

Package ‘RprobitB’

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Type Package

Title Bayes Estimation of Latent Class Mixed Multinomial Probit Models

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Description

Fitting latent class mixed multinomial probit (LCMMNP) models to simulated or empirical data. Estimation takes place in a Bayesian framework using a Gibbs sampler. The number of latent classes can be updated within the algorithm on a weight-based strategy. For a reference on the method see Oelschl ager and Bauer (2021) <<https://trid.trb.org/view/1759753>>.

License GPL-3

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LinkingTo Rcpp, RcppArmadillo

Suggests knitr, rmarkdown

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 check_data

Check data

Description

Function that checks the input data.

Usage

```
check_data(data, model, parm, norm)
```

Arguments

- data A list of data information.
- model A list of model information.
- parm A list of true parameter values.
- norm A list of normalization information.

Value

A list of data and parm.

check_init	<i>Check init</i>
------------	-------------------

Description

Function that checks the input `init` and sets default values.

Usage

```
check_init(init, model, parm, lcus)
```

Arguments

- init A list of initial values for the Gibbs sampler.
- model A list of model information.
- parm A list of true parameter values.
- lcus A list of latent class updating scheme parameters.

Details

If `lcus$do_lcus = TRUE`, initialisation at true parameter values is not possible.

Value

`init`

`check_lcus`*Check lcus*

Description

Function that checks the input `lcus` and sets default values.

Usage

```
check_lcus(lcus, model)
```

Arguments

`lcus` A list of latent class updating scheme parameters.
`model` A list of model information.

Value

`lcus`

`check_mcmc`*Check mcmc*

Description

Function that checks the input `mcmc` and sets default values.

Usage

```
check_mcmc(mcmc)
```

Arguments

`mcmc` A list of Markov chain Monte Carlo parameters.

Value

`mcmc`

check_model	<i>Check model</i>
-------------	--------------------

Description

Function that checks the input model and sets default values.

Usage

```
check_model(model, data)
```

Arguments

model	A list of model information.
data	A list data information.

Value

model

check_norm	<i>Check norm</i>
------------	-------------------

Description

Function that checks the input norm and sets default values.

Usage

```
check_norm(norm, model)
```

Arguments

norm	A list of normalization information.
model	A list of model information.

Value

norm

check_out	<i>Check out</i>
-----------	------------------

Description

Function that checks the input out and sets default values.

Usage

```
check_out(out)
```

Arguments

out	A list of output settings.
-----	----------------------------

Value

out

check_parm	<i>Check parm</i>
------------	-------------------

Description

Function that checks the input parm and draws missing parameter values.

Usage

```
check_parm(parm, model, data, norm)
```

Arguments

parm	A list of true parameter values.
model	A list of model information.
data	A list of data information.
norm	A list of normalization information.

Value

parm

check_prior	<i>Check prior</i>
-------------	--------------------

Description

Function that checks the input prior and sets default values.

Usage

```
check_prior(prior, model)
```

Arguments

prior	A list of prior parameters.
model	A list of model information.

Value

prior

check_saving	<i>Saving checks</i>
--------------	----------------------

Description

Function that checks overwriting and saves model objects.

Usage

```
check_saving(out, objects)
```

Arguments

out	A list of output settings.
objects	A list of R objects.

Details

Model results with `model[["id"]]="test"` will be overwriting.

Value

No return value. Saves rds-files of elements in objects in folder "`out[["rdir"]]/out[["id"]]`".

compute_suff_statistics
Sufficient statistics

Description

Function that computes sufficient statistics for estimation.

Usage

```
compute_suff_statistics(model, data)
```

Arguments

model	A list of model identifications.
data	A list of data information.

Value

A list of sufficient statistics.

compute_waic *WAIC*

Description

Function that computes the Widely Applicable Information Criterion (WAIC).

Usage

```
compute_waic(model, gibbs_samples, data)
```

Arguments

model	A list of model information.
gibbs_samples	A list of gibbs samples.
data	A list of data information.

Value

WAIC value (numeric).

dmvnrn_arma_mc *Routine to compute the density of a multivariate normal*

Description

Routine to compute the density of a multivariate normal

Usage

```
dmvnrn_arma_mc(x, mean, sigma, logd = FALSE)
```

Arguments

x	A matrix, the arguments
mean	A vector, the mean
sigma	A matrix, the covariance matrix
logd	A boolean, wheter to apply the logarithm

Value

A vector, the computed multivariate normal densities

end_timer *Routine to terminate the timer for Gibbs sampling*

Description

Routine to terminate the timer for Gibbs sampling

Usage

```
end_timer(R)
```

Arguments

R	An integer, total number of iterations
---	--

Value

No return value, called for on-screen information.

gibbs_acf	<i>Autocorrelation plots</i>
-----------	------------------------------

Description

Function that plots the autocorrelation of the Gibbs samples.

Usage

```
gibbs_acf(gibbs_samples, model, mcmc, out)
```

Arguments

gibbs_samples	A list of Gibbs samples.
model	A list of model information.
mcmc	A list of Markov chain Monte Carlo parameters.
out	A list of output settings.

Details

Function computes the **effective sample size**.

Value

No return value. Creates pdf-file "acf.pdf" in folder "out[["rdir"]]/out[["id"]]."

gibbs_contour	<i>Contour plots</i>
---------------	----------------------

Description

Function that creates contour plot and progress contour plots of the Gibbs samples.

Usage

```
gibbs_contour(gibbs_samples, model, estimates, parm, mcmc, lcus, out)
```

Arguments

gibbs_samples	A list of gibbs samples.
model	A list of model information.
estimates	A list of model estimates.
parm	A list of true parameter values.
mcmc	A list of Markov chain Monte Carlo parameters.
lcus	A list of latent class updating scheme parameters.
out	A list of output settings.

Details

Only in case of `model[["P_r"]]=2`. Progress contour plots only in case of `out[["pp"]]=TRUE`.

Value

No return value. Creates pdf-files "contour.pdf" and "contour_progress.pdf" in folder "out[["rdir"]]/out[["id"]]".

gibbs_estimates	<i>Point estimates</i>
-----------------	------------------------

Description

Function that computes and prints point estimates, standard deviations and 5% and 95% quantiles.

Usage

```
gibbs_estimates(gibbs_samples, model, parm)
```

Arguments

gibbs_samples	A list of Gibbs samples.
model	A list of model information.
parm	A list of true parameter values.

Value

A list of model estimates.

gibbs_loop	<i>Routine to perform Gibbs sampling for the LCMMNP model</i>
------------	---

Description

Routine to perform Gibbs sampling for the LCMMNP model

Usage

```

gibbs_loop(
  R,
  B,
  nprint,
  N,
  Jm1,
  P_f,
  P_r,
  C,
  lcus,
  suff_statistics,
  prior,
  init
)

```

Arguments

R	An integer, the number of iterations
B	An integer, the length of the burn-in period
nprint	An integer, the step number for printing the sampling progress
N	An integer, the number (greater or equal one) of decision makers
Jm1	An integer, one minus the number of choice alternatives (fixed across decision makers and choice occasions)
P_f	An integer, the number of attributes that are connected to fixed coefficients (can be zero)
P_r	An integer, the number of attributes that are connected to random, decision maker specific coefficients (can be zero)
C	An integer, the number of latent classes (ignored if P_r = 0)
lcus	A list, latent class updating scheme parameters
suff_statistics	A list, sufficient statistics
prior	A list, prior parameters
init	A list, initial values for the Gibbs sampler

Value

A list of Gibbs samples

gibbs_marginals	<i>Marginal mixing distributions</i>
-----------------	--------------------------------------

Description

Function that plots the estimated marginal mixing distributions.

Usage

```
gibbs_marginals(gibbs_samples, model, estimates, parm, out)
```

Arguments

gibbs_samples	A list of Gibbs samples.
model	A list of model information.
estimates	A list of model estimates.
parm	A list of true parameter values.
out	A list of output settings.

Details

Adds true mixing distribution if available.

Value

No return value. Creates pdf-file "marginal.pdf" in folder "out[["rdir"]]/out[["id"]]".

gibbs_trace	<i>Trace plots</i>
-------------	--------------------

Description

Function that plots traces of the Gibbs samples.

Usage

```
gibbs_trace(gibbs_samples, model, mcmc, out)
```

Arguments

gibbs_samples	A list of Gibbs samples.
model	A list of model information.
mcmc	A list of Markov chain Monte Carlo parameters.
out	A list of output settings.

Value

No return value. Creates pdf-file "trace.pdf" in folder "out[["rdir"]]/out[["id"]]."

gibbs_transform	<i>Transformation of Gibbs samples</i>
-----------------	--

Description

Function that normalizes, burnes and thins the Gibbs samples.

Usage

```
gibbs_transform(gibbs_loop_out, model, mcmc, norm)
```

Arguments

gibbs_loop_out	Output of gibbs_loop.
model	A list of model information.
mcmc	A list of Markov chain Monte Carlo parameters.
norm	A list of normalization information.

Value

A list of normalized, burned and thinned Gibbs samples.

make_labels	<i>Coefficient labels</i>
-------------	---------------------------

Description

Function that creates labels for the model coefficients.

Usage

```
make_labels(gibbs_samples, model, symm)
```

Arguments

gibbs_samples	A list of Gibbs samples.
model	A list of model information.
symm	A boolean, determining whether labels for symmetric matrix elements should be added.

Value

A list of model coefficient labels.

print_settings	<i>Model setting</i>
----------------	----------------------

Description

Function that prints the model settings.

Usage

```
print_settings(model, lcus, init, mcmc, norm, out)
```

Arguments

model	A list of model information.
lcus	A list of latent class updating scheme parameters.
init	A list of initial values.
mcmc	A list of Markov chain Monte Carlo parameters.
norm	A list of normalization information.
out	A list of output settings.

Value

No return value.

rdirichlet	<i>Routine to draw from Dirichlet</i>
------------	---------------------------------------

Description

Routine to draw from Dirichlet

Usage

```
rdirichlet(alpha)
```

Arguments

alpha	A vector, the concentration parameter
-------	---------------------------------------

Value

A vector, the sample from the Dirichlet distribution

rpb	<i>Estimation of latent class mixed multinomial probit models via Gibbs sampling</i>
-----	--

Description

Function that performs Gibbs sampling and returns model results.

Usage

```
rpb(  
  model = NULL,  
  data = NULL,  
  parm = NULL,  
  lcus = NULL,  
  init = NULL,  
  prior = NULL,  
  mcmc = NULL,  
  norm = NULL,  
  out = NULL  
)
```

Arguments

model	A list of model information.
data	A list of data information.
parm	A list of true parameter values.
lcus	A list of latent class updating scheme parameters.
init	A list of initial values for the Gibbs sampler.
prior	A list of prior parameters.
mcmc	A list of Markov chain Monte Carlo parameters.
norm	A list of normalization information.
out	A list of output settings.

Details

The model specifications are ordered in named lists. You can either specify none, all, or only selected parameters. Unspecified parameters are set to default values. See the README file for details.

Value

No return value by default. Function returns a list of estimates if `out[["return"]] = TRUE`. Results saved in folder `"out[["rdir"]]/out[["id"]]"`.

Examples

```
## Not run:
### fit a multinomial probit model to simulated data with default parameters
### computation time: < 1 min
rpb()

## End(Not run)
```

rwishart	<i>Routine to draw from Wishart and inverted Wishart</i>
----------	--

Description

Routine to draw from Wishart and inverted Wishart

Usage

```
rwishart(nu, V)
```

Arguments

nu	A double, the degrees of freedom
V	A matrix, the scale matrix

Value

A list, the draw from the Wishart (W), inverted Wishart (IW), and Cholesky decompositions (C and CI)

simulate_data	<i>Simulate data</i>
---------------	----------------------

Description

Function that simulates choice data from a LCMMNP model.

Usage

```
simulate_data(model, parm, sd = 3)
```

Arguments

model	A list of model information.
parm	A list of true parameter values.
sd	A numeric value, standard deviation for the simulation of the regressors. Currently fixed to sd=3.

Value

A list of data and additional parm.

start_timer	<i>Routine to initialize the timer for Gibbs sampling</i>
-------------	---

Description

Routine to initialize the timer for Gibbs sampling

Usage

```
start_timer()
```

Value

No return value, called for on-screen information.

transform_data	<i>Data transformation</i>
----------------	----------------------------

Description

Function that transforms empirical data for estimation.

Usage

```
transform_data(data_raw, cov_col, cov_ord, cov_zst)
```

Arguments

data_raw	A data frame of choice data in "wide" format.
cov_col	A numeric vector, columns of data_raw with covariates.
cov_ord	A character vector, order of covariates, where fixed-coefficient covariates come first.
cov_zst	A boolean, if TRUE covariates get z-standardized.

Details

data_raw must contain columns named "id" (unique identifier for each decision maker) and "choice" (the chosen alternatives).

Value

A list of transformed data.

update_timer	<i>Routine to update the timer for Gibbs sampling</i>
--------------	---

Description

Routine to update the timer for Gibbs sampling

Usage

```
update_timer(rep, R)
```

Arguments

rep	An integer, current iteration
R	An integer, total number of iterations

Value

No return value, called for on-screen information.

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