Package 'sprm'

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Type Package

Title Sparse and Non-Sparse Partial Robust M Regression

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Description

Robust methods for dimension reduction and regression analysis are implemented that yield estimates with a partial least squares alike interpretability. Partial robust M regression is robust to both vertical outliers and leverage points. Sparse partial robust M regression is a related robust method with sparse coefficient estimate, and therefore with intrinsic variable selection.

License GPL (>= 3)

Depends ggplot2, grid

Imports cvTools, reshape2, pcaPP

NeedsCompilation no

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`sprm-package` *Sparse and Non-Sparse Partial Robust M Regression*

Description

In this package two methods for dimension reduction and regression analysis are implemented that yield estimates with a partial least squares alike interpretability. Partial robust M regression is robust to both vertical outliers and leverage points. Sparse partial robust M regression is a related robust method with sparse coefficient estimate, and therefore with intrinsic variable selection.

Details

Package:	sprm
Type:	Package
Version:	1.1
Date:	2014-12-10
License:	GPL(>=3)

The main functions in this package are `prms` and `sprms` for non-spares and sparse partial robust M regression, respectively. Further cross validation procedures for tuning parameter selection are implemented in `prmsCV` and `sprmsCV`. Various plot options are available to visualize the results.

Author(s)

Sven Serneels, BASF Corp and Irene Hoffmann

References

Sven Serneels et al. (2014) Sparse partial robust M regression

Serneels, S., Croux, C., Filzmoser, P., Van Espen, P.J., Partial Robust M-Regression. Chemometrics and Intelligent Laboratory Systems, 79 (2005), 55-64.

See Also

`prms`, `sprms`

Examples

```
set.seed(50235)
U1 <- c(rep(3,20), rep(4,30))
U2 <- rep(3.5,50)
X1 <- replicate(5, U1+rnorm(50))
X2 <- replicate(20, U2+rnorm(50))
X <- cbind(X1,X2)
beta <- c(rep(1, 5), rep(0,20))
```

```
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
mod <- prms(y~., data=d, a=2, fun="Hampel")
smod <- sprms(y~., data=d, a=2, eta=0.5, fun="Hampel")

biplot(mod)
biplot(smod)
```

`biplot.prm` *Biplot for prm objects*

Description

This biplot for prm objects visualizes the original variables which contribute to the model and their impact on the latent components as well as the position of the observations in the transformed space. The data is projected onto two of the latent components.

Usage

```
## S3 method for class 'prm'
biplot(x, comps = c(1, 2),
colors = list(scores = "#0000AA", loadings = "red", background = "#BBBBEE"),
textsize = 6, arrowshapes = c(25, 0.03), ...)
```

Arguments

`x`	object of class prm.
`comps`	vector with two integers, referring to the components to be plotted.
`colors`	list of three elements named `scores`, `loadings` and `background` with color codes or names.
`textsize`	the text size in which to print the scores and loading names.
`arrowshapes`	vector of length two containing the angle of the arrowheads and their relative length in npc.
`...`	further arguments. Currently not used.

Author(s)

Sven Serneels, BASF Corp.

References

Sven Serneels et al. (2014) Sparse partial robust M regression

Serneels, S., Croux, C., Filzmoser, P., Van Espen, P.J., Partial Robust M-Regression. Chemometrics and Intelligent Laboratory Systems, 79 (2005), 55-64.

See Also

plot.prm, prms, biplot.sprm

Examples

```
set.seed(5023)
U <- c(rep(3,20), rep(4,30))
X <- replicate(6, U+rnorm(50))
beta <- c(rep(1, 3), rep(-1,3))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
mod <- prms(y~., data=d, a=2, fun="Hampel")
biplot(mod, comps = c(1, 2))
```

---

biplot.sprm *Biplot for sprm objects*

Description

This biplot for sprm objects visualizes the original variables which contribute to the model and their impact on the latent components as well as the position of the observations in the transformed space. The data is projected onto two of the latent components.

Usage

```
## S3 method for class 'sprm'
biplot(x, comps = c(1, 2),
colors = list(scores = "#0000AA", loadings = "red", background = "#BBBBEE"),
textsize = 6, arrowshapes = c(25, 0.03), ...)
```

Arguments

x	object of class sprm.
comps	vector with two integers, referring to the components to be plotted.
colors	list of three elements named scores, loadings and background with color codes or names.
textsize	the text size in which to print the scores and loading names.
arrowshapes	vector of length two containing the angle of the arrowheads and their relative length in npc.
...	further arguments. Currently not used.

Details

The sparsity of the biplot is inherited by the sparsity of the model. Only the contributing variables are included in the plot, which leads to better visualization and easier interpretation.

Author(s)

Sven Serneels, BASF Corp.

References

Sven Serneels et al. (2014) Sparse partial robust M regression

See Also

plot.sprm, sprm, biplot.prm

Examples

```
set.seed(5023)
U1 <- c(rep(3,20), rep(4,30))
U2 <- rep(3.5,50)
X1 <- replicate(5, U1+rnorm(50))
X2 <- replicate(20, U2+rnorm(50))
X <- cbind(X1,X2)
beta <- c(rep(1, 5), rep(0,20))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
mod <- sprms(y~., data=d, a=2, eta=0.5, fun="Hampel")
biplot(mod, comps = c(1, 2))
```

---

plot.prm *Plots for prm objects*

Description

Four types of plot options are available:

y vs y predicted plot, plot of case weights used for robust weighted regression, plot of estimated coefficients, distance-distance plot.

Usage

```
## S3 method for class 'prm'
plot(x, type = "yyp", alpha = 0.025, colors = list(bars = "#0000AA",
errorbars = "red", background = "#BBBBEE", abline = "#21A0D2", scores= "#0000AA",
cutoffs="#00EEEE",  badouts="darkred", modouts="black"), textsize = 6,
errorbar_width = 1, data, yscale = NULL, ...)
```

Arguments

x	object of class prm.
type	choices are "yyp", "weights", "coefficients", "dd" (see Details).
alpha	significance level. Default is 0.025. Will be ignored if type="weights".
colors	list with six elements with color codes or names for bar, errorbars, background, abline, scores cutoffs, badouts (outliers with weight zero) and modouts (moderate outliers).
textsize	the text size in which to print the scores and loading names. Will be ignored if type is "weights" or "coefficients".
errorbar_width	a numeric containing the width of the error bars for type="yyp".
data	optional data frame, containing new cases to predict and plot for type="yyp".
yscale	optional scale vector for the yscale in the y vs y predicted plot (e.g. if two different regression plots have to be on the same scale)
...	further arguments. Currently not used.

Details

The choices for type are:

type="yyp" - y vs y predicted plot with confidence intervals for each observation.

type="weights" - plot of case weights used for robust weighted regression.

type="coefficients" - plot of the value of each coefficient estimate with confidence interval.

type="dd" - distance-distance plot for visualization of leverage points. Robust distances are plotted agains Mahalanobis distances.

Author(s)

Sven Serneels, BASF Corp.

References

Sven Serneels et al. (2014) Sparse partial robust M regression

Serneels, S., Croux, C., Filzmoser, P., Van Espen, P.J., Partial Robust M-Regression. Chemometrics and Intelligent Laboratory Systems, 79 (2005), 55-64.

See Also

prms, biplot.prm

Examples

```
set.seed(5023)
U <- c(rep(2,20), rep(5,30))
X <- replicate(6, U+rnorm(50))
beta <- c(rep(1, 3), rep(-1,3))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
```

```
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
mod <- prms(y~., data=d, a=2, fun="Hampel")

plot(mod, type="yyp", errorbar_width=0.001)
plot(mod, type="coefficients",
colors = list(bars = "darkgreen", errorbars = "red", background = "lightgray"))
plot(mod, type="weights")
```

`plot.sprm` *Plots for sprm objects*

Description

Four types of plot options are available:

y vs y predicted plot, plot of case weights used for robust weighted regression, plot of estimated coefficients, distance-distance plot.

Usage

```
## S3 method for class 'sprm'
plot(x, type = "yyp", alpha = 0.025, colors = list(bars = "#0000AA",
errorbars = "red", background = "#BBBBEE", abline = "#21A0D2", scores = "#0000AA",
cutoffs = "#00EEEE", badouts="darkred", modouts="black"), textsize = 6,
errorbar_width = 1, data, yscale = NULL, ...)
```

Arguments

`x`	object of class sprm.
`type`	choices are `"yyp"`, `"weights"`, `"coefficients"`, `"dd"` (see Details).
`alpha`	significance level. Default is 0.025. Will be ignored if `type="weights"`.
`colors`	list with six elements with color codes or names for `bar`, `errorbars`, `background`, `abline`, `scores`, `cutoffs`, `badouts` (outliers with weight zero) and `modouts` (moderate outliers).
`textsize`	the text size in which to print the scores and loading names. Will be ignored if type is `"weights"` or `"coefficients"`.
`errorbar_width`	a numeric containing the width of the error bars for `type="yyp"`.
`data`	optional data frame, containing new cases to predict and plot for `type="yyp"`.
`yscale`	optional scale vector for the yscale in the y vs y predicted plot (e.g. if two different regression plots have to be on the same scale)
`...`	further arguments. Currently not used.

Details

The choices for type are:

type="yyp" - y vs y predicted plot with confidence intervals for each observation.

type="weights" - plot of case weights used for robust weighted regression.

type="coefficients" - plot of the value of each coefficient estimate with confidence interval.

type="dd" - distance-distance plot for for visualization of leverage points. Robust distances are plotted agains Mahalanobis distances.

Author(s)

Sven Serneels, BASF Corp.

References

Sven Serneels et al. (2014) Sparse partial robust M regression

See Also

sprm, biplot.sprm

Examples

```
set.seed(5023)
U1 <- c(rep(2,20), rep(5,30))
U2 <- rep(3.5,50)
X1 <- replicate(5, U1+rnorm(50))
X2 <- replicate(20, U2+rnorm(50))
X <- cbind(X1,X2)
beta <- c(rep(1, 5), rep(0,20))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
smod <- sprms(y~., data=d, a=1, eta=0.5, fun="Hampel")
mod <- prms(y~., data=d, a=1, fun="Hampel")

plot(smod, type="yyp", errorbar_width=0.001)

plot(smod, type="coefficients")
plot(mod, type="coefficients")

plot(smod, type="weights")

plot(smod, type="dd", colors=list(background="lightgray", scores="darkblue", cutoffs="red"))
```

predict.prm *Predict method for models of class prm*

Description

Predictions from a partial robust M regression model.

Usage

```
## S3 method for class 'prm'
predict(object, newdata, ...)
```

Arguments

object	object of class prm.
newdata	optional data frame with new observations.
...	further arguments. Currently not used.

Details

If newdata is specified the sprm model is used to predict the fitted values for this data set, otherwise the fitted values of the model are returned.

Value

predict.sprm returns a vector of the predicted response.

Author(s)

Sven Serneels, BASF Corp and Irene Hoffmann

References

Sven Serneels et al. (2014) Sparse partial robust M regression

Serneels, S., Croux, C., Filzmoser, P., Van Espen, P.J., Partial Robust M-Regression. Chemometrics and Intelligent Laboratory Systems, 79 (2005), 55-64.

See Also

prms, prmsCV

Examples

```
set.seed(5023)
U <- c(rep(2,20), rep(5,30))
X <- replicate(6, U+rnorm(50))
beta <- c(rep(1, 3), rep(-1,3))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
mod <- prms(y~., data=d, a=2, fun="Hampel")

dnew <- as.data.frame(replicate(6, U+rnorm(10)))
ynewp <- predict(mod, newdata=dnew)
```

`predict.sprm` *Predict method for models of class sprm*

Description

Predictions from a sparse partial robust M regression model.

Usage

```
## S3 method for class 'sprm'
predict(object, newdata, ...)
```

Arguments

`object`	object of class sprm.
`newdata`	optional data frame with new observations.
`...`	further arguments. Currently not used.

Details

If `newdata` is specified the sprm model is used to predict the fitted values for this data set, otherwise the fitted values of the model are returned.

Value

`predict.sprm` returns a vector of the predicted response.

Author(s)

Sven Serneels, BASF Corp and Irene Hoffmann

References

Sven Serneels et al. (2014) Sparse partial robust M regression

See Also

sprms, sprmsCV

Examples

```
set.seed(5023)
U1 <- c(rep(2,20), rep(5,30))
U2 <- rep(3.5,50)
X1 <- replicate(5, U1+rnorm(50))
X2 <- replicate(20, U2+rnorm(50))
X <- cbind(X1,X2)
beta <- c(rep(1, 5), rep(0,20))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
smod <- sprms(y~., data=d, a=1, eta=0.5, fun="Hampel")

dnew <- as.data.frame(cbind(replicate(5, U1+rnorm(10)), replicate(20, U2+rnorm(10))))
ynewp <- predict(smod, newdata=dnew)
```

---

prms *Partial robust M regression*

Description

Partial robust M regression for models with univariate response. This method for dimension reduction and regression analysis yields estimates with a partial least squares alike interpretability that are robust to both vertical outliers and leverage points.

Usage

```
prms(formula, data, a, fun = "Hampel", probp1 = 0.95, hampelp2 = 0.975,
hampelp3 = 0.999, center = "median", scale = "qn", usesvd = FALSE,
numit = 100, prec = 0.01)
```

Arguments

formula	an object of class formula.
data	a data frame or list which contains the variables given in formula.
a	the number of PRMS components to be estimated in the model.
fun	an internal weighting function for case weights. Choices are "Hampel" (preferred), "Huber" or "Fair".

probp1	the 1-alpha value at which to set the first outlier cutoff for the weighting function.
hampelp2	the 1-alpha values for second cutoff. Only applies to fun="Hampel".
hampelp3	the 1-alpha values for third cutoff. Only applies to fun="Hampel".
center	type of centering of the data in form of a string that matches an R function, e.g. "mean" or "median".
scale	type of scaling for the data in form of a string that matches an R function, e.g. "sd" or "qn" or alternatively "no" for no scaling.
usesvd	logical, default is FALSE. If TRUE singular value decomposition is performed.
numit	the number of maximal iterations for the convergence of the coefficient estimates.
prec	a value for the precision of estimation of the coefficients.

Details

The NIPLS algorithm combined with weighted regression is used for the model estimation.

a is the number of components in the model. Note that it is not possible to simply reduce the number of weighting vectors to obtain a model with a smaller number of components. Each model has to be estimated separately due to its dependence on robust case weights.

Value

prms returns an object of class prm.

Functions summary, predict and plot are available. Also the generic functions coefficients, fitted.values and residuals can be used to extract the corresponding elements from the prm object.

coefficients	vector of coefficients of the weighted regression model.
intercept	intercept of weighted regression model.
wy	the case weights in the y space.
wt	the case weights in the score space.
w	the overall case weights used for weighted regression (depending on the weight function). w=wy*wt.
scores	the matrix of scores.
weighting.vectors	the matrix to transform data to scores.
loadings	the matrix of loadings.
fitted.values	the vector of estimated response values.
residuals	vector of residuals, true response minus estimated response.
coefficients.scaled	vector of coefficients of the weighted regression model with scaled data.
intercept.scaled	intercept of weighted regression model with scaled data.

YMeans	value used internally to center response.
XMean	vector used internally to center data.
Xscales	vector used internally to scale data.
Yscales	value used internally to scale response.
Yvar	percentage of contribution for each component to the explanation of the variance of the response.
Xvar	percentage of contribution for each component to the explanation of the variance of the variables.
inputs	list of inputs: parameters, data and scaled data.

Author(s)

Sven Serneels, BASF Corp and Irene Hoffmann

References

Sven Serneels et al. (2014) Sparse partial robust M regression

Serneels, S., Croux, C., Filzmoser, P., Van Espen, P.J., Partial Robust M-Regression. Chemometrics and Intelligent Laboratory Systems, 79 (2005), 55-64.

See Also

prmsCV, plot.prm, biplot.prm, predict.prm, sprms

Examples

```
set.seed(5023)
U <- c(rep(2,20), rep(5,30))
X <- replicate(6, U+rnorm(50))
beta <- c(rep(1, 3), rep(-1,3))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
mod <- prms(y~., data=d, a=2, fun="Hampel")
summary(mod)
```

---

prmsCV *Cross validation method for prm models.*

Description

k-fold cross validation for the selection of the number of components for partial robust M regression.

Usage

```
prmsCV(formula, data, as, nfold = 10, fun = "Hampel", probp1 = 0.95, hampelp2 = 0.975,
hampelp3 = 0.999, center = "median", scale = "qn", usesvd = FALSE, plot = TRUE,
numit = 100, prec = 0.01, alpha = 0.15)
```

Arguments

formula	an object of class formula.
data	a data frame or list which contains the variables given in formula.
as	a vector with positive integers, which are the number of PRMS components to be estimated in the models.
nfold	the number of folds used for cross validation, default is nford=10 for 10-fold CV.
fun	an internal weighting function for case weights. Choices are "Hampel" (preferred), "Huber" or "Fair".
probp1	the 1-alpha value at which to set the first outlier cutoff for the weighting function.
hampelp2	the 1-alpha values for second cutoff. Only applies to fun="Hampel".
hampelp3	the 1-alpha values for third cutoff. Only applies to fun="Hampel".
center	type of centering of the data in form of a string that matches an R function, e.g. "mean" or "median".
scale	type of scaling for the data in form of a string that matches an R function, e.g. "sd" or "qn" or alternatively "no" for no scaling.
usesvd	logical, default is FALSE. If TRUE singular value decomposition is performed.
plot	logical, default is TRUE. If TRUE a plot is generated with a measure of the prediction accuracy for each model (see Details).
numit	the number of maximal iterations for the convergence of the coefficient estimates.
prec	a value for the precision of estimation of the coefficients.
alpha	value used for alpha trimmed mean squared error, which is the cross validation criterion (see Details).

Details

The alpha - trimmed mean squared error of the predicted response over all observations is used as robust decision criterion to choose the optimal model. For plot=TRUE a graphic visualizes the alpha - trimmed mean squared error for each model.

Value

opt.mod	object of class prm. (see prms)
spe	matrix with squared prediction error for each observation and each number of components.

Author(s)

Irene Hoffmann

References

Sven Serneels et al. (2014) Sparse partial robust M regression

Serneels, S., Croux, C., Filzmoser, P., Van Espen, P.J., Partial Robust M-Regression. Chemometrics and Intelligent Laboratory Systems, 79 (2005), 55-64.

See Also

prms, plot.prm, predict.prm, sprmsCV

Examples

```
set.seed(5023)
U <- c(rep(2,20), rep(5,30))
X <- replicate(6, U+rnorm(50))
beta <- c(rep(1, 3), rep(-1,3))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
res <- prmsCV(y~., data=d, as=2:4, plot=TRUE, prec=0.05)
summary(res$opt.mod)
```

---

sprms *Sparse partial robust M regression*

Description

Sparse partial robust M regression for models with univariate response. This method for dimension reduction and regression analysis yields estimates with a partial least squares alike interpretability that are both sparse and robust to both vertical outliers and leverage points. The sparsity is tuned with an L1 penalty.

Usage

```
sprms(formula, data, a, eta, fun = "Hampel", probp1 = 0.95, hampelp2 = 0.975,
hampelp3 = 0.999, center = "median", scale = "qn", print = FALSE,
numit = 100, prec = 0.01)
```

Arguments

formula	an object of class formula.
data	a data frame which contains the variables given in formula or a list of two elements, where the first element is the response vector and the second element is a matrix of the explanatory variables.
a	the number of SPRMS components to be estimated in the model.
eta	a tuning parameter for the sparsity with 0\le eta<1.
fun	an internal weighting function for case weights. Choices are "Hampel" (preferred), "Huber" or "Fair".
probp1	the 1-alpha value at which to set the first outlier cutoff for the weighting function.
hampelp2	the 1-alpha values for second cutoff. Only applies to fun="Hampel".
hampelp3	the 1-alpha values for third cutoff. Only applies to fun="Hampel".
center	type of centering of the data in form of a string that matches an R function, e.g. "mean" or "median".
scale	type of scaling for the data in form of a string that matches an R function, e.g. "sd" or "qn" or alternatively "no" for no scaling.
print	logical, default is FALSE. If TRUE the variables included in each component are reported.
numit	the maximum number of iterations for the convergence of the coefficient estimates.
prec	a value for the precision of estimation of the coefficients.

Details

The NIPLS algorithm with a L1 sparsity constrained combined with weighted regression is used for the model estimation.

a is the number of components in the model. Note that it is not possible to simply reduce the number of weighting vectors to obtain a model with a smaller number of components. Each model has to be estimated separately due to its dependence on robust case weights.

Value

sprms returns an object of class sprm.

Functions summary, predict and plot are available. Also the generic functions coefficients, fitted.values and residuals can be used to extract the corresponding elements from the sprm object.

coefficients	vector of coefficients of the weighted regression model.
intercept	intercept of weighted regression model.
wy	the case weights in the y space.
wt	the case weights in the score space.

w	the overall case weights used for weighted regression (depending on the weight function). w=wy*wt.
scores	the matrix of scores.
weighting.vectors	the matrix to transform data to scorse.
loadings	the matrix of loadings.
fitted.values	the vector of estimated response values.
residuals	vector of residuals, true response minus estimated response.
coefficients.scaled	vector of coefficients of the weighted regression model with scaled data.
intercept.scaled	intercept of weighted regression model with scaled data.
YMeans	value used internally to center response.
XMean	vector used internally to center data.
Xscales	vector used internally to scale data.
Yscales	value used internally to scale response.
Yvar	percentage of contribution for each component to the explanation of the variance of the response.
Xvar	percentage of contribution for each component to the explanation of the variance of the variables.
inputs	list of inputs: parameters, data and scaled data.
used.vars	Indices of variables included in the model.

Author(s)

Sven Serneels, BASF Corp and Irene Hoffmann

References

Sven Serneels et al. (2014) Sparse partial robust M regression

See Also

sprmsCV, plot.sprm, biplot.sprm, predict.sprm, prms

Examples

```
set.seed(50235)
U1 <- c(rep(3,20), rep(4,30))
U2 <- rep(3.5,50)
X1 <- replicate(5, U1+rnorm(50))
X2 <- replicate(20, U2+rnorm(50))
X <- cbind(X1,X2)
beta <- c(rep(1, 5), rep(0,20))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
```

```
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
mod <- sprms(y~., data=d, a=1, eta=0.5, fun="Hampel")
sprmfit <- predict(mod)

plot(y,sprmfit, main="SPRM")
abline(0,1)
```

---

sprmsCV *Cross validation method for sprm models.*

Description

k-fold cross validation for the selection of the number of components and the sparsity parameter for sparse partial robust M regression.

Usage

```
sprmsCV(formula, data, as, etas, nfold = 10, fun = "Hampel", probp1 = 0.95,
hampelp2 = 0.975, hampelp3 = 0.999, center = "median", scale = "qn",
plot = TRUE, numit = 100, prec = 0.01, alpha = 0.15)
```

Arguments

formula	an object of class formula.
data	a data frame or list which contains the variables given in formula.
as	a vector with positive integers, which are the number of PRMS components to be estimated in the models.
etas	vector of values for the tuning parameter for the sparsity. Values have to between 0 and 1.
nfold	the number of folds used for cross validation, default is nford=10 for 10-fold CV.
fun	an internal weighting function for case weights. Choices are "Hampel" (preferred), "Huber" or "Fair".
probp1	the 1-alpha value at which to set the first outlier cutoff for the weighting function.
hampelp2	the 1-alpha values for second cutoff. Only applies to fun="Hampel".
hampelp3	the 1-alpha values for third cutoff. Only applies to fun="Hampel".
center	type of centering of the data in form of a string that matches an R function, e.g. "mean" or "median".
scale	type of scaling for the data in form of a string that matches an R function, e.g. "sd" or "qn" or alternatively "no" for no scaling.

plot	logical, default is TRUE. If TRUE two contour plots are generated for number of components and sparsity parameter. The first contour plot shows the trimmed mean squared error of the prediction of the response (see Details) the second the number of variables in the model.
numit	the number of maximal iterations for the convergence of the coefficient estimates.
prec	a value for the precision of estimation of the coefficients.
alpha	value used for alpha trimmed mean squared error, which is the cross validation criterion (see Details).

Details

The alpha - trimmed mean squared error of the predicted response over all observations is used as robust decision criterion to choose the optimal model.

There may occur combinations of "a" and "eta" where the model cannot be estimated. Then the function issues a warning "CV broke off at "a" and "eta"". Make sure that this does not happen close to your optimum.

Value

opt.mod	object of class sprm. (see sprms)
spe	array with squared prediction error for each observation and each combination of tuning parameters
nzcoef	array with the number of variables in the model for each cross validation subset and each combination of tuning parameters

Author(s)

Irene Hoffmann

References

Sven Serneels et al. (2014) Sparse partial robust M regression

See Also

prms, plot.prm, predict.prm, sprmsCV

Examples

```
set.seed(50235)
U1 <- c(rep(3,20), rep(4,30))
U2 <- rep(3.5,50)
X1 <- replicate(5, U1+rnorm(50))
X2 <- replicate(20, U2+rnorm(50))
X <- cbind(X1,X2)
beta <- c(rep(1, 5), rep(0,20))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
y <- X%*%beta + e
```

```
d <- as.data.frame(X)
d$y <- y
res <- sprmsCV(y~., data=d, as=1:3, etas=seq(0,0.9,0.1), fun="Hampel", prec=0.1)
summary(res$opt.mod)
```

`summary.prm` *Summary of a prm model*

Description

Summarizing models of class prm.

Usage

```
## S3 method for class 'prm'
summary(object, ...)
## S3 method for class 'prm'
print(x, ...)
```

Arguments

`object, x`	object of class prm
`...`	optional arguments for internal print function.

Value

`summary` prints model parameters and explained variances.

`print` prints model parameters.

Author(s)

Irene Hoffmann

References

Sven Serneels et al. (2014) Sparse partial robust M regression

Serneels, S., Croux, C., Filzmoser, P., Van Espen, P.J., Partial Robust M-Regression. Chemometrics and Intelligent Laboratory Systems, 79 (2005), 55-64.

See Also

`prms`

Examples

```
set.seed(5023)
U <- c(rep(2,20), rep(5,30))
X <- replicate(6, U+rnorm(50))
beta <- c(rep(1, 3), rep(-1,3))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
mod <- prms(y~., data=d, a=2, fun="Hampel")
summary(mod)
```

`summary.sprm` *Summary of a sprm model*

Description

Summarizing models of class sprm.

Usage

```
## S3 method for class 'sprm'
summary(object, ...)
## S3 method for class 'sprm'
print(x, ...)
```

Arguments

`object, x`	object of class sprm.
`...`	optional arguments for internal print function.

Value

`summary` prints model parameters and explained variances.

`print` prints model parameters.

Author(s)

Irene Hoffmann

References

Sven Serneels et al. (2014) Sparse partial robust M regression

See Also

`sprms`

Examples

```
set.seed(50235)
U1 <- c(rep(3,20), rep(4,30))
U2 <- rep(3.5,50)
X1 <- replicate(5, U1+rnorm(50))
X2 <- replicate(20, U2+rnorm(50))
X <- cbind(X1,X2)
beta <- c(rep(1, 5), rep(0,20))
e <- c(rnorm(45,0,1.5),rnorm(5,-20,1))
y <- X%*%beta + e
d <- as.data.frame(X)
d$y <- y
mod <- sprms(y~., data=d, a=1, eta=0.5, fun="Hampel")
summary(mod)
```

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