Package 'MonoPoly'

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Type Package

Title Functions to fit monotone polynomials

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Description Package contains functions to fit monotone polynomials to data

License GPL (>=2)

Depends R (>= 2.15.0), quadprog

LazyData yes

Encoding latin1

R topics documented:

coef.monpol *Extract Model Coefficients*

Description

coef method for 'monpol' objects.

Usage

```
## S3 method for class monpol
coef(object, scale = c("original", "fitted"), type = c("beta", "monpar"), ...)
```

Arguments

object	A 'monpol' object.
scale	Extract coefficients on the original scale of the data or on the scale used during fitting.
type	Extract coefficients in the 'beta' parameterisation of the polynomial or for the monotone parameterisation used in the algorithm.
...	Additional optionals arguments. At present no optional arguments are used.

Details

This is the coef method for objects inheriting from class "monpol".

Value

Coefficients extracted from the model object object.

Author(s)

Berwin A Turlach

evalPol *Evaluating Polynomials*

Description

Function to evaluate polynomials in a numerical robust way using the Horner scheme

Usage

```
evalPol(x, beta)
```

Arguments

x	numerical values at which to evaluate polynomials, can be provided in a vector, matrix, array or data frame
beta	numerical vector containing the coefficient of the polynomial

Value

The result of evaluating the polynomial at the values in x, returned in the same dimension as x has.

Author(s)

Berwin A Turlach

Examples

```
## The function is currently defined as
function (x, beta)
{
    res <- 0
    for(bi in rev(beta))
      res <- res*x + bi
    res
  }

beta <- c(1,2,1)

x <- 0:10
evalPol(x, beta)
str(evalPol(x, beta))

x <- cbind(0:10, 10:0)
evalPol(x, beta)
str(evalPol(x, beta))


x <- data.frame(x=0:10, y=10:0)
evalPol(x, beta)
str(evalPol(x, beta))
```

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fitted.monpol *Extract Model Fitted Values*

Description

fitted method for 'monpol' objects.

Usage

```
## S3 method for class monpol
fitted(object, scale = c("original", "fitted"), ...)
```

Arguments

object	A 'monpol' object.
scale	Extract fitted values on the original scale of the data or on the scale used during fitting.
...	Additional optionals arguments. At present no optional arguments are used.

Details

This is the `fitted` method for objects inheriting from class `"monpol"`.

Value

Fitted values extracted from the model object `object`.

Author(s)

Berwin A Turlach

`hawkins` *hawkins*

Description

This data gives x and y variables for the data published in Hawkins' 1994 article. This data was originally simulated from a standard cubic polynomial with equally spaced x values between -1 and 1.

Format

A data frame with 50 simulated observations on the following 2 variables.

`y` a numeric vector

`x` a numeric vector

References

Hawkins, D. M. (1994) Fitting monotonic polynomials to data. *Computational Statistics* **9**(3): 233–247.

Examples

```
data(hawkins)
```

`model.matrix.monpol` *Construct Design Matrices*

Description

`model.matrix` creates a design (or model) matrix for 'monpol' objects.

Usage

```
## S3 method for class monpol
model.matrix(object, scale = c("original", "fitted"), ...)
```

Arguments

object	A 'monpol' object.
scale	Create design matrix on the original scale of the data or on the scale used during fitting.
...	Additional optionals arguments. At present no optional arguments are used.

Details

This is the model.matrix method for objects inheriting from class "monpol".

Value

Design matrix created from the model object object.

Author(s)

Berwin A Turlach

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monpol *Monotone Polynomials*

Description

Determine the least-squares estimates of the parameters of a monotone polynomial

Usage

```
monpol(formula, data, subset, weights, na.action,
       degree=3, K, start, trace = FALSE, plot.it = FALSE,
       control = monpol.control(),
       algorithm = c("Full", "Hawkins", "BCD", "CD1", "CD2"),
       ptype = c("Elphinstone", "EHH", "Penttila"),
       ctype = c("cge0", "c2"),
       model=FALSE, x=FALSE, y=FALSE)
```

Arguments

formula	an object of class "formula" (or one that can be coerced to that class): a symbolic description of the model to be fitted.
data	an optional data frame, list or environment (or object coercible by as.data.frame to a data frame) containing the variables in the model. If not found in data, the variables are taken from environment(formula), typically the environment from which monpol is called.
subset	an optional vector specifying a subset of observations to be used in the fitting process.
weights	an optional vector of weights to be used in the fitting process. Should be NULL or a numeric vector.

na.action	a function which indicates what should happen when the data contain NAs. The default is set by the na.action setting of options, and is na.fail if that is unset. The 'factory-fresh' default is na.omit. Another possible value is NULL, no action. Value na.exclude can be useful.
degree	a polynomail with highest power equal to degree will be fitted to the data.
K	a polynomial with highest power $2K + 1$ will be fitted to the data.
start	optional starting value for the iterative fitting.
trace	print out information about the progress of the interative fitting at the start and then every trace iterations.
plot.it	plot the data and initial fit, then plot current fit every plot.it iterations.
control	settings that control the iterative fit; see monpol.control for details.
algorithm	algorithm to be used. It is recommended to use either 'Full' or 'Hawkins'; see paper in 'References' for details.
ptype	parameterisation to be used; see paper in 'References' for details.
ctype	parameterisation to be used; see paper in 'References' for details.
model, x, y	logicals. If TRUE the corresponding components of the fit (the model frame, the model matrix, the response, the QR decomposition) are returned.

Details

A monpol object is a type of fitted model object. it has methods for the generic function coef, fitted, formula, logLik, model.matrix, predict, print, residuals.

Value

monpol returns an object of class "monpol"

Author(s)

Berwin A Turlach

References

Murray, K., Mueller, S. and Turlach, B.A. (2013). Revisiting fitting monotone polynomials to data, *Computational Statistics* **28**(5): 1989–2005. Doi:10.1007/s00180-012-0390-5.

Examples

```
monpol(y~x, w0)
```

monpol.control *Control the Iterations in monpol*

Description

Allow the user to set some characteristics of the monpol monotone polynomial fitting algorithm.

Usage

```
monpol.control(maxiter = 1000, tol = 1e-05,
               tol1=1e-10, tol2=1e-07, tolqr=1e-07)
```

Arguments

maxiter	A positive integer specifying the maximum number of iterations allowed, used in all algorithms.
tol	A positive numeric value specifying an absolute tolerance for determining whether entries in the gradient are zero for algorithms 'Full', 'BCD', 'CD1' and 'CD2'.
tol1	A positive numeric value, used in algorithm 'Hawkins'. Any number not smaller than -tol1 is deemed to be non-negative.
tol2	A positive numeric value, used in algorithm 'Hawkins'. Any number whose absolute value is smaller than tol2 is taken to be zero.
tolqr	A positive numeric value, used in algorithm 'Hawkins' as tolerance for the QR factorisation of the design matrix.

Value

A list with exactly five components:

maxiter

tol

tol1

tol2

tolqr

with meanings as explained under 'Arguments'.

Author(s)

Berwin A Turlach

See Also

monpol, monpol.fit, qr

Examples

```
monpol.control(maxiter = 2000)
monpol.control(tolqr = 1e-10)
```

monpol.fit *Monotone Polynomials*

Description

This is the basic computing engine called by monpol used to fit monotonic polynomials. These should usually *not* be used directly unless by experienced users.

Usage

```
monpol.fit(x, y, w, K=1, start, trace = FALSE, plot.it = FALSE,
           control = monpol.control(),
           algorithm = c("Full", "Hawkins", "BCD", "CD1", "CD2"),
           ptype = c("Elphinstone", "EHH", "Penttila"),
           ctype = c("cge0", "c2"))
```

Arguments

x	vector containing the observed values for the regressor variable.
y	vector containing the observed values for the response variable; should be of same length as x.
w	optional vector of weights; should be of the same length as x if specified.
K	a polynomial with highest power $2K + 1$ will be fitted to the data.
start	optional starting value for the iterative fitting.
trace	print out information about the progress of the interative fitting at the start and then every trace iterations.
plot.it	plot the data and initial fit, then plot current fit every plot.it iterations.
control	settings that control the iterative fit; see monpol.control for details.
algorithm	algorithm to be used; see monpol for details.
ptype	parameterisation to be used; see monpol for details.
ctype	parameterisation to be used; see monpol for details.

Value

a list with components

par	the fitted parameters.
grad	the gradient of the objective function at the fitted parameters.
beta	the coefficients of the fitted polynomial in the 'beta' parameterisation; on the fitted scale.
RSS	the value of the objective function; on the fitted scale.
niter	number of iterations.
converged	indicates whether algorithm has converged.
ptype	input parameter ptype.
ctype	input parameter cptype.

beta.raw	the coefficients of the fitted polynomial in the 'beta' parameterisation; on the original scale.
fitted.values	the fitted values; on the fitted scale.
residuals	the residuals; on the fitted scale.
K	input parameter K.
minx	the minimum value in the vector x.
sclx	the difference between the maximum and minimum values in the vector x.
miny	the minimum value in the vector y.
scly	the difference between the maximum and minimum values in the vector y.
algorithm	input paramater algorithm.

Author(s)

Berwin A Turlach

References

Murray, K., Mueller, S. and Turlach, B.A. (2013). Revisiting fitting monotone polynomials to data, *Computational Statistics* **28**(5): 1989–2005. Doi:10.1007/s00180-012-0390-5.

See Also

monpol which you should use for fitting monotonic polynomials unless you know better.

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predict.monpol *Predicting from Monotone Polynomial Fits*

Description

predict.monpol produces predicted values, obtained by evaluating the monotone polynomial in the frame newdata.

Usage

```
## S3 method for class monpol
predict(object, newdata, scale = c("original", "fitted"), ...)
```

Arguments

object	A 'monpol' object.
newdata	A named list or data frame in which to look for variables with which to predict. If newdata is missing the fitted values at the original data points are returned.
scale	Predict values on the original scale of the data or on the scale used during fitting. Data in newdata is assumed to be on the indicated scale.
...	Additional optionals arguments. At present no optional arguments are used.

Details

This is the predict method for objects inheriting from class "monpol".

Value

`predict.monpol` produces a vector of predictions.

Author(s)

Berwin A Turlach

`print.monpol` *Printing Monotone Polynomials*

Description

`print` method for 'monpol' objects.

Usage

```
## S3 method for class monpol
print(x, digits = max(3, getOption("digits") - 3), ...)
```

Arguments

`x`	A 'monpol' object.
`digits`	minimal number of *significant* digits, see `print.default`.
`...`	Additional optionals arguments. At present only those additaion arguments for coef.monpol are used.

Details

This is the `print` method for objects inheriting from class `"monpol"`.

Value

`x` returned invisibly.

Author(s)

Berwin A Turlach

residuals.monpol *Extract Model Residuals*

Description

`residuals` method for 'monpol' objects.

Usage

```
## S3 method for class monpol
residuals(object, scale = c("original", "fitted"), ...)
```

Arguments

`object`	A 'monpol' object.
`scale`	Extract residuals on the original scale of the data or on the scale used during fitting.
`...`	Additional optionals arguments. At present no optional arguments are used.

Details

This is the `residuals` method for objects inheriting from class `"monpol"`.

Value

Residuals extracted from the model object `object`.

Author(s)

Berwin A Turlach

w0 *Simulated w0 data used in Murray et al. (2013)*

Description

This data set gives simulated data from the function

$$y = 0.1x^3 + e$$

for $e \sim N(0, 0.01^2)$ and x evenly spaced between -1 and 1.

Format

A data frame with 21 observations on the following 2 variables.

`y` a numeric vector

`x` a numeric vector

Source

Murray, K., Mueller, S. and Turlach, B.A. (2013). Revisiting fitting monotone polynomials to data, *Computational Statistics* **28**(5): 1989–2005. Doi:10.1007/s00180-012-0390-5.

Examples

```
str(w0)
plot(y~x, w0)
monpol(y~x, w0)
```

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w2 *Simulated w2 data used in Murray et al. (2013)*

Description

Simulated data from the function

$$y_{ij} = 4\pi - x_i + \cos(x_i - \frac{\pi}{2}) + e_{ij}$$

for $x_i = 0, 1, \ldots, 12$; $n_i = 5$ for $i = 0$ and $n_i = 3$ otherwise; $e_{ij} \sim N(0, 0.5^2)$

Format

A data frame with 41 observations on the following 2 variables.

`y` a numeric vector

`x` a numeric vector

Source

Murray, K., Mueller, S. and Turlach, B.A. (2013). Revisiting fitting monotone polynomials to data, *Computational Statistics* **28**(5): 1989–2005. Doi:10.1007/s00180-012-0390-5.

Examples

```
str(w2)
plot(y~x, w2)
monpol(y~x, w2)
monpol(y~x, w2, K=2)
```

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