x, y, lim = NULL, ... )
```

Arguments

x	values of the first variable (on the X axis).
y	values of the second variable (on the Y axis).
lim	optional vector of two elements specifying the limits of both axes).
...	further arguments are passed to plot.

Author(s)

Arne Henningsen

Examples

```
set.seed( 123 )
x <- runif( 25 )
y <- 2 + 3 * x + rnorm( 25 )
ols <- lm( y ~ x )

compPlot( y, fitted( ols ) )
compPlot( y, fitted( ols ), lim = c( 0, 10 ) )
compPlot( y, fitted( ols ), pch = 20 )
compPlot( y, fitted( ols ), xlab = "observed", ylab = "fitted" )
compPlot( y, fitted( ols ), log = "xy" )
```

ddnorm *Derivative of the Normal Distribution's Density Function*

Description

This function returns the derivative(s) of the density function of the normal (Gaussian) distribution with respect to the quantile, evaluated at the quantile(s), mean(s), and standard deviation(s) specified by arguments x, mean, and sd, respectively.

Usage

```
ddnorm( x, mean = 0, sd = 1 )
```

Arguments

x	quantile or vector of quantiles.
mean	mean or vector of means.
sd	standard deviation or vector of standard deviations.

Value

numeric value(s): derivative(s) of the density function of the normal distribution with respect to the quantile

Author(s)

Arne Henningsen

See Also

dnorm

Examples

```
ddnorm( c( -1, 0, 1 ) )
```

---

histDens *Histogram with a Density Line*

Description

Plot a histrogram and add a kernel density line.

Usage

```
histDens( x, breaks = "Sturges", ... )
```

Arguments

x	values of the variable.
breaks	passed to hist.
...	further arguments are passed to hist.

Author(s)

Arne Henningsen

Examples

```
set.seed( 123 )
x <- rnorm( 100 )
histDens( x )
histDens( x, 20 )
histDens( x, 20, main = "My Title" )
```

`insertCol` *Insert Column into a Matrix*

Description

Insert a new column into a matrix.

Usage

```
insertCol( m, c, v = NA, cName = "" )
```

Arguments

`m`	matrix.
`c`	column number where the new column should be inserted.
`v`	optional values of the new column.
`cName`	optional character string: the name of the new column.

Value

a matrix with one more column than the provided matrix `m`.

Author(s)

Arne Henningsen

See Also

`insertRow`.

Examples

```
m <- matrix( 1:4, 2 )
insertCol( m, 2, 5:6 )
```

`insertRow` *Insert Row into a Matrix*

Description

Insert a new row into a matrix.

Usage

```
insertRow( m, r, v = NA, rName = "" )
```

Arguments

`m`	matrix.
`r`	row number where the new row should be inserted.
`v`	optional values for the new row.
`rName`	optional character string: the name of the new row.

Value

a matrix with one more row than the provided matrix `m`.

Author(s)

Arne Henningsen

See Also

`insertCol`.

Examples

```
m <- matrix( 1:4, 2 )
insertRow( m, 2, 5:6 )
```

isSemidefinite *Positive or Negative Semidefiniteness*

Description

Check whether a symmetric matrix is positive or negative semidefinite.

Usage

```
isSemidefinite( m, ... )

## Default S3 method:
isSemidefinite( m, ... )

## S3 method for class 'matrix'
isSemidefinite( m, positive = TRUE,
   tol = 100 * .Machine$double.eps,
   method = ifelse( nrow( m ) < 13, "det", "eigen" ), ... )

## S3 method for class 'list'
isSemidefinite( m, ... )

semidefiniteness( m, ... )
```

Arguments

m	a symmetric quadratic matrix or a list containing symmetric quadratic matrices.
positive	logical. Check for positive semidefiniteness (if TRUE, default) or for negative semidefiniteness (if FALSE).
tol	tolerance level (values between -tol and tol are considered to be zero).
method	method to test for semidefiniteness, either checking the signs of the principal minors (if "det", default for matrices with up to 12 rows/columns) or checking the signs of the eigenvalues (if "eigen", default for matrices with 13 or more rows/columns).
...	further arguments of isSemidefinite.list are passed to isSemidefinite.matrix;. further arguments of semidefiniteness are passed to isSemidefinite; further arguments of other functions are currently ignored.

Details

Function semidefiniteness() passes all its arguments to isSemidefinite(). It is only kept for backward-compatibility and may be removed in the future.

If argument positive is set to FALSE, isSemidefinite() checks for negative semidefiniteness by checking for positive semidefiniteness of the negative of argument m, i.e. -m.

If method "det" is used (default for matrices with up to 12 rows/columns), isSemidefinite() checks whether all principal minors (not only the leading principal minors) of the matrix m (or

of the matrix -m if argument positive is FALSE) are larger than -tol. Due to rounding errors, which are unavoidable on digital computers, the calculated determinants of singular (sub-)matrices (which should theoretically be zero) can considerably deviate from zero. In order to reduce the probability of incorrect results due to rounding errors, isSemidefinite() does not calculate the determinants of (sub-)matrices with reciprocal condition numbers smaller than argument tol but sets the corresponding principal minors to (exactly) zero. The number of principal minors of an $N \times N$ matrix is $\sum_{k=1}^{N} (N \text{ choose } k)$, which gets very large for large matrices. Therefore, it is not recommended to use method "det" for matrices with, say, more than 12 rows/columns.

If method "eigen" (default for matrices with 13 or more rows/columns) is used, isSemidefinite() checks whether all eigenvalues of the matrix m (or of the matrix -m if argument positive is FALSE) are larger than -tol. In case of a singular or nearly singular matrix, some eigenvalues that theoretically should be zero can considerably deviate from zero due to rounding errors, which are unavoidable on digital computers. isSemidefinite() uses the following procedure to reduce the probability of incorrectly returning FALSE due to rounding errors in the calculation of eigenvalues of singular or nearly singular matrices: if the reciprocal condition number of an $N \times N$ matrix is smaller than argument tol and not all of the eigenvalues of this matrix are larger than -tol, isSemidefinite() checks whether all $(N \text{ choose } (N-k))$ $(N-k) \times (N-k)$ submatrices are positive semidefinite, where k with $0 < k < N$ is the number of eigenvalues in the interval -tol and tol. If necessary, this procedure is done recursively.

Please note that a matrix can be neither positive semidefinite nor negative semidefinite.

Value

isSemidefinite() and semidefiniteness() return a locigal value (if argument m is a matrix) or a logical vector (if argument m is a list) indicating whether the matrix (or each of the matrices) is positive/negative (depending on argument positive) semidefinite.

Author(s)

Arne Henningsen

References

Chiang, A.C. (1984): *Fundamental Methods of Mathematical Economics*, 3rd ed., McGraw-Hill.

Gantmacher, F.R. (1959): *The Theory of Matrices*, Chelsea Publishing.

Examples

```
# a positive semidefinite matrix
isSemidefinite( matrix( 1, 3, 3 ))

# a negative semidefinite matrix
isSemidefinite( matrix(-1, 3, 3 ), positive = FALSE )

# a matrix that is positive and negative semidefinite
isSemidefinite( matrix( 0, 3, 3 ))
isSemidefinite( matrix( 0, 3, 3 ), positive = FALSE )

# a matrix that is neither positive nor negative semidefinite
```

```
isSemidefinite( symMatrix( 1:6 ) )
isSemidefinite( symMatrix( 1:6 ), positive = FALSE )

# checking a list of matrices
ml <- list( matrix( 1, 3, 3 ), matrix(-1, 3, 3 ), matrix( 0, 3, 3 ) )
isSemidefinite( ml )
isSemidefinite( ml, positive = FALSE )
```

---

margEff *Method for Returning Marginal Effects*

Description

Currently, this package just defines the generic function `margEff` so that it can be used to define `margEff` methods for objects of specific classes in other packages.

Usage

```
margEff( object, ... )
```

Arguments

`object`	an object of which marginal effects should be calculated.
`...`	further arguments for methods

Author(s)

Arne Henningsen

---

nObs *Return number of observations for statistical models*

Description

Returns number of observations for statistical models. The default method assumes presence of a component `param$nObs` in `x`.

Usage

```
nObs(x, ...)
## Default S3 method:
nObs(x, ...)
## S3 method for class 'lm'
nObs(x, ...)
```

Arguments

x	a statistical model, such as created by lm
...	further arguments for methods

Details

This is a generic function. The default method returns the component x$param$nObs. The lm-method is based on qr-decomposition, in the same way as the does summary.lm.

Value

numeric, number of observations

Author(s)

Ott Toomet, <otoomet@econ.au.dk>

Examples

```
# Construct a simple OLS regression:
x1 <- runif(100)
x2 <- runif(100)
y <- 3 + 4*x1 + 5*x2 + rnorm(100)
m <- lm(y~x1+x2)  # estimate it
nObs(m)
```

---

nParam *Number of model parameters*

Description

This function returns the number of model parameters. The default method returns the component x$param$nParam.

Usage

```
nParam(x, free=FALSE, ...)
## Default S3 method:
nParam(x, ...)
## S3 method for class 'lm'
nParam(x, ...)
```

Arguments

x	a statistical model
free	logical, whether to report only the free parameters or the total number of parameters (default)
...	other arguments for methods

Details

Free parameters are the parameters with no equality restrictions. Some parameters may be restricted (e.g. sum of two probabilities may be restricted to equal unity). In this case the total number of parameters may depend on the normalisation.

Value

Number of parameters in the model

Author(s)

Ott Toomet, <otoomet@econ.au.dk>

See Also

nObs for number of observations

Examples

```
# Construct a simple OLS regression:
x1 <- runif(100)
x2 <- runif(100)
y <- 3 + 4*x1 + 5*x2 + rnorm(100)
m <- lm(y~x1+x2)  # estimate it
summary(m)
nParam(m) # you get 3
```

---

quasiconcavity *Test for quasiconcavity / quasiconvexity*

Description

Test wether a function is quasiconcave or quasiconvex. The bordered Hessian of this function is checked by quasiconcavity() or quasiconvexity().

Usage

```
quasiconcavity( m, tol = .Machine$double.eps )
quasiconvexity( m, tol = .Machine$double.eps )
```

Arguments

m	a bordered Hessian matrix or a list containing bordered Hessian matrices
tol	tolerance level (values between -tol and tol are considered to be zero).

Value

locigal or a logical vector (if m is a list).

Author(s)

Arne Henningsen

References

Chiang, A.C. (1984) *Fundamental Methods of Mathematical Economics*, 3rd ed., McGraw-Hill.

Examples

```
quasiconcavity( matrix( 0, 3, 3 ) )

quasiconvexity( matrix( 0, 3, 3 ) )

m <- list()
m[[1]] <- matrix( c( 0,-1,-1, -1,-2,3, -1,3,5 ), 3, 3 )
m[[2]] <- matrix( c( 0,1,-1, 1,-2,3, -1,3,5 ), 3, 3 )

quasiconcavity( m )

quasiconvexity( m )
```

`rowMedians` *Medians of Rows*

Description

Compute the sample medians of the rows of a data.frame or matrix.

Usage

```
rowMedians( x, na.rm = FALSE )
```

Arguments

`x`	a data.frame or matrix.
`na.rm`	a logical value indicating whether `NA` values should be stripped before the computation proceeds.

Value

A vector of the medians of each row of `x`.

Author(s)

Arne Henningsen

See Also

`colMedians`,`median`,`colMeans`.

Examples

```
m <- matrix( 1:12, nrow = 4 )
rowMedians( m )
```

`rSquared` *Calculate R squared value*

Description

Calculate R squared value.

Usage

```
rSquared( y, resid )
```

Arguments

`y`	vector of endogenous variables
`resid`	vector of residuals

Author(s)

Arne Henningsen

Examples

```
data( "Electricity", package = "Ecdat" )
reg <- lm( cost ~ q + pl + pk + pf, Electricity )
rSquared( Electricity$cost, reg$residuals )
summary( reg )$r.squared  # returns the same value
```

`stdEr` *Standard deviations*

Description

Extract standard deviations from estimated models.

Usage

```
  stdEr(x, ...)
## Default S3 method:
stdEr(x, ...)
## S3 method for class 'lm'
stdEr(x, ...)
```

Arguments

x	a statistical model, such as created by lm
...	further arguments for methods

Details

stdEr is a generic function with methods for objects of "lm" class. The default method returns the square root of the diagonal of the variance-covariance matrix.

Value

numeric, the estimated standard errors of the coefficients.

Author(s)

Ott Toomet <otoomet@ut.ee>

See Also

vcov, summary.

Examples

```
data(cars)
lmRes <- lm(dist ~ speed, data=cars)
stdEr( lmRes )
```

---

sumKeepAttr *Sum of an Array While Keeping its Attributes*

Description

This function returns the sum of an numeric array (e.g. vector or matrix) while keeping its attributes.

Usage

```
sumKeepAttr( x, keepNames = FALSE, na.rm = FALSE )
```

Arguments

x	an numeric array (e.g. vector or matrix).
keepNames	logical. Should the name(s) of the element(s) ofx be assigned to the returned sum? (only relevant if codex has only one element).
na.rm	logical. Passed to sum. Should missing values be removed?

Value

the sum (see sum).

Author(s)

Arne Henningsen

See Also

sum

Examples

```
a <- 1:10
attr( a, "min" ) <- 1
attr( a, "max" ) <- 10
sum(a)
sumKeepAttr(a)
```

---

summarizeDF *Summarize a data.rrame*

Description

This function summarizes each variable that is in a data.frame. It can be used, e.g., in an R script to write summary information about a data.frame into a text file that is in a version control system so that one can see in the version control system whether one or more variables in the data frame have changed.

Usage

```
summarizeDF( dat, printValues = TRUE, maxLevel = 20, file = NULL, ... )
```

Arguments

dat	a data.frame.
printValues	logical. If FALSE only MD5 checksums are returned, which could be desirable if the data frame contains confidential data that should not be included in the output.
maxLevel	integer. If the number of unique values in a variable is less than or equal to the number specified in this argument (and argument printValues is TRUE), a frequency table is included in the output.
file	a character string or a writable connection naming the file to write to.
...	further arguments forwarded to sink() if argument file is not NULL.

Author(s)

Arne Henningsen

symMatrix *Symmetric Matrix*

Description

Create a Symmetric Matrix.

Usage

```
symMatrix( data = NA, nrow = NULL, byrow = FALSE,
upper = FALSE )
```

Arguments

data	an optional data vector.
nrow	the desired number of rows and columns.
byrow	logical. If 'FALSE' (the default) the matrix is filled by columns, otherwise the matrix is filled by rows.
upper	logical. If 'FALSE' (the default) the lower triangular part of the matrix (including the diagonal) is filled, otherwise the upper triangular part of the matrix is filled.

Value

a symmetric matrix.

Author(s)

Arne Henningsen

See Also

matrix, lower.tri.

Examples

```
# fill the lower triangular part by columns
symMatrix( 1:10, 4 )
# fill the upper triangular part by columns
symMatrix( 1:10, 4, upper = TRUE )
# fill the lower triangular part by rows
symMatrix( 1:10, 4, byrow = FALSE )
```

triang *Upper triangular matrix from a vector*

Description

Creates an upper triangular square matrix from a vector.

Usage

```
triang( v, n )
```

Arguments

v	vector
n	desired dimension of the returned square matrix

Note

If the vector has less elements than the upper triangular matrix, the last elements are set to zero.

Author(s)

Arne Henningsen

See Also

veclipos.

Examples

```
v <- c( 1:5 )
triang( v, 3 )
```

vecli *Vector of linear independent values*

Description

Returns a vector containing the linear independent elements of a symmetric matrix (of full rank).

Usage

```
vecli( m )
```

Arguments

m	symmetric matrix

Author(s)

Arne Henningsen

See Also

veclipos.

Examples

```
# a symmetric n x n matrix
m <- cbind(c(11,12,13),c(12,22,23),c(13,23,33))
vecli(m)  # returns: 11 12 13 22 23 33
```

---

vecli2m *Convert vector of linear independent values into a Matrix*

Description

Converts a vector into a symmetric matrix that the original vector contains the linear independent values of the returned symmetric matrix.

Usage

```
vecli2m( v )
```

Arguments

v	a vector.

Author(s)

Arne Henningsen

See Also

vecli, veclipos.

Examples

```
v <- c( 11, 12, 13, 22, 23, 33 )
vecli2m( v )
```

`veclipos` *Position in a vector of linear independent values*

Description

Returns the position of the [i,j]th element of a symmetric n × n matrix that this element has in a vector of the linear independent values of the matrix.

Usage

```
veclipos( i, j, n )
```

Arguments

i	row of the element in the matrix.
j	column of the element in the matrix.
n	dimension of the matrix.

Note

A symmetric n × n matrix has n*(n+1)/2 independent values.
The function is: n*(n-1)/2-((n-min(i,j))*(n-min(i,j)+1)/2)+max(i,j)

Author(s)

Arne Henningsen

See Also

vecli, vecli2m.

Examples

```
veclipos( 1, 2, 3 )  # returns: 2
```

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