Package 'MRwarping'

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Type Package

Title Multiresolution time warping for functional data.

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Description The Bayesian procedure starts with one warplet in the model and uses the posterior distributions as priors for a more ex-
tended model with one more warplet. The model is built with adding one warplet at a time and allows for amplitude variations.

Depends boa, SemiPar

License GPL-2

LazyLoad yes

NeedsCompilation yes

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R topics documented:

MRwarping-package *This package performs Bayesian multiresolution time warping for functional data.*

Description

Time warping is performed via a composition of warplets. The Bayesian model starts with one warplet and adds warplets one at a time until the warping action becomes negligible in the sense of having almost zero intensity or too narrow domains. The posterior distributions are used as prior distributions for the extended model in the next step. Warplets have an immediate interpretation as warping functions and the inverse warplet is trivial to obtain.

Details

Package:	MRwarping
Type:	Package
Version:	1.0
Date:	2012-10-22
License:	What license is it under?
LazyLoad:	yes

Author(s)

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References

Slaets, Claeskens and Silverman (2010). Warping functional data in R and C via a Bayesian Multiresolution approach. Journal of Statistical Software, 55(3), 1-22,
URL http://www.jstatsoft.org/v55/i03/.

Claeskens, Silverman and Slaets (2010). A multiresolution approach to time warping achievec by a Bayesian prior-posterior transfer fitting strategy. Journal of the Royal Statistical Society, Series B, 72(5), 673-694.

comp *Constructs and evaluates a single warplet.*

Description

A quartic warplet kernel is used to construct a warplet with parameters a,lambda,r1,r2,x. This function is used within MRwarp.

Usage

```
comp(a, lambda, r1, r2, x)
```

Arguments

a	Center of the warplet kernel.
lambda	Intensity of the warp, should be between (-1,1).
r1	Radius on the left-hand side of the center a, such that a-r1 is the lower bound of the warping domain.
r2	Radius on the right-hand side of the center a, such that a+r2 is the upper bound of the warping domain.
x	Time point where to evaluate the warplet.

Value

The vector of warped time points.

Author(s)

L. Slaets, G. Claeskens, B.W. Silverman.

References

See the papers: Slaets, Claeskens and Silverman (2010). Warping functional data in R and C via a Bayesian Multiresolution approach. Journal of Statistical Software, 55(3), 1-22,
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MRwarp *Main function to perform multiresolution warping for functional data in a Bayesian way.*

Description

The Bayesian procedure starts with one warplet in the model and uses the posterior distributions as priors for a more extended model with one more warplet. The model is built with adding one warplet at a time and allows for amplitude variations.

Usage

```
MRwarp(Xdata, Ydata, chain = 400, thin = 10, burnin = 200, kernel.s,
  components = 1, selection = "FIXED", shr = 0.3, outputfit = 1,
alpha = 0.1)
```

Arguments

Xdata	N by T matrix containing the T x-coordinates or time points of the N curve observations. Each row corresponds to a particular subject. No default.
Ydata	N by T matrix containing the T y-coordinates or response values of the N curve observations. Each row corresponds to a particular subject. No default.
chain	The total number of MCMC iterations (default=400).
thin	The thinning factor of the MCMC algorithm (default=10).
burnin	The number of MCMC iterations that are discarded (default=200).
kernel.s	Vector containing the starting values for the kernel parameters. No default.
components	The number of warping components in the final model (default=1). The value is ignored when selection="STEP".
selection	Whether we want to estimate a fixed number of warplets ("FIXED"), or evaluate the warping procedure after each component ("STEP") (default= "FIXED").
shr	Determines the variance of the prior on the warplet intensities and shifts (default = 0.3).
outputfit	1 if the warped curves should be plotted after each estimated model, 0 otherwise (default=1).
alpha	The significance level to be used in the model selection procedure (default=0.1).

Value

last	List of output values for the last fitted model.
previous	List of output values for the one but last fitted model.
shift	Component of the output list. A MCMC chain of the estimated horizontal shift for curves 1 to N.
warping	Component of the output list that is itself a list containing four quantities: lower, A, upper and Intensities.
lower	Component of warping. Adaptive MCMC chains of the estimated warping lower bounds $(w_{l,1}, \ldots, w_{l,Q-1})$.
A	Component of warping. Adaptive MCMC chains of the estimated warping centers $(a_1, \ldots, a_{Q-1})$.
upper	Component of warping. AMCMC chains of the estimated warping upper bounds $(w_{u,1}, \ldots, w_{u,Q-1})$.
Intensities	Component of warping. Adaptive MCMC chains of the estimated warping intensities, first all N values for warplet 1,..., all N values for warplet Q.
kernels	Component of the output list. Adaptive MCMC chains of the estimated kernel lower bounds, centers and upper bounds.
error.variance	Component of the output list. The estimated value of the error variance.
max.post.dens	Component of the output list. The row in the parameter chain vectors/matrices corresponding to the highest posterior pseudo-log-likelihood.

Author(s)

L. Slaets, G. Claeskens, B.W. Silverman.

References

See the papers: Slaets, Claeskens and Silverman (2010). Warping functional data in R and C via a Bayesian Multiresolution approach. Journal of Statistical Software, 55(3), 1-22,
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Examples

```
data(TICdata)
TIC = as.matrix(TICdata)

index = 1:200*2-1
TICy = t(matrix(index,200,11))
x = 1:400
for (i in 1:11)
{
TIC.sm = spm(TIC[i,]~f(x))
TICy[i,] = TIC.sm$fit$fitted[index]
}
TICx = t(matrix(index,200,11))
kernel.s = c(70,100,130,270,285,300)

## Not run:
output = MRwarp(Xdata=TICx,Ydata=TICy,chain=100,thin=5,burnin=50,kernel.s,
components=1,selection="FIXED",shr=0.3,outputfit=1,alpha=0.1)

## End(Not run)
```

TICdata *TIC data.*

Description

A sample of 11 curves with TIC counts of a Liquid Chromatography-Mass Spectrometry (LS-MS) data set.

Usage

```
data(TICdata)
```

Format

A data frame with 400 observations for each of 11 curves. The different rows correspond to the different curves.

Source

Listgarten, J., Neal, R.M., Roweis, S.T. and Emili, A. (2005). Multiple Alignment of Continuous Time Series, in Advances in Neural Information Processing Systems 17, Eds Saul, L.K., Weiss Y. and Bottou, L., MIT Press, Cambridge, MA, 817–824.

Examples

```
data(TICdata)
TIC=as.matrix(TICdata)

## Preparation of the TIC data for use in warping.

# for smoothing the LC-MS data TIC
library("SemiPar")

index = 1:200*2-1
TICy = t(matrix(index,200,11))
TIC = as.matrix(TICdata)
x = 1:400
for (i in 1:11)
{
TIC.sm = spm(TIC[i,]~f(x))
TICy[i,] = TIC.sm$fit$fitted[index]
}
TICx = t(matrix(index,200,11))
```

---

warp *Evaluates a composition of warplets.*

Description

The function warp evaluates a composition of warplets that are constructed by the function comp.

Usage

```
warp(A, Lambda, R1, R2, x)
```

Arguments

A	Vector of centers of the warplets.
Lambda	Vector of intensities.
R1	Vector of radii on the left-hand side of the centers.
R2	Vector of radii on the right-hand side of the centers.
x	Vector of time points at which to evaluate the warping function.

Value

warp contains the warping function evaluated at x, see also comp.

Author(s)

L. Slaets, G. Claeskens, B.W. Silverman.

References

See the papers: Slaets, Claeskens and Silverman (2010). Warping functional data in R and C via a Bayesian Multiresolution approach. Journal of Statistical Software, 55(3), 1-22,
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Examples

```
t = seq(0,10,length.out=1000)
tau.t = warp(c(5,2),c(0.6,0.4),c(2,1.5),c(3,2),t)

## The function is currently defined as
warp =
function(A,Lambda,R1,R2,x)
{
Wx = x
for (i in 1:length(A))
     {
warp = comp(A[i],Lambda[i],R1[i],R2[i],Wx)
Wx = warp
}
return(Wx)
}
```

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