

Package ‘lpme’

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Title Measurement Error Analysis and Correction Under Identification Restrictions

Version 0.1

Description An R package for analyzing latent variable models with measurement error correction, including Item Response Theory (IRT) models. It provides tools for implementing various correction methods such as Bayesian MCMC, overimputation, bootstrapping for robust standard errors, OLS, and IV-based approaches. The package supports flexible specification of observable indicators and groupings, making it suitable for latent variable analyses in social sciences and other fields.

Depends R (>= 3.3.3)

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Encoding UTF-8

LazyData false

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Imports reticulate,
stats,
sensemakr,
pscl,
AER,
sandwich,
mvtnorm,
Amelia,
emIRT,
gtools

Suggests testthat (>= 3.0.0),
knitr,
rmarkdown

VignetteBuilder knitr

Config/testthat/edition 3

RoxygenNote 7.3.2

URL <https://github.com/cjerzak/lpme>

BugReports <https://github.com/cjerzak/lpme/issues>

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Description

Implements bootstrapped analysis for latent variable models with measurement error correction

Usage

```
lpme(
  Yobs,
  ObservablesMat,
  ObservablesGroupings = colnames(ObservablesMat),
  MakeObservablesGroupings = F,
  nBoot = 32L,
  nPartition = 10L,
  bootBasis = 1:length(Yobs),
  ReturnIntermediaries = T,
  EstimationMethod = "emIRT",
  conda_env = NULL,
  Sys.setenv_text = NULL,
  ordinal = F
)
```

Arguments

Yobs	A vector of observed outcome variables
ObservablesMat	A matrix of observable indicators used to estimate the latent variable
ObservablesGroupings	A vector specifying groupings for the observable indicators. Default is column names of ObservablesMat.
MakeObservablesGroupings	Logical. If TRUE, creates dummy variables for each level of the observable indicators. Default is FALSE.
nBoot	Integer. Number of bootstrap iterations. Default is 32.
nPartition	Integer. Number of partitions for each bootstrap iteration. Default is 10.
bootBasis	Vector of indices or grouping variable for stratified bootstrap. Default is 1:length(Yobs).
ReturnIntermediaries	Logical. If TRUE, returns intermediate results. Default is TRUE.

Details

This function implements a bootstrapped latent variable analysis with measurement error correction. It performs multiple bootstrap iterations, each with multiple partitions. For each partition, it calls the LatentOneRun function to estimate latent variables and apply various correction methods. The results are then aggregated across partitions and bootstrap iterations to produce final estimates and bootstrap standard errors.

Value

A list containing various estimates and statistics:

- OLSCoef: Coefficient from naive OLS regression
- OLSSE: Bootstrap standard error of naive OLS coefficient
- OLSStat: T-statistic of naive OLS coefficient
- Corrected_OLSCoef: OLS coefficient corrected for measurement error
- Corrected_OLSSE: Bootstrap standard error of corrected OLS coefficient
- Corrected_OLSStat: T-statistic of corrected OLS coefficient
- Corrected_OLSCoef_alt: Alternative corrected OLS coefficient
- Corrected_OLSSE_alt: Bootstrap standard error of alternative corrected OLS coefficient
- Corrected_OLSStat_alt: T-statistic of alternative corrected OLS coefficient
- IVRegCoef: Coefficient from instrumental variable regression
- IVRegSE: Bootstrap standard error of IV regression coefficient
- IVRegStat: T-statistic of IV regression coefficient
- Corrected_IVRegCoef: IV regression coefficient corrected for measurement error
- Corrected_IVRegSE: Bootstrap standard error of corrected IV coefficient
- Corrected_IVRegStat: T-statistic of corrected IV coefficient
- x.est1: First set of latent variable estimates
- x.est2: Second set of latent variable estimates
- VarEst_split: Estimated variance of the measurement error
- VarEst_split_se: Bootstrap standard error of the estimated variance of the measurement error

Examples

```
# Generate some example data
set.seed(123)
Yobs <- rnorm(1000)
ObservablesMat <- as.data.frame( matrix(sample(c(0,1), 1000*10, replace = T), ncol = 10) )

# Run the bootstrapped analysis
results <- lpme(Yobs, ObservablesMat, nBoot = 100, nPartition = 5)

# View the corrected IV coefficient and its standard error
print(c(results$Corrected_IVRegCoef, results$Corrected_IVRegSE))
```

lpme_onerun

lpme_onerun

Description

Implements analysis for latent variable models with measurement error correction

Usage

```
lpme_onerun(
  Yobs,
  ObservablesMat,
  ObservablesGroupings = colnames(ObservablesMat),
  MakeObservablesGroupings = F,
  EstimationMethod = "emIRT",
  conda_env = NULL,
  Sys.setenv_text = NULL,
  ordinal = F,
  seed = NULL
)
```

Arguments

Yobs	A vector of observed outcome variables
ObservablesMat	A matrix of observable indicators used to estimate the latent variable
ObservablesGroupings	A vector specifying groupings for the observable indicators. Default is column names of ObservablesMat.
MakeObservablesGroupings	Logical. If TRUE, creates dummy variables for each level of the observable indicators. Default is FALSE.
seed	Random seed for reproducibility. Default is a random integer between 1 and 10000 (used internally)

Details

This function implements a latent variable analysis with measurement error correction. It splits the observable indicators into two sets, estimates latent variables using each set, and then applies various correction methods including OLS correction and instrumental variable approaches.

Value

A list containing various estimates and statistics:

- OLSCoef: Coefficient from naive OLS regression
- OLSSE: Standard error of naive OLS coefficient
- OLSTstat: T-statistic of naive OLS coefficient
- Corrected_OLSCoef: OLS coefficient corrected for measurement error
- Corrected_OLSSE: Standard error of corrected OLS coefficient (currently NA)
- Corrected_OLSTstat: T-statistic of corrected OLS coefficient (currently NA)
- Corrected_OLSCoef_alt: Alternative corrected OLS coefficient
- IVRegCoef: Coefficient from instrumental variable regression
- IVRegSE: Standard error of IV regression coefficient
- IVRegTstat: T-statistic of IV regression coefficient
- x.est1: First set of latent variable estimates
- x.est2: Second set of latent variable estimates
- Corrected_IVRegCoef: IV regression coefficient corrected for measurement error

- Corrected_IVRegSE: Standard error of corrected IV coefficient (currently NA)
- Corrected_IVRegTstat: T-statistic of corrected IV coefficient
- VarEst_split: Estimated variance of the measurement error

Examples

```
# Generate some example data
set.seed(123)
Yobs <- rnorm(100)
ObservablesMat <- as.data.frame( matrix(sample(c(0,1), 1000*10, replace = T), ncol = 10) )

# Run the analysis
results <- lpme_onerun(Yobs, ObservablesMat)

# View the corrected OLS coefficient
print(results$Corrected_OLSCoef)
```

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