Package ‘ftnonpar’

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Title Features and Strings for Nonparametric Regression
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Description The package contains R-functions to perform the methods in
           nonparametric regression and density estimation, described in
           Davies, P. L. and Kovac, A. (2001) Local Extremes, Runs,
           Strings and Multiresolution (with discussion) Annals of
           Densities, Spectral Densities and Modality Annals of
           (2006) Smooth functions and local extreme values. Computational
           Statistics and Data Analysis (to appear) Dümbgen, L. and
           49,185-245.
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R topics documented:

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dclamp .......................................................... 3
djdata ........................................................... 3
Data from a weather balloon

Description

The data consist of 4984 observations taken from a balloon about 30 kilometres above the surface of the earth. The outliers are caused by the fact that the balloon slowly rotates, causing the ropes from which the measuring instrument is suspended to cut off the direct radiation from the sun.

Usage

data(djdata)

Format

A one-dimensional data set of size 4984

Source


Examples

data(balloon)
plot(balloon)
dclaw

The Claw Distribution

Description
Generates a sample from the claw distribution.

Usage
dclaw(x)

Arguments
x Vector of points where the claw density is evaluated.

Author(s)
Arne Kovac <A.Kovac@bristol.ac.uk>

References
Marron, J. S. and Wand, M. P. (1992) Exact mean integrated squared error

See Also
rclaw

Examples
plot(dclaw(seq(-3,3,len=1000)),ty="l")

djdata

Donoho-Johnstone test signals

Description
Four samples, each of size 2048 from Donoho and Johnstone’s famous signals commonly used as test beds for smoothing methods.

Usage
data(djdata)

Format
Four one-dimensional data sets, each of size 2048
Source


Examples

data(djdata)
par(mfrow=c(2,2))
plot(djdoppler)
plot(djheavisine)
plot(djblocks)
plot(djbumps)

---

*frun*  
*Runs and local extremes*

Description

Calculation of bounds for functions such that the residuals satisfy a run criterion

Usage

`frun(y, ..., alpha = 0.5, r = 0, mr = 0)`

Arguments

- `y` the data
- `...` an optional argument which specifies the approximate positions of the local extreme values. These should be consistent with the run length otherwise the result will be nonsensical. Should you wish to use this option then you should first run the macro without it. The item `xb` of the output list gives the acceptable limits of the local extreme values. You can then specify the positions within these limits.
- `alpha` Quantile determining the acceptable run length.
- `r` Acceptable run length: Overrides alpha if not 0
- `mr` `mr=0` minimizes the run length consistent with the number of local extreme values found for the specified run length. `mr=1` disables the option.

Value

- `l1` lower bounds
- `u1` upper bounds
- `lR` lower bound with specified extremes: the default choices for the positions of the local extreme values are the mid-points of the intervals specified by `xb` above.
- `uR` upper bound with specified extremes
- `f` function between `l2` and `u2` satisfying run condition
bounds for location of extremes: the position of the ith extreme value lies between \( xb[2*i-1] \) and \( xb[2*i] \)

\( nx \) number of extremes

\( r \) run length: may differ from specified if mr=1

**Note**

IN GENERAL THE MEAN OF THE BOUNDS \( l2 \) AND \( u2 \) \( (l2+u2)/2 \) GIVES A BETTER REGRESSION FUNCTION THAN \( f \). HOWEVER THIS FUNCTION IS INFINITE AT THE TWO ENDPOINTS AND AT LOCAL EXTREME VALUES. IN THESE INTERVALS IT CAN BE REPLACED BY ANY VALUES WHICH DO NOT ALTER THE NUMBER OF LOCAL EXTREME VALUES. THE MEDIAN OF THE \( y \)-VALUES IN THESE INTERVALS IS A REASONABLE CHOICE.

**Author(s)**

Laurie Davies <Laurie.Davies@uni-essen.de>

**References**


**See Also**

mintvmon, pmreg, l1pmreg

---

**Description**

Applies the generalised taut string method to one-dimensional data.

**Usage**

genpmreg(y, beta = 0.5, squeezing.factor = 0.5, verbose = FALSE, localsqueezing = TRUE, dyadic = TRUE,

**Arguments**

\( y \) observed values (ordered by value of independent variable)

\( beta \) If method=1 specifies the quantile

\( squeezing.factor \) The amount of decrement applied to the bandwidths

\( verbose \) logical, if T progress (for each iteration) is illustrated graphically
localsqueezing logical, if T (default) the bandwidth is changed locally.

DYADIC If T checks the multiresolution criterion only on dyadic intervals, otherwise all intervals are checked.

thr.const smoothing parameter for the multiresolution criterion (should be approximately 2.5)

extrema.nr if set to a positive integer an approximation with the specified number of local extreme values is calculated.

bandwidth if set to a positive value the specified bandwidth is used instead of the multiresolution criterion.

SETTOMEAN logical, if T (default) the value of the taut string approximation at local extreme values is set to the mean or median of the observations on the interval where the extremum is taken.

method The method used which can be 1 (quantile regression), 2 (usual taut string), 3 (logistic regression) and 4 (Poisson regression).

Passed to the plot command if verbose=T

Value
A list with components

y The approximation of the given data
lambda Values for lambda used
nmax Number of local extreme values

Author(s)
Arne Kovac <A.Kovac@bristol.ac.uk>

References

See Also
pmreg

Examples

data(djdata)
par(mfrow=c(2,2))
plot(djblocks,col="grey")
lines(genpmreg(djblocks,verbose=FALSE,method=2,thr.const=2.5)$y,col="red")
title("Usual taut string method")
ind <- sample(1:length(djblocks),300)
djblocks[ind] <- djblocks[ind]+rnorm(length(ind),0,100)
plot(djblocks,col="grey")
lines(genpmreg(djblocks,verbose=FALSE,method=2)$y,col="red")
title("Usual taut string method with outliers")
Generalized Kuiper Metrics

Description
Calculates the generalized k-th Kuiper metric

Usage
kkuip(x, k=1)

Arguments
x Data vector
k Number of intervals to be used for the generalized Kuiper metric. The usual Kuiper metric is obtained by the default value 1.

Value
metric Value of the metric
a The left borders of the intervals where the maximum is obtained.
b The right borders of the intervals where the maximum is obtained.

Author(s)
Arne Kovac <A.Kovac@bristol.ac.uk>

References

See Also
pmden

Examples
aaa <- rclaw(500)
kkuip(aaa, 9)
**Description**

Applies the generalized taut string method to quantile regression.

**Usage**

```r
quantpmpreg(y, beta = 0.5, squeezing.factor = 0.5, verbose = FALSE, localsqueezing = TRUE, dyadic = TRUE, thrNconst = 2, extremaNnr = 0, bandwidth = 0.5, settomean = FALSE, method = 1)
```

**Arguments**

- `y`: observed values (ordered by value of independent variable)
- `beta`: quantile. The default is 0.5 which corresponds to the robust taut string.
- `squeezing.factor`: The amount of decrement applied to the bandwidth
- `verbose`: logical, if T progress (for each iteration) is illustrated grahically
- `localsqueezing`: logical, if T (default) the bandwidth is changed locally.
- `dyadic`: logical, if T (default) the multiresolution criterion is only verified on intervals with dyadic endpoints.
- `thrNconst`: smoothing parameter for the multiresolution criterion (should be approximately 2)
- `extremaNnr`: if set to a positive integer an approximation with the specified number of local extreme values is calculated
- `bandwidth`: if set to a positive value the specified bandwidth is used instead of the multiresolution criterion.
- `settomean`: logical, if T (default) the value of the taut string approximation at local extreme values is set to the mean or median of the observations on the interval where the extremum is taken.
- `method`: The method used which can be 1 (quantile regression), 2 (usual taut string), 3 (logistic regression) and 4 (Poisson regression)
- `...`: Passed to the plot command if verbose=T

**Value**

A list with components

- `y`: The approximation of the given data
- `lambda`: The final values of lambda
- `nmax`: Number of local extreme values
mintvmon

Author(s)

Arne Kovac <A.Kovac@bristol.ac.uk>

References


See Also

pmreg, frun

Description

Finds a function vector which minimizes the total variation of the function or a derivative under multiresolution constraints and monotonicity and convexity constraints.

Usage

mintvmon(y, sigma = -1, DYADIC = TRUE, thresh = -1, method = 2, MONCONST = TRUE, CONVCONST = FALSE)

Arguments

y
    observed values (ordered by value of independent variable).
sigma
    if set to a positive value the standard deviation is set to sigma and not estimated from the data
DYADIC
    logical, if T (default) the multiresolution constraints are only verified on intervals with dyadic endpoints
thresh
    if set to a positive value other thresholds for the multiresolution criterion than the default sqrt(2*log(n))*sigma can be used.
method
    Number of derivative the total variation of which is minimized. Possible values are 0,1,2. Higher values lead to numerical inconsistencies.
MONCONST
    logical, if T (default) additional monotonicity constraints are gathered from minimizing the total variation of f. Makes only sense, if method is 1 or 2.
CONVCONST
    logical, if T (default) additional convexity constraints are gathered from minimizing the total variation of f'. Makes only sense, if method is 2.
Value

A list with components

\[ y \] The approximation of the given data
\[ \text{derivsign} \] Vector of 1 and -1, monotonicity constraints used if MONCONST was true
\[ \text{secsign} \] Vector of 1 and -1, convexity constraints used if CONVCONST was true
\[ \text{jact} \] Left endpoints of active multiresolution constraints for the final approximation
\[ \text{kact} \] Right endpoints of active multiresolution constraints for the final approximation
\[ \text{signact} \] Vector of 1 and -1, gives for each active multiresolution constraints, if the residuals on that interval attain upper or lower bound
\[ \text{pl} \] Left endpoint of piecewise constant intervals of the derivative of \( f \) being minimized
\[ \text{pr} \] Right endpoint of piecewise constant intervals of the derivative of \( f \) being minimized

Author(s)

Arne Kovac

References


See Also

\[ \text{pmreg} \]

Examples

```
data(djdata)
djdoppler.tv0 <- mintvmon(djdoppler,method=0)
djdoppler.tv1 <- mintvmon(djdoppler,method=1)
djdoppler.tv2 <- mintvmon(djdoppler)
par(mfrow=c(2,2))
plot(djdoppler,col="lightgrey")
plot(djdoppler,col="lightgrey")
lines(djdoppler.tv0$y,col="blue")
plot(djdoppler,col="lightgrey")
lines(djdoppler.tv1$y,col="green")
plot(djdoppler,col="lightgrey")
lines(djdoppler.tv2$y,col="red")
```
**pmden**

**Piecewise monotone density estimation with taut strings**

**Description**

Applies the taut string method to one-dimensional data.

**Usage**

\[ \text{pmden}(x, \text{DISCR=}\text{FALSE}, \text{verbose} = \text{FALSE}, \text{bandwidth}=-1, \text{extrema.nr} = -1, \text{accuracy} = \text{mad}(x)/1000, \text{extrema.mean} = \text{FALSE}, \text{maxkuipnr} = 1, \text{asympbounds} = \text{FALSE}, \text{tolerance} = 1e^{-8}, \text{localsq} = \text{TRUE}, \text{locsq.factor} = 1) \]

**Arguments**

- **x**: observed values
- **DISCR**: logical, if T a discrete density is fitted
- **verbose**: logical, if T progress (for each iteration) is illustrated graphically
- **bandwidth**: if set to a positive value the specified bandwidth is used instead of the automatic criterion based on generalized Kuiper metrics.
- **extrema.nr**: if set to a positive integer an approximation with the specified number of local extreme values is calculated
- **accuracy**: Precision of the data. Handling of identical observations depends on this parameter.
- **extrema.mean**: logical, if T the value at the local extrema is changed to the mean frequency of observations on that interval
- **maxkuipnr**: The order of the highest generalized Kuiper metric used for the automatic choice of the bandwidth
- **asympbounds**: If set to T asymptotic bounds derived from a Brownian Bridge are used for the Kuiper criterion. Otherwise simulated bounds for various sample sizes are interpolated for the size of the data \( x \)
- **tolerance**: Accuracy used for the determination of the bandwidth when \( \text{extrema.nr} \) is greater than 0.
- **localsq**: If set to TRUE (default) performs, if necessary, additional local squeezing after the Kuiper metrics are small enough
- **locsq.factor**: The amount of decrement applied to the bandwidths if local squeezing is carried out.

**Value**

- **y**: values of the density approximation between the observations
- **widthes**: bandwidth used for the taut string approximation
- **nmax**: number of local extreme values
- **ind**: indices of knots points of the taut string
- **trans**: taut string at the observations, should look like uniform noise
pmlogreg

Description
Applies the taut string method to binary data.

Usage
pmlogreg(y, thr.const=2.5, verbose=FALSE, extrema.nr=-1, bandwidth=-1, 
localsqueezing=TRUE, squeezing.factor=0.5, tolerance=0.001,extrema.mean=TRUE)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>observed values (ordered by value of independent variable)</td>
</tr>
<tr>
<td>thr.const</td>
<td>smoothing parameter for the multiresolution criterion (should be approximately 2.5)</td>
</tr>
<tr>
<td>verbose</td>
<td>logical, if T progress (for each iteration) is illustrated graphically</td>
</tr>
<tr>
<td>extrema.nr</td>
<td>if set to a positive integer an approximation with the specified number of local extreme values is calculated</td>
</tr>
<tr>
<td>bandwidth</td>
<td>if set to a positive value the specified bandwidth is used instead of the multiresolution criterion.</td>
</tr>
<tr>
<td>localsqueezing</td>
<td>logical, if T (default) the bandwidth is changed locally.</td>
</tr>
<tr>
<td>squeezing.factor</td>
<td>The amount of decrement applied to the bandwidths</td>
</tr>
<tr>
<td>tolerance</td>
<td>Accuracy used for the determination of the bandwidth when extrema.nr is greater than 0.</td>
</tr>
<tr>
<td>extrema.mean</td>
<td>logical, if T (default) the value of the taut string approximation at local extreme values is set to the mean of the observations on the interval where the extremum is taken.</td>
</tr>
</tbody>
</table>
pmreg

Value
A list with components

<table>
<thead>
<tr>
<th>y</th>
<th>The approximation of the given data</th>
</tr>
</thead>
<tbody>
<tr>
<td>widths</td>
<td>Bandwidth used</td>
</tr>
<tr>
<td>nmax</td>
<td>Number of local extreme values</td>
</tr>
<tr>
<td>knotsind</td>
<td>Indices of knot points</td>
</tr>
<tr>
<td>knotsy</td>
<td>y-coordinates of knots of the taut string</td>
</tr>
</tbody>
</table>

Author(s)
Arne Kovac <A.Kovac@bristol.ac.uk>

See Also
l1pmreg, pmden, pmspec

Examples
```r
aaa <- rbinom(1024, 1, 0.5 + 0.5 * sin(seq(0, 10 * pi, len = 1024)))
pmlogreg(aaa, verbose = TRUE)$n
```

---

**pmreg**

*Piecewise monotone regression with taut strings*

Description
Applies the taut string method to one-dimensional data.

Usage
```
pmreg(y, thr.const=2.3, verbose=FALSE, extrema.nr=-1, bandwidth=-1, sigma=-1, localsqueezing=TRUE, squeezing.factor=0.5, tolerance=1e-08, extrema.mean=TRUE, DYADIC=TRUE, dyad.factor=1.1, POSTISO=TRUE)
```

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>observed values (ordered by value of independent variable)</td>
</tr>
<tr>
<td>thr.const</td>
<td>smoothing parameter for the multiresolution criterion (should be approximately 2.3)</td>
</tr>
<tr>
<td>verbose</td>
<td>logical, if T progress (for each iteration) is illustrated graphically</td>
</tr>
<tr>
<td>extrema.nr</td>
<td>if set to a positive integer an approximation with the specified number of local extreme values is calculated</td>
</tr>
<tr>
<td>bandwidth</td>
<td>if set to a positive value the specified bandwidth is used instead of the multiresolution criterion.</td>
</tr>
</tbody>
</table>
sigma if set to a positive value sigma the standard deviation is set to sigma and not estimated from the data
localsqueezing logical, if TRUE (default) the bandwidth is changed locally.
squeezing.factor The amount of decrement applied to the bandwidths
tolerance Accuracy used for the determination of the bandwidth when extrema.nr is greater than 0.
extrema.mean logical, if TRUE (default) the value of the taut string approximation at local extreme values is set to the mean of the observations on the interval where the extremum is taken.
DYADIC If TRUE the multiresolution constraints are only checked on dyadic intervals.
dyad.factor If the multiresolution constraints are checked on dyadic intervals, dyad.factor determines the ratio between the lengths of two subsequent level (default is 1.1).
POSTISO If TRUE (default) any bias caused by local squeezing is removed by applying isotonic and isotonic regression between each two local extreme values.

Value
A list with components

y The approximation of the given data
sigma Standard deviation used
widthes Bandwidth used
rmax Number of local extreme values
knotsind Indices of knot points
knotsy y-koordinates of knots of the taut string

Author(s)
Arne Kovac <A.Kovac@bristol.ac.uk>

References

See Also
mintvmon,l1pmreg,pmden,pmspec

Examples
data(djdata)
pmreg(djdata,verbose=TRUE)$n
**pmspec**

*Piecewise monotone spectral density approximation with taut strings*

**Description**

Applies the taut string method to spectral densities.

**Usage**

```r
pmspec(x, pks=0, alpha=0.9, sqzf=0.9, mult=0, lcl=0, ln=0, fig = 0, pow=10^-2)
```

**Arguments**

- `x` data
- `pks` if `pks=0` then the number of peaks is determined automatically. If `pks = k >0` then a density with `n` peaks is returned
- `alpha` If `pks=0` then on Gaussian test beds the number of peaks of the true density is at least the returned value with an asymptotic probability of at least `alpha`. If `pks > 0` then the parameter is not operational
- `sqzf` Squeeze factor for the taut string `sqzf`
- `mult` If `mult = T` then rescaled empirical density is compared with the exponential distribution only on intervals forming a multiresolution scheme. If `T = F` then all intervals are used. If the sample size of the data is less than 512 then `T = F` is default
- `lcl` If `lcl = T` then string is calculated using local squeezing. If `lcl = F` then global squeezing is used.
- `fig` If `fig = T` then the data are automatically plotted
- `ln` If `fig = T` and `ln = T` then the densities are plotted on a log scale. If `ln = F` then no transformation is performed
- `pow` Peaks with a power less than `pow * total power` will be ignored

**Value**

- `edf` Empirical spectral density
- `df` String density
- `pks` Number of peaks
- `ll` Lower boundary for string
- `uu` Upper boundary for string
- `str` String

**Author(s)**

Laurie Davies <Laurie.Davies@uni-essen.de>
References


See Also

pmreg, l1pmreg, pmden

rclaw

The Claw Distribution

Description

Generates a sample from the claw distribution.

Usage

rclaw(n)

Arguments

n Sample size

Author(s)

Arne Kovac <A.Kovac@bristol.ac.uk>

References

Marron, J. S. and Wand, M. P. (1992) Exact mean integrated squared error

See Also

dclaw

Examples

aaa <- rclaw(500)
kkuip(aaa,9)
rtennonormal  

*Mixture of ten normal distributions*

**Description**

Generates a sample from a mixture of ten normal distributions.

**Usage**

```
rtennonormal(n)
```

**Arguments**

- `n`  
  Sample size

**Author(s)**

Arne Kovac (&lt;A.Kovac@bristol.ac.uk&gt;)

**See Also**

`rclaw`

**Examples**

```r
aaa <- rtennonormal(500)
kkuip(aaa,9)
```

smdenreg  

*Piecewise monotone density estimation with smooth taut strings*

**Description**

Applies the smooth taut string method to one-dimensional data.

**Usage**

```
smdenreg(x, verbose = FALSE, bandwidth=-1, maxkuipnr=19, asympbounds=NULL, squeezing.factor=0.9, firstlambda=10, smepts=1/length(x), fsign=double(0), gensign=TRUE,...)
```
Arguments

- **x**: observed values
- **verbose**: logical, if T progress (for each iteration) is illustrated graphically
- **bandwidth**: if set to a positive value the specified bandwidth is used instead of the automatic criterion based on generalized Kuiper metrics.
- **maxkuipnr**: The order of the highest generalized Kuiper metric used for the automatic choice of the bandwidth
- **asymbounds**: If set to T asymptotic bounds derived from a Brownian Bridge are used for the Kuiper criterion. Otherwise simulated bounds for various sample sizes are interpolated for the size of the data x
- **squeezing.factor**: The amount of decrement applied to the bandwidths
- **firstlambda**: Initial value of lambda’s for global squeezing.
- **smqeps**: Distance between the (equally-spaced) time points.
- **fsign**: Monotonicity constraints, vector of size n-1 of -1,0 and 1’s. If fsign[i]==1, then fhat[i+1]>= fhat[i]. If fsign[i]==-1, then fhat[i+1]<=f[i]. Otherwise no constraint at this position.
- **gensign**: If TRUE the taut string method is used to automatically produce suitable monotonicity constraints.
- **...**: Passed to the plot command if verbose=T.

Value

- **x**: The sorted data
- **y**: values of the density approximation between the observations
- **nmax**: Number of local extreme values
- **trans**: taut string at the observations, should look like uniform noise

Author(s)

Arne Kovac <A.Kovac@bristol.ac.uk>

References


See Also

- `pmreg`, `l1pmreg`, `pmspec`

Examples

```r
y <- rclaw(500)
hist(y,col="lightgrey",40,freq=FALSE)
lines(smdenreg(y),col="red")
```
**smqreg**

*Smooth piecewise monotone regression with taut strings*

**Description**

Applies the smooth taut string method to one-dimensional data.

**Usage**

```r
smqreg(y, thr.const=2.5, verbose=FALSE, bandwidth=-1,
       sigma=-1, localsqueezing=TRUE, squeezing.factor=0.5, DYADIC=TRUE,
       firstlambda=100, smqeps=1/length(y), fsign=double(0), gensign=TRUE,
       tolerance = 1e-12, ...)
```

**Arguments**

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>observed values (ordered by value of independent variable)</td>
</tr>
<tr>
<td>thr.const</td>
<td>smoothing parameter for the multiresolution criterion (should be approximately 2.5)</td>
</tr>
<tr>
<td>verbose</td>
<td>logical, if T progress (for each iteration) is illustrated graphically</td>
</tr>
<tr>
<td>bandwidth</td>
<td>if set to a positive value the specified bandwidth is used instead of the multiresolution criterion.</td>
</tr>
<tr>
<td>sigma</td>
<td>if set to a positive value sigma the standard deviation is set to sigma and not estimated from the data</td>
</tr>
<tr>
<td>localsqueezing</td>
<td>logical, if T (default) the bandwidth is changed locally.</td>
</tr>
<tr>
<td>squeezing.factor</td>
<td>The amount of decrement applied to the bandwidths</td>
</tr>
<tr>
<td>DYADIC</td>
<td>If TRUE the multiresolution constraints are only checked on dyadic intervals.</td>
</tr>
<tr>
<td>firstlambda</td>
<td>Initial value of lambda’s for local or global squeezing.</td>
</tr>
<tr>
<td>smqeps</td>
<td>Distance between the (equally-spaced) time points.</td>
</tr>
<tr>
<td>fsign</td>
<td>Monotonicity constraints, vector of size n-1 of -1, 0 and 1’s. If fsign[i]==1, then fhat[i+1] &gt;= fhat[i]. If fsign[i]==-1, then fhat[i+1] &lt;= fhat[i]. Otherwise no constraint at this position.</td>
</tr>
<tr>
<td>gensign</td>
<td>If TRUE the taut string method is used to automatically produce suitable monotonicity constraints.</td>
</tr>
<tr>
<td>tolerance</td>
<td>Precision for the nested intervals for solving the minimisation problem.</td>
</tr>
<tr>
<td>...</td>
<td>Passed to the plot command if verbose=T.</td>
</tr>
</tbody>
</table>

**Value**

A list with components

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>The approximation of the given data</td>
</tr>
<tr>
<td>nmax</td>
<td>Number of local extreme values</td>
</tr>
<tr>
<td>sigma</td>
<td>Standard deviation used</td>
</tr>
</tbody>
</table>
Author(s)

Arne Kovac <A.Kovac@bristol.ac.uk>

References


See Also

pmreg, mintvmon, l1pmreg, pmden, pmspec

Examples

data(djdata)
par(mfrow=c(2,2))
plot(djblocks,col="grey")
lines(smqreg(djblocks)$y,col="red")
plot(djbumps,col="grey")
lines(smqreg(djbumps)$y,col="red")
plot(djheavisine,col="grey")
lines(smqreg(djheavisine)$y,col="red")
plot(djdoppler,col="grey")
lines(smqreg(djdoppler)$y,col="red")
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