Package 'DeconWK'

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Type Package

Title Deconvolution by Weighted Kernels

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Description This package contains code for density deconvolution using weighted kernel estimators.

Depends R (>= 2.7.0), kernlab, stats

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LazyLoad yes

URL https://r-forge.r-project.org/projects/deconwk/

R topics documented:

`DeconWK-package` *Deconvolution by Weighted Kernels*

Description

This package contains code for density deconvolution using weighted kernel estimators. Type 'citation("DeconWK")' for details of the implemented methods.

Details

The main functions are:

w.hat:	Calculates the weights for density deconvolution using weighted kernel estimators
wkde:	Calculates a weighted kernel density estimates
decon.f:	Calculates a classical deconvolution estimate

Author(s)

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References

Hazelton, M.L. and Turlach, B.A. (2009). Nonparametric density deconvolution by weighted kernel estimators, Statistics and Computing 19(3): 217–228. http://dx.doi.org/10.1007/s11222-008-9086-7.

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decon.f *Classical deconvolution density estimate*

Description

Calculates the classical deconvolution density estimate given in equation (4) of Hazelton and Turlach (2009).

Usage

```
decon.f(y, eval = NA, h = NA, sigma)
```

Arguments

y	the observed values.
eval	grid on which the deconvolution density estimate be calculated.
h	the smoothing parameter to be used.
sigma	the standard deviation of the contaminating (normal) distribution.

Details

If "eval" is not specified, it defaults to seq(min(y)-sd(y), max(y)+sd(y), length=100).

If "h" is not specified, the plug-in bandwidth selector developed by Delaigle and Gijbels (2004) is used.

Value

A matrix with two columns named "x" and "y"; the first column contains the evaluation grid, "eval", and the second column the deconvolution density estimate.

Author(s)

Martin L Hazelton <m.hazelton@massey.ac.nz>

References

Delaigle, A. and Gijbels, I. (2004). Practical bandwidth selection in deconvolution kernel density estimation. Computational Statistics & Data Analysis 45(2): 249–267.

Hazelton, M.L. and Turlach, B.A. (2009). Nonparametric density deconvolution by weighted kernel estimators, Statistics and Computing 19(3): 217–228. http://dx.doi.org/10.1007/s11222-008-9086-7.

Examples

```
set.seed(100712)
y <- rden(100, DEN=3, sigma=sqrt(29/40)) # Var(Z)/Var(X) = 0.1
f.hat <- decon.f(y, sigma=sqrt(29/40))
plot(f.hat, type="l")
```

`getmin` *Approximates the minimum of a function given on a grid*

Description

Approximates the minimum of a function given on a grid. Quadratic approximation around the point where the mimimal function value is observed is used (if that point is in the interior).

Usage

```
getmin(x, y, which="global", count.minima=FALSE, verbose=TRUE)
```

Arguments

`x`	Vector with the x-values at which the function is observed. Should be sorted.
`y`	Vector with the function values.
`which`	Defines which miminum we want to find. Possible values are "global" for the global minimum, "left" for the left-most local minimum and "right" for the right-most local minimum. Abbreviations ("g", "r", "gl", etc.) may be used.
`count.minima`	If TRUE, the number of local minima in the observed function values is returned.
`verbose`	If TRUE, the routine will give a warning if any exceptions occur.

Value

A list with the following elements is returned:

`xmin`	The x-coordinate of the minimum.
`ymin`	The approximate value of the function at the minimum.
`nmin`	The number of local minima in the y-vector (if requested, otherwise 0).
`excep`	Indicates whether an exeption has occurred: -1 if the minimum was found at the left end, 1 if the minimum was found at the right end, 5 if the minimum was in the middle but the quadratic fit yielded a location of the minimum which was outside of the interval defined by the three points used for the quadratic fit and 0 in all other cases.

Note

The vector x must be sorted.

Author(s)

Berwin A Turlach <berwin@maths.uwa.edu.au>

Examples

```
x <- -100:100/50
y <- x*x
getmin(x,y)
```

`rden` *Simulates from specific (contaminated) distributions*

Description

Simulates from the distributions considered in Hazelton and Turlach (2009); details of the distributions (all Gaussian mixtures) are given on pages 221–222.

Usage

```
rden(N, DEN = 1, sigma)
```

Arguments

`N`	number of observations to be simulated; Should be a single number.
`DEN`	density to simulate from; possible values are 1, 2, 3 and 4 corresponding to the densities described in the paper.
`sigma`	the standardard deviation of the contaminating measurement error.

Details

The generated random variates are from $X + Z$ where the distribution of X is determined by the argument `DEN` and Z has a normal distribution with mean zero and standard deviation `sigma`; X and Z are independent.

Value

A vector with the generated random variates.

Author(s)

Martin L Hazelton <m.hazelton@massey.ac.nz>

References

Hazelton, M.L. and Turlach, B.A. (2009). Nonparametric density deconvolution by weighted kernel estimators, Statistics and Computing 19(3): 217–228. http://dx.doi.org/10.1007/s11222-008-9086-7.

solveqp — *Solves a specific quadratic programming problem*

Description

Solves the quadratic programming problem (9) of Hazelton and Turlach via a homotopy algorithm approach as described in Appendix B.

Usage

```
solveqp(Qmat, bvec)
```

Arguments

Qmat	The matrix **Q** in equation (9a) of Hazelton and Turlach (2009)
bvec	The vector ***b*** in equation (9a) of Hazelton and Turlach (2009)

Value

The vector ***w*** that solves the quadratic problem (9).

Note, the entries in this vector add to one as the code works with a different parameterisation of the weight vector.

Author(s)

Berwin A Turlach <berwin@maths.uwa.edu.au>

References

Hazelton, M.L. and Turlach, B.A. (2009). Nonparametric density deconvolution by weighted kernel estimators, Statistics and Computing 19(3): 217–228. http://dx.doi.org/10.1007/s11222-008-9086-7.

See Also

ipop

w.hat — *Calculate weights for deconvolution*

Description

Routine to calculate the weights for deconvolution via weighted kernel density estimates.

Usage

```
w.hat(y, sigma, h, gamma,
      METHOD=c("exact", "exact.cv", "svm", "svm.cv"), K=5, verb=FALSE)
```

Arguments

y	the observed, contaminated data.
sigma	the standard deviation of the contaminating (normal) distribution.
h	the bandwidth to be used for the weighted kernel density estimate; if missing the bandwidth returned by `bw.SJ(y, method="dpi")` will be used.
gamma	the regularisation parameter to be used; either a scalar for methods `"exact"` and `"svm"`, or a vector of values from which a suitable value is selected via K-fold cross-validation for methods `"exact.cv"` and `"svm.cv"`.
METHOD	method to be used to solve the quadratic programming problem involved in calculating the weights; if `"exact"` or `"exact.cv"` then the solver described in the paper is used, otherwise the routine `ipop` from the `kernlab` package.
K	number of folds to be used if `gamma` is chosen by cross-validation; defaults to 5.
verb	logical; if `TRUE` some progress report will be printed during cross-validation.

Value

A vector containing the weights; if `gamma` is chosen by cross-validation, the selected value is returned as an attribute.

Author(s)

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Berwin A Turlach <berwin@maths.uwa.edu.au>

References

Hazelton, M.L. and Turlach, B.A. (2009). Nonparametric density deconvolution by weighted kernel estimators, Statistics and Computing 19(3): 217–228. http://dx.doi.org/10.1007/s11222-008-9086-7.

Examples

```
set.seed(100712)
sig <- sqrt(29/40)  # Var(Z)/Var(X) = 0.1
y <- rden(100, DEN=3, sigma=sig)
gamma <- exp(seq(from=0, to=6, length=17))
w1 <- w.hat(y, sigma=sig, gamma=gamma, METHOD="exact.cv", verb=TRUE)
plot(y, w1, type="h")
attributes(w1)
w2 <- w.hat(y, sigma=sig, gamma=gamma, METHOD="svm.cv", verb=TRUE)
plot(y, w2, type="h")
attributes(w2)

w1 <- w.hat(y, sigma=sig, gamma=gamma, METHOD="exact.cv", K=10, verb=TRUE)
plot(y, w1, type="h")
attributes(w1)
w2 <- w.hat(y, sigma=sig, gamma=gamma, METHOD="svm.cv", K=10, verb=TRUE)
plot(y, w2, type="h")
attributes(w2)
```

`wkde` *Weighted kernel density estimate*

Description

Calculates a weighted kernel density estimate as defined by equation (5) of Hazelton and Turlach (2009).

Usage

```
wkde(y, eval = NA, w = NA, h = NA)
```

Arguments

`y`	the observed values.
`eval`	grid on which the deconvolution density estimate be calculated.
`w`	the weights to be used.
`h`	the smoothing parameter to be used.

Details

If `"eval"` is not specified, it defaults to `seq(min(y)-0.1*sd(y), max(y)+0.1*sd(y), length=100)`.

If `"w"` is not specified, it defaults to a vector of ones.

If `"h"` is not specified, it defaults to `bw.SJ(y, method="dpi")`.

Value

A matrix with two columns named `"x"` and `"y"`; the first column contains the evaluation grid, `"eval"`, and the second column the deconvolution density estimate.

Author(s)

Martin L Hazelton <m.hazelton@massey.ac.nz>

References

Hazelton, M.L. and Turlach, B.A. (2009). Nonparametric density deconvolution by weighted kernel estimators, Statistics and Computing 19(3): 217–228. http://dx.doi.org/10.1007/s11222-008-9086-7.

Examples

```
set.seed(100712)
sig <- sqrt(29/40)  # Var(Z)/Var(X) = 0.1
y <- rden(100, DEN=3, sigma=sig)
f.hat <- wkde(y)
plot(f.hat, type="l", ylim=c(0, 0.2))
w <- w.hat(y, sigma=sig, gamma=1.6)
fd.hat <- wkde(y, w=w)
lines(fd.hat, col="red")
```

```
w <- w.hat(y, sigma=sig, gamma=2.7)
fd.hat <- wkde(y, w=w)
lines(fd.hat, col="blue")
```

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