Package 'srm'

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Title Structural Equation Modeling for the Social Relations Model

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Description Provides functionality for structural equation modeling for the social relations model (Kenny & La Voie, 1984; <doi:10.1016/S0065-2601(08)60144-6>; Warner, Kenny, & Soto, 1979, <doi:10.1037/0022-3514.37.10.1742>). Maximum likelihood estimation (Gill & Swartz, 2001, <doi:10.2307/3316080>; Nestler, 2018, <doi:10.3102/1076998617741106>) and least squares estimation is supported (Bond & Malloy, 2018, <doi:10.1016/B978-0-12-811967-9.00014-X>).

Depends R (>= 3.1)

Imports Rcpp, stats, utils

Enhances amen, TripleR

LinkingTo Rcpp, RcppArmadillo

License GPL (>= 2)

URL https://github.com/alexanderrobitzsch/srm, https://sites.google.com/site/alexanderrobitzsch2/software

NeedsCompilation yes

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Contents

`srm-package` *Structural Equation Modeling for the Social Relations Model*

Description

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References

Bond, C. F., & Malloy, T. E. (2018a). Social relations analysis of dyadic data structure: The general case. In T. E. Malloy. *Social relations modeling of behavior in dyads and groups* (Ch. 14). Academic Press. doi: 10.1016/B9780128119679.00014X

Gill, P. S., & Swartz, T. B. (2001). Statistical analyses for round robin interaction data. *Canadian Journal of Statistics, 29*(2), 321-331. doi: 10.2307/3316080

Kenny, D. A., & La Voie, L. J. (1984). The social relations model. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 18, pp. 142-182). Orlando, FL: Academic. doi: 10.1016/S00652601(08)601446

Nestler, S. (2018). Likelihood estimation of the multivariate social relations model. *Journal of Educational and Behavioral Statistics, 43*(4), 387-406. doi: 10.3102/1076998617741106

Warner, R. M., Kenny, D. A., & Soto, M. (1979). A new round robin analysis of variance for social interaction data. *Journal of Personality and Social Psychology, 37*(10), 1742-1757. doi: 10.1037/00223514.37.10.1742

See Also

See also the R packages **amen** and **TripleR** for estimating the social relations model.

data.back *Dataset Back et al. (2011)*

Description

Dataset used in Back, Schmukle and Egloff (2011).

Usage

```
data(data.back)
```

Format

- The dataset data.back is a round-robin desiogn with 54 units and has the following structure

```
'data.frame': 2862 obs. of 8 variables:
$ Group : num 1 1 1 1 1 1 1 1 1 1 ...
$ Actor : int 1 1 1 1 1 1 1 1 1 1 ...
$ Partner: int 2 3 4 5 6 7 8 9 10 11 ...
$ Dyad : int 1 2 3 4 5 6 7 8 9 10 ...
$ y : int 3 3 2 2 4 3 3 2 3 3 ...
$ sex : int 1 1 1 1 1 1 1 1 1 1 ...
$ age : int 22 22 22 22 22 22 22 22 22 22 ...
$ n : num -1.17 -1.17 -1.17 -1.17 -1.17 -1.17 -1.17 -1.17 -1.17 -1.17 ...
```

Source

https://osf.io/zd67x/

References

Back, M. D., Schmukle, S. C., & Egloff, B. (2011). A closer look at first sight: Social relations lens model analysis of personality and interpersonal attraction at zero acquaintance. *European Journal of Personality, 25*(3), 225-238. doi: 10.1002/per.790

data.bm *Dataset Bond and Malloy (2018)*

Description

This is the illustration dataset of Bond and Malloy (2018) for a bivariate social relations model. The round robin design contains 16 persons and some missing values for one person.

Usage

```
data(data.bm1)
data(data.bm2)
```

Format

- The dataset `data.bm1` contains all ratings in a wide format. The two outcomes are arranged one below the other.

```
'data.frame': 32 obs. of 16 variables:
$ a: int NA 12 13 14 15 15 14 14 13 13 ...
$ b: int 10 NA 10 18 7 15 14 8 12 12 ...
$ c: int 13 12 NA 14 13 14 13 13 11 12 ...
[...]
$ p: int 11 13 14 14 9 8 17 13 11 12 ...
```

- The dataset `data.bm2` is a subdataset of `data.bm1` which contains observations 9 to 16.

Source

http://thomasemalloy.org/arbsrm-the-general-social-relations-model/

References

Bond, C. F., & Malloy, T. E. (2018a). Social relations analysis of dyadic data structure: The general case. In T. E. Malloy. *Social relations modeling of behavior in dyads and groups* (Ch. 14). Academic Press. doi: 10.1016/B9780128119679.00014X

`data.srm` *Example Datasets for the* **srm** *Package*

Description

Some simulated example datasets for the **srm** package.

Usage

```
data(data.srm01)
```

Format

- The dataset `data.srm01` contains three variables, 10 round robin groups with 10 members each.

```
'data.frame': 900 obs. of 7 variables:
$ Group : num 1 1 1 1 1 1 1 1 1 1 ...
$ dyad : num 1 2 3 4 5 6 7 8 9 10 ...
$ Actor : num 1 1 1 1 1 1 1 1 1 2 ...
$ Partner: num 2 3 4 5 6 7 8 9 10 3 ...
$ Wert1 : num -0.15 -0.95 0.82 1.15 -1.79 1.17 1.79 -0.57 -0.46 1.19 ...
$ Wert2 : num -0.77 0.17 0.42 0.16 -0.44 0.89 1.67 -1.9 -0.74 2.67 ...
$ Wert3 : num -0.49 0.08 -0.12 1.16 -2.78 -0.74 2.66 -1.28 -0.45 1.93 ...
```

HallmarkKenny *Hallmark and Kenny Round Robin Data*

Description

Data from Kenny et al. (1994)

Usage

```
data(HallmarkKenny)
```

Format

A data frame with 802 measurements of 30 round-robin groups on the following 7 round-robin variables (taken on unnumbered 7-point rating scales with higher numbers indicating a higher value of the trait):

`calm`: rating of dimension calm-anxious
`sociable` rating of dimension sociable-withdrawn
`liking` rating of dimension like-do not like
`careful` rating of dimension careful-careless
`relaxed` rating of dimension relaxed-tense
`talkative` rating of dimension talkative-quiet
`responsible` rating of dimension responsible-undependable

The data frame also contains participants gender (`actor.sex`; 1 = F, 2 = M) and their age in years (`actor.age`). Note that the data was assessed in two conditions: odd round robin group numbers indicate groups in which participants rated all traits for a person at a time whereas even numbers refer to groups in which participants rated all the people for each trait.

Source

http://davidakenny.net/srm/srmdata.htm

References

Kenny, D. A., Albright, L., Malloy, T. E., & Kashy, D. A. (1994). Consensus in interpersonal perception: Acquaintance and the big five. *Psychological Bulletin, 116*(2), 245-258. doi: 10.1037/00332909.116.2.245

Kenzer *Zero Acquaintance Round Robin Data from Kenny*

Description

Data from Albright et al. (1988) Study 2

Usage

```
data(Kenzer)
```

Format

A data frame with 124 measurements from 7 round-robin groups on the following 5 round-robin variables (taken on unnumbered 7-point rating scales with higher numbers indicating a higher value of the trait):

`sociable`: rating of dimension sociable
`irritable`: rating of dimension good-natured
`responsible`: rating of dimension responsible
`anxious`: rating of dimension calm
`intellectual`: rating of dimension intellectual

The data frame also contains the gender (`actor.sex`; `1` = F, `2` = M) of the participants and their self-ratings on the five assessed traits (`actor.sociable` and so on).

Source

http://davidakenny.net/srm/srmdata.htm

References

Albright, L., Kenny, D. A., & Malloy, T. E. (1988). Consensus in personality judgments at zero acquaintance. *Journal of Personality and Social Psychology, 55*(3), 387-395. doi: 10.1037/0022-3514.55.3.387

Malzer *Zero Acquaintance Round Robin Data from Malloy*

Description

Data from Albright et al. (1988) Study 1

Usage

```
data(Malzer)
```

Format

A data frame with 216 measurements from 12 round-robin groups on the following 5 round-robin variables (assessed on numbered 7-point rating scales with higher numbers indicating a higher value of the trait with the exception for good and calm):

`sociable`: rating of dimension sociable
`irritable`: rating of dimension good-natured
`responsible`: rating of dimension responsible
`anxious`: rating of dimension calm
`intellectual`: rating of dimension intellectual

The data frame also contains the gender (`actor.sex`; 1 = F, 2 = M) of the participants and their self-ratings on the five assessed traits (`actor.sociable` and so on).

Source

http://davidakenny.net/srm/srmdata.htm

References

Albright, L., Kenny, D. A., & Malloy, T. E. (1988). Consensus in personality judgments at zero acquaintance. *Journal of Personality and Social Psychology, 55*(3), 387-395. doi: 10.1037/0022-3514.55.3.387

`srm` *Structural Equation Model for the Social Relations Model*

Description

Provides an estimation routine for a multiple group structural equation model for the social relations model (SRM; Kenny & La Voie, 1984; Warner, Kenny, & Soto, 1979). The model is estimated by maximum likelihood (Gill & Swartz, 2001; Nestler, 2018).

Usage

```
srm(model.syntax = NULL, data = NULL, group.var = NULL, rrgroup_name = NULL,
  person_names = c("Actor", "Partner"), fixed.groups = FALSE, var_positive = -1,
  optimizer = "srm", maxiter = 300, conv_dev = 1e-08, conv_par = 1e-06,
 do_line_search = TRUE, line_search_iter_max = 6, verbose = TRUE, use_rcpp = TRUE,
  shortcut = TRUE, use_woodbury = TRUE)

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

```
summary(object, digits=3, file=NULL, layout=1, ...)
## S3 method for class 'srm'
logLik(object, ...)
```

Arguments

model.syntax	Syntax similar to **lavaan** language, see Examples.
data	Data frame containing round robin identifier variables and variables in the round robin design
group.var	Name of grouping variable
rrgroup_name	Name of variable indicating round robin group
person_names	Names for identifier variables for actors and partners
fixed.groups	Logical indicating whether groups should be handled with fixed effects
var_positive	Nonnegative value if variances are constrained to be positive
optimizer	Optimizer to be used: "srm" for internal optimization using Fisher scoring and "nlminb" for L-FBGS optimization.
maxiter	Maximum number of iterations
conv_dev	Convergence criterion for change relative deviance
conv_par	Convergence criterion for change in parameters
do_line_search	Logical indicating whether line search should be performed
line_search_iter_max	Number of iterations during line search algorithm
verbose	Logical indicating whether convergence progress should be displayed
use_rcpp	Logical indicating whether **Rcpp** package should be used
shortcut	Logical indicating whether shortcuts for round robin groups with same structure should be used
use_woodbury	Logical indicating whether matrix inversion should be simplified by Woodbury identity
object	Object of class srm
file	Optional file name for summary output
digits	Number of digits after decimal in summary output
layout	Different layouts (1 or 2) for layout of summary
...	Further arguments to be passed

Value

List with following entries (selection)

parm.table	Parameter table with estimated values
coef	Vector of parameter estimates
vcov	Covariance matrix of parameter estimates
parm_list	List of model matrices
sigma	Model implied covariance matrices
...	Further values

References

Gill, P. S., & Swartz, T. B. (2001). Statistical analyses for round robin interaction data. *Canadian Journal of Statistics, 29*(2), 321-331. doi: 10.2307/3316080

Kenny, D. A., & La Voie, L. J. (1984). The social relations model. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 18, pp. 142-182). Orlando, FL: Academic. doi: 10.1016/S00652601(08)601446

Nestler, S. (2018). Likelihood estimation of the multivariate social relations model. *Journal of Educational and Behavioral Statistics, 43*(4), 387-406. doi: 10.3102/1076998617741106

Warner, R. M., Kenny, D. A., & Soto, M. (1979). A new round robin analysis of variance for social interaction data. *Journal of Personality and Social Psychology, 37*(10), 1742-1757. doi: 10.1037/00223514.37.10.1742

See Also

See also **TripleR** and **amen** packages for alternative estimation routines for the SRM.

Examples

```
##############################################################################
# EXAMPLE 1: Univariate SRM
##############################################################################

data(data.srm01, package="srm")
dat <- data.srm01

#-- define model
mf <- '
%Person
F1@A =~ 1*Wert1@A
F1@P =~ 1*Wert1@P
Wert1@A ~~ 0*Wert1@A + 0*Wert1@P
Wert1@P ~~ 0*Wert1@P

%Dyad
F1@AP =~ 1*Wert1@AP
F1@PA =~ 1*Wert1@PA
Wert1@AP ~~ 0*Wert1@AP + 0*Wert1@PA
Wert1@PA ~~ 0*Wert1@PA
'

#-- estimate model
mod1 <- srm::srm(mf, data = dat, rrgroup_name="Group", conv_par=1e-4, maxiter=20)
summary(mod1)
round(coef(mod1),3)


##############################################################################
# EXAMPLE 2: Bivariate SRM
##############################################################################
```

```
data(data.srm01, package="srm")
dat <- data.srm01

#-- define model
mf <- '
%Person
F1@A =~ 1*Wert1@A
F1@P =~ 1*Wert1@P
F2@A =~ 1*Wert2@A
F2@P =~ 1*Wert2@P
Wert1@A ~~ 0*Wert1@A + 0*Wert1@P
Wert1@P ~~ 0*Wert1@P
Wert2@A ~~ 0*Wert2@A + 0*Wert2@P
Wert2@P ~~ 0*Wert2@P

%Dyad
F1@AP =~ 1*Wert1@AP
F1@PA =~ 1*Wert1@PA
F2@AP =~ 1*Wert2@AP
F2@PA =~ 1*Wert2@PA
Wert1@AP ~~ 0*Wert1@AP + 0*Wert1@PA
Wert1@PA ~~ 0*Wert1@PA
Wert2@AP ~~ 0*Wert2@AP + 0*Wert2@PA
Wert2@PA ~~ 0*Wert2@PA
'

#-- estimate model
mod1 <- srm::srm(mf, data = dat, rrgroup_name="Group", conv_par=1e-4, maxiter=20)
summary(mod1)

################################################################################
# EXAMPLE 3: One-factor model
################################################################################

data(data.srm01, package="srm")
dat <- data.srm01

#-- define model
mf <- '
# definition of factor for persons and dyad
%Person
f1@A=~Wert1@A+Wert2@A+Wert3@A
f1@P=~Wert1@P+Wert2@P+Wert3@P

%Dyad
f1@AP=~Wert1@AP+Wert2@AP+Wert3@AP

# define some constraints
Wert1@AP ~~ 0*Wert1@PA
Wert3@AP ~~ 0*Wert3@PA
'
#-- estimate model
mod1 <- srm::srm(mf, data = dat, rrgroup_name="Group", conv_par=1e-4)
```

```
summary(mod1)
coef(mod1)

#- use stats::nlminb() optimizer
mod1 <- srm::srm(mf, data = dat, rrgroup_name="Group", optimizer="nlminb", conv_par=1e-4)
summary(mod1)
```

`srm_arbsrm` *Least Squares Estimation of the Social Relations Model (Bond & Malloy, 2018)*

Description

Provides least squares estimation of the bivariate social relations model with missing completely at random data (Bond & Malloy, 2018a). The code is basically taken from Bond and Malloy (2018b) and rewritten for reasons of computation time reduction.

Usage

```
srm_arbsrm(data, serror = TRUE, use_srm = TRUE)

## S3 method for class 'srm_arbsrm'
coef(object, ...)
## S3 method for class 'srm_arbsrm'
summary(object, digits=3, file=NULL, ...)
```

Arguments

`data`	Rectangular dataset currently containing only one round robin group. Bivariate observations are stacked one below the other (see example dataset `data.bm1`).
`serror`	Logical indicating whether standard errors should be calculated.
`use_srm`	Logical indicating whether the rewritten code (`TRUE`) or the original code of Bond and Malloy (2018b) should be used.
`object`	Object of class `srm_arbsrm`
`file`	Optional file name for summary output
`digits`	Number of digits after decimal in summary output
`...`	Further arguments to be passed

Value

List containing entries

`par_summary`	Parameter summary table
`est`	Estimated parameters (as in Bond & Malloy, 2018b)
`se`	Estimated standard errors (as in Bond & Malloy, 2018b)

Note

If you use this function, please also cite Bond and Malloy (2018a).

Author(s)

Rewritten code of Bond and Malloy (2018b). See http://thomasemalloy.org/arbsrm-the-general-social-relations and http://thomasemalloy.org/wp-content/uploads/2017/09/arbcodeR.pdf.

References

Bond, C. F., & Malloy, T. E. (2018a). Social relations analysis of dyadic data structure: The general case. In T. E. Malloy. *Social relations modeling of behavior in dyads and groups* (Ch. 14). Academic Press. doi: 10.1016/B9780128119679.00014X

Bond, C. F., & Malloy, T. E. (2018b). *ARBSRM - The general social relations model*. http://thomasemalloy.org/arbsrm-the-general-social-relations-model/.

See Also

Without missing data, ANOVA estimation can be conducted with the **TripleR** package.

Examples

```
#############################################################################
# EXAMPLE 1: Bond and Malloy (2018) illustration dataset
#############################################################################

data(data.bm2, package="srm")
dat <- data.bm2

#- estimation
mod1 <- srm::srm_arbsrm(dat)
mod1$par_summary
coef(mod1)
summary(mod1)


#-- estimation with original Bond and Malloy code
mod1a <- srm::srm_arbsrm(dat, use_srm=FALSE)
summary(mod1a)
```

Warner *Round Robin Data Reported in Warner et al.*

Description

Data from Warner et al. (1979)

Usage

```
data(Warner)
```

Format

A data frame with 56 measurements of a single round-robin group on a single round-robin variable that was measured at three consecutive time points. The variable reflects the proportion of time an actor spent when speaking to a partner.

`prop.T1`: proportion of time spent in the first interaction
`prop.T2`: proportion of time spent in the second interaction
`prop.T3`: proportion of time spent in the third interaction

Source

See Table 7 (p. 1752) of the Warner et al. (1979).

References

Warner, R. M., Kenny, D. A., & Soto, M. (1979). A new round robin analysis of variance for social interaction data. *Journal of Personality and Social Psychology, 37*(10), 1742-1757. doi: 10.1037/00223514.37.10.1742

`Zero` *Zero Acquaintance Round Robin Data From Albirght, Kenny, and Malloy*

Description

Data from Study 3 of Albright et al. (1988)

Usage

```
data(Zero)
```

Format

A data frame with 636 measurements of 36 round robin groups on the following 15 round-robin variables (taken on 7-point rating scales with higher values indicating more of the trait):

`sociable`: rating of dimension sociable-reclusive
`good`: rating of dimension good-natured-irritable
`responsible`: rating of dimension responsible-undependable
`calm`: rating of dimension calm-anxious
`intellectual`: rating of dimension intellectual-unintellectual
`imaginative`: rating of dimension imaginative-unimaginative

`talkative`: rating of dimension talkative-silent
`fussy`: rating of dimension fussy-careless
`composed`: rating of dimension composed-excitable
`cooperative`: rating of dimension cooperative-negativistic
`physically_attractive`: rating of dimension physically attractive-unattractive
`formal_dress`: rating of dimension formal dress-casual dress
`neatly_dressed`: rating of dimension neatly dressed-sloppy dress
`athletic`: rating of dimension athletic-not athletic
`young`: rating of dimension young-old

The data frame also contains the gender (`actor.sex`; `1` = F, `2` = M) of the participants and their self-ratings on the five assessed traits (`actor.sociable` and so on).

Source

http://davidakenny.net/srm/srmdata.htm

References

Albright, L., Kenny, D. A., & Malloy, T. E. (1988). Consensus in personality judgments at zero acquaintance. *Journal of Personality and Social Psychology, 55*(3), 387-395. doi: 10.1037/0022-3514.55.3.387

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