Package ‘MultOrdRS’

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Title Model Multivariate Ordinal Responses Including Response Styles
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Description In the case of multivariate ordinal responses, parameter estimates can be severely bi-
ased if personal response styles are ignored. This package provides methods to account for per-
sonal response styles and to explain the effects of covariates on the response style, as pro-
posed by Schauberger and Tutz 2021 <doi:10.1177/1471082X20978034>. The method is imple-
mented both for the multivariate cumulative model and the multivariate adjacent categories model.
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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)

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References


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

```r
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

```r
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

```r
m.tense3 <- multordRS(f.tense1, data = tenseness)
m.tense3
```

```r
plot(m.tense3)
```

#### Cumulative Models

## Multivariate cumulative model, without response style, without explanatory variables

```r
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

```r
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

```r
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

```r
m.tense3.cumul <- multordRS(f.tense1, data = tenseness, model = "cumulative")
m.tense3.cumul
```

```r
plot(m.tense3.cumul)
```

Examples from Schauberger and Tutz (2020)

Data from the German Longitudinal Election Study (GLES) 2017

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
###

```r
## 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", opt.method = "nlminb", cores = 6, RS = FALSE))
m.GLES2 <- multordRS(f.GLES, data = GLES17, model="cumul", 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**

```r
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)**

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**References**

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

```r
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

```r
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

```r
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

```r
m.tense3.cumul <- multordRS(f.tense1, data = tenseness, model = "cumulative")
m.tense3.cumul
```

```r
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
###

###

```r
## load GLES data
data(GLES17)
```

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

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

```r
## 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

References


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 observation, 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)

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References

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(">Email(names(tenseness)[1:4],collapse="","" ,"" ~ 1"))
f.tense1 <- as.formula(paste("cbind(">Email(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

```r
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

```r
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

```r
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

```r
m.tense3.cumul <- multordRS(f.tense1, data = tenseness, model = "cumulative")
m.tense3.cumul
```

```r
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

```r
## load GLES data
data(GLES17)
```

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

## define formula

```r
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

```r
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
```
## 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 respect to location and response styles. The coefficient pairs are displayed as stars, where the rays represent (1-alpha) confidence intervals.

**Usage**

```r
## S3 method for class 'MultOrdRS'
plot(x, alpha = 0.05, CIfactor = 0.9, 
xlab = expression(exp(gamma)), ylab = expression(exp(alpha)), 
xlim = range(c(1,betaX.KI)), ylim = range(c(1,betaXRS.KI)), ...)
```

**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.
- `xlab`: Label for x-axis
- `ylab`: Label for y-axis
- `xlim`: Limits for x-axis
- `ylim`: Limits for y-axis
- `...`: Further plot arguments.
Value
No return value, called for side effects

Author(s)
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References

See Also
multordRS, ctrl.multordRS

Examples

```r
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
```r
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")
```

---

**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 intensities 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 household 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


Examples

```r
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))
```


```r
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)
```
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