Package 'SIHR'

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Type Package

Title Statistical Inference in High Dimensional Regression

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Description Inference procedures in the high-dimensional setting for
(1) linear functionals in generalized linear regression ('Cai et al.' (2019) <arXiv:1904.12891>, 'Guo et al.' (2020) <arXiv:2012.07133>, 'Cai et al.' (2021)),
(2) individual treatment effects in generalized linear regression,
(3) quadratic functionals in generalized linear regression ('Guo et al.' (2019) <arXiv:1909.01503>).

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LazyData true

RoxygenNote 7.2.0

URL https://github.com/prabrishar1/SIHR

Imports CVXR,
glmnet,
stats

R topics documented:

ITE 1
LF 3
QF 5

Index **7**

`ITE` *Inference for difference of linear combinations of the regression vectors in high dimensional generalized linear regressions*

Description

Computes the bias-corrected estimator of the difference of linearcombinations of the regression vectors for the high dimensional generalized linear regressions and the corresponding standard error.

Usage

```
ITE(
  X1,
  y1,
  X2,
  y2,
  loading.mat,
  model = c("linear", "logistic", "logistic_alter"),
  intercept = TRUE,
  intercept.loading = FALSE,
  beta.init1 = NULL,
  beta.init2 = NULL,
  lambda = NULL,
  mu = NULL,
  prob.filter = 0.05,
  rescale = 1.1,
  alpha = 0.05,
  verbose = FALSE
)
```

Arguments

X1	Design matrix for the first sample, of dimension n_1 x p
y1	Outcome vector for the first sample, of length n_1
X2	Design matrix for the second sample, of dimension n_2 x p
y2	Outcome vector for the second sample, of length n_1
loading.mat	Loading matrix, nrow=p, each column corresponds to a loading of interest
model	The high dimensional regression model, either "linear" or "logistic" or "logistic_alter"
intercept	Should intercept(s) be fitted for the initial estimators (default = TRUE)
intercept.loading	Should intercept term be included for the loading (default = FALSE)
beta.init1	The initial estimator of the regression vector for the 1st data (default = NULL)
beta.init2	The initial estimator of the regression vector for the 2nd data (default = NULL)
lambda	The tuning parameter in fitting initial model. If NULL, it will be picked by cross-validation. (default = NULL)
mu	The dual tuning parameter used in the construction of the projection direction. If NULL it will be searched automatically. (default = NULL)
prob.filter	The threshold of estimated probabilities for filtering observations in logistic regression. (default = 0.05)
rescale	The factor to enlarge the standard error to account for the finite sample bias. (default = 1.1)
alpha	Level of significance to construct two-sided confidence interval (default = 0.05)
verbose	Should intermediate message(s) be printed (default = FALSE)

Value

A list consists of plugin estimators, debiased estimators, and confidence intervals. For logistic regression, it also returns those items after probability transformation.

`est.plugin.vec` The vector of plugin(biased) estimators for the linear combination of regression coefficients, length of `ncol(loading.mat)`; corresponding to different column in `loading.mat`

`est.debias.vec` The vector of bias-corrected estimators for the linear combination of regression coefficients, length of `ncol(loading.mat)`; corresponding to different column in `loading.mat`

`se.vec` The vector of standard errors of the bias-corrected estimators, length of `ncol(loading.mat)`; corresponding to different column in `loading.mat`

`ci.mat` The matrix of two.sided confidence interval for the linear combination, dimension of `ncol(loading.mat)` x 2; the row corresponding to different column in `loading.mat`

`prob.debias.vec` The vector of bias-corrected estimators after probability transformation, length of `ncol(loading.mat)`; corresponding to different column in `loading.mat`.

`prob.se.vec` The vector of standard errors of the bias-corrected estimators after probability transformation, length of `ncol(loading.mat)`; corresponding to different column in `loading.mat`.

`prob.ci.mat` The matrix of two.sided confidence interval of the bias-corrected estimators after probability transformation, dimension of `ncol(loading.mat)` x 2; the row corresponding to different column in `loading.mat`.

Examples

```
X1 = matrix(rnorm(100*5), nrow=100, ncol=5)
y1 = -0.5 + X1[,1] * 0.5 + X1[,2] * 1 + rnorm(100)
X2 = matrix(rnorm(90*5), nrow=90, ncol=5)
y2 = -0.4 + X2[,1] * 0.48 + X2[,2] * 1.1 + rnorm(90)
loading1 = c(1, 1, rep(0,3))
loading2 = c(-0.5, -1, rep(0,3))
loading.mat = cbind(loading1, loading2)
Est = ITE(X1, y1, X2, y2, loading.mat, model="linear")

## compute confidence intervals
ci(Est, alpha=0.05, alternative="two.sided")

## summary statistics
summary(Est)
```

LF *Inference for linear combination of the regression vector in high dimensional generalized linear regression*

Description

Inference for linear combination of the regression vector in high dimensional generalized linear regression

Usage

```
LF(
  X,
  y,
  loading.mat,
  model = c("linear", "logistic", "logistic_alter"),
  intercept = TRUE,
  intercept.loading = FALSE,
  beta.init = NULL,
  lambda = NULL,
  mu = NULL,
  prob.filter = 0.05,
  rescale = 1.1,
  alpha = 0.05,
  verbose = FALSE
)
```

Arguments

X	Design matrix, of dimension n x p
y	Outcome vector, of length n
loading.mat	Loading matrix, nrow=p, each column corresponds to a loading of interest
model	The high dimensional regression model, either "linear" or "logistic" or "logistic_alter"
intercept	Should intercept be fitted for the initial estimator (default = TRUE)
intercept.loading	Should intercept term be included for the loading (default = FALSE)
beta.init	The initial estimator of the regression vector (default = NULL)
lambda	The tuning parameter in fitting initial model. If NULL, it will be picked by cross-validation. (default = NULL)
mu	The dual tuning parameter used in the construction of the projection direction. If NULL it will be searched automatically. (default = NULL)
prob.filter	The threshold of estimated probabilities for filtering observations in logistic regression. (default = 0.05)
rescale	The factor to enlarge the standard error to account for the finite sample bias. (default = 1.1)
alpha	Level of significance to construct two-sided confidence interval (default = 0.05)
verbose	Should intermediate message(s) be printed, the projection direction be returned. (default = FALSE)

Value

est.plugin.vec	The vector of plugin(biased) estimators for the linear combination of regression coefficients, length of ncol(loading.mat); each corresponding to a loading of interest
est.debias.vec	The vector of bias-corrected estimators for the linear combination of regression coefficients, length of ncol(loading.mat); each corresponding to a loading of interest

se.vec	The vector of standard errors of the bias-corrected estimators, length of ncol(loading.mat); each corresponding to a loading of interest
ci.mat	The matrix of two.sided confidence interval for the linear combination, of dimension ncol(loading.mat) x 2; each row corresponding to a loading of interest
proj.mat	The matrix of projection directions; each column corresponding to a loading of interest. It will be returned only if verbose set as TRUE

Examples

```
X = matrix(rnorm(100*5), nrow=100, ncol=5)
y = -0.5 + X[,1] * 0.5 + X[,2] * 1 + rnorm(100)
loading1 = c(1, 1, rep(0, 3))
loading2 = c(-0.5, -1, rep(0, 3))
loading.mat = cbind(loading1, loading2)
Est = LF(X, y, loading.mat, model="linear")

## compute confidence intervals
ci(Est, alpha=0.05, alternative="two.sided")

## summary statistics
summary(Est)
```

QF *Inference for quadratic forms of the regression vector in high dimensional generalized linear regressions*

Description

Inference for quadratic forms of the regression vector in high dimensional generalized linear regressions

Usage

```
QF(
  X,
  y,
  G,
  A = NULL,
  model = c("linear", "logistic", "logistic_alter"),
  intercept = TRUE,
  beta.init = NULL,
  split = TRUE,
  lambda = NULL,
  mu = NULL,
  prob.filter = 0.05,
  rescale = 1.1,
  tau = c(0.25, 0.5),
  alpha = 0.05,
  verbose = FALSE
)
```

Arguments

X	Design matrix, of dimension n x p
y	Outcome vector, of length n
G	The set of indices, G in the quadratic form
A	The matrix A in the quadratic form, of dimension $\|G\|\times\|G\|$. If NULL A would be set as the $\|G\|\times\|G\|$ submatrix of the population covariance matrix corresponding to the index set G (default = NULL)
model	The high dimensional regression model, either "linear" or "logistic" or "logistic_alter"
intercept	Should intercept be fitted for the initial estimator (default = TRUE)
beta.init	The initial estimator of the regression vector (default = NULL)
split	Sampling splitting or not for computing the initial estimator. It take effects only when beta.init = NULL. (default = TRUE)
lambda	The tuning parameter in fitting initial model. If NULL, it will be picked by cross-validation. (default = NULL)
mu	The dual tuning parameter used in the construction of the projection direction. If NULL it will be searched automatically. (default = NULL)
prob.filter	The threshold of estimated probabilities for filtering observations in logistic regression. (default = 0.05)
rescale	The factor to enlarge the standard error to account for the finite sample bias. (default = 1.1)
tau	The enlargement factor for asymptotic variance of the bias-corrected estimator to handle super-efficiency. It allows for a scalar or vector. (default = c(0.25,0.5))
alpha	Level of significance to construct two-sided confidence interval (default = 0.05)
verbose	Should intermediate message(s) be printed, the projection direction be returned. (default = FALSE)

Value

est.plugin	The plugin(biased) estimator for the quadratic form of the regression vector restricted to G
est.debias	The bias-corrected estimator of the quadratic form of the regression vector
se	Standard errors of the bias-corrected estimator, length of tau; corrsponding to different values of tau
ci.mat	The matrix of two.sided confidence interval for the quadratic form of the regression vector; row corresponds to different values of tau
proj	The projection direction. It will be returned only if verbose set as TRUE

Examples

```
X = matrix(rnorm(100*5), nrow=100, ncol=5)
y = X[,1] * 0.5 + X[,2] * 1 + rnorm(100)
G = c(1,2)
A = matrix(c(1.5, 0.8, 0.8, 1.5), nrow=2, ncol=2)
Est = QF(X, y, G, A, model="linear")
## compute confidence intervals
ci(Est, alpha=0.05, alternative="two.sided")

## summary statistics
summary(Est)
```

Index

ITE, 1

LF, 3

QF, 5