

Package ‘srm’

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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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srm-package

Structural Equation Modeling for the Social Relations Model

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>).

Author(s)

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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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/10.1037/00223514.37.10.1742)

See Also

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

data.back	<i>Dataset Back et al. (2011)</i>
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Description

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

Usage

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

Format

- The dataset data.back is a round-robin design 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](https://doi.org/10.1002/per.790)

data.bm	<i>Dataset Bond and Malloy (2018)</i>
---------	---------------------------------------

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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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

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

Value

List with following entries (selection)

<code>parm.table</code>	Parameter table with estimated values
<code>coef</code>	Vector of parameter estimates
<code>vcov</code>	Covariance matrix of parameter estimates
<code>parm_list</code>	List of model matrices
<code>...</code>	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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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	<i>Least Squares Estimation of the Social Relations Model (Bond & Malloy, 2018)</i>
------------	---

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, error = 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 <code>data.bm1</code>).
error	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 <code>srm_arbsrm</code>
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](https://doi.org/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)
```

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](https://doi.org/10.1037/00223514.37.10.1742)

Zero

Zero Acquaintance Round Robin Data From Albright, 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-excitabile
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](https://doi.org/10.1037/0022-3514.55.3.387)

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