Package 'MFHD'

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Type Package

Title Multivariate Functional Halfspace Depth

Version 0.0.1

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Depends fda.usc

Imports deldir, depth, depthTools, matrixStats

Description Multivariate functional halfspace depth and median for two-dimensional functional data.

License GPL (>= 2)

LazyLoad yes

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NeedsCompilation no

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R topics documented:

MFHD-package	*Multivariate functional halfspace depth and median for two-dimensional functional data.*

Description

These functions compute the Multivariate Functional Halfspace Depth depth and median for two-dimensional functional data. Additionally MFHD computes for every curve at every time point whether or not it is outlying, based on the bivariate bagplot.

Details

Package:	MFHD
Type:	Package
Version:	0.1.1
Date:	2013-02-13
Depends:	deldir, utils, fda, depth, geometry, matrixStats, fda.usc, depthTools
Imports:	deldir, utils, fda, depth, geometry, matrixStats, fda.usc, depthTools
Suggests:	mvtnorm
License:	GPL (>= 2)
LazyLoad:	yes

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```
MFHD              Function to compute the Multivariate Functional Halfspace Depth
                   for bivariate curves.
MFHD_bagplot      Internal function called by MFHD.
derivcurves       Internal function called MFHD.
```

Author(s)

M. Hubert, K. Vakili. Maintainer: K. Vakili <kaveh.vakili@wis.kuleuven.be>

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derivcurves	*Computes the derivative of functional data.*

Description

Often one set of curves y1 is given, and the second set of curves y2 are the (estimated) derivatives. This function computes these derivatives.

Usage

```
derivcurves(y1,method="bspline")
```

Arguments

y1	A n by T matrix of functional data.
method	Type of derivative method, for more information see details.

Details

- If method="bspline", "exponential", "fourier", "monomial" or "polynomial", the "derivcurves" function creates a basis to represent the functional data.

- If "method"="diff", raw derivation is applied. Not recommended to use this method when the values are not equally spaced.

This function is a wraper for ″fda.usc::fdata.deriv″. See `help("fda.usc::fdata.deriv")`.

Value

Returns the derivative of functional data.

Author(s)

K. Vakili.

Examples

```
set.seed(123)
n<-50;
T<-100;
t.<-seq(0,2*pi,l=T)
y<-matrix(NA,n,T)
for(i in 1:n) y[i,]<-runif(1,0,1)*sin(t.)+runif(1,0,1)*cos(t.)
y2<-derivcurves(y)
```

MFHD	*Multivariate functional halfspace depth and median for two-dimensional functional data.*

Description

MFHD calculates the MFHD depth and MFHD median for two-dimensional functional data. Additionally MFHD computes for every curve at every time point whether or not it is outlying, based on the bivariate bagplot.

Usage

```
MFHD(y1,y2,alpha=0.125,Beta=0.5,Time=NULL)
```

Arguments

y1   first set of n functional curves, matrix with T columns.

y2   second set of curves (in particular, y2 can be the derivative of y1).

alpha   the level of the depth regions used for the computation of the weights: This value should be smaller than the maximal halfspace depth at any time point, divided by n. Default is 0.125. alpha=NULL defaults to uniform weights for all cross-sections.

Beta   beta-value for the dispersion curve. Should be between 0 and 1. Default is 0.50.

Time   If the measurements are not equidistant, a sorted numeric vector containing a set of time points. Default to NULL in which case it is ignored.

Value

A list with the following components:

MFHDdepth   n-vector containing the MFHD depth of every curve.

MFHDmedian   2 by T-vector of MFHD median.

weights   T-vector of MFHD weights (used in the definition of the MFHD depth).

disp   (2xT)-vector of dispersion curves (of level Beta) for y1 and y2.

loc.outl   n by T matrix of flags (takes value 1 if curve i is outlying at time point j).

Author(s)

M. Hubert, K. Vakili.

References

Claeskens, G., Hubert, M., Slaets, L. and Vakili, K. (2013) "Multivariate Functional Halfspace Depth", Journal of the American Statistical Association, in press.

Examples

```
set.seed(123)
n<-30;
T<-60;
t.<-seq(0,2*pi,l=T)
y1<-matrix(NA,n,T)
for(i in 1:n) y1[i,]<-loess((1/2*sin(t.)+3/2*cos(t.)+rnorm(T))~I(1:T),span=1/4)$fitted
y2<-derivcurves(y1)
results<-MFHD(y1=y1,y2=y2,alpha=0.125,Beta=0.5)
```

MFHD_bagplot	*Computes the bagplot for the MFHD algorithm.*

Description

This is an internal function not intended to be called by the user. This function is a minimally modified adaptation of `"aplpack::bagplot"`. The main difference is that while aplpack::bagplot returns the coordinate of the observations outside the fence, this version returns the index of the observations outside the fence. For more details, see `help("aplpack::bagplot")`.

Usage

```
MFHD_bagplot(x, y,factor=3,approx.limit=300,verbose=FALSE)
```

Arguments

x	x values of a data set; in "bagplot": an object of class "bagplot" computed by "compute.bagplot".
y	y values of the data set.
factor	Expanding factor of the fence.
approx.limit	if the number of data points exceeds "approx.limit" a sample is used to compute some of the quantities; default: 300.
verbose	automatic commenting of calculations.

Value

Returns a list. Component "center" is a two dimensional vector with the coordinate of the center. Component outliers is a n-vector of binary values (the observations outside the fence are assigned value 1).

Author(s)

M. Hubert and K. Vakili.

References

P. J. Rousseeuw, I. Ruts, J. W. Tukey (1999): The bagplot: a bivariate boxplot, The American Statistician, vol. 53, no. 4, 382–387.

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