

Package ‘semnova’

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Type Package

Title Latent Repeated Measures ANOVA

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Imports lavaan, Matrix, parallel, MASS, stats, methods

Suggests testthat, knitr, rmarkdown

Depends R (>= 3.4.0)

Description Latent repeated measures ANOVA (L-RM-ANOVA) is a structural equation modeling based alternative to traditional repeated measures ANOVA. L-RM-ANOVA extends the latent growth components approach by Mayer et al. (2012) <doi:10.1080/10705511.2012.713242> and introduces latent variables to repeated measures analysis.

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R topics documented:

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|-------------------|--|
| anova, lgc-method | <i>Comparing the fit of LGC objects.</i> |
|-------------------|--|

Description

Comparing the fit of LGC objects.

Usage

```
## S4 method for signature 'lgc'
anova(object, ...)
```

Arguments

| | |
|--------|---|
| object | lgc object. An lgc object to be compared against other lgc objects. |
| ... | lgc object. More lgc objects to be compared. |

| | |
|---------------|--|
| create_mmodel | <i>Specifying a measurement model.</i> |
|---------------|--|

Description

Specifying a measurement model.

Usage

```
create_mmodel(..., list = NULL, lv_scaling = "effect", invariance = NULL)
```

Arguments

| | |
|------------|---|
| ... | Named arguments each representing a latent variable. The arguments are character vectors containing the variable names the latent variables are measured by. |
| list | List. Each list element represents a latent variable. List elements are character vectors containing the variable names the latent variables are measured by. |
| lv_scaling | Character vector. Defines the strategy for latent variable scaling. Default is lv_scaling = "effect". Possible strategies are: c("effect", "referent"). |
| invariance | Not yet implemented. |

Value

Object of classe mmodel.

Examples

```
mmodel <- create_mmodel(  
  A1B1 = "var1",  
  A2B1 = "var2",  
  A3B1 = "var3",  
  A1B2 = "var4",  
  A2B2 = "var5",  
  A3B2 = "var6",  
  lv_scaling = "referent"  
)
```

lgc

General function to specify a general latent growth components model.

Description

General function to specify a general latent growth components model.

Usage

```
lgc(  
  data,  
  mmodel,  
  C_matrix,  
  hypotheses = NULL,  
  covariates = NULL,  
  groups = NULL,  
  append = NULL,  
  verbose = FALSE,  
  compound_symmetry = FALSE,  
  sphericity = FALSE,  
  multiv_tests = c("wilks", "wald"),  
  univ_tests = NULL,  
  randomization = list(ncores = 1, nsamples = 1000),  
  ...  
)
```

Arguments

| | |
|-----------------------|---|
| <code>data</code> | Dataframe. Data object to be passed to lavaan. |
| <code>mmodel</code> | Object of class <code>mmodel</code> . If not provided, manifest variables from the formula object will be used. Otherwise, use <code>create_mmodel()</code> to specify measurement model. |
| <code>C_matrix</code> | Contrast matrix. Must be invertible. |

| | |
|--------------------------------|--|
| <code>hypotheses</code> | List of numeric vectors. Each list element represents a hypothesis. For each hypothesis, the contrasts indicated by the elements of the vectors are tested against zero. |
| <code>covariates</code> | Not implemented yet. |
| <code>groups</code> | Not implemented yet. |
| <code>append</code> | Character. Syntax that is to be appended to lavaan syntax. |
| <code>verbose</code> | Boolean. Print details during procedure. |
| <code>compound_symmetry</code> | Boolean. When set to TRUE, compound symmetry is assumed. |
| <code>sphericity</code> | Boolean or formula. When set to TRUE, sphericity is assumed for all effects. |
| <code>multiv_tests</code> | Character vector. Multivariate test statistics that are to be computed. Possible statistics are: <code>c("wilks", "wald")</code> . Default is <code>multiv_tests = c("wilks", "wald")</code> . |
| <code>univ_tests</code> | Character vector. Univariate test statistics that are to be computed. Possible statistics are: <code>c("F")</code> . Default is <code>univ_tests = NULL</code> . |
| <code>randomization</code> | Not yet supported. |
| <code>...</code> | Additional arguments to be passed to lavaan. |

Value

Function returns an lgc object. Use `summary(object)` to print hypotheses. Otherwise use `object@sem_obj` to get access to the underlying lavaan object.

Examples

```
set.seed(323412431)

data("semnova_test_data", package = "semnova")

mmodel <- create_mmodel(
  A1B1 = "var1",
  A2B1 = "var2",
  A3B1 = "var3",
  A1B2 = "var4",
  A2B2 = "var5",
  A3B2 = "var6",
  lv_scaling = "referent"
)

hypotheses <- list(
  Intercept = c(1),
  A          = c(2, 3),
  B          = c(4),
  AB         = c(5, 6)
)

C_matrix <- matrix(
  c(1, 1, 0, 1, 1, 0,
```

```

      1, 0, 1, 1, 0, 1,
      1,-1,-1, 1,-1,-1,
      1, 1, 0,-1,-1, 0,
      1, 0, 1,-1, 0,-1,
      1,-1,-1,-1, 1, 1),
    nrow=6
  )

fit_lgc <- lgc(data = semnova_test_data, mmodel, C_matrix, hypotheses)
summary(fit_lgc)

```

| | |
|-----------|-------------------|
| lgc-class | <i>LGC Class.</i> |
|-----------|-------------------|

Description

LGC Class.

| | |
|---------|--|
| semnova | <i>Latent repeated-measures ANOVA using the LGC approach</i> |
|---------|--|

Description

Function specifies an LGC model. The `idata` object is used to create the contrast matrix that is passed to the `lgc()` function. Typical hypotheses are specified as well.

Usage

```

semnova(
  formula,
  idesign,
  idata,
  data,
  mmodel = NULL,
  covariates = NULL,
  groups = NULL,
  append = NULL,
  icontrasts = c("contr.poly", "contr.sum"),
  verbose = FALSE,
  compound_symmetry = FALSE,
  sphericity = FALSE,
  multiv_tests = c("wilks", "wald"),
  univ_tests = c("F"),
  randomization = list(ncores = 1, nsamples = 1000),
  ...
)

```

Arguments

| | |
|-------------------|--|
| formula | Formula. |
| idesign | Formula. Within-subjects design formula. |
| idata | Dataframe. The dataframe contains the factorial design. |
| data | Dataframe. Data object to be passed to lavaan. |
| mmodel | Object of class <code>mmodel</code> . If not provided, manifest variables from the formula object will be used. Otherwise, use <code>create_mmodel()</code> to specify measurement model. |
| covariates | Not implemented yet. |
| groups | Not implemented yet. |
| append | Character vector. Syntax that is to be appended to lavaan syntax. |
| icontrasts | Character vector. Use this argument to select the type of contrasts to be used. Default is <code>c("contr.sum", "contr.poly")</code> (not ordered, ordered). |
| verbose | Boolean. Print details during procedure. |
| compound_symmetry | Boolean. When set to <code>TRUE</code> , compound symmetry is assumed among dependent variables. |
| sphericity | Boolean or formula. When set to <code>TRUE</code> , sphericity is assumed for all effects. |
| multiv_tests | Character vector. Multivariate test statistics that are to be computed. Possible statistics are: <code>c("wilks", "wald")</code> . Default is <code>multiv_tests = c("wilks", "wald")</code> . |
| univ_tests | Character vector. Univariate test statistics that are to be computed. Possible statistics are: <code>c("F")</code> . Default is <code>univ_tests = NULL</code> . |
| randomization | Not yet supported. |
| ... | Additional arguments to be passed to lavaan. |

Value

Function returns an `lgc` object. Use `summary(object)` to print hypotheses. Otherwise use `object@sem_obj` to get access to the underlying lavaan object.

Examples

```
set.seed(323412431)

data("semnova_test_data", package = "semnova")

idata <- expand.grid(A = c("A1", "A2", "A3"), B = c("B1", "B2"))

mmodel <- create_mmodel(
  A1B1 = "var1",
  A2B1 = "var2",
  A3B1 = "var3",
  A1B2 = "var4",
  A2B2 = "var5",
```

```

    A3B2 = "var6",
    lv_scaling = "referent"
  )

fit_semnova <-
  semnova(
    formula = cbind(A1B1, A2B1, A3B1, A1B2, A2B2, A3B2) ~ 1,
    data = semnova_test_data,
    idata = idata,
    idesign = ~ A * B,
    mmodel = mmodel
  )

summary(fit_semnova)

```

semnova_test_data *This data set serves for examples and tests.*

Description

This is a simulated data set that 100 observation of six normally distributed variables with mean = 0, variance = 1 and covariance 0.5.

Usage

```
semnova_test_data
```

Format

A data frame with 100 rows and 6 variables:

summary,lgc-method *Printing the summary for an LGC object.*

Description

Printing the summary for an LGC object.

Usage

```
## S4 method for signature 'lgc'
summary(object, ...)
```

Arguments

object lgc object. The object to get a summary about.
 ... Additional arguments. Currently none supported.

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