

Package ‘crov’

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Type Package

Title Constrained Regression Model for an Ordinal Response and Ordinal Predictors

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Description

Fits a constrained regression model for an ordinal response with ordinal predictors and possibly others, Espinosa and Hennig (2018) <arXiv:1804.08715>. The parameter estimates associated with an ordinal predictor are constrained to be monotonic. If a monotonicity direction (isotonic or antitonic) is not specified for an ordinal predictor by the user, then the monotonicity direction classification procedure establishes it. A monotonicity test is also available to test the null hypothesis of monotonicity over a set of parameters associated with an ordinal predictor.

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Encoding UTF-8

LazyData TRUE

Imports VGAM (>= 1.0-5), gtools (>= 3.5.0), stats (>= 3.4.3)

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R topics documented:

crovData	2
mdep	2
monoTestBonf	4

Index	6
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 crovData

Real data example

Description

Uses an extract of real data.

Usage

```
crovData
```

Format

Data frame with 9 variables

mdcp

Monotonicity Direction Classification (MDC) procedure

Description

Fits a constrained regression model for an ordinal response with ordinal predictors and possibly others, Espinosa and Hennig (2018) <arXiv:1804.08715>. The parameter estimates associated with an ordinal predictor are constrained to be monotonic. If a monotonicity direction (isotonic or antitonic) is not specified for an ordinal predictor by the user, then the monotonicity direction classification procedure establishes it.

Usage

```
mdcp(formula, data = NULL, tryAllMonoDir = FALSE, monoDir = NULL,
      CLS1 = 0.95, TLBS2 = 0.85, TLNS2 = 0.999, StepSizeCLS2 = 1e-04)
```

Arguments

formula	A formula to be fitted with ordinal response, one or more ordinal predictors, and possibly one or more other predictors. For ordinal response and ordinal predictors use ordered factors.
data	A data.frame, list or environment (or object coercible by <code>as.data.frame</code> to a data.frame), containing the variables in formula. Neither a matrix nor an array will be accepted.
tryAllMonoDir	A logical value that indicates whether one model should be fitted for each one of the possible combinations of monotonicity directions. Use TRUE if none monotonicity direction is pre-specified using <code>monoDir</code> and the MDC procedure is not used.

monoDir	Vector with monotonicity directions for the ordinal predictors to be used as constraints. Possible values for monoDir are TRUE and FALSE. Use TRUE for "isotonic" and FALSE for "antitonic". The order of the elements in monoDir must be the same as the order of the ordinal predictors in the object formula, i.e., the j-th element of monoDir must correspond to the monotonicity direction of the j-th ordinal predictor in formula. If tryAllMonoDir and monoDir are not used (default option), the monotonicity direction classification procedure is executed to find the monotonicity directions associated with the model with the maximum log-likelihood.
CLS1	Numerical value for the confidence level to be used in the first step of the MDC procedure. This parameter is active if tryAllMonoDir and monoDir are not used.
TLBS2	Numerical value for the tolerance level to be used in the second step of the MDC procedure over those ordinal predictors classified as "Both" in the first step. This parameter is active if tryAllMonoDir and monoDir are not used.
TLNS2	Numerical value for the tolerance level to be used in the second step of the MDC procedure over those ordinal predictors classified as "None" in the first step. This parameter is active if tryAllMonoDir and monoDir are not used.
StepSizeCLS2	Numerical value for the magnitude in which the confidence levels will be increased or decreased during the second step of the MDC procedure. This parameter is active if tryAllMonoDir and monoDir are not used.

Value

MDCproc: Data frame with the monotonicity direction classification (Isotonic, Antitonic, Both, or None) used for each ordinal predictor in each one of the steps of the MDC procedure (S1, S2 and S3), together with their individual confidence levels (CL). If monoDir is used, MDCproc shows the monotonicity directions in monoDir.

estimates: Vector of parameter estimates of the model.

log.lik: Value of the log-likelihood of the model.

allModels: Data frame with monotonicity directions, log-likelihood and parameter estimates of all models involved in the third step of the MDC procedure. If parameter monoDir is used, allModels shows these results from the model with monotonicity directions used in monoDir only. If parameter tryAllMonoDir is used, allModels shows these results from all the models according to all possible combinations of monotonicity directions.

constrOptimRes: List with the outcomes provided by the function [constrOptim](#).

UMLE: Vector with the parameter estimates of the unconstrained version of the model.

UMLE_SE: Vector with the standard errors of the unconstrained version of the model.

References

Espinosa J., Hennig C. "A constrained regression model for an ordinal response with ordinal predictors." arXiv:1804.08715, 2018.

See Also

[monoTestBonf](#), [constrOptim](#).

Examples

```
# Ordinal predictors: EduLevel, IncQuint, Health,
# Overcrowd, and NumChildren
mdcpExample <- mdcp(QoL ~ EduLevel + Age + IncQuint + Gender + Health +
Overcrowd + Activity + NumChildren, data = crovData,
CLS1 = 0.95, TLBS2 = 0.90, TLNS2 = 0.99, StepSizeCLS2 = 0.0002)
mdcpExample$MDCproc
cbind("CMLE"=mdcpExample$estimates,"UMLE"=mdcpExample$UMLE)
mdcpExample$UMLE_SE
mdcpExample$log.lik
mdcpExample$allModels[1:6]
```

monoTestBonf

Monotonicity test

Description

Tests the null hypothesis of monotonicity over a set of parameters associated with an ordinal predictor.

Usage

```
monoTestBonf(simultAlpha = 0.1, OP_UMLE, OP_SE)
```

Arguments

simultAlpha	Numerical value for the simultaneous significance level.
OP_UMLE	Vector with the unconstrained parameter estimates of an ordinal predictor's categories represented by dummy variables in an unconstrained model for ordinal response (see vlgm).
OP_SE	Vector with the standard error of the parameters of an ordinal predictor's categories represented by dummy variables in an unconstrained model for ordinal response (see vlgm).

Value

testRes: String value with outcomes either "Reject H₀" or "Not Reject H₀".

simultAlpha: Numerical value with the simultaneous significance level.

indivAlphaA: Numerical value with the individual significance level for each confidence interval.

simultPvalue: Numerical value with the p-value associated with the simultaneous significance level.

References

Espinosa J., Hennig C. "A constrained regression model for an ordinal response with ordinal predictors." arXiv:1804.08715, 2018.

See Also

[mdcp](#), [vlgm](#).

Examples

```
# Vectors "OP_UMLE" and "OP_SE" use the values from the unconstrained
# results for the ordinal predictor "Overcrowd" after executing the command
# example("mdcp").
monoTestBonf(simultAlpha=0.05, OP_UMLE = c(0.256116, -0.5058427, 1.5799115),
OP_SE = c(0.229569, 0.6948236, 0.4059133))
```

Index

*Topic **datasets**

`crovData`, [2](#)

`as.data.frame`, [2](#)

`constrOptim`, [3](#)

`crovData`, [2](#)

`mdcp`, [2](#), [5](#)

`monoTestBonf`, [3](#), [4](#)

`vlgm`, [4](#), [5](#)