

Package ‘misclassifyr’

September 8, 2024

Title Estimation and Inference for Misclassification Models.

Version 0.9.0

Description This package provides tools for estimation and inference of simple misclassification models, as described in Mattheis (2024).

License `use_mit_license()`

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Imports Rcpp,
dplyr,
ggplot2,
parallel,
pbapply,
numDeriv,
Matrix

Suggests testthat (>= 3.0.0)

Config/testthat/edition 3

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log_prior_Delta_NP	<i>Evaluates the log of the prior of Delta at model_to_Delta_NP(psi).</i>
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Description

Evaluates the log of the prior of Delta at model_to_Delta_NP(psi).

Usage

```
log_prior_Delta_NP(psi)
```

Arguments

psi	A numeric vector parameterizing Delta through model_to_Delta_NP.
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Value

A numeric value equal to the log of the flat prior of Delta at psi, re-scaled for the logit transform.

log_prior_Delta_NP_ind	<i>Evaluates the log of the prior of Delta at model_to_Delta_NP_ind of psi.</i>
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Description

Evaluates the log of the prior of Δ at model_to_Delta_NP_ind(psi).

Usage

```
log_prior_Delta_NP_ind(psi)
```

Arguments

psi	A numeric vector parameterizing Delta through model_to_Delta_NP_ind.
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Value

A numeric value equal to the log of the flat prior of Delta at psi, re-scaled for the logit transform.

`log_prior_Delta_RL_ind`*Evaluates the log of the prior of Delta at model_to_Delta_RL_ind(psi).*

Description

Evaluates the log of the prior of Delta at model_to_Delta_RL_ind(psi).

Usage

```
log_prior_Delta_RL_ind(psi)
```

Arguments

`psi` A numeric vector parameterizing Delta through model_to_Delta_RL_ind.

Value

A numeric value equal to the log of the flat prior of Delta at psi, re-scaled for the logit transform.

`log_prior_Pi_NP`*Evaluates the log of the prior of Pi at model_to_Pi_NP(phi).*

Description

Evaluates the log of the prior of Pi at model_to_Pi_NP(phi).

Usage

```
log_prior_Pi_NP(phi)
```

Arguments

`phi` A numeric vector parameterizing Pi through model_to_Pi.

Value

A numeric value equal to the log of the flat prior of Pi at phi, re-scaled for the logit transform.

misclassifyfyr	<i>misclassifyfyr</i>
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Description

This function provides a menu of options for estimation and inference of misclassification models in which the analyst has access to two noisy measures, Y1 and Y2 of a latent outcome Y^* , a correctly measured covariate X, and discrete controls W.

Usage

```
misclassifyfyr(
  tab,
  J,
  K,
  model_to_Pi = model_to_Pi_NP,
  model_to_Delta = model_to_Delta_NP_ind,
  makeplots = T,
  phi_0 = NA,
  psi_0 = NA,
  X_names = NA,
  Y_names = NA,
  W_names = NA,
  estimate_beta = F,
  estimate_betas = F,
  X_vals = NA,
  Y_vals = NA,
  X_col_name = "X",
  Y_col_name = "Y",
  mle = T,
  optim_tol = 1e-08,
  optim_maxit = 1e+05,
  check_stability = F,
  stability_sd = 0.1,
  bayesian = F,
  log_prior_Pi = log_prior_Pi_NP,
  log_prior_Delta = log_prior_Delta_NP_ind,
  n_mcmc_draws = 10000,
  n_burnin = 5000,
  thinning_rate = 1,
  gibbs_proposal_sd = 0.1,
  cores = 1
)
```

Arguments

tab	A dataframe or a list of dataframes containing tabulated data or a list of tabulated data split by controls. The columns should be numeric with names Y1, Y2, X, and n where Y1 and Y2 take each value between 1 and J, X takes each value between 1 and K, and
J	An integer or list corresponding to the number of unique values of Y1 and Y2.

K	An integer or list corresponding to the number of unique values of X.
model_to_Pi	A function or list of functions mapping the parameters of a model for the joint distribution to the joint distribution π .
model_to_Delta	A function or list of functions mapping the parameters of a model to the conditional distribution $Y_1, Y_2 Y^*, \Delta$.
makeplots	A logical value for whether to make trace plots and plots of π and Δ . Defaults to TRUE.
phi_0	A numeric vector or list of numeric vectors providing the starting location for optimization for the argument to model_to_Pi.
psi_0	A numeric vector or list of numeric vectors providing the starting location for optimization for the argument to model_to_Delta.
X_names	A character vector or list corresponding to the values of the regressor X.
Y_names	A character vector or list corresponding to the values of the outcome Y.
W_names	A character vector corresponding to the values of the control W in each cell.
estimate_beta	A logical value indicating whether to regress Y on X.
X_vals	A numeric vector or list of numeric vectors providing the values of X associated with the columns of π .
Y_vals	A numeric vector or list of numeric vectors providing the values of Y associated with the rows of π .
X_col_name	A character vector corresponding to the variable of the regressor X, used only for plots.
Y_col_name	A character vector corresponding to the variable of the outcome Y, used only for plots.
mle	A logical value indicating whether to estimate π and Δ via MLE. Defaults to TRUE.
optim_tol	A numeric value giving the relative tolerance for optimization with the optim.
optim_maxit	An integer giving the maximum number of iterations for optim.
check_stability	A logical value indicating whether to perform a more rigorous stability test for the numerical optimizer.
stability_sd	A numerical value giving the standard deviation of the noise added to the initial parameter value for the stability test of the MLE.
bayesian	A logical value indicating whether or not to compute the posterior of values.
log_prior_Pi	A function or list of functions evaluating the log of the prior of π at phi (in logs!).
log_prior_Delta	A function or list of functions evaluating the log of the prior of Δ at psi (in logs!).
n_mcmc_draws	An integer corresponding to the length of the MCMC chain.
n_burnin	An integer giving the length of the burn-in period for each MCMC chain, must be shorter than n_mcmc_draws.
thinning_rate	An integer indicating how frequently to record posterior draws from the MCMC chain – e.g. a thinning_rate of 2 records every other draw.
gibbs_proposal_sd	A numeric value giving the standard deviation for the proposal distribution in each Gibbs step.

cores	An integer for the number of CPUs available for parallel processing.
split_eta	An integer or list indicating where to split the vector eta in phi and psi, the arguments to model_to_Pi and model_to_Delta respectively.

Value

A list containing the following components:

- $\hat{\Pi}_{MLE}$: The MLE estimate of the joint distribution of X and Y^* , Π .

model_to_Delta_NP	<i>Maps model parameters, psi, to Delta, the fully non-parametric distribution of $Y1, Y2 \mid Y^*$</i>
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Description

Maps model parameters, psi, to Delta, the fully non-parametric distribution of $Y1, Y2 \mid Y^*$

Usage

```
model_to_Delta_NP(psi)
```

Arguments

psi A numeric vector of length $J^2(J-1)$ containing all but the last row of Delta.

Value

A numeric vector corresponding to the $J \times J^2$ matrix Delta.

model_to_Delta_NP_ind	<i>Maps model parameters, psi, to Delta, the distribution of $Y1, Y2 \mid Y^*$ under conditional independence of $Y1, Y2$ on Y</i>
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Description

Maps model parameters, psi, to Delta, the distribution of $Y1, Y2 \mid Y^*$ under conditional independence of $Y1, Y2$ on Y

Usage

```
model_to_Delta_NP_ind(psi)
```

Arguments

psi A numeric vector of length $2 \times J \times (J-1)$ containing $\Delta^{(1)}$ and $\Delta^{(2)}$.

Value

A numeric vector of length J^3 corresponding to the values of the $J \times J^2$ matrix Delta.

model_to_Delta_RL_ind *Maps model parameters, psi, to Delta, the distribution of $Y1, Y2 \mid Y^*$ under record linkage error structure.*

Description

Maps model parameters, psi, to Delta, the distribution of $Y1, Y2 \mid Y^*$ under record linkage error structure.

Usage

```
model_to_Delta_RL_ind(psi)
```

Arguments

psi A numeric vector of length $2(J-1)+2J$ corresponding to the column and row scales of the record linkage.

Value

A numeric vector of length J^3 corresponding to the values of the $J \times J^2$ matrix Delta.

model_to_Pi_NP *Maps model parameters, phi, to the joint distribution of X and Y^* , Pi.*

Description

Maps model parameters, phi, to the joint distribution of X and Y^* , Pi.

Usage

```
model_to_Pi_NP(phi, J, ...)
```

Arguments

phi A numeric vector.
 J An integer corresponding to the dimension of Y .
 ... Additional, optional arguments.

Value

A numeric vector corresponding to the $J \times K$ matrix Pi

Pi_to_beta

Maps the joint distribution, P_i , of X and Y^ to a scalar, β*

Description

Maps the joint distribution, P_i , of X and Y^* to a scalar, β

Usage

```
Pi_to_beta(Pi, X_vals, Y_vals, W_weights)
```

Arguments

Pi	A numeric vector or list of numeric vectors containing the elements of P_i .
X_vals	A numeric vector or a list of numeric vectors representing the scalar values associated with X .
Y_vals	A numeric vector or a list of numeric vectors representing the scalar values associated with Y .
W_weights	A numeric vector representing the sample size of each control cell.

Value

A scalar equal to β .

prep_misclassification_data

prep_misclassification_data

Description

This function tabulates data and generates metadata in a format to be used with the misclassifyr() function.

Usage

```
prep_misclassification_data(
  data,
  outcome_1,
  outcome_2,
  regressor,
  controls = NA,
  weights = NA,
  record_vals = F
)
```


Arguments

data	A data.frame containing the outcome variable,
outcome_1	A character string denoting the variable in the dataframe to be used as the first measure of an outcome, Y_1.
outcome_2	A character string denoting the variable in the dataframe to be used as the second measure of an outcome, Y_2.
regressor	A character string denoting the variable in the dataframe to be used as a regressor, X.
controls	A character string or vector of character strings denoting the variable/variables to be used as non-parametric controls, W.
weights	A character string denoting a variable containing individual level weights
record_vals	A logical value indicating whether to record the unique values of the outcomes and the regressor. If record_vals = F, you likely want to order the data by the regressor and outcomes before applying prep_misclassification_data.

Value

A list of objects including tabulated data to be used in misclassifyr()

se_beta_deltamethod	<i>Computes the standard error of beta as function of the joint distribution of X and Y*, Pi</i>
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Description

Computes the standard error of beta as function of the joint distribution of X and Y*, Pi

Usage

```
se_beta_deltamethod(Pi, cov_Pi, X_vals, Y_vals, W_weights)
```

Arguments

Pi	A numeric vector or list of numeric vectors containing the elements of Pi.
cov_Pi	A numeric vector or a list of numeric vectors representing the covariance of estimates of the elements of Pi.
X_vals	A numeric vector or a list of numeric vectors representing the scalar values associated with X.
Y_vals	A numeric vector or a list of numeric vectors representing the scalar values associated with Y.
W_weights	A numeric vector representing the sample size of each control cell.

Value

A scalar equal to the standard error of beta.

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