Package 'MultOrdRS'

October 12, 2022

Type Package

Title Model Multivariate Ordinal Responses Including Response Styles

Version 0.1-2

Date 2021-03-26

Author Gunther Schauberger

Maintainer Gunther Schauberger <gunther.schauberger@tum.de>

Description In the case of multivariate ordinal responses, parameter estimates can be severely biased if personal response styles are ignored. This packages provides methods to account for personal response styles and to explain the effects of covariates on the response style, as proposed by Schauberger and Tutz 2021 <doi:10.1177/1471082X20978034>. The method is implemented both for the multivariate cumulative model and the multivariate adjacent categories model.

License GPL (>= 2)

Imports Rcpp (>= 0.12.4), statmod

LinkingTo Rcpp, RcppArmadillo

SystemRequirements C++11

RoxygenNote 7.1.1

NeedsCompilation yes

Repository CRAN

Date/Publication 2021-03-29 23:42:06 UTC

R topics documented:

MultOrdRS-package *Model Multivariate Ordinal Responses Including Response Styles*

Description

A model for multivariate ordinal responses. The response is modelled using a mixed model approach that is also capable of the inclusion of response style effects of the respondents.

Author(s)

Gunther Schauberger
<gunther.schauberger@tum.de>
https://orcid.org/0000-0002-0392-1580

References

Schauberger, Gunther and Tutz, Gerhard (2021): Multivariate Ordinal Random Effects Models Including Subject and Group Specific Response Style Effects, *Statistical Modelling*, https://journals.sagepub.com/doi/10.1177/1471082X20978034

See Also

multordRS ctrl.multordRS plot.MultOrdRS

Examples

```
data(tenseness)

## create a small subset of the data to speed up calculations
set.seed(1860)
tenseness <- tenseness[sample(1:nrow(tenseness), 300),]

## scale all metric variables to get comparable parameter estimates
tenseness$Age <- scale(tenseness$Age)
tenseness$Income <- scale(tenseness$Income)

## two formulas, one without and one with explanatory variables (gender and age)
f.tense0 <- as.formula(paste("cbind(",paste(names(tenseness)[1:4],collapse=","),") ~ 1"))
f.tense1 <- as.formula(paste("cbind(",paste(names(tenseness)[1:4],collapse=","),") ~ Gender + Age"))



####
## Adjacent Categories Models
####

## Multivariate adjacent categories model, without response style, without explanatory variables
m.tense0 <- multordRS(f.tense0, data = tenseness, control = ctrl.multordRS(RS = FALSE, cores = 2))
m.tense0
```

```
## Multivariate adjacent categories model, with response style as a random effect,
## without explanatory variables
m.tense1 <- multordRS(f.tense0, data = tenseness)
m.tense1

## Multivariate adjacent categories model, with response style as a random effect,
## without explanatory variables for response style BUT for location
m.tense2 <- multordRS(f.tense1, data = tenseness, control = ctrl.multordRS(XforRS = FALSE))
m.tense2

## Multivariate adjacent categories model, with response style as a random effect, with
## explanatory variables for location AND response style
m.tense3 <- multordRS(f.tense1, data = tenseness)
m.tense3

plot(m.tense3)



####
## Cumulative Models
####

## Multivariate cumulative model, without response style, without explanatory variables
m.tense0.cumul <- multordRS(f.tense0, data = tenseness, control = ctrl.multordRS(RS = FALSE),
  model = "cumulative")
m.tense0.cumul

## Multivariate cumulative model, with response style as a random effect,
## without explanatory variables
m.tense1.cumul <- multordRS(f.tense0, data = tenseness, model = "cumulative")
m.tense1.cumul

## Multivariate cumulative model, with response style as a random effect,
## without explanatory variables for response style BUT for location
m.tense2.cumul <- multordRS(f.tense1, data = tenseness, control = ctrl.multordRS(XforRS = FALSE),
  model = "cumulative")
m.tense2.cumul

## Multivariate cumulative model, with response style as a random effect, with
## explanatory variables for location AND response style
m.tense3.cumul <- multordRS(f.tense1, data = tenseness, model = "cumulative")
m.tense3.cumul

plot(m.tense3.cumul)

#################################################################
## Examples from Schauberger and Tutz (2020)
## Data from the German Longitudinal Election Study (GLES) 2017
#################################################################
```

```
####
## Source: German Longitudinal Election Study 2017
## Rossteutscher et al. 2017, https://doi.org/10.4232/1.12927
####

## load GLES data
data(GLES17)

## scale data
GLES17[,7:11] <- scale(GLES17[,7:11])

## define formula
f.GLES <- as.formula(cbind(RefugeeCrisis, ClimateChange, Terrorism,
                      Globalization, Turkey, NuclearEnergy) ~
                      Age + Gender + Unemployment + EastWest + Abitur)

## fit adjacent categories model without and with response style parameters
m.GLES0 <- multordRS(f.GLES, data = GLES17, control =  ctrl.multordRS(RS = FALSE, cores = 6))
m.GLES <- multordRS(f.GLES, data = GLES17, control =  ctrl.multordRS(cores = 6))

m.GLES0
m.GLES

plot(m.GLES, main = "Adjacent categories model")


## fit cumulative model without and with response style parameters (takes pretty long!!!)
m.GLES20 <- multordRS(f.GLES, data = GLES17,  model="cumul",
control = ctrl.multordRS(opt.method = "nlminb", cores = 6, RS = FALSE))

m.GLES2 <- multordRS(f.GLES, data = GLES17,  model="cumul",
control = ctrl.multordRS(opt.method = "nlminb", cores = 6))

m.GLES20
m.GLES2

plot(m.GLES2, main = "Cumulative model")
```

`ctrl.multordRS` *Control Function for multordRS*

Description

Control function for multordRS, a model for multivariate ordinal responses including response styles

Usage

```
ctrl.multordRS(
  RS = TRUE,
  thresholds.acat = c("full", "shift", "minimal"),
  XforRS = TRUE,
  opt.method = c("L-BFGS-B", "nlminb"),
  Q = 10,
  cores = 5,
  lambda = 0.01
)
```

Arguments

RS	Logical value indicating whether response style should be modelled.
thresholds.acat	Type of parametrization used for thresholds: thresholds = "full" implies separate estimates of threshold values for each response variable; thresholds = "shift" implies equal threshold parameter across all response variables modified by shift parameters for each response variable; thresholds = "minimal" implies equal threshold parameter across all response variables. This option only applies for adjacent categories models (model = "acat" and is not implemented for cumulative models.)
XforRS	Logical value indicating whether also covariate effects on the response style should be considered. Only relevant if RS = TRUE.
opt.method	Specifies optimization algorithm used by optim, either L-BFGS-B or nlminb.
Q	Number of nodes to be used (per dimension) in Gauss-Hermite-Quadrature. If RS = TRUE, Gauss-Hermite-Quadrature is two-dimensional.
cores	Number of cores to be used in parallelized computation.
lambda	Tuning parameter for internal ridge penalty. It is supposed to be set to a small value to stabilize estimates.

Value

Returns list of control parameters used in multordRS.

Author(s)

Gunther Schauberger
<gunther.schauberger@tum.de>
https://orcid.org/0000-0002-0392-1580

References

Schauberger, Gunther and Tutz, Gerhard (2021): Multivariate Ordinal Random Effects Models Including Subject and Group Specific Response Style Effects, *Statistical Modelling*, https://journals.sagepub.com/doi/10.1177/1471082X20978034

See Also

multordRS MultOrdRS-package plot.MultOrdRS

Examples

```
data(tenseness)

## create a small subset of the data to speed up calculations
set.seed(1860)
tenseness <- tenseness[sample(1:nrow(tenseness), 300),]

## scale all metric variables to get comparable parameter estimates
tenseness$Age <- scale(tenseness$Age)
tenseness$Income <- scale(tenseness$Income)

## two formulas, one without and one with explanatory variables (gender and age)
f.tense0 <- as.formula(paste("cbind(",paste(names(tenseness)[1:4],collapse=","),") ~ 1"))
f.tense1 <- as.formula(paste("cbind(",paste(names(tenseness)[1:4],collapse=","),") ~ Gender + Age"))



####
## Adjacent Categories Models
####

## Multivariate adjacent categories model, without response style,
## without explanatory variables
m.tense0 <- multordRS(f.tense0, data = tenseness, control = ctrl.multordRS(RS = FALSE))
m.tense0

## Multivariate adjacent categories model, with response style as a random effect,
## without explanatory variables
m.tense1 <- multordRS(f.tense0, data = tenseness)
m.tense1

## Multivariate adjacent categories model, with response style as a random effect,
## without explanatory variables for response style BUT for location
m.tense2 <- multordRS(f.tense1, data = tenseness, control = ctrl.multordRS(XforRS = FALSE))
m.tense2

## Multivariate adjacent categories model, with response style as a random effect, with
## explanatory variables for location AND response style
m.tense3 <- multordRS(f.tense1, data = tenseness)
m.tense3

plot(m.tense3)



####
## Cumulative Models
```

```
####

## Multivariate cumulative model, without response style, without explanatory variables
m.tense0.cumul <- multordRS(f.tense0, data = tenseness,
  control = ctrl.multordRS(RS = FALSE), model = "cumulative")
m.tense0.cumul

## Multivariate cumulative model, with response style as a random effect,
## without explanatory variables
m.tense1.cumul <- multordRS(f.tense0, data = tenseness, model = "cumulative")
m.tense1.cumul

## Multivariate cumulative model, with response style as a random effect,
## without explanatory variables for response style BUT for location
m.tense2.cumul <- multordRS(f.tense1, data = tenseness,
  control = ctrl.multordRS(XforRS = FALSE), model = "cumulative")
m.tense2.cumul

## Multivariate cumulative model, with response style as a random effect, with
## explanatory variables for location AND response style
m.tense3.cumul <- multordRS(f.tense1, data = tenseness, model = "cumulative")
m.tense3.cumul

plot(m.tense3.cumul)

#####################################################################
## Examples from Schauberger and Tutz (2020) on
## Data from the German Longitudinal Election Study (GLES) 2017
#####################################################################

####
## Source: German Longitudinal Election Study 2017
## Rossteutscher et al. 2017, https://doi.org/10.4232/1.12927
####

## load GLES data
data(GLES17)

## scale data
GLES17[,7:11] <- scale(GLES17[,7:11])

## define formula
f.GLES <- as.formula(cbind(RefugeeCrisis, ClimateChange, Terrorism,
                      Globalization, Turkey, NuclearEnergy) ~
                      Age + Gender + Unemployment + EastWest + Abitur)

## fit adjacent categories model without and with response style parameters
m.GLES0 <- multordRS(f.GLES, data = GLES17, control =  ctrl.multordRS(RS = FALSE, cores = 6))
m.GLES <- multordRS(f.GLES, data = GLES17, control =  ctrl.multordRS(cores = 6))

m.GLES0
m.GLES
```

```
plot(m.GLES, main = "Adjacent categories model")


## fit cumulative model without and with response style parameters (takes pretty long!!!)
m.GLES20 <- multordRS(f.GLES, data = GLES17,  model="cumul",
control = ctrl.multordRS(opt.method = "nlminb", cores = 6, RS = FALSE))

m.GLES2 <- multordRS(f.GLES, data = GLES17,  model="cumul",
control = ctrl.multordRS(opt.method = "nlminb", cores = 6))

m.GLES20
m.GLES2

plot(m.GLES2, main = "Cumulative model")
```

GLES17 *German Longitudinal Election Study 2017 (GLES17)*

Description

Data from the German Longitudinal Election Study (GLES) from 2017 (Rossteutscher et al., 2017, https://doi.org/10.4232/1.12927). The GLES is a long-term study of the German electoral process. It collects pre- and post-election data for several federal elections, the data used here originate from the pre-election study for 2017.

Format

A data frame containing data from the German Longitudinal Election Study with 2036 observations. The data contain socio-demographic information about the participants as well as their responses to items about specific political fears.

RefugeeCrisis How afraid are you due to the refugee crisis? (Likert scale from 1 (not afraid at all) to 7 (very afraid))

ClimateChange How afraid are you due to the global climate change? (Likert scale from 1 (not afraid at all) to 7 (very afraid))

Terrorism How afraid are you due to the international terrorism? (Likert scale from 1 (not afraid at all) to 7 (very afraid))

Globalization How afraid are you due to the globalization? (Likert scale from 1 (not afraid at all) to 7 (very afraid))

Turkey How afraid are you due to the political developments in Turkey? (Likert scale from 1 (not afraid at all) to 7 (very afraid))

NuclearEnergy How afraid are you due to the use of nuclear energy? (Likert scale from 1 (not afraid at all) to 7 (very afraid))

Age Age in years

Gender 0: male, 1: female

EastWest 0: West Germany, 1: East Germany

Abitur High School Diploma, 1: Abitur/A levels, 0: else

Unemployment 1: currently unemployed, 0: else

Source

https://gles-en.eu/ and doi: 10.4232/1.12927

References

Rossteutscher, S., Schmitt-Beck, R., Schoen, H., Wessels, B., Wolf, C., Bieber, I., Stovsand, L.-C., Dietz, M., and Scherer, P. (2017). Pre-election cross section (GLES 2017). *GESIS Data Archive, Cologne, ZA6800 Data file Version 2.0.0.*, doi: 10.4232/1.12927.

Schauberger, Gunther and Tutz, Gerhard (2021): Multivariate Ordinal Random Effects Models Including Subject and Group Specific Response Style Effects, *Statistical Modelling*, https://journals.sagepub.com/doi/10.1177/1471082X20978034

Examples

```
#################################################################
## Examples from Schauberger and Tutz (2020)
## Data from the German Longitudinal Election Study (GLES) 2017
#################################################################

####
## Source: German Longitudinal Election Study 2017
## Rossteutscher et al. 2017, https://doi.org/10.4232/1.12927
####

## load GLES data
data(GLES17)

## scale data
GLES17[,7:11] <- scale(GLES17[,7:11])

## define formula
f.GLES <- as.formula(cbind(RefugeeCrisis, ClimateChange, Terrorism,
                      Globalization, Turkey, NuclearEnergy) ~
                      Age + Gender + Unemployment + EastWest + Abitur)

## fit adjacent categories model without and with response style parameters
m.GLES0 <- multordRS(f.GLES, data = GLES17, control =  ctrl.multordRS(RS = FALSE, cores = 6))
m.GLES <- multordRS(f.GLES, data = GLES17, control =  ctrl.multordRS(cores = 6))

m.GLES0
m.GLES

plot(m.GLES, main = "Adjacent categories model")
```

```
## fit cumulative model without and with response style parameters (takes pretty long!!!)
m.GLES20 <- multordRS(f.GLES, data = GLES17,  model="cumul",
control = ctrl.multordRS(opt.method = "nlminb", cores = 6, RS = FALSE))

m.GLES2 <- multordRS(f.GLES, data = GLES17,  model="cumul",
control = ctrl.multordRS(opt.method = "nlminb", cores = 6))

m.GLES20
m.GLES2

plot(m.GLES2, main = "Cumulative model")
```

`multordRS` *Model Multivariate Ordinal Responses Including Response Styles*

Description

A model for multivariate ordinal responses. The response is modelled using a mixed model approach that is also capable of the inclusion of response style effects of the respondents.

Usage

```
multordRS(
  formula,
  data = NULL,
  control = ctrl.multordRS(),
  se = TRUE,
  model = c("acat", "cumulative")
)
```

Arguments

`formula`	Formula containing the (multivariate) ordinal response on the left side and the explanatory variables on the right side.
`data`	Data frame containing the ordinal responses as well as the explanatory variables from the `formula`.
`control`	Control argument for `multord()` function. For details see `ctrl.multordRS`.
`se`	Should standard errors be calculated for the regression coefficients? Default is `TRUE`.
`model`	Specifies, which type of model is used, either the (multivariate) adjacent categories model (`model = "acat"`) or the (multivariate) cumulative model (`model = "cumulative"`).

Value

beta.thresh	Matrix containing all threshold parameters for the respective model.
beta.shift	Vector containing all shift parameters. Only relevant if model = "acat" and thresholds.acat = "shift".
beta.X	Vector containing parameter estimates for the location effects of the explanatory variables.
beta.XRS	Vector containing parameter estimates for the response style effects of the explanatory variables.
Sigma	Estimate of the variance (or covariance matrix) of the random effects. The estimate is a matrix if person-specific random response style effects are considered in the model (i.e. if RS = TRUE).
Y	Matrix containing the explanatory variables.
X	Data frame containing the multivariate ordinal response, one row per obeservation, one column per response variable.
se.thresh	Matrix containing all standard errors of the threshold parameters for the respective model.
se.shift	Vector containing all standard errors of the shift parameters. Only relevant if model = "acat" and thresholds.acat = "shift".
se.X	Vector containing standard errors of the parameter estimates for the location effects of the explanatory variables.
se.XRS	Vector containing standard errors of the parameter estimates for the response style effects of the explanatory variables.
coef.vec	Complete vector of all parameter estimates (for internal use).
se.vec	Complete vector of all standard errors (for internal use).
design.values	Some values of the design matrix (for internal use).
loglik	(Marginal) Log Likelihood
call	Function call
df	Degrees of freedom
control	Control argument from function call

Author(s)

Gunther Schauberger
<gunther.schauberger@tum.de>
https://orcid.org/0000-0002-0392-1580

References

Schauberger, Gunther and Tutz, Gerhard (2021): Multivariate Ordinal Random Effects Models Including Subject and Group Specific Response Style Effects, *Statistical Modelling*, https://journals.sagepub.com/doi/10.1177/1471082X20978034

See Also

ctrl.multordRS MultOrdRS-package plot.MultOrdRS

Examples

```
data(tenseness)

## create a small subset of the data to speed up calculations
set.seed(1860)
tenseness <- tenseness[sample(1:nrow(tenseness), 300),]

## scale all metric variables to get comparable parameter estimates
tenseness$Age <- scale(tenseness$Age)
tenseness$Income <- scale(tenseness$Income)

## two formulas, one without and one with explanatory variables (gender and age)
f.tense0 <- as.formula(paste("cbind(",paste(names(tenseness)[1:4],collapse=","),") ~ 1"))
f.tense1 <- as.formula(paste("cbind(",paste(names(tenseness)[1:4],collapse=","),") ~ Gender + Age"))



####
## Adjacent Categories Models
####

## Multivariate adjacent categories model, without response style, without explanatory variables
m.tense0 <- multordRS(f.tense0, data = tenseness, control = ctrl.multordRS(RS = FALSE, cores = 2))
m.tense0



## Multivariate adjacent categories model, with response style as a random effect,
## without explanatory variables
m.tense1 <- multordRS(f.tense0, data = tenseness)
m.tense1

## Multivariate adjacent categories model, with response style as a random effect,
## without explanatory variables for response style BUT for location
m.tense2 <- multordRS(f.tense1, data = tenseness, control = ctrl.multordRS(XforRS = FALSE))
m.tense2

## Multivariate adjacent categories model, with response style as a random effect, with
## explanatory variables for location AND response style
m.tense3 <- multordRS(f.tense1, data = tenseness)
m.tense3

plot(m.tense3)



####
```

```
## Cumulative Models
####

## Multivariate cumulative model, without response style, without explanatory variables
m.tense0.cumul <- multordRS(f.tense0, data = tenseness, control = ctrl.multordRS(RS = FALSE),
  model = "cumulative")
m.tense0.cumul

## Multivariate cumulative model, with response style as a random effect,
## without explanatory variables
m.tense1.cumul <- multordRS(f.tense0, data = tenseness, model = "cumulative")
m.tense1.cumul

## Multivariate cumulative model, with response style as a random effect,
## without explanatory variables for response style BUT for location
m.tense2.cumul <- multordRS(f.tense1, data = tenseness, control = ctrl.multordRS(XforRS = FALSE),
  model = "cumulative")
m.tense2.cumul

## Multivariate cumulative model, with response style as a random effect, with
## explanatory variables for location AND response style
m.tense3.cumul <- multordRS(f.tense1, data = tenseness, model = "cumulative")
m.tense3.cumul

plot(m.tense3.cumul)

#####################################################################
## Examples from Schauberger and Tutz (2020)
## Data from the German Longitudinal Election Study (GLES) 2017
#####################################################################

####
## Source: German Longitudinal Election Study 2017
## Rossteutscher et al. 2017, https://doi.org/10.4232/1.12927
####

## load GLES data
data(GLES17)

## scale data
GLES17[,7:11] <- scale(GLES17[,7:11])

## define formula
f.GLES <- as.formula(cbind(RefugeeCrisis, ClimateChange, Terrorism,
                      Globalization, Turkey, NuclearEnergy) ~
                      Age + Gender + Unemployment + EastWest + Abitur)

## fit adjacent categories model without and with response style parameters
m.GLES0 <- multordRS(f.GLES, data = GLES17, control =  ctrl.multordRS(RS = FALSE, cores = 6))
m.GLES <- multordRS(f.GLES, data = GLES17, control =  ctrl.multordRS(cores = 6))

m.GLES0
m.GLES
```

```
plot(m.GLES, main = "Adjacent categories model")


## fit cumulative model without and with response style parameters (takes pretty long!!!)
m.GLES20 <- multordRS(f.GLES, data = GLES17,  model="cumul",
control = ctrl.multordRS(opt.method = "nlminb", cores = 6, RS = FALSE))

m.GLES2 <- multordRS(f.GLES, data = GLES17,  model="cumul",
control = ctrl.multordRS(opt.method = "nlminb", cores = 6))

m.GLES20
m.GLES2

plot(m.GLES2, main = "Cumulative model")
```

`plot.MultOrdRS` *Plot function for MultOrdRS*

Description

Plot function for a `MultOrdRS` object. Plots show coefficients of the explanatory variables, both with repect to location and response styles. The coefficient pairs are displayed as stars, where the rays represent (1-alpha) confidence intervals.

Usage

```
## S3 method for class 'MultOrdRS'
plot(x, alpha = 0.05, CIfactor = 0.9, ...)
```

Arguments

`x`	`MultOrdRS` object
`alpha`	Specifies the confidence level 1-alpha of the confidence interval.
`CIfactor`	Argument that helps to control the appearance (the width) of the stars that represent the confidence intervals of both parameters (location and response style) corresponding to one covariate.
`...`	Further plot arguments.

Value

No return value, called for side effects

Author(s)

Gunther Schauberger
<gunther.schauberger@tum.de>
https://orcid.org/0000-0002-0392-1580

References

Schauberger, Gunther and Tutz, Gerhard (2021): Multivariate Ordinal Random Effects Models Including Subject and Group Specific Response Style Effects, *Statistical Modelling*, https://journals.sagepub.com/doi/10.1177/1471082X20978034

See Also

multordRS, ctrl.multordRS

Examples

```
data(tenseness)

## create a small subset of the data to speed up calculations
set.seed(1860)
tenseness <- tenseness[sample(1:nrow(tenseness), 300),]

## scale all metric variables to get comparable parameter estimates
tenseness$Age <- scale(tenseness$Age)
tenseness$Income <- scale(tenseness$Income)

## two formulas, one without and one with explanatory variables (gender and age)
f.tense0 <- as.formula(paste("cbind(",paste(names(tenseness)[1:4],collapse=","),") ~ 1"))
f.tense1 <- as.formula(paste("cbind(",paste(names(tenseness)[1:4],collapse=","),") ~ Gender + Age"))



####
## Adjacent Categories Models
####

## Multivariate adjacent categories model, without response style, without explanatory variables
m.tense0 <- multordRS(f.tense0, data = tenseness, control = ctrl.multordRS(RS = FALSE))
m.tense0


## Multivariate adjacent categories model, with response style as a random effect,
## without explanatory variables
m.tense1 <- multordRS(f.tense0, data = tenseness)
m.tense1

## Multivariate adjacent categories model, with response style as a random effect,
## without explanatory variables for response style BUT for location
m.tense2 <- multordRS(f.tense1, data = tenseness, control = ctrl.multordRS(XforRS = FALSE))
m.tense2

## Multivariate adjacent categories model, with response style as a random effect, with
## explanatory variables for location AND response style
m.tense3 <- multordRS(f.tense1, data = tenseness)
m.tense3
```

```
plot(m.tense3)



####
## Cumulative Models
####

## Multivariate cumulative model, without response style, without explanatory variables
m.tense0.cumul <- multordRS(f.tense0, data = tenseness,
  control = ctrl.multordRS(RS = FALSE), model = "cumulative")
m.tense0.cumul

## Multivariate cumulative model, with response style as a random effect,
## without explanatory variables
m.tense1.cumul <- multordRS(f.tense0, data = tenseness, model = "cumulative")
m.tense1.cumul

## Multivariate cumulative model, with response style as a random effect,
## without explanatory variables for response style BUT for location
m.tense2.cumul <- multordRS(f.tense1, data = tenseness,
  control = ctrl.multordRS(XforRS = FALSE), model = "cumulative")
m.tense2.cumul

## Multivariate cumulative model, with response style as a random effect, with
## explanatory variables for location AND response style
m.tense3.cumul <- multordRS(f.tense1, data = tenseness, model = "cumulative")
m.tense3.cumul

plot(m.tense3.cumul)

######################################################################
## Examples from Schauberger and Tutz (2020)
## Data from the German Longitudinal Election Study (GLES) 2017
######################################################################

####
## Source: German Longitudinal Election Study 2017
## Rossteutscher et al. 2017, https://doi.org/10.4232/1.12927
####

## load GLES data
data(GLES17)

## scale data
GLES17[,7:11] <- scale(GLES17[,7:11])

## define formula
f.GLES <- as.formula(cbind(RefugeeCrisis, ClimateChange, Terrorism,
                      Globalization, Turkey, NuclearEnergy) ~
                      Age + Gender + Unemployment + EastWest + Abitur)

## fit adjacent categories model without and with response style parameters
```

```
m.GLES0 <- multordRS(f.GLES, data = GLES17, control =  ctrl.multordRS(RS = FALSE, cores = 6))
m.GLES <- multordRS(f.GLES, data = GLES17, control =  ctrl.multordRS(cores = 6))

m.GLES0
m.GLES

plot(m.GLES, main = "Adjacent categories model")


## fit cumulative model without and with response style parameters (takes pretty long!!!)
m.GLES20 <- multordRS(f.GLES, data = GLES17,  model="cumul",
control = ctrl.multordRS(opt.method = "nlminb", cores = 6, RS = FALSE))

m.GLES2 <- multordRS(f.GLES, data = GLES17,  model="cumul",
control = ctrl.multordRS(opt.method = "nlminb", cores = 6))

m.GLES20
m.GLES2

plot(m.GLES2, main = "Cumulative model")
```

`tenseness` *Tenseness data from the Freiburg Complaint Checklist (tenseness)*

Description

Data from the Freiburg Complaint Checklist. The data contain all 8 items corresponding to the scale *Tenseness* for 1847 participants of the standardization sample of the Freiburg Complaint Checklist. Additionally, several person characteristics are available.

Format

A data frame containing data from the Freiburg Complaint Checklist with 1847 observations. All items refer to the scale *Tenseness* and are measured on a 5-point Likert scale where low numbers correspond to low frequencies or low intensitites of the respective complaint and vice versa.

Clammy_hands Do you have clammy hands?

Sweat_attacks Do you have sudden attacks of sweating?

Clumsiness Do you notice that you behave clumsy?

Wavering_hands Are your hands wavering frequently, e.g. when lightning a cigarette or when holding a cup?

Restless_hands Do you notice that your hands are restless?

Restless_feet Do you notice that your feet are restless?

Twitching_eyes Do you notice unvoluntary twitching of your eyes?

Twitching_mouth Do you notice unvoluntary twitching of your mouth?

Gender Gender of the participant

Household Does participant live alone in a houshold or together with others?

WestEast is the participant from East Germany (former GDR) or West Germany?

Age Age in 15 categories, treated as continuous variable

Abitur Does the participant have Abitur (a-levels)?

Income Income in 11 categories, treated as continuous variable

Source

ZPID (2013). PsychData of the Leibniz Institute for Psychology Information ZPID. Trier: Center for Research Data in Psychology.

Fahrenberg, J. (2010). Freiburg Complaint Checklist [Freiburger Beschwerdenliste (FBL)]. Goettingen, Hogrefe.

Examples

```
data(tenseness)

## create a small subset of the data to speed up calculations
set.seed(1860)
tenseness <- tenseness[sample(1:nrow(tenseness), 300),]

## scale all metric variables to get comparable parameter estimates
tenseness$Age <- scale(tenseness$Age)
tenseness$Income <- scale(tenseness$Income)

## two formulas, one without and one with explanatory variables (gender and age)
f.tense0 <- as.formula(paste("cbind(",paste(names(tenseness)[1:4],collapse=","),") ~ 1"))
f.tense1 <- as.formula(paste("cbind(",paste(names(tenseness)[1:4],collapse=","),") ~ Gender + Age"))



####
## Adjacent Categories Models
####

## Multivariate adjacent categories model, without response style, without explanatory variables
m.tense0 <- multordRS(f.tense0, data = tenseness, control = ctrl.multordRS(RS = FALSE))
m.tense0


## Multivariate adjacent categories model, with response style as a random effect,
## without explanatory variables
m.tense1 <- multordRS(f.tense0, data = tenseness)
m.tense1

## Multivariate adjacent categories model, with response style as a random effect,
## without explanatory variables for response style BUT for location
m.tense2 <- multordRS(f.tense1, data = tenseness, control = ctrl.multordRS(XforRS = FALSE))
```

```
m.tense2

## Multivariate adjacent categories model, with response style as a random effect, with
## explanatory variables for location AND response style
m.tense3 <- multordRS(f.tense1, data = tenseness)
m.tense3

plot(m.tense3)



####
## Cumulative Models
####

## Multivariate cumulative model, without response style, without explanatory variables
m.tense0.cumul <- multordRS(f.tense0, data = tenseness, control =
  ctrl.multordRS(RS = FALSE), model = "cumulative")

m.tense0.cumul

## Multivariate cumulative model, with response style as a random effect,
## without explanatory variables
m.tense1.cumul <- multordRS(f.tense0, data = tenseness, model = "cumulative")
m.tense1.cumul

## Multivariate cumulative model, with response style as a random effect,
## without explanatory variables for response style BUT for location
m.tense2.cumul <- multordRS(f.tense1, data = tenseness,
  control = ctrl.multordRS(XforRS = FALSE), model = "cumulative")

m.tense2.cumul

## Multivariate cumulative model, with response style as a random effect,
## with explanatory variables
## for location AND response style
m.tense3.cumul <- multordRS(f.tense1, data = tenseness, model = "cumulative")
m.tense3.cumul

plot(m.tense3.cumul)
```

Index