Package 'bmlm'

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Title Bayesian Multilevel Mediation

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Description Easy estimation of Bayesian multilevel mediation models with Stan.

URL https://github.com/mvuorre/bmlm/

BugReports http://github.com/mvuorre/bmlm/issues/

License GPL (>= 3)

LazyData true

NeedsCompilation yes

Depends R (>= 3.0.2), Rcpp (>= 0.12.0)

Imports rstan (>= 2.12.1), ggplot2 (>= 2.0.0), methods

Suggests qgraph, knitr, rmarkdown, reshape2, dplyr, ReporteRs

LinkingTo StanHeaders (>= 2.12.0), rstan (>= 2.12.1), BH (>= 1.60.0), Rcpp (>= 0.12.0), RcppEigen

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R topics documented:

`BLch9` *Relationship between work stressors, work dissatisfaction, and relationship dissatisfaction.*

Description

Simulated data from Intensive Longitudinal Methods: An Introduction to Diary and Experience Sampling Research. (Bolger, & Laurenceau, 2013, chapter 9; http://www.intensivelongitudinal.com/index.html).

Usage

```
data(BLch9)
```

Format

A data frame with 2100 rows and 8 variables:

id ID of study participant

time Time

fwkstrs Number of work stressors

fwkdis Work dissatisfaction rating

freldis Relationship dissatisfaction

x Subject-mean deviated number of work stressors

m Subject-mean deviated work dissatisfaction rating

y Subject-mean deviated relationship dissatisfaction

Source

http://www.intensivelongitudinal.com/datasets.html

`bmlm` *bmlm: Easy estimation of Bayesian multilevel mediation models with Stan.*

Description

See https://mvuorre.github.io/bmlm/ for a short tutorial.

isolate *Create isolated within- (and optionally between-) person variables.*

Description

Creates variables that represent pure within- and between-person predictors.

Usage

```
isolate(d = NULL, by = NULL, value = NULL, z = FALSE,
  which = "within")
```

Arguments

d	A data.frame.
by	A vector of values in d by which the data is clustered. i.e. a vector of unique participant IDs.
value	Names of columns in d to isolate. Multiple values can be given by value = c("var1", "var2", "var3")
z	Should the created values be standardized (defaults to FALSE).
which	Which component to return. "within" (default) returns within-person deviations only; "between" returns between-person means only; "both" returns both.

Value

A data.frame with additional columns for the within- and between-person variables. The new columns are labelled _cw for centered-within and _cb for centered-between.

Author(s)

Matti Vuorre <mv2521@columbia.edu>

Examples

```
# Create within-person deviations of work stressors in BLch9.
data(BLch9)
BLch9 <- isolate(BLch9, by = "id", value = "fwkstrs")
head(BLch9)  # Now has new column for within-person work stressors.
```

`mlm` *Estimate a multilevel mediation model*

Description

Estimates a Bayesian multilevel mediation model using Stan.

Usage

```
mlm(d = NULL, id = "id", x = "x", m = "m", y = "y", priors = NULL,
  binary_y = FALSE, ...)
```

Arguments

`d`	A `data.frame` or a `data_frame`.
`id`	Column of participant IDs in `data`.
`x`	Column of X values in `data`.
`m`	Column of M values in `data`.
`y`	Column of Y values in `data`.
`priors`	A list of named values to be used as the prior scale and shape parameters. See details.
`binary_y`	Set to TRUE if y is binary and should be modelled with logistic regression. Defaults to FALSE (y treated as continuous.)
`...`	Other optional parameters passed to `rstan::stan()`.

Details

Draw samples from the joint posterior distribution of a multilevel mediation model using Stan.

Priors:

Users may pass a list of named values for the `priors` argument. This list may specify some or all of the following parameters:

dy, dm Regression intercepts (for Y and M as outcomes, respectively.)

a, b, cp Regression slopes.

tau_x Varying effects SDs for above parameters (e.g replace x with a.)

lkj_shape Shape parameter for the LKJ prior.

See examples for specifying the following: Gaussian distributions with SD = 10 as priors for the intercepts, Gaussians with SD = 2 for the slopes, Half-Cauchy distributions with scale parameters 1 for the varying effects SDs, and an LKJ prior of 2.

Value

An object of S4 class stanfit, with all its available methods.

Author(s)

Matti Vuorre <mv2521@columbia.edu>

Examples

```
## Not run:
## Run example from Bolger and Laurenceau (2013)
data(BLch9)
fit <- mlm(BLch9)
mlm_summary(fit)

### With priors
Priors <- list(dy = 10, dm = 10, a = 2, b = 2, cp = 2,
               tau_dy = 1, tau_dm = 1, tau_a = 1, tau_b = 1, tau_cp = 1,
               lkj_shape = 2)
fit <- mlm(BLch9, priors = Priors)

## End(Not run)
```

---

mlm_pars_plot *Plot estimated parameters of multilevel mediation model*

Description

Plot the model's estimated parameters as histograms or a coefficient plot.

Usage

```
mlm_pars_plot(mod = NULL, type = "hist", color = "black", p_shape = 15,
  p_size = 1.2, level = 0.95, nrow = 3, pars = c("a", "b", "cp",
  "corrab", "ab", "c", "pme"))
```

Arguments

mod	A Stanfit model estimated with `mlm()`.
type	Type of the plot, `hist` or `coefplot`.
color	Color (and fill) for plots.
p_shape	Shape of points for coefplot.
p_size	Size of points for coefplot.
level	X level for Credible Intervals. (Defaults to .95.)
nrow	Number of rows for multiple histograms.
pars	Which parameters to plot.

Details

The point estimate for the coefficient plot is the posterior mean.

Value

A ggplot2 object.

Author(s)

Matti Vuorre <mv2521@columbia.edu>

`mlm_path_plot` *Plot* `bmlm`*'s mediation model as a path diagram*

Description

Plots a path diagram for an estimated multilevel mediation model.

Usage

```
mlm_path_plot(mod = NULL, xlab = "X", ylab = "Y", mlab = "M",
  level = 0.95, text = FALSE, template = FALSE, id = NULL, ...)
```

Arguments

`mod`	A Stanfit model estimated with `mlm()`.
`xlab`	Label for X
`ylab`	Label for Y
`mlab`	Label for M
`level`	"Confidence" level for credible intervals. (Defaults to .95.)
`text`	Should additional parameter values be displayed? (Defaults to FALSE.)
`template`	Should an empty template diagram be plotted? (Defaults to FALSE.)
`id`	Plot an individual-level path diagram by specifying ID number.
`...`	Other arguments passed on to `qgraph::qgraph()`.

Details

Plots a path diagram of the mediation model, with estimated parameter values and credible intervals. Can also be used to draw a template diagram of the mediation model by setting `template = TRUE`.

To modify various settings of the underlying qgraph object, see `qgraph`.

Value

A qgraph object.

Author(s)

Matti Vuorre <mv2521@columbia.edu>

Examples

```
# Draw a template path diagram of the mediation model
mlm_path_plot(template = TRUE)
```

`mlm_summary` *Print a summary of the estimated multilevel mediation model*

Description

Prints the estimated parameters (numerical summaries of the marginal posterior distributions).

Usage

```
mlm_summary(mod = NULL, level = 0.95, pars = c("a", "b", "cp", "ab", "c",
  "pme", "covab", "corrab"), digits = 2)
```

Arguments

`mod`	A `stanfit` object obtained from `mlm()`
`level`	"Confidence" level; Defines the limits of the credible intervals. Defaults to .95 (i.e. displays 95% CIs.)
`pars`	Parameters to summarize. Defaults to main average-level parameters. See Details for more information.
`digits`	How many decimal points to display in the output. Defaults to 2.

Details

After estimating a model (drawing samples from the joint posterior probability distribution) with `mlm()`, show the estimated results by using `mlm_summary(fit)`, where "fit" is an object containing the fitted model.

The function shows, for each parameter specified with `pars`, the posterior mean, and limits of the Credible Interval as specified by `level`. For example, `level = .91` shows a 91% Credible Interval, which summarizes the central 91% mass of the marginal posterior distribution.

Parameters: By default, `mlm()` estimates and returns a large number of parameters, including the varying effects, and their associated standard deviations. However, `mlm_summay()` by default only displays a subset of the estimated parameters:

a Regression slope of the X -> M relationship.

b Regression slope of the M -> Y relationship.

cp Regression slope of the X -> Y relationship. (The direct effect.)

ab Mediated effect (`a * b`).

c Total effect of X on Y. ($cp + ab + \sigma_a b$)

pme Percent mediated effect.

covab Estimated covariance of the participant-level a_j and b_j parameters.

corrab Estimated correlation of the participant-level a_j and b_j parameters.

The user may specify `pars = NULL` to display all estimated parameters. Other options include e.g. `pars = "tau"` to display the varying effects' standard deviations.

To learn more about the additional parameters, refer to the Stan code (`cat(get_stancode(fit))`).

Value

A `data.frame` summarizing the estimated multilevel mediation model:

Parameter Name of parameter

Mean Mean of parameter's posterior distribution.

Median Median of parameter's posterior distribution.

SD Standard deviation of parameter's posterior distribution.

ci_lwr The lower limit of Credible Intervals.

ci_upr The upper limit of Credible Intervals.

n_eff Number of efficient samples.

Rhat Should be 1.00.

Author(s)

Matti Vuorre <mv2521@columbia.edu>

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tab2doc *Create a word document from a summary table.*

Description

Saves a Word document to the current working directory.

Usage

```
tab2doc(d = NULL, name = NULL)
```

Arguments

d	A `data.frame`.
name	Name of file to create. Defaults to "Table.docx".

Details

Requires the ReporteRs R package. Copy-pasting individual values is error-prone. Use `tab2doc()` to create a word document containing a summary table.

Value

Saves a word document in the current working directory.

Author(s)

Matti Vuorre <mv2521@columbia.edu>

Examples

```
## Not run:
tab2doc(mlm_summary(fit), name = "Fit_summary")

## End(Not run)
```

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