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Description Implementation of a Gaussian Process model (both likelihood and bayesian approaches) for kriging and model emulation. Includes functions for sampling design and prediction.
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arate	<i>Acceptance rate</i>
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Description

Acceptance rate

Usage

arate(x)

Arguments

x vector of MCMC samples

Author(s)

Michael Dietze

calcSpatialCov	<i>calcSpatialCov</i>
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Description

calcSpatialCov

Usage

calcSpatialCov(d, psi, tau, ...)

Arguments

d	either a spatial distance matrix or a list of component spatial distance matrices
psi	spatial corr
tau	spatial var
...	Additional arguments

Author(s)

Michael Dietze

calcSpatialCov.list	<i>Currently assumes an exponential spatial dependency</i>
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Description

Can make gaussian by passing squared distance matrix

Usage

```
## S3 method for class 'list'
calcSpatialCov(d, psi, tau, ...)
```

Arguments

d	list of component spatial distance matrices
psi	spatial corr
tau	spatial var
...	additional arguments (currently unused)

Value

spatial covariance matrix

Author(s)

Michael Dietze

`calcSpatialCov.matrix` *Currently assumes an exponential spatial dependency*

Description

Can make gaussian by passing squared distance matrix

Usage

```
## S3 method for class 'matrix'
calcSpatialCov(d, psi, tau, ...)
```

Arguments

<code>d</code>	spatial distance matrix
<code>psi</code>	spatial corr
<code>tau</code>	spatial var
<code>...</code>	additional arguments (currently unused)

Value

spatial covariance matrix

Author(s)

Michael Dietze

`distance` *distance*

Description

distance

Usage

```
distance(x, power = 1)
```

Arguments

<code>x</code>	matrix of locations in physical or parameter space
<code>power</code>	exponent used for calculating distance, default value of 2 = Pythagorean distance

Value

list of per-dimension pairwise distance matrices

Author(s)

Michael Dietze

distance_matrix	<i>distance_matrix</i>
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Description

distance_matrix

Usage

distance_matrix(x, power = 1, dim = 2)

Arguments

- | | |
|-------|---|
| x | matrix of locations in physical or parameter space |
| power | exponent used for calculating distance, default value of 2 = Pythagorean distance |
| dim | dimension |

Value

symmetric matrix of pairwise squared distances

Author(s)

Michael Dietze

distance12_matrix	<i>distance12_matrix</i>
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Description

distance12_matrix

Usage

distance12_matrix(x, n1, power = 1)

Arguments

x	matrix of locations in parameter space
n1	number of rows in the original dataset
power	exponent used for calculating distance, default value of 2 = Pythagorean distance

Value

cross-distance matrix of dimensions n x (n - n1)

Author(s)

Michael Dietze

GaussProcess	<i>GaussProcess</i>
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Description

GaussProcess

Usage

```
GaussProcess(  
  x,  
  y,  
  isotropic = TRUE,  
  nugget = TRUE,  
  method = "bayes",  
  ngibbs = 5000,  
  burnin = 1000,  
  thin = 1,  
  jump.ic = c(1.1, 0.2),  
  prior = "IG",  
  mix = "joint",  
  psi = NULL,  
  zeroMean = FALSE,  
  exclude = NULL,  
  ...  
)
```

Arguments

x	set of independent variables
y	dependent variable
isotropic	Boolean indicating whether the GP is fit isotropically. If FALSE, distances are calculated deparately for each direction

nugget	allows additional error in Y rather than fix interpolation to go through points
method	method for calculating correlations
ngibbs	number of MCMC iterations (per chain) to run
burnin	Number of samples to discard as burnin (auto must be FALSE)
thin	thinning of the matrix to make things faster. Default is to thin to 1
jump.ic	initial condition for jump standard deviation.
prior	'unif', 'IG'
mix	joint=mix over psi simultaneously, each=mix over psi individually
psi	spatial corr
zeroMean	True if mean is 0, else false
exclude	<- isn't used anywhere, should be dropped
...	Additional arguments

Author(s)

Michael Dietze

gp_mle

gp_mle

Description

gp_mle

Usage

gp_mle(theta, d, nugget, myY, maxval = Inf)

Arguments

theta	proposed parameter vector: [mu, tauw, tauv, phi1...phiK]
d	spatial distance matrix
nugget	allows additional error in Y rather than fix interpolation to go through points
myY	vector of observed data
maxval	maximum value

Value

negative log-likelihood value, or maxval if the computation fails

Author(s)

Michael Dietze

gp_mle2	<i>gp_mle2</i>
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Description

gp_mle2

Usage

gp_mle2(theta, d, nugget, myY, maxval = Inf)

Arguments

- | | |
|--------|---|
| theta | proposed parameter vector: [mu, tauw, tauv, phi1...phiK] |
| d | spatial distance matrix |
| nugget | allows additional error in Y rather than fix interpolation to go through points |
| myY | vector of observed data |
| maxval | maximum value |

groupid	<i>groupid</i>
---------	----------------

Description

groupid

Usage

groupid(x)

Arguments

- | | |
|---|----------------------------|
| x | matrix of parameter values |
|---|----------------------------|

Author(s)

Michael Dietze

`jump`*jump*

Description`jump`**Usage**`jump(ic = 0, rate = 0.4, ...)`**Arguments**

<code>ic</code>	optional data vector
<code>rate</code>	target acceptance rate
<code>...</code>	Additional arguments

Author(s)

Michael Dietze

`jump-class`*define a class for automatically tuning jump distributions*

Description

define a class for automatically tuning jump distributions

Author(s)

Michael Dietze

ldinvgamma	<i>Log-dinvgamma, based on MCMCpack</i>
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Description

Log-dinvgamma, based on MCMCpack

Usage

```
ldinvgamma(x, shape, scale = 1)
```

Arguments

x	vector of quantiles
shape, scale	shape and scale parameters for the inverse Gamma distribution

Value

log density of the inverse Gamma distribution evaluated at x

Author(s)

Michael Dietze

lhc	<i>Latin Hyper Cube</i>
-----	-------------------------

Description

Simple uniform sampling with LHC permutation

Usage

```
lhc(x, n.samp)
```

Arguments

x	<- list (n.dim x 2)
n.samp	number of samples

Author(s)

Michael Dietze

mvjump	<i>mvjump</i>
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Description

mvjump

Usage

mvjump(ic = 0, rate = 0.4, nc = 2, ...)

Arguments

ic	optional data vector
rate	target acceptance rate
nc	NetCDF object containing target variable
...	Additional arguments

mvjump-class	<i>multivariate version of jump class</i>
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Description

multivariate version of jump class

nderiv	<i>nderiv</i>
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Description

nderiv

Usage

nderiv(x, y)

Arguments

x	Name of variable to plot on X axis
y	Name of variable to plot on Y axis

Value

numeric vector of numerical derivatives of y with respect to x

Author(s)

Michael Dietze

p	<i>p</i>
---	----------

Description

p

Usage

p(x, ...)

Arguments

x	jump distribution
...	Additional arguments

p.jump	<i>Extract current jump parameter value for a jump object</i>
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Description

Extract current jump parameter value for a jump object

Usage

```
## S3 method for class 'jump'  
p(x, ...)
```

Arguments

x	object of class jump
...	additional arguments (currently unused)

Value

The most recent jump parameter value.

Author(s)

Michael Dietze

p.mvjump

Extract current jump parameter values for a mvjump object

Description

Extract current jump parameter values for a mvjump object

Usage

```
## S3 method for class 'mvjump'  
p(x, ...)
```

Arguments

x	object of class mvjump
...	additional arguments (currently unused)

Value

The most recent row of the multivariate jump parameter history.

Author(s)

Michael Dietze

plot.jump

Plot diagnostic history for a jump tuning object

Description

Displays the jump parameter trace and acceptance rate over MCMC iterations.

Usage

```
## S3 method for class 'jump'  
plot(x, ...)
```

Arguments

x	object of class jump
...	additional arguments (currently unused)

Author(s)

Michael Dietze

plot.mvjump	<i>Plot diagnostic history for a mvjump tuning object</i>
-------------	---

Description

Displays the multivariate jump parameter trace and acceptance rate over MCMC iterations.

Usage

```
## S3 method for class 'mvjump'
plot(x, ...)
```

Arguments

x	object of class mvjump
...	additional arguments (currently unused)

Author(s)

Michael Dietze

predict.density	<i>Simple interpolation of a density object to new points</i>
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Description

Simple interpolation of a density object to new points

Usage

```
## S3 method for class 'density'
predict(object, xnew, ...)
```

Arguments

object	a density object (as returned by density)
xnew	numeric vector of new x coordinates at which to evaluate the density
...	additional arguments (currently unused)

Value

numeric vector of interpolated density values at xnew

Author(s)

Michael Dietze

predict.GP	<i>Predict method for Gaussian Process objects</i>
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Description

Performs kriging prediction from a fitted Gaussian Process model.

Usage

```
## S3 method for class 'GP'
predict(object, xpred, cI = NULL, pI = NULL, splinefcns = NULL, ...)
```

Arguments

object	a Gaussian Process object (class GP) as returned by GaussProcess
xpred	value of x where prediction should be made
cI	credible interval quantiles, or NULL to skip
pI	prediction interval quantiles, or NULL to skip
splinefcns	optional list of spline functions for trend-surface adjustment
...	additional arguments (currently unused)

Value

Kriged predictions or a list of credible/prediction interval quantiles.

Author(s)

Michael Dietze

summarize_GP	<i>summarize_GP</i>
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Description

summarize_GP

Usage

```
summarize_GP(gp, pdf_file = NULL, txt_file = NULL)
```

Arguments

gp	Gaussian Process
pdf_file	filename you want figures written out to
txt_file	filename you want figures written out to

Author(s)

Michael Dietze

update.jump

*Update method for adaptive MCMC jump-tuning objects***Description**

Adapts the jump standard deviation based on recent acceptance rate to keep acceptance near the target rate.

Usage

```
## S3 method for class 'jump'
update(object, chain, ...)
```

Arguments

object	object of class jump
chain	numeric matrix of recent MCMC chain values used to compute acceptance rate
...	additional arguments (currently unused)

Value

Updated jump object with adjusted history and acceptance rate.

Author(s)

Michael Dietze

update.mvjump

*Update method for adaptive MCMC multivariate jump-tuning objects***Description**

Adapts each dimension of the multivariate jump standard deviation based on recent acceptance rate for each dimension to keep acceptance near the target rate.

Usage

```
## S3 method for class 'mvjump'
update(object, chain, ...)
```

Arguments

object	object of class mvjump
chain	numeric matrix of recent MCMC chain values used to compute acceptance rates
...	additional arguments (currently unused)

Value

Updated mvjump object with adjusted history and acceptance rates.

Author(s)

Michael Dietze

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