Package ‘L1pack’

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Author Felipe Osorio [aut, cre] (<https://orcid.org/0000-0002-4675-5201>),
Tymoteusz Wolodzko [aut]
Maintainer Felipe Osorio <felipe.osorios@usm.cl>
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confint.lad ......................................................... 2
l1fit .............................................................. 3
lad ............................................................... 4
lad.fit ........................................................... 5
lad.fit-methods .................................................. 6
Laplace ............................................................ 7
mLaplace ......................................................... 8
simulate.lad ....................................................... 10
vcov.lad ......................................................... 11
Description

Computes confidence intervals for one or more parameters in a fitted model corresponding to a \texttt{lad} object.

Usage

\begin{verbatim}
## S3 method for class 'lad'
confint(object, parm, level = 0.95, ...)
\end{verbatim}

Arguments

- \texttt{object}: a fitted model object.
- \texttt{parm}: a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. If missing, all parameters are considered.
- \texttt{level}: the confidence level required.
- \texttt{...}: additional argument(s) for methods.

Details

\texttt{confint} is a generic function. Confidence intervals associated to \texttt{lad} objects are asymptotic, and needs suitable \texttt{coef} and \texttt{vcov} methods to be available.

Value

A matrix (or vector) with columns giving lower and upper confidence limits for each parameter. These will be labelled as \((1\text{-}\text{level})/2\) and \(1 - (1\text{-}\text{level})/2\) in \% (by default 2.5\% and 97.5\%).

See Also

\texttt{confint.glm} and \texttt{confint.nls} in package \texttt{MASS}.

Examples

\begin{verbatim}
fm <- lad(stack.loss ~ ., data = stackloss, method = "BR")
confint(fm) # based on asymptotic normality
\end{verbatim}
l1fit

Minimum absolute residual (L1) regression

Description

Performs an L1 regression on a matrix of explanatory variables and a vector of responses.

Usage

l1fit(x, y, intercept = TRUE, tolerance = 1e-07, print.it = TRUE)

Arguments

x vector or matrix of explanatory variables. Each row corresponds to an observation and each column to a variable. The number of rows of x should equal the number of data values in y, and there should be fewer columns than rows. Missing values are not allowed.
y numeric vector containing the response. Missing values are not allowed.
intercept logical flag. If TRUE, an intercept term is included in the regression model.
tolerance numerical value used to test for singularity in the regression.
print.it logical flag. If TRUE, then warnings about non-unique solutions and rank deficiency are given.

Details

The Barrodale-Roberts algorithm, which is a specialized linear programming algorithm, is used.

Value

list defining the regression (compare with function lsfit).

coefficients vector of coefficients.
residuals residuals from the fit.
message vector of one or two character strings stating whether a non-unique solution is possible, or if the x matrix was found to be rank deficient.

References

Examples

```r
l1fit(stack.x, stack.loss)
```

---

### Least absolute deviations regression

**Description**

This function is used to fit linear models considering Laplace errors.

**Usage**

```r
lad(formula, data, subset, na.action, method = "BR", tol = 1e-7, maxiter = 200, model = TRUE, x = FALSE, y = FALSE, contrasts = NULL)
```

**Arguments**

- `formula`: an object of class "formula": a symbolic description of the model to be fitted.
- `data`: an optional 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 `lad` is called.
- `subset`: an optional expression indicating the subset of the rows of data that should be used in the fit.
- `na.action`: a function that indicates what should happen when the data contain NAs.
- `method`: character string specifying the fitting method to be used; the options are "BR" Barrodale and Roberts’ method (the default) and "EM" for an EM algorithm using IRLS.
- `tol`: the relative tolerance for the iterative algorithm. Default is `tol = 1e-7`.
- `maxiter`: The maximum number of iterations for the EM method. Default to 200.
- `model, x, y`: logicals. If TRUE the corresponding components of the fit (the model frame, the model matrix, the response) are returned.
- `contrasts`: an optional list. See the contrasts.arg of model.matrix.default.

**Value**

An object of class `lad` representing the linear model fit. Generic function `print`, show the results of the fit.

The functions print and summary are used to obtain and print a summary of the results. The generic accessor functions coefficients, fitted.values and residuals extract various useful features of the value returned by `lad`.

**Author(s)**

The design was inspired by the R function `lm`. 
References


Examples

```r
fm <- lad(stack.loss ~ ., data = stackloss, method = "BR")
summary(fm)
```

---

**lad.fit**

* Fitter functions for least absolute deviation (LAD) regression

**Description**

This function is a switcher among various numerical fitting functions (*lad.fit.BR*, and *lad.fit.EM*). The argument method does the switching: "BR" for *lad.fit.BR*, etc. This should usually not be used directly unless by experienced users.

**Usage**

```r
lad.fit(x, y, method = "BR", tol = 1e-7, maxiter = 200)
```

**Arguments**

- **x** design matrix of dimension $n \times p$.
- **y** vector of observations of length $n$.
- **method** currently, methods "BR" (default), and "EM" are supported.
- **tol** the relative tolerance for the iterative algorithm. Default is tol = 1e-7.
- **maxiter** The maximum number of iterations for the EM method. Default to 200.

**Value**

A list with components:

- **coefficients** a named vector of coefficients.
- **scale** final scale estimate of the random error.
- **residuals** the residuals, that is response minus fitted values.
- **fitted.values** the fitted values.
- **SAD** the sum of absolute deviations.
- **weights** estimated EM weights.
- **basic** basic observations, that is observations with zero residuals.
- **logLik** the log-likelihood at convergence.
See Also

lad.fit.BR, lad.fit.EM.

Examples

```r
x <- cbind(1, stack.x)
fm <- lad.fit(x, stack.loss, method = "BR")
fm
```

lad.fit-methods  
Fit a least absolute deviation (LAD) regression model

Description

Fits a linear model using LAD methods, returning the bare minimum computations.

Usage

```r
lad.fit.BR(x, y, tol = 1e-7)
lad.fit.EM(x, y, tol = 1e-7, maxiter = 200)
```

Arguments

- `x, y` numeric vectors or matrices for the predictors and the response in a linear model. Typically, but not necessarily, `x` will be constructed by one of the fitting functions.
- `tol` the relative tolerance for the iterative algorithm. Default is `tol = 1e-7`.
- `maxiter` The maximum number of iterations for the EM method. Default to 200.

Value

The bare bones of a `lad` object: the coefficients, residuals, fitted values, and some information used by `summary.lad`.

See Also

`lad, lad.fit, lm`

Examples

```r
x <- cbind(1, stack.x)
z <- lad.fit.BR(x, stack.loss)
z
```
The Laplace distribution

Description
Density, distribution function, quantile function and random generation for the Laplace distribution with location parameter location and scale parameter scale.

Usage

dlaplace(x, location = 0, scale = 1, log = FALSE)
plaplace(q, location = 0, scale = 1, lower.tail = TRUE, log.p = FALSE)
qlaplace(p, location = 0, scale = 1, lower.tail = TRUE, log.p = FALSE)
rlaplace(n, location = 0, scale = 1)

Arguments

x, q
vector of quantiles.

p
vector of probabilities.

n
number of observations. If length(n) > 1, the length is taken to be the number required.

location
location parameter μ, which is the mean.

scale
scale parameter φ. Scale must be positive.

log, log.p
logical; if TRUE, probabilities p are given as \( \log(p) \).

lower.tail
logical; if TRUE (default), probabilities are \( P[X \leq x] \), otherwise, \( P[X > x] \).

Details

If location or scale are not specified, they assume the default values of 0 and 1 respectively.

The Laplace distribution with location \( \mu \) and scale \( \phi \) has density

\[
f(x) = \frac{1}{\sqrt{2}\phi} \exp(-\sqrt{2}|x - \mu|/\phi),
\]

where \( -\infty < y < \infty, -\infty < \mu < \infty \) and \( \phi > 0 \). The mean is \( \mu \) and the variance is \( \phi^2 \).

The cumulative distribution function, assumes the form

\[
F(x) = \begin{cases} 
\frac{1}{2} \exp(\sqrt{2}(x - \mu)/\phi) & x < \mu, \\
1 - \frac{1}{2} \exp(-\sqrt{2}(x - \mu)/\phi) & x \geq \mu. 
\end{cases}
\]

The quantile function, is given by

\[
F^{-1}(p) = \begin{cases} 
\mu + \frac{\phi}{\sqrt{2}} \log(2p) & p < 0.5, \\
\mu - \frac{\phi}{\sqrt{2}} \log(2(1-p)) & p \geq 0.5. 
\end{cases}
\]
Value

dlaplace, plaplace, and qlaplace are respectively the density, distribution function and quantile function of the Laplace distribution. rlaplace generates random deviates from the Laplace.

The length of the result is determined by n for rlaplace, and is the maximum of the lengths of the numerical parameters for the other functions.

Author(s)

Felipe Osorio and Tymoteusz Wolodzko

References


See Also

Distributions for other standard distributions and rmLaplace for the random generation from the multivariate Laplace distribution.

Examples

```r
x <- rlaplace(1000)
## Q-Q plot for Laplace data against true theoretical distribution:
qqplot(qlaplace(ppoints(1000)), x, main = "Laplace Q-Q plot",
     xlab = "Theoretical quantiles", ylab = "Sample quantiles")
abline(c(0,1), col = "red", lwd = 2)
```

---

**mLaplace**

_Multivariate Laplace distribution_

Description

These functions provide the density and random number generation from the multivariate Laplace distribution.

Usage

dmLaplace(x, center = rep(0, nrow(Scatter)), Scatter = diag(length(center)), log = FALSE)
rmLaplace(n = 1, center = rep(0, nrow(Scatter)), Scatter = diag(length(center)))
**Arguments**

- **x**: vector or matrix of data.
- **n**: the number of samples requested.
- **center**: a $k \times 1$ vector giving the locations.
- **Scatter**: a $k \times k$ positive-definite dispersion matrix.
- **log**: logical; if TRUE, the logarithm of the density function is returned.

**Details**

The multivariate Laplace distribution is a multidimensional extension of the one-dimensional or univariate symmetric Laplace distribution. There are multiple forms of the multivariate Laplace distribution. Here, a particular case of the multivariate power exponential distribution introduced by Gomez et al. (1998) is considered.

The multivariate Laplace distribution with location $\mu = \text{center}$ and $\Sigma = \text{Scatter}$ has density

$$f(x) = \frac{\Gamma(k/2)}{\pi^{k/2} \Gamma(k/2 + 1)} \left| \Sigma \right|^{-1/2} \exp \left\{ -\frac{1}{2} [(x - \mu)^T \Sigma^{-1} (x - \mu)]^{1/2} \right\}.$$  

The function `rmLaplace` is an interface to C routines, which make calls to subroutines from LAPACK. The matrix decomposition is internally done using the Cholesky decomposition. If `Scatter` is not non-negative definite then there will be a warning message.

**Value**

If $n = 1$ a vector of the same length as `center`, otherwise a matrix of $n$ rows of random vectors.

**References**


**Examples**

```r
# dispersion parameters
Scatter <- matrix(c(1,.5,.5,1), ncol = 2)
Scatter

# generate the sample
y <- rmLaplace(n = 2000, Scatter = Scatter)

# scatterplot of a random bivariate Laplace sample with center
# vector zero and scale matrix ‘Scatter’
par(pty = "s")
plot(y, xlab = "", ylab = ")
title("bivariate Laplace sample", font.main = 1)
```
simulate.lad

Simulate responses from lad models

Description

Simulate one or more responses from the distribution corresponding to a fitted lad object.

Usage

```r
## S3 method for class 'lad'
simulate(object, nsim = 1, seed = NULL, ...)
```

Arguments

- `object`: an object representing a fitted model.
- `nsim`: number of response vectors to simulate. Defaults to 1.
- `seed`: an object specifying if and how the random number generator should be initialized (‘seeded’). For the “lad” method, either `NULL` or an integer that will be used in a call to `set.seed` before simulating the response vectors. If set, the value is saved as the “seed” attribute of the returned value. The default, `NULL` will not change the random generator state, and return `.Random.seed` as the “seed” attribute, see ‘Value’.
- `...`: additional optional arguments.

Value

For the “lad” method, the result is a data frame with an attribute “seed”. If argument `seed` is `NULL`, the attribute is the value of `.Random.seed` before the simulation was started.

Author(s)

Tymoteusz Wołodzko and Felipe Osorio

Examples

```r
fm <- lad(stack.loss ~ ., data = stackloss)
sm <- simulate(fm, nsim = 4)
```
vcov.lad

Calculate variance-covariance matrix from lad models

Description

Returns the variance-covariance matrix of the main parameters of a fitted model for lad objects. The “main” parameters of model correspond to those returned by coef, and typically do not contain a nuisance scale parameter.

Usage

## S3 method for class 'lad'
vcov(object, ...)

Arguments

object an object representing a fitted model.
...

additional arguments for method functions.

Value

A matrix of the estimated covariances between the parameter estimates in the linear regression model. This should have row and column names corresponding to the parameter names given by the coef method.
Index

* datagen
  simulate.lad, 10
* distribution
  Laplace, 7
  mLaplace, 8
* models
  confint.lad, 2
  simulate.lad, 10
  vcov.lad, 11
* multivariate
  mLaplace, 8
* regression
  lsfit, 3
  lad, 4
  l1fit, 5
  l1fit-methods, 6
.Random.seed, 10
  coef, 2, 11
  confint.glm, 2
  confint.lad, 2
  confint.nls, 2

Distributions, 8
dlaplace (Laplace), 7
dmLaplace (mLaplace), 8
  l1fit, 3
  lad, 4, 6
  lad.fit, 5, 6
  lad.fit-methods, 6
  lad.fit.BR, 5, 6
  lad.fit.BR (lad.fit-methods), 6
  lad.fit.EM, 5, 6
  lad.fit.EM (lad.fit-methods), 6
  Laplace, 7
  list, 5
  lm, 4, 6
  lsfit, 3
  mLaplace, 8
plaplace (Laplace), 7
qlaplace (Laplace), 7
rlaplace (Laplace), 7
rmLaplace, 8
rmLaplace (mLaplace), 8
simulate.lad, 10
vcov, 2
vcov.lad, 11