Package 'SIHR'

September 25, 2022

Type Package

Title Statistical Inference in High Dimensional Regression

Version 1.1.0

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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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Encoding UTF-8

LazyData true

RoxygenNote 7.2.0

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

Imports CVXR,
glmnet,
stats

R topics documented:

`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 = TRUE
)
```

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)
rescale	The constant to enlarge the standard error, considering 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 = TRUE)

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*10), nrow=100, ncol=10)
y1 = -0.5 + X1[,1] * 0.5 + X1[,2] * 1 + rnorm(100)
X2 = matrix(rnorm(90*10), nrow=90, ncol=10)
y2 = -0.4 + X2[,1] * 0.48 + X2[,2] * 1.1 + rnorm(90)
loading1 = c(1, 1, rep(0,8))
loading2 = c(-0.5, -1, rep(0,8))
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 = TRUE
)
```

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)
rescale	The enlargement factor for asymptotic variance of the bias-corrected estimator to handle super-efficiency. (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 = TRUE)

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*10), nrow=100, ncol=10)
y = -0.5 + X[,1] * 0.5 + X[,2] * 1 + rnorm(100)
loading1 = c(1, 1, rep(0, 8))
loading2 = c(-0.5, -1, rep(0, 8))
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,
  tau1 = 0.5,
  tau2 = c(0, 0.5, 1),
  alpha = 0.05,
  verbose = TRUE
)
```

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 (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 enlargement factor for asymptotic variance of the bias-corrected estimator to handle super-efficiency. (default = 1.1)
tau1	The enlargement factor for asymptotic variance of the bias-corrected estimator to handle super-efficiency. It allows for a scalar or vector. (default = 0.5)
tau2	The enlargement factor for asymptotic variance of the initial estimator to handle super-efficiency. It allows for a scalar or vector (default = c(0, 0.5,1))
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 = TRUE)

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 tau1; corrsponding to different values of tau1
add.len	Added lengths accounted for asymptotic variance of the initial estimators
ci.mat	The matrix of two.sided confidence interval for the quadratic form of the regression vector; row corresponds to different values of tau1 and tau2
proj	The projection direction. It will be returned only if verbose set as TRUE

Examples

```
X = matrix(rnorm(100*10), nrow=100, ncol=10)
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