Package 'MFDF'

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Title Modeling Functional Data in Finance

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Depends R (>= 2.4.0),fda,zoo

Suggests odesolve, R.matlab, quadprog, DierckxSpline, nlme

Description The package contains functions designed to modeling or analyzing the functional data arising in financial research and practice, as well as some interesting data sets.

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R topics documented:

`fglm` *Estimation for Functional Generalized Linear Models*

Description

The function implements the estimation procedure for the slope function described in Dou etal.(2009). The estimation procedure is based on functional principal components analysis.

Usage

```
fglm(y,x, family = gaussian, N,m = N)
```

Arguments

`y`	a numeric vector.
`x`	a vector of functional data objects.
`family`	a description of the error distribution and link function to be used in the model. This can be a character string naming a family function, a family function or the result of a call to a family function. (See family for details of `family` functions.)
`N`	An integer.
`m`	An integer.

Details

y contains responses and x contains covariate functions. Integer N is the cut-off points corresponding to change of measure or asymptotic equivalence. Integer m is the cut-off points in order to minimize the error in bias-variance trade-off.

Value

It is a LIST consists of

`b`	A functional data object which is the estimated slope function.
`intercept`	intercept term.

Note

The estimation procedure was studied in details in Dou etal.(2009) and the authorts showed that the estimation is minimax optimal under certain mild assumptions.

Author(s)

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References

Dou, W., Pollard, D. and Zhou, H.H. (2009). Functional Regression for General Exponential Families *manuscripts*.

Examples

```
### Simulate Gaussian processes ###

fr <- 31       #terms in the fourier expansion#

basisobj.bx <- create.fourier.basis(rangeval=c(0, 1), 2*fr-1)

samplesize <- 1000

xx <-matrix(rnorm(samplesize*fr), samplesize, fr)

xcoef <- matrix(0, samplesize, 2*fr-1)

alpha <- 1.5

for(j in 1:fr){

    xcoef[,2*j-1] <- xx[,j]*(j^(-alpha/2))

}

#- get functional object -#

x.fd <- fd(t(xcoef),basisobj.bx)


### True slope function ###


b.coef <- rep(0, 2*fr-1)

beta <- 3

for(i.fr in 1:fr){

     b.coef[2*i.fr-1] <- ((-1)^(i.fr))*((i.fr)^(-beta))
}

b <- fd(b.coef, basisobj.bx)


### Generate Bernoulli responses according functional logistic model ###

y <- rep(0,samplesize)

int <- xcoef

p <- exp(int)/(1+exp(int))

for(ii in 1: samplesize){
```

```
    y[ii] <- sample(c(0,1),1,prob=c(1-p[ii],p[ii]))

}

### Estimate the slope function ###

fg <- fglm(y,x.fd,family=binomial(link = "logit"), N=15,m=2)

b.hat <- fg$b

### plot the result ###

plot.fd(b.hat)
grids <- seq(0,1,by=0.01)
points(grids,eval.fd(grids,b), type="l")
```

`usrecession` *Records of U.S.economic recessions from 1953 to 2009*

Description

The National Bureau of Economic Research (NBER) provides the most widely accepted definition of a recession (NBER 2008): *A recession is a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in production, employment, real income, and other indicators. A recession begins when the economy reaches a peak of activity and ends when the economy reaches its trough. Between trough and peak, the economy is in an expansion.* The latest dating result of U.S. recessions can be found at the official web site of NBER (http://www.nber.org/cycles.html)

Usage

```
data(usrecession)
```

Format

A data frame with 682 observations on the following 3 variables. `time index` is a numeric vector. `flag` is a numeric vector. `time` is a factor contains characters specifying the month and year.

Source

Official web site of NBER (http://www.nber.org/cycles.html)

References

Dou, W., Pollard, D and Zhou, H.H. (2009) Functional Regression for General Exponential Families. *manuscripts*.

Examples

```
data(usrecession)
```

`usyields` *U.S. treasury yields from 1953 to 2009*

Description

This data set contains U.S. treasury yields from 1953 to 2009. This data set combines a data set obtained from Wharton Research Data Services (http://wrds.wharton.upenn.edu/) and the official Federal Reserve web site (http://www.federalreserve.gov/econresdata/researchdata.html)

Usage

```
data(usyields)
```

Format

A data frame with 673 observations on the following 34 variables.

`time|maturity` a numeric vector

`0.08` a numeric vector

`0.25` a numeric vector

`0.5` a numeric vector

`1` a numeric vector

`2` a numeric vector

`3` a numeric vector

`4` a numeric vector

`5` a numeric vector

`6` a numeric vector

`7` a numeric vector

`8` a numeric vector

`9` a numeric vector

`10` a numeric vector

`11` a numeric vector

`12` a numeric vector

`13` a numeric vector

`14` a numeric vector

`15` a numeric vector

`16` a numeric vector

`17` a numeric vector

`18` a numeric vector

`19` a numeric vector

`20` a numeric vector

`21` a numeric vector

`22` a numeric vector

`23` a numeric vector

`24` a numeric vector

`25` a numeric vector

`26` a numeric vector

`27` a numeric vector

`28` a numeric vector

`29` a numeric vector

`30` a numeric vector

Details

`time index` is the time index, for example, April 1953 is indexed as 1953.25. `yields` is the yields for various maturities. `time` is the month and year during which the yield curve is observed.

Source

Official Fed web site (http://www.federalreserve.gov/econresdata/researchdata.html) and Wharton Research Data Services (http://wrds.wharton.upenn.edu)

References

Dou, W., Pollard, D and Zhou, H.H. (2009) Functional Regression for General Exponential Families. *manuscripts*. G\"U RKAYNAK, R. S., SACK, B. and WRIGHT, J. H. (2006). The u.s. treasury yield curve: 1961 to the present. *Tech. rep*.

Examples

```
data(usyields)
```

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