Package 'symSEM'

July 16, 2020

Type Package

Title Symbolic Computation for Structural Equation Models

Version 0.1

Date 2020-07-15

Depends R (>= 3.3.0)

Imports OpenMx, metaSEM, Ryacas, mvtnorm

Suggests testthat

Maintainer Mike Cheung <mikewlcheung@nus.edu.sg>

Description A collection of functions for symbolic computation using 'Ryacas' package for structural equation models. This package includes functions to calculate model-implied covariance (and correlation) matrix and sampling covariance matrix of functions of variables using the first-order Taylor approximation. Reference: McArdle and McDonald (1984) <doi:10.1111/j.2044-8317.1984.tb00802.x>.

License GPL (>= 2)

LazyLoad yes

LazyData yes

ByteCompile yes

URL https://github.com/mikewlcheung/symsem

NeedsCompilation no

Author Mike Cheung [aut, cre] (<https://orcid.org/0000-0003-0113-0758>)

Repository CRAN

Date/Publication 2020-07-16 08:10:02 UTC

R topics documented:

`symSEM-package` *Symbolic Computation for Structural Equation ModelsSymbolic Computation for Structural Equation Models*

Description

A collection of functions for symbolic computation using 'Ryacas' package for structural equation models. This package includes functions to calculate model-implied covariance (and correlation) matrix and sampling covariance matrix of functions of variables using the first-order Taylor approximation. Reference: McArdle and McDonald (1984) <doi:10.1111/j.2044-8317.1984.tb00802.x>.

Details

Package:	symSEM
Type:	Package
Version:	0.1
Date:	2020-07-15
License:	GPL (>=2)
LazyLoad:	yes

Author(s)

Mike W.-L. Cheung <mikewlcheung@nus.edu.sg>

Maintainer: Mike W.-L. Cheung <mikewlcheung@nus.edu.sg>

`as.matrix` *Convert a Ryacas Symbolic Matrix to a Character Matrix*

Description

It converts a Ryacas Symbolic Matrix to a Character Matrix in R.

Usage

```
## S3 method for class 'yac_symbol'
as.matrix(x, ...)
```

Arguments

`x`	A symbolic matrix of class "yac_symbol".
`...`	not used

Value

A character matrix.

Author(s)

Mike W.-L. Cheung <mikewlcheung@nus.edu.sg>

See Also

sym

Examples

```
## Create a character matrix
A1 <- matrix(c(1, 2, 3, "a", "b", "c"), ncol=2, nrow=3)
#      [,1] [,2]
# [1,] "1"  "a"
# [2,] "2"  "b"
# [3,] "3"  "c"

## Convert it to an Ryacas matrix for symbolic calculations
A2 <- sym(A1)
# {{1, a},
#  {2, b},
#  {3, c}}

## Convert it back to a character matrix
as.matrix(A2)
#      [,1] [,2]
# [1,] "1"  "a"
# [2,] "2"  "b"
# [3,] "3"  "c"
```

`deltamethod` *Compute the Variance-Covariance Matrix of Functions using the first-order Delta Method*

Description

It computes the variance-covariance matrix of functions using the first-order delta method.

Usage

```
deltamethod(fn, Covvars, vars, Var.name="V", Cov.name="C", simplify=TRUE)
```

Arguments

fn	A function in character strings or a vector of functions.
Covvars	Variance-covariance matrix of the variables.
vars	A vector of characters of the random variables.
Var.name	Name of the variances.
Cov.name	Name of the covariances.
simplify	Attempts to simplify the expression. Please note that it may not work well.

Value

Variance-covariance matrix of the functions.

Author(s)

Mike W.-L. Cheung <mikewlcheung@nus.edu.sg>

Examples

```
#### Fisher-z-transformation
fn  <- "0.5*log((1+r)/(1-r))"

## Sampling variance of r
Covvars <- "(1-r^2)^2/n"

deltamethod(fn=fn, Covvars=Covvars, vars="r")
## $fn
##     [,1]
## fn1 "0.5*log((r+1)/(1-r))"

## $Covfn
##     fn1
## fn1 "1/n"

## $vars
## [1] "r"

## $Covvars
##   r
## r "(1-r^2)^2/n"

## $Jmatrix
##     r
## fn1 "(0.5*(1-r+r+1)*(1-r))/((1-r)^2*(r+1))"

#### Raw mean difference: y_treatment - y_control
fn <- "yt - yc"

## Sampling covariance matrix
## S2p: pooled variance
## nt: n_treatment
```

```
## nc: n_control
Covvars <- matrix(c("S2p/nt", 0,
                    0, "S2p/nc"),
                  ncol=2, nrow=2)

deltamethod(fn=fn, Covvars=Covvars, vars=c("yt", "yc"))
## $fn
##     [,1]
## fn1 "yt-yc"

## $Covfn
##     fn1
## fn1 "(S2p*nt+S2p*nc)/(nt*nc)"

## $vars
## [1] "yt" "yc"

## $Covvars
##    yt       yc
## yt "S2p/nt" "0"
## yc "0"      "S2p/nc"

## $Jmatrix
##     yt  yc
## fn1 "1" "-1"

#### log(odds)
fn <- "log(p/(1-p))"

## Sampling variance of p
Covvars <- "p*(1-p)/n"

## Though it is correct, the simplification does not work well.
deltamethod(fn=fn, Covvars=Covvars, vars="p")
## $fn
##     [,1]
## fn1 "log(p/(1-p))"

## $Covfn
##     fn1
## fn1 "(3*p^2-p^3-3*p+1)/((p^4-4*p^3+6*p^2-4*p+1)*p*n)"

## $vars
## [1] "p"

## $Covvars
##   p
## p "(p*(1-p))/n"

## $Jmatrix
##     p
## fn1 "((1-p+p)*(1-p))/((1-p)^2*p)"
```

impliedS *Compute a Symbolic Model-Implied Covariance/Correlation Matrix*

Description

It computes a symbolic model-implied covariance (or correlation) matrix in SEM using the RAM inputs.

Usage

```
impliedS(RAM, corr=FALSE)
```

Arguments

RAM	A RAM object including a list of matrices of the model returned from lavaan2RAM
corr	Whether the model implied matrix is covariance (default) or correlation.

Value

The model implied covariance (or correlation) matrix.

Author(s)

Mike W.-L. Cheung <mikewlcheung@nus.edu.sg>

Examples

```
#### A mediation model
model1 <- "y ~ c*x + b*m
           m ~ a*x
           ## Means
           y ~ b0*1
           m ~ m0*1
           x ~ x0*1"

RAM1 <- metaSEM::lavaan2RAM(model1)

## Model-implied covariance matrix and mean structure
impliedS(RAM1, corr=FALSE)

## Model-implied correlation matrix
impliedS(RAM1, corr=TRUE)

#### A CFA model
model2 <- "f =~ x1 + x2 + x3 + x4"

RAM2 <- metaSEM::lavaan2RAM(model2)

## Model-implied covariance matrix
```

```
impliedS(RAM2, corr=FALSE)

## Model-implied correlation matrix
impliedS(RAM2, corr=TRUE)
```

---

sym *Convert a Character Expression to Ryacas Symbol or matrix*

Description

It converts a Character Expression or Matrix in R to Ryacas symbolic expression or matrix.

Usage

```
sym(x)
```

Arguments

x	A character expression or matrix.

Details

It converts mathematic operators from R to mathematic operators in yacas and then uses ysym to convert the R character expression or matrix to Ryacas symbolic expression or matrix. The Ryacas expression or matrix can be used for further symbolic calculations.

Value

An expression or matrix of class "yac_symbol".

Author(s)

Mike W.-L. Cheung <mikewlcheung@nus.edu.sg>

See Also

ysym, as.matrix

Examples

```
A1 <- "log(x) + exp(y)"

sym(A1)
# y: Ln(x)+Exp(y)

A2 <- matrix(c(1, 2, 3, "a", "sqrt(b)", "sin(c)"), ncol=2, nrow=3)
A2
#     [,1] [,2]
# [1,] "1"  "a"
```

```
# [2,] "2"  "sqrt(b)"
# [3,] "3"  "sin(c)"

sym(A2)
# {{      1,       a},
#  {      2, Sqrt(b)},
#  {      3,  Sin(c)}}
```

Index