Package 'UPCM'

January 20, 2025

Type Package

Title Uncertainty in Partial Credit Models

Version 0.0-3

Date 2021-04-27

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Description Provides an extension to the Partial Credit Model and Generalized Partial Credit Models which allows for an additional person parameter that characterizes the uncertainty of the person. The method was originally proposed by Tutz and Schauberger (2020) <doi:10.1177/0146621620920932>.

License GPL (>= 2)

Imports Rcpp (>= 0.12.4), cubature, mvtnorm, numDeriv, statmod

Depends R (>= 3.5.0), ltm

LinkingTo Rcpp, RcppArmadillo

SystemRequirements C++11

RoxygenNote 7.1.1

NeedsCompilation yes

Repository CRAN

Date/Publication 2021-04-27 13:20:05 UTC

Contents

UPCM-package *Uncertainty in Partial Credit Models*

Description

Performs UPCM, a method to model uncertainty in (Generalized) Partial Credit Models

Author(s)

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References

Tutz, Gerhard and Schauberger, Gunther (2020): Uncertainty in Latent Trait Models, *Applied Psychological Measurement*, https://journals.sagepub.com/doi/abs/10.1177/0146621620920932?journalCode=apma

See Also

UPCM

Examples

```
data(tenseness)

Y <- data.matrix(tenseness[,1:4])
X <- model.matrix(~ Gender + Age, data = tenseness)[,-1]

m_upcm <- UPCM(Y = Y, X = X, cores = 2, GPCM = FALSE)
m_upcm
plot(m_upcm)
```

plot.UPCM *Plot function for UPCM*

Description

Plot function for a UPCM or a UGPCM object. Plots show coefficient estimates together with confidence intervals displayed as star plots.

Usage

```
## S3 method for class 'UPCM'
plot(x, sig = 0.05, KIfactor = 0.9, xlim, ylim, ...)
```

Arguments

x	UPCM object
sig	Significance level for confidence intervals, default is sig = 0.05.
KIfactor	Parameter to regulate the shape of the resulting star.
xlim	See xlim in plot.default.
ylim	See ylim in plot.default.
...	Further plot arguments.

Value

No return value, called for side effects

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m_upcm
plot(m_upcm)
```

tenseness *Tenseness data from the Freiburg Complaint Checklist*

Description

Data from the Freiburg Complaint Checklist. The data contain all 8 items corresponding to the scale *Tenseness* for 2042 participants of the standardization sample of the Freiburg Complaint Checklist.

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 person

Household Does the person live alone in a household or together with somebody?

Income Income, categorized to levels from 1 (low income) to 11(high income). For simplicity, due to the high number of categories income can be treated as a metric variable.

WestEast Is the person from East Germany (former GDR)?

Abitur Does the person have Abitur (A-levels)?

Age Age of the person

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)
```

UPCM *Uncertainty in (Generalized) Partial Credit Models*

Description

Performs UPCM, a method to model uncertainty in (Generalized) Partial Credit Models

Usage

```
UPCM(
  Y,
  X = NULL,
  GPCM = TRUE,
  Q = 10,
  cores = 2,
  lambda = 0.01,
  se = TRUE,
  method = c("nlminb", "L-BFGS-B"),
 ctrl.nlminb = list(eval.max = 200, iter.max = 150, abs.tol = 1e-08, rel.tol = 1e-08,
    trace = 0, step.min = 0.1, x.tol = 1e-08, xf.tol = 1e-08)
)
```

Arguments

Y	Matrix containing the ordinal item response data (as ordered factors), one row per observation, one column per item.
X	Matrix containing explanatory variables which are used both for trait parameters and uncertainty parameters, one row per observation, one column per variable.
GPCM	Specifies the baseline model. GPCM = TRUE results in a UGPCM while GPCM = FALSE results in a UPCM.
Q	Number of nodes to be used (per dimension) in two-dimensional Gauss-Hermite-Quadrature.
cores	Number of cores to be used in parallelized computation
lambda	Tuning parameter for ridge penalty on all coefficients except sigma/slope parameters. Should be small, only used to stabilize results.
se	Should standard errors be computed? Standard errors are necessary for plot.UPCM. Computation is time-consuming because numerical optimization methods are used.
method	Specifies optimization algorithm used , either nlminb or L-BFGS-B (optim).
ctrl.nlminb	List of control arguments for optimization procedure nlminb.

Value

delta	Matrix containing all item parameters for the UPCM pr UGPCM model, one row per item, one column per category.
Sigma	2*2 covariance matrix for both random effects, namely the trait parameters theta and the uncertainty parameters alpha.
xi	Estimates for covariate effects on trait parameters.
alpha	Estimates for covariate effects on uncertainty parameters.
slopes	Estimates item slope parameters (only for GPCM = TRUE).
se.delta	
se.xi	Estimates of standard errors for covariate effects on trait parameters.
se.alpha	Estimates of standard errors for covariate effects on uncertainty parameters.
se.sigma	Estimates of standard errors for covariance parameters. Attention: First and third parameter are estimates of se for both variances, the variance of theta and the variance of alpha. Second parameter is the estimate for correlation coefficient between theta and alpha, NOT of the corresponding covariance.
se.slopes	Estimates of standard errors of item slope parameters (only for GPCM = TRUE).
delta.GPCM	Estimates of item parameters theta in the PCM or GPCM model.
sigma.GPCM	Estimate of variance of trait parameters theta in the PCM or GPCM model.
slopes.GPCM	Estimates of slope parameters in the GPCM (only for GPCM = TRUE).
Y	Matrix containing the ordinal item response data, one row per obeservation, one column per item.
loglik	Marginal log-likelihood
coefs	Complete vector of all estimated parameters (for internal use).
se.vec	Complete vector of all estimated standard errors (for internal use).

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See Also

plot.UPCM UPCM-package

Examples

```
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