Package ‘robreg3S’

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robreg3S

Robust regression estimation and inference in the presence of cellwise and casewise contamination

Description

Find 3S-robust regression estimator using the adaptive consistent filter.
Usage

robreg3S(y, x, dummies=NULL, filter=TRUE, alpha=0.20, K=5, ...)

Arguments

y vector of responses.
x matrix of the numerical variables.
dummies matrix of the dummy covariates, i.e., where each column are 0–1 vectors.
filter logical, whether the filtering is used. Default value is TRUE.
alpha 1-alpha upper quantile (and alpha lower quantile) of the covariate distribution used in tail comparison in the first step. An exponential tail is used as the reference distribution. Default value is 0.20.
K number of alternating M-S iterations in the estimation of the coefficients of the dummy covariates. Default value is 5. See Leung et al. for more details.
... optional arguments to be used in the computation of GSE in the second step. See GSE

Details

This function computes 3S-robust regression as described in Leung et al. (2015). If the model contains dummy variables (i.e., dummies != NULL), 3S-regression is computed using an iterative algorithm as described in Leung et al. (2015). Briefly, the algorithm first estimates the coefficients of the dummies using an M-estimator of regression and the coefficients of the continuous covariates using the original 3S-regression. See Leung et al. (2015) for more details.

Value

A list with components:

Summary.Table Matrix of information available about the estimator. It contains regression coefficients, and for dummies != NULL, columns for the standard error, t-statistic, and p-value.
coef vector of regression coefficients.
acov matrix of the asymptotic covariate matrix, only for dummies != NULL.
resid vector of residuals, that is the response minus the fitted values.
sigma.hat the squared Mahalanobis distances of each observation based on the continuous covariates to the generalized location S-estimator with respect to the generalized scatter S-estimator.
MD the squared Mahalanobis distances of each observation based on the continuous covariates to the generalized location S-estimator with respect to the generalized scatter S-estimator.
xfilter filtered matrix of the numerical variables from Step 1 of the estimator.
ximpute matrix of the numerical variables with filtered cells imputed from Step 2 of the estimator.
weight vector of the weights used in the estimation of the location generalized S-estimator. Not meant to be accessed.
Syx estimated generalized S-scatter from Step 2. Not meant to be accessed.
myx estimated generalized S-location from Step 2. Not meant to be accessed.
Author(s)

Andy Leung <andy.leung@stat.ubc.ca>, Hongyang Zhang, Ruben H. Zamar

References


See Also

GSE, generate.cellcontam.regress, generate.casecontam.regress, generate.casecontam.regress.dummies, generate.casecontam.regress.dummies

Examples

```r
## Boston housing data
data(Boston, package="MASS")
boston <- Boston; rm(Boston)
boston$crim <- log(boston$crim)
boston$nox <- boston$nox^2
boston$rm <- boston$rm^2
boston$dis <- log(boston$dis)
boston$1stat <- log(boston$1stat)
boston$medv <- log(boston$medv)
boston$black <- boston$black/1000
boston$age <- boston$age/100
boston$tax <- boston$tax/100
boston$indus <- boston$indus/100
boston <- subset( boston, select=c(medv, crim, nox, rm, age, dis, tax, ptratio, black, lstat) )

## LS, MM, 3S
set.seed(100)
fit.LS <- lm(medv ~ ., data=boston)
fit.MM <- robustbase::lmrob(medv ~ ., data=boston)
fit.2S <- robreg3S( y=boston$medv, x=as.matrix(subset(boston,select=-medv)), filter = FALSE )
fit.3S <- robreg3S( y=boston$medv, x=as.matrix(subset(boston,select=-medv)) )

## Compare estimated coefficients
nrow(boston) *sum((coef(fit.LS)[-1] - coef(fit.3S)[-1])^2* apply(boston[,-1], 2, mad)^2)

## Summary table
summary(fit.3S)
```
**simulation-tools**

Data generator for simulation study on cell- and case-wise contamination

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**Description**

Includes the data generator for the simulation study on cell- and case-wise contamination that appears on Leung et al. (2015).

**Usage**

- `generate.randbeta(p)`
- `generate.cellcontam.regress(n, p, A, sigma, b, k, cp)`
- `generate.casecontam.regress(n, p, A, sigma, b, l, k, cp)`
- `generate.cellcontam.regress.dummies(n, p, pd, probd, A, sigma, b, k, cp)`
- `generate.casecontam.regress.dummies(n, p, pd, probd, A, sigma, b, l, k, cp)`

**Arguments**

- `n` integer indicating the number of observations to be generated.
- `p` integer indicating the number of continuous variables to be generated.
- `pd` integer indicating the number of dummy variables to be generated.
- `probd` vector of quantiles of length `pd`. To generate dummy variables, continuous variables are first generated. Then, the variables are dichotomize at normal quantiles of `probd`.
- `A` a correlation matrix. See also `generate.randcorr`.
- `sigma` residual standard deviation.
- `b` vector of regression coefficients.
- `k` size of cellwise outliers and vertical outliers. See Leung et al. for details.
- `l` size of leverage outliers. See Leung et al. for details.
- `cp` proportion of cell- or case-wise contamination. Maximum of 10% for cellwise and 50% for casewise.

**Value**

A list with components:

- `x` multivariate normal sample with cell- or case-wise contamination.
- `y` vector of responses.
- `dummies` vector of dummies.
Author(s)
Andy Leung <andy.leung@stat.ubc.ca>, Hongyang Zhang, Ruben H. Zamar

References

See Also
generate.randcorr

Examples

```r
# Cellwise contaminated data simulation
# (continuous covariates only)
set.seed(10)
b <- 10*generate.randbeta(p=15)
A <- generate.randcorr(cond=100, p=15)
dat <- generate.cellcontam.regress(n=300, p=15, A=A, sigma=0.5, b=b, k=10, cp=0.05)

# LS
fit.LS <- lm( y ~ x, dat)
mean((coef(fit.LS)[1] - b)^2)

# MM regression
fit.MM <- robustbase::lmrob( y ~ x, dat)
mean((coef(fit.MM)[1] - b)^2)

# S regression
fit.SS <- robregSs( y~dat$y, x=dat$x, init="imputed")
mean((coef(fit.SS)[-1] - b)^2)
```

```r
# Casewise contaminated data simulation
# (continuous covariates only)
set.seed(10)
b <- 10*generate.randbeta(p=10)
A <- generate.randcorr(cond=100, p=10)
dat <- generate.casecontam.regress(n=200, p=10, A=A, sigma=0.5, b=b, l=8, k=10, cp=0.10)

# LS
fit.LS <- lm( y ~ x, dat)
mean((coef(fit.LS)[-1] - b)^2)

# MM regression
fit.MM <- robustbase::lmrob( y ~ x, dat)
mean((coef(fit.MM)[-1] - b)^2)
```
## 3S regression
fit.3S <- robreg3S(y=dat$y, x=dat$x, init="imputed")
mean((coef(fit.3S)[-1] - b)^2)

## Not run:

### Cellwise contaminated data simulation
### (continuous and dummies covariates)
set.seed(10)
b <- 10*generate.randbeta(p=15)
A <- generate.randcorr(cond=100, p=15)
dat <- generate.cellcontam.regress.dummies(n=300, p=12, pd=3, probd=c(1/2,1/3,1/4), A=A, sigma=0.5, b=b, k=10, cp=0.05)

### LS
fit.LS <- lm(dat$y ~ dat$x + dat$dummies)
mean((coef(fit.LS)[-1] - b)^2)

### MM regression
fit.MM <- robustbase::lmrob(dat$y ~ dat$x + dat$dummies)
mean((coef(fit.MM)[-1] - b)^2)

### 3S regression
fit.3S <- robreg3S(y=dat$y, x=dat$x, dummies=dat$dummies, init="imputed")
mean((coef(fit.3S)[-1] - b)^2)

### Casewise contaminated data simulation
### (continuous and dummies covariates)
set.seed(10)
b <- 10*generate.randbeta(p=15)
A <- generate.randcorr(cond=100, p=15)
dat <- generate.casecontam.regress.dummies(n=300, p=12, pd=3, probd=c(1/2,1/3,1/4), A=A, sigma=0.5, b=b, l=7, k=10, cp=0.10)

### LS
fit.LS <- lm(dat$y ~ dat$x + dat$dummies)
mean((coef(fit.LS)[-1] - b)^2)

### MM regression
fit.MM <- robustbase::lmrob(dat$y ~ dat$x + dat$dummies)
mean((coef(fit.MM)[-1] - b)^2)

### 3S regression
fit.3S <- robreg3S(y=dat$y, x=dat$x, dummies=dat$dummies, init="imputed")
mean((coef(fit.3S)[-1] - b)^2)

## End(Not run)
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