Package 'revss'

June 20, 2024

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revss-package	*Robust Estimation in Very Small Samples*

Description

Implements the estimation techniques described in Rousseeuw & Verboven (2002) <doi:10.1016/S0167-9473(02)00078-6> for the location and scale of very small samples.

Details

The DESCRIPTION file:

Package:	revss
Type:	Package
Title:	Robust Estimation in Very Small Samples
Version:	2.0.0
Date:	2024-06-20
Authors@R:	c(person(given = "Avraham", family = "Adler", role = c("aut", "cph", "cre"), email = "Avraham.Adler@
Description:	Implements the estimation techniques described in Rousseeuw & Verboven (2002) <doi:10.1016/S0167
License:	BSD_2_clause + file LICENSE
URL:	https://github.com/aadler/revss
BugReports:	https://github.com/aadler/revss/issues
Encoding:	UTF-8
Suggests:	covr, tinytest
Imports:	stats
NeedsCompilation:	no
Author:	Avraham Adler [aut, cph, cre] (<https://orcid.org/0000-0002-3039-0703>)
Maintainer:	Avraham Adler <Avraham.Adler@gmail.com>

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```

Author(s)

Avraham Adler [aut, cph, cre] (<https://orcid.org/0000-0002-3039-0703>)

Maintainer: Avraham Adler <Avraham.Adler@gmail.com>

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adm   *Average Distance to the Median*

Description

Compute the mean absolute deviation from the median, and (by default) adjust by a factor for asymptotically normal consistency.

Usage

```
adm(x, center = median(x), constant = sqrt(pi / 2), na.rm = FALSE)
```

Arguments

x	A numeric vector.
center	The central value from which to measure the average distance. Defaults to the median.
constant	A scale factor for asymptotic normality defaulting to $\sqrt{\frac{\pi}{2}}$.
na.rm	If TRUE then NA values are stripped from x before computation takes place.

Details

Computes the average distance, as an absolute value, between each observation and the central observation—usually the median. In statistical literature this is also called the **mean absolute deviation around the median**. Unfortunately, this shares the same acronym as the median absolute deviation (MAD), which is the median equivalent of this function.

General practice is to adjust the factor for asymptotically normal consistency. In large samples this approaches $\sqrt{\frac{2}{\pi}}$. The default is to multiple the results by the reciprocal. However, it is important to note that this asymptotic behavior may **not** hold with the smaller sample sizes for which this package is intended.

If na.rm is TRUE then NA values are stripped from x before computation takes place. If this is not done then an NA value in x will cause mad to return NA.

Value

$$ADM = C\frac{1}{n}\sum_{i=1}^{n}|x_i - \text{center}(x)|$$

where C is the consistency constant and center defaults to median.

Author(s)

Avraham Adler <Avraham.Adler@gmail.com>

References

Nair, K. R. (1947) A Note on the Mean Deviation from the Median. *Biometrika*, **34**, 3/4, 360–362. doi:10.2307/2332448

See Also

mad for the median absolute deviation from the median

Examples

```
adm(c(1:9))
x <- c(1,2,3,5,7,8)
c(adm(x), adm(x, constant = 1))
```

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robLoc	*Robust Estimate of Location*

Description

Compute the robust estimate of location for very small samples.

Usage

```
robLoc(x, scale = NULL, na.rm = FALSE, maxit = 80L, tol = sqrt(.Machine$double.eps))
```

Arguments

x	A numeric vector.
scale	The scale, if known, can be used to enhance the estimate for the location; defaults to unknown.
na.rm	If TRUE then NA values are stripped from x before computation takes place.
maxit	The maximum number of iterations; defaults to 80.
tol	The desired accuracy.

Details

Computes the M-estimator for location using the logistic ψ function of Rousseeuw & Verboven (2002, 4.1). If there are three or fewer entries, the function defaults to the median.

If the scale is known and passed through scale, the algorithm uses the suggestion in Rousseeuw & Verboven section 5 (2002), substituting the known scale for the mad.

If na.rm is TRUE then NA values are stripped from x before computation takes place. If this is not done then an NA value in x will cause mad to return NA.

The tolerance and number of iterations are similar to those in existing base R functions.

Rousseeuw & Verboven suggest using this function when there are 3–8 samples. It is implied that having more than 8 samples allows the use of more standard estimators.

Value

Solves for the robust estimate of location, T_n, which is the solution to

$$\frac{1}{n}\sum_{i=1}^{n}\psi\left(\frac{x_i - T_n}{S_n}\right) = 0$$

where S_n is fixed at `mad(x)`. The ψ-function selected by Rousseeuw & Verboven is:

$$\psi_{log}(x) = \frac{e^x - 1}{e^x + 1}$$

This is equivalent to `2 * plogis(x) - 1`.

Author(s)

Avraham Adler `<Avraham.Adler@gmail.com>`

References

Rousseeuw, Peter J. and Verboven, Sabine (2002) Robust estimation in very small samples. *Computational Statistics & Data Analysis*, **40**, (4), 741–758. [doi:10.1016/S01679473(02)000786](doi:10.1016/S01679473(02)000786)

See Also

median

Examples

```
robLoc(c(1:9))
x <- c(1,2,3,5,7,8)
robLoc(x)
```

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robScale   *Robust Estimate of Scale*

Description

Compute the robust estimate of scale for very small samples.

Usage

```
robScale(x, loc = NULL, implbound = 1e-4, na.rm = FALSE, maxit = 80L,
         tol = sqrt(.Machine$double.eps))
```

Arguments

x	A numeric vector.
loc	The location, if known, can be used to enhance the estimate for the scale; defaults to unknown.
implbound	The smallest value that mad is allowed before being considered too close to 0.
na.rm	If TRUE then NA values are stripped from x before computation takes place.
maxit	The maximum number of iterations; defaults to 80.
tol	The desired accuracy.

Details

Computes the M-estimator for scale using a smooth ρ-function defined as the square of the logistic ψ function used in location estimation (Rousseeuw & Verboven, 2002, 4.2). When the sequence of observations is too short for a robust estimate, the scale estimate will default to mad so long as mad has not "imploded", i.e. it is greater than implbound which defaults to 0.0001. When mad has imploded, adm is used instead.

If the location is known and passed through loc, the algorithm uses the suggestion in Rousseeuw & Verboven section 5 (2002) converting the observations to distances from 0 and iterating on the adjusted sequence.

If na.rm is TRUE then NA values are stripped from x before computation takes place. If this is not done then an NA value in x will cause mad to return NA.

The tolerance and number of iterations are similar to those in existing base R functions.

Rousseeuw & Verboven suggest using this function when there are 3–8 samples. It is implied that having more than 8 samples allows the use of more standard estimators.

Value

Solves for the robust estimate of scale, S_n, which is the solution to

$$\frac{1}{n} \sum_{i=1}^{n} \rho \left(\frac{x_i - T_n}{S_n} \right) = \beta$$

where T_n is fixed at median(x) and β is fixed at 0.5. The ρ-function selected by Rousseeuw & Verboven is based on the square of the ψ-function used in robLoc. Specifically

$$\rho_{log}(x) = \psi_{log}^2 \left(\frac{x}{0.37394112142347236} \right)$$

The constant 0.37394112142347236 is necessary so that

$$\beta = \int \rho(u) \, d\Phi(u) = 0.5$$

Author(s)

Avraham Adler <Avraham.Adler@gmail.com>

References

Rousseeuw, Peter J. and Verboven, Sabine (2002) Robust estimation in very small samples. *Computational Statistics & Data Analysis*, **40**, (4), 741–758. doi:10.1016/S01679473(02)000786

See Also

adm and mad as basic robust estimators of scale.

Qn and Sn in the **robustbase** package which are specialized robust scale estimators for larger samples. The latter two are based on code written by Peter Rousseeuw.

Examples

```
robScale(c(1:9))
x <- c(1,2,3,5,7,8)
c(robScale(x), robScale(x, loc = 5))
```

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