Package: srp (via r-universe)

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Title Smooth-Rough Partitioning of the Regression Coefficients

Version 1.2.0

Description Performs the change-point detection in regression coefficients of linear model by partitioning the regression coefficients into two classes of smoothness. The change-point and the regression coefficients are jointly estimated.

Depends R (>= 3.4.0)

License GPL

LazyData true

Imports fda, mgcv

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Contents

ncs *The natural cubic spline interpolation*

Description

This function performs the natural cubic spline interpolation of a design matrix.

Usage

```
ncs(x)
```

Arguments

x	The design matrix.

Details

Usually only called by srp.c and srp.l.

Value

cf0	The coefficient matrix for B-splines obtained by natural cubic spline interpolation of x.

Author(s)

Hyeyoung Maeng, <h.maeng@lse.ac.uk>

See Also

srp.c, srp.l

Examples

```
x <- matrix(rnorm(100), ncol=10)
ncs(x)$cf0
```

predict.srp.c *The Smooth-Rough Partition model prediction*

Description

This function performs the predictions from the results of Smooth-Rough Partition fitting.

Usage

```
## S3 method for class 'srp.c'
predict(object, x, ...)
```

Arguments

object	An object of class either 'srp.c', returned by srp.c.
x	A new matrix you wish to fit Smooth-Rough Partition model. The dimension of row is the number of covariates.
...	Further parameters that can be passed to predict.srp.c.

Details

The Smooth-Rough Partition model is described in "Regularised forecasting via smooth-rough partitioning of the regression coefficients", H. Maeng and P. Fryzlewicz (2018), preprint.

Value

yhat	The vector of predicted values.

Author(s)

Hyeyoung Maeng, <h.maeng@lse.ac.uk>

See Also

sic.c, srp.c

predict.srp.l *The Smooth-Rough Partition model prediction*

Description

This function performs the predictions from the results of Smooth-Rough Partition fitting.

Usage

```
## S3 method for class 'srp.l'
predict(object, x, ...)
```

Arguments

object	An object of class 'srp.l', returned by srp.l.
x	A new matrix you wish to fit Smooth-Rough Partition model. The dimension of row is the number of covariates.
...	Further parameters that can be passed to predict.srp.l.

Details

The Smooth-Rough Partition model is described in "Regularised forecasting via smooth-rough partitioning of the regression coefficients", H. Maeng and P. Fryzlewicz (2018), preprint.

Value

yhat	The vector of predicted values.

Author(s)

Hyeyoung Maeng, <h.maeng@lse.ac.uk>

See Also

sic.l, srp.l

sic.c *Optimisation of the Smooth-Rough Partition model*

Description

This function performs the optimisation of the number of unconstrained regression parameters in Smooth-Rough Partition model by minimising SIC criterion and gives the change-point of smoothness in regression parameters.

Usage

```
sic.c(x.basis = x.basis, B.basis = B.basis, x = x, y = y,
  cf0 = cf0, maxq = maxq, fixedq = F, L = L, inisp = inisp)
```

Arguments

x.basis	The b-spline basis defined for interpolated x in srp.c
B.basis	The b-spline basis defined for constrained regression coefficient.
x	The design matrix used in srp.c.
y	The response variable used in srp.c.
cf0	The coefficient matrix obtained by natural cubic spline interpolation of x in ncs.
maxq	The maximum number of unconstrained parameters if fixedq is FALSE. Otherwise, it is considered as a unique number of unconstrained parameters.
fixedq	If TRUE, maxq is considered as a fixed number of unconstrained parameters and if FALSE, maxq is a maximum and a sequence of possible values are investigated to select the optimal.
L	The dimension of b-spline expansion for constrained parameters used in srp.c.
inisp	The initial value for the optimisation of tuning parameters in srp.c.

Details

Usually only called by srp.c.

Value

The following components are obtained only when fixedq is FALSE:

qhat	The optimal number of unconstrained parameters.
sicq	The vector of Schwarz criterion with length maxq which is computed for the different number of unconstrained parameters.

The following components are obtained only when fixedq is TRUE:

muhat	The estimator of constant parameter.
bhat	The vector of evaluated constrained functional regression coefficient.

ahat	The vector of unconstrained regression coefficient estimators.
etahat	The vector containing both bhat and ahat with unevaluated form.
yhat	The vector of estimated response variable.
sp	The vector of two tuning parameters estimated by minimising generalised cross validation (GCV).
L	The number of b-spline bases used for constrained regression parameters.

Author(s)

Hyeyoung Maeng, <h.maeng@lse.ac.uk>

See Also

sic.l, predict.srp.c, srp.c

Examples

```
library(fda)
x <- matrix(rnorm(10000), ncol=100)
y <- matrix(rnorm(100), ncol=1)
p <- dim(x)[1] + 1
t <- seq(0, 1, length.out=dim(x)[1])*(dim(x)[1])
x.basis <- as.fd(splinefun(t, x[, 1], method="natural"))$basis
B.basis <- create.bspline.basis(rangeval=c(0, dim(x)[1]), norder=4, nbasis=35)
result <- sic.c(x.basis=x.basis, B.basis=B.basis, x=x, y=y, cf0=ncs(x)$cf0, maxq=10, L=35, inisp=1)
plot(result$sicq, type="b")
```

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sic.l *Optimisation of the (simpler) Smooth-Rough Partition model*

Description

This function performs the optimisation of the number of unconstrained regression parameters in (simpler) Smooth-Rough Partition model by minimising SIC criterion and gives the change-point in regression parameters.

Usage

```
sic.l(x.basis = x.basis, M.basis = M.basis, x = x, y = y,
  cf0 = cf0, maxq = maxq, fixedq = F)
```

Arguments

x.basis	The b-spline basis defined for interpolated x in srp.l.
M.basis	The monomial basis defined for constrained regression coefficient.
x	The design matrix used in srp.l.
y	The response variable used in srp.l.
cf0	The coefficient matrix obtained by natural cubic spline interpolation of x in ncs.
maxq	The maximum number of unconstrained parameters if fixedq is FALSE. Otherwise, it is considered as a unique number of unconstrained parameters.
fixedq	If TRUE, maxq is considered as a fixed number of unconstrained parameters and if FALSE, maxq is a maximum and a sequence of possible values are investigated to select the optimal.

Details

Usually only called by srp.l.

Value

The following components are obtained only when fixedq is FALSE:

qhat	The optimal number of unconstrained parameters.
sicq	The vector of Schwarz criterion with length maxq which is computed for the different number of unconstrained parameters.

The following components are obtained only when fixedq is TRUE:

muhat	The estimator of constant parameter.
bhat	The vector of evaluated constrained functional regression coefficient.
ahat	The vector of unconstrained regression coefficient estimators.
etahat	The vector containing both bhat and ahat with unevaluated form.
yhat	The vector of estimated response variable.

Author(s)

Hyeyoung Maeng, <h.maeng@lse.ac.uk>

See Also

sic.c, srp.l

Examples

```
library(fda)
x <- matrix(rnorm(10000), ncol=100)
y <- matrix(rnorm(100), ncol=1)
p <- dim(x)[1] + 1
t <- seq(0, 1, length.out=dim(x)[1])*(dim(x)[1])
x.basis <- as.fd(splinefun(t, x[, 1], method="natural"))$basis
M.basis <- create.monomial.basis(rangeval=c(0, dim(x)[1]), nbasis=2)
result <- sic.l(x.basis=x.basis, M.basis=M.basis, x=x, y=y, cf0=ncs(x)$cf0, maxq=10)
plot(result$sicq, type="b")
```

`srp` *srp: Detecting the change-point of smoothness in linear regression coefficients*

Description

The srp package performs the change-point detection in regression coefficients of a linear model by partitioning the regression coefficients into two classes of smoothness. To start with, see the function `srp.c`.

Author(s)

Hyeyoung Maeng, <h.maeng@lse.ac.uk>

References

"Regularised forecasting via smooth-rough partitioning of the regression coefficients", H. Maeng and P. Fryzlewicz (2018), preprint.

See Also

`srp.c`

`srp.c` *The Smooth-Rough Partition model fitting*

Description

This function performs the Smooth-Rough Partition linear regression with the input matrix.

Usage

```
srp.c(x, y, maxq = max(30, ceiling(0.1 * dim(x)[1])), L = 35,
  norder = 4, inisp = 1, plot = T)
```

Arguments

x	A matrix you wish to fit Smooth-Rough Partition model. The dimension of row is the number of variables which are pre-ordered in terms of their importance in prediction.
y	A vector you wish to use as a response variable in case of regressing y on x. If y is missing, the response variable is obtained from the last row of x.
maxq	An integer specifying the maximum number of unconstrained parameters which the model can have. The default is max(30, ceiling(0.1*dim(x)[1])).
L	An integer specifying the dimension of b-spline expansion for the constrained (smoothed) parameters. The default is 35.
norder	An integer specifying the order of b-splines. The default of 4 performs cubic splines.
inisp	An initial value for optimising the tuning parameters and the default is 1.
plot	If true, it gives the plot of estimated regression coefficients.

Details

The estimation procedure of Smooth-Rough Partition model is described in "Regularised forecasting via smooth-rough partitioning of the regression coefficients", H. Maeng and P. Fryzlewicz (2018), preprint.

Value

muhat	The estimator of constant parameter.
bhat	The vector of evaluated constrained functional regression coefficient.
ahat	The vector of unconstrained regression coefficient estimators.
etahat	The vector containing both bhat and ahat with unevaluated form.
yhat	The vector of estimated response variable.
SIC	The vector of Schwarz criterion with length maxq which is computed for the different number of unconstrained parameters.
qhat	The optimal number of unconstrained parameters selected in the model.
sp	The vector of two tuning parameters estimated by minimising generalised cross validation (GCV).
L	The number of bases used for constrained regression parameters.
norder	The order of b-splines specified.

Author(s)

Hyeyoung Maeng, <h.maeng@lse.ac.uk>

See Also

sic.c, predict.srp.c, srp.l

Examples

```
x <- matrix(rnorm(10000), ncol=100)
srp.c(x)
```

`srp.l` *The (simpler) Smooth-Rough Partition linear regression model fitting*

Description

This function performs same as `srp.c` except that constrained functional coefficient is estimated as a linear function.

Usage

```
srp.l(x, y, maxq = max(30, ceiling(0.1 * dim(x)[1])), plot = T)
```

Arguments

`x`	A matrix you wish to fit Smooth-Rough Partition model. The dimension of row is the number of variables which are pre-ordered in terms of their importance in prediction.
`y`	A vector you wish to use as a response variable in case of regressing `y` on `x`. If `y` is missing, the response variable is obtained from the last row of `x`.
`maxq`	An integer specifying the maximum number of unconstrained parameters which the model can have. The default is max(30, ceiling(0.1*dim(x)[1])).
`plot`	If true, it gives the plot of estimated regression coefficients.

Details

The estimation procedure of Smooth-Rough Partition model is described in "Regularised forecasting via smooth-rough partitioning of the regression coefficients", H. Maeng and P. Fryzlewicz (2018), preprint.

Value

`muhat`	The estimator of constant parameter.
`bhat`	The vector of evaluated constrained (linear) functional regression coefficient.
`ahat`	The vector of unconstrained regression coefficient estimators.
`etahat`	The vector containing both `bhat` and `ahat` with unevaluated form.
`yhat`	The vector of estimated response variable.
`SIC`	The vector of Schwarz criterion with length `maxq` which is computed for the different number of unconstrained parameters.
`qhat`	The optimal number of unconstrained parameters selected in the model.

Author(s)

Hyeyoung Maeng, <h.maeng@lse.ac.uk>

See Also

srp.c, predict.srp.l, sic.l

Examples

```
x <- matrix(rnorm(10000), ncol=100)
srp.l(x)
```

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truebeta *A dataset containing true regression coefficients for simulation*

Description

True regression coefficients used for simulations in "Regularised forecasting via smooth-rough partitioning of the regression coefficients", H. Maeng and P. Fryzlewicz (2018), preprint.

Usage

```
data(truebeta)
```

Format

A matrix with 356 rows and 4 variables:

Case 1 true regression coefficients for case 1

Case 2 true regression coefficients for case 2

Case 3 true regression coefficients for case 3

Case 4 true regression coefficients for case 4

Index