# Package 'pyinit'

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**Type** Package

**Title** Pena-Yohai Initial Estimator for Robust S-Regression

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**Description** Deterministic Pena-Yohai initial estimator for robust S estimators of regression. The procedure is described in detail in Pena, D., & Yohai, V. (1999) <doi:10.2307/2670164>.

**Imports** robustbase

**Suggests** testthat

**License** GPL (>= 2)

**URL** https://github.com/dakep/pyinit

**BugReports** https://github.com/dakep/pyinit/issues

**NeedsCompilation** yes

**Biarch** true

**Copyright** See the file COPYRIGHTS for copyright details on some of the functions.

**RoxygenNote** 7.1.1

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**Repository** CRAN

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`mscale` *Robust M-estimate of Scale*

## Description

Compute the M-estimate of scale using the MAD as initial estimate.

## Usage

```
mscale(
  x,
  delta = 0.5,
  rho = c("bisquare", "huber", "gauss"),
  cc,
  eps = 1e-08,
  maxit = 200
)
```

## Arguments

| | |
|---|---|
| `x` | numeric vector. |
| `delta` | desired value for the right-hand side of the M-estimation equation. |
| `rho` | rho function to use in the M-estimation equation. Valid options are `bisquare`, `huber` and `gauss`. |
| `cc` | non-negative constant for the chosen rho function. If missing, it will be chosen such that the expected value of the rho function under the normal model is equal to `delta`. |
| `eps` | threshold for convergence. Defaults to `1e-8`. |
| `maxit` | maximum number of iterations. Defaults to `200`. |

## Details

This solves the M-estimation equation given by

$$\sum_{i=1}^{n} \rho(x_i/s_n; cc) = ndelta$$

All `NA` values in `x` are removed before calculating the scale.

## Value

Numeric vector of length one containing the solution `s_n` to the equation above.

pyinit *PY (Pena-Yohai) initial estimates for S-estimates of regression*

## Description

Computes the PY initial estimates for S-estimates of regression.

## Usage

```
pyinit(
  x,
  y,
  intercept = TRUE,
  delta = 0.5,
  cc,
  maxit = 10,
  psc_keep,
  resid_keep_method = c("threshold", "proportion"),
  resid_keep_prop,
  resid_keep_thresh,
  eps = 1e-08,
  mscale_maxit = 200,
  mscale_tol = eps,
  mscale_rho_fun = c("bisquare", "huber", "gauss")
)
```

## Arguments

| | |
|---|---|
| x | a matrix with the data, each observation in a row. |
| y | the response vector. |
| intercept | logical, should an intercept be included in the model? Defaults to TRUE. |
| delta, cc | parameters for the M-scale estimator equation. If cc is missing it will be set to yield consistency under the Normal model for the given delta (right-hand side of the M-scale equation). |
| maxit | the maximum number of iterations to perform. |
| psc_keep | proportion of observations to keep based on PSCs. |
| resid_keep_method | how to clean the data based on large residuals. If "threshold", all observations with scaled residuals larger than resid_keep_thresh will be removed (resid_keep_thresh corresponds to the constant $C_1$ from equation (21) in Pena & Yohai (1999). If "proportion", observations with the largest resid_keep_prop residuals will be removed. |
| resid_keep_prop, resid_keep_thresh | see parameter resid_keep_method for details. |
| eps | the relative tolerance for convergence. Defaults to 1e-8. |

| | |
|---|---|
| mscale_maxit | maximum number of iterations allowed for the M-scale algorithm. Defaults to 200. |
| mscale_tol | convergence threshold for the m-scale |
| mscale_rho_fun | A string containing the name of the rho function to use for the M-scale. Valid options are bisquare, huber and gauss. |

## Value

| | |
|---|---|
| coefficients | numeric matrix with coefficient vectors in columns. These are regression estimators based on "cleaned" subsets of the data. The M-scales of the corresponding residuals are returned in the entry objective. The regression coefficients with smallest estimated residual scale is in the first column, but the others need not be ordered. |
| objective | vector of values of the M-scale estimate of the residuals associated with each vector of regression coefficients in the columns of coefficients. |

## References

Pena, D., & Yohai, V.. (1999). A Fast Procedure for Outlier Diagnostics in Large Regression Problems. *Journal of the American Statistical Association*, 94(446), 434-445. <doi:10.2307/2670164>

## Examples

```
# generate a simple synthetic data set for a linear regression model
# with true regression coefficients all equal to one "(1, 1, 1, 1, 1)"
set.seed(123)
x <- matrix(rnorm(100*4), 100, 4)
y <- rnorm(100) + rowSums(x) + 1
# add masked outliers
a <- svd(var(x))$v[,4]
x <- rbind(x, t(outer(a, rnorm(20, mean=4, sd=1))))
y <- c(y, rnorm(20, mean=-2, sd=.2))

# these outliers are difficult to find
plot(lm(y~x), ask=FALSE)

# use pyinit to obtain estimated regression coefficients
tmp <- pyinit(x=x, y=y, resid_keep_method='proportion', psc_keep = .5, resid_keep_prop=.5)
# the vector of regression coefficients with smallest residuals scale
# is returned in the first column of the "coefficients" element
tmp$coefficients[,1]
# compare that with the LS estimator on the clean data
coef(lm(y~x, subset=1:100))
# compare it with the LS estimator on the full data
coef(lm(y~x))
```

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