

Package ‘tvdenoising’

June 13, 2025

Title Univariate Total Variation Denoising

Version 1.0.0

Description Total variation denoising can be used to approximate a given sequence of noisy observations by a piecewise constant sequence, with adaptively-chosen break points. An efficient linear-time algorithm for total variation denoising is provided here, based on Johnson (2013) <doi:10.1080/10618600.2012.681238>.

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URL <https://github.com/glmgen/tvdenoising>,
<https://glmgen.github.io/tvdenoising/>

BugReports <https://github.com/glmgen/tvdenoising/issues>

Imports Rcpp, rlang

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

LinkingTo Rcpp

Config/testthat/edition 3

Encoding UTF-8

RoxygenNote 7.3.2

NeedsCompilation yes

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Depends R (>= 3.5.0)

Repository CRAN

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 tvdenoising

Univariate total variation denoising

Description

Denoises a sequence of observations by solving the univariate total variation denoising optimization problem at a given regularization level.

Usage

```
tvdenoising(y, lambda, weights = NULL)
```

Arguments

y	Vector of observations to be denoised.
lambda	Regularization parameter value. Must be ≥ 0 .
weights	Vector of observation weights. The default is NULL, which corresponds to unity weights. If specified, this vector must have the same length as y, and must have positive entries.

Details

This function minimizes the univariate total variation denoising (also called fused lasso) criterion squares criterion

$$\frac{1}{2} \sum_{i=1}^n (y_i - \theta_i)^2 + \lambda \sum_{i=1}^{n-1} |\theta_{i+1} - \theta_i|,$$

over θ . This is a special structured convex optimization problem which can be solved in linear time ($O(n)$ operations) using algorithms based on dynamic programming (Viterbi) or taut string methods. The current function implements a highly-efficient dynamic programming method developed by Johnson (2013).

Value

Vector of denoised values.

References

Johnson (2013), "A dynamic programming algorithm for the fused lasso and L0-segmentation."

Examples

```
y <- c(rep(0, 50), rep(3, 50)) + rnorm(100)
yhat <- tvdenoising(y, 5)
plot(y, pch = 16, col = "gray60")
lines(yhat, col = "firebrick", lwd = 2)
```

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