The WeedMap Package

February 16, 2008

Title Map of weed intensity

Version 0.1

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Description Compute spatial predictions from exact count and a covariate

Depends RandomFields, fields

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URL www.inapg.inra.fr/ens_rech/mathinfo/personnel/guillot/welcome.html

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R topics documented:

`WeedMap-package` *Spatial prediction of weed intensities*

Description

Simulation, inference and prediction for a Bayesian spatial statistical model for weed intensities and a covariate

Details

Package:	WeedMap
Type:	Package
Version:	0.1
Date:	2006-09-28
License:	GPL

The function `sim.weed` makes simulation from the model. The simulated dataset can be graphically displayed with `show.sim.weed`. The function `pred.weed` makes inference and prediction whose results can be graphically displayed with `show.pred.weed` (monitoring of Markov chain simulation) and with `check.model.weed` (goodness of fit assessment).

Author(s)

Gilles Guillot www.inapg.inra.fr/ens_rech/mathinfo/personnel/guillot/welcome.html

References

G. Guillot, N. Loren, M. Rudemo, Bayesian spatial prediction of weed intensities from exact count data and picture based indexes, 2006, submitted

Examples

```
## Simulate a data set
sim <- sim.weed(nx=30, ny=20, nxy=20, nz=49,
                param.cov=c(mean=0,variance=1,nugget=0,scale=.1),
                mu=80, sigma=70, lambda=1, tau=0.2, nbin=10,
                true.field = TRUE, npix =  c(100,100), z.on.grid = TRUE)


## show the graphics
show.sim.weed(sim)

## Not run:

## make joint inference and prediction
res <- pred.weed(nit=10000,
                 thin=10,
                 ## data
                 x=sim$x,
                 xy=sim$xy,
                 y=sim$y,
                 z=sim$z,
                 wx=sim$wx,
                 wxy=sim$wxy,
                 i=sim$i,
                 ## init
                 #alpha=alpha,
                 #beta=beta,
                 lambda=1,
```

```
                  #tau=tau,
                  #kappa=kappa,
                  ## proposals
                  sd.prop.h=0.1,
                  sd.prop.alpha=0.1,
                  sd.prop.beta=0.01,
                  sd.prop.lambda=0.,
                  sd.prop.tau=0.5,
                  delta.prop.kappa=2,
                  ## priors
                  mprior.alpha=0.625,
                  vprior.alpha=1,
                  mprior.beta=0.0125,
                  vprior.beta=1,
                  mprior.kappa=.5,
                  vprior.kappa=999,
                  mprior.lambda=1,
                  vprior.lambda=1,
                  mprior.tau=0.1,
                  vprior.tau=10,
                  n.kappa=30,
                  kappa.max=5*sim$param.cov[4])

show.pred.weed(sim=sim,
               res=res,
               param=TRUE,
               pairs=TRUE,
               wy=FALSE,
               wz=FALSE,
               nit=res$nit,
               thin=res$thin,
               burnin=500)

check.model.weed(x=sim$x,
                 xy=sim$xy,
                 y=sim$y,
                 wx=sim$wx,
                 wxy=sim$wxy,
                 i=sim$i,
                 ## output of MCMC run
                 res=res,
                 ## options
                 nit=res$nit,
                 thin=res$thin,
                 burnin=500,
                 bin=seq(.1,.5,.05),
                 nqqplot=500,
                 nresamp=200)

## End(Not run)
```

check.model.weed *Check goodness of fit of the model*

Description

Plot various graphics to assess goddness of fit of the transformed Gaussian model

Usage

```
check.model.weed(x, xy, y, wx, wxy, i, res, nit, thin, burnin, bin, nqqplot, nresam
```

Arguments

x	Coordinates of sites where weed counts only are given
xy	Coordinates of sites where weeds and images are given
y	Coordinates of sites where image indexes only are given
wx	Weed values at sites x
wxy	Weed values at sites xy
i	Image values at sites xy and y. Values are concatenated in the same vector in this order
res	Output of pred.weed
nit	Number of iterations
thin	Thinning of the Markov chain
burnin	Number of values to discard before computing statistics about the empirical posterior
bin	Binning for the empirical variograms
nqqplot	Number of observation in the qqplot
nresamp	Number of realisation resampled to get enveloppe estimates

Details

Value

None

Author(s)

Gilles Guillot

References

G. Guillot, N. Loren, M. Rudemo, Bayesian spatial prediction of weed intensities from exact count data and picture based indexes, 2006, submitted

Examples

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pred.weed *Spatial prediction of weed counts*

Description

Makes joint Bayesian inference and spatial prediction within a model for weed count data and a covariate

Usage

```
pred.weed(nit, thin = 1, x = NULL, xy = NULL, y = NULL, z, wx = NULL,
wxy = NULL,
i = NULL, alpha = NULL, beta = NULL, lambda = NULL, tau = NULL, kappa =
NULL,
sd.prop.h = 0.1, sd.prop.alpha = 0.5, sd.prop.beta = 0.5, sd.prop.lambda
= 0.1, sd.prop.tau = 0.1,
delta.prop.kappa = 2, mprior.alpha, vprior.alpha, mprior.beta, vprior.beta, mprior.
```

Arguments

`nit`	Number of iterations
`thin`	Thinning of the Markov chain
`x`	Coordinates of sites where weed counts only are given
`xy`	Coordinates of sites where weeds and images are given
`y`	Coordinates of sites where image indexes only are given
`z`	Coordinates of sites where predcited values are sought
`wx`	Weed values at sites `x`
`wxy`	Weed values at sites `xy`
`i`	Image values at sites `xy` and `y`. Values have to be concatenated in the same vector in this order
`alpha`	Init value for the shape parameter of `w`
`beta`	Init value for the scale parameter of `w`
`lambda`	Init value for the scaling parameter relating `w` and `i` as $i = \lambda w \epsilon$
`tau`	Init value for the variance of noise $epsilon$
`kappa`	Init value for the spatial scale parameter of the Gausian random field
`sd.prop.h`	Standard deviation of the Gaussian increment in the proposal of Gaussian components h
`sd.prop.alpha`	Standard deviation of the Gaussian increment in the proposal for `alpha`

sd.prop.beta Standard deviation of the Gaussian increment in the proposal for beta

sd.prop.lambda
Standard deviation of the Gaussian increment in the proposal for lambda

sd.prop.tau Standard deviation of the Gaussian increment in the proposal for tau

delta.prop.kappa
Maximum number of increments allowed (the amplitude of an increment being kappa.max/n.kappa) for a move in the proposal of kappa

mprior.alpha A priori mean of alpha

vprior.alpha A priori variance of alpha

mprior.beta A priori mean of beta

vprior.beta A priori variance of beta

mprior.kappa A priori mean of kappa

vprior.kappa A priori variance of kappa

mprior.tau A priori mean of tau

vprior.tau A priori variance of tau

mprior.lambda
A priori mean of lambda

vprior.lambda
A priori variance of lambda

n.kappa Number of steps in the discretisation of the support of kappa

kappa.max Maximum value in the truncation of the support of kappa

Details

If standard deviation of the Gaussian increment in the update of alpha, beta, lambda or tau, or if the step in the increment of kappa is equal to 0, then this variable is not processed in the MCMC run and stays at its initial value. This is the way to specify that inference should not be made on a one or several variable. See examples in WeedMap where lambda is initialised at 1 and not updated (sd.prop.lambda=0).

If init values are not given, the corresponding parameters are initialised from the prior.

Value

A list whose elements are:

x Coordinates of sites where weed counts only are given

y Coordinates of sites where image indexes only are given

z Coordinates of sites where predcited values are sought

wx Weed values at sites x

i Image values at sites xy and y. Values are concatenated in the same vector in this order

nit Number of iterations

thin Thinning of the Markov chain

wy.MC	A matrix with ny rows and nit/thin columns containing sampled values of wy
wz.MC	A matrix with nz rows and nit/thin columns containing sampled values of wz
alpha.MC	A vector of length nit/thin of simulated alpha values
beta.MC	A vector of length nit/thin of simulated beta values
lambda.MC	A vector of length nit/thin of simulated lambda values
tau.MC	A vector of length nit/thin of simulated tau values
kappa.MC	A vector of length nit/thin of simulated kappa values
n.kappa	Number of steps in the discretisation of the support of kappa
kappa.max	Maximum value in the truncation of the support of kappa

Author(s)

Gilles Guillot

References

G. Guillot, N. Loren, M. Rudemo, Bayesian spatial prediction of weed intensities from exact count data and picture based indexes, 2006, submitted

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show.pred.weed *Plot results of pred.weed*

Description

Plot traces of Markov chains simulated by pred.weed, compute statistics on the posterior distribution, compare to known true values. (if any)

Usage

```
show.pred.weed(sim = NULL, res, param = TRUE, pairs = TRUE, wy = TRUE, wz = TRUE, r
```

Arguments

sim	A list, typically the output of function sim.weed
res	A list, typically the output of function pred.weed
param	Logical: if TRUE graphs of simulated parameters contained in res are displayed
pairs	Logical: if TRUE pair plots of predicted weed values are ploted against known true values provided as outputof function sim are displayed (for debuging and convergence checking)
wy	Logical: if TRUE chains corresponding to the nine first sites in y are displayed
wz	Logical: if TRUE chains corresponding to the nine first sites in z are displayed

`nit`	Number of Markov iterations
`thin`	Thinning of the chain
`burnin`	Number of values to discard before computing statistics about the empirical posterior. The number of iterations discarded is the number of stored iterations, e.g. if `nit=10000` and `thin=10`, then only 1000 iterations are stored and `burnin=100` will remove the 100 first which correspond to actually thin*burnin=1000 Markov iterations.

Value

No value returned

Author(s)

Gilles Guillot

References

G. Guillot, N. Loren, M. Rudemo, Bayesian spatial prediction of weed intensities from exact count data and picture based indexes, 2006, submitted

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`show.sim.weed` *Plot simulated weed dataset*

Description

Takes the output of `sim.weed` and plot the different variables according to the options of simulations

Usage

```
show.sim.weed(sim)
```

Arguments

`sim`	A list as produced by `sim.weed`

Value

No value is returned

Author(s)

Gilles Guillot

References

G. Guillot, N. Loren, M. Rudemo, Bayesian spatial prediction of weed intensities from exact count data and picture based indexes, 2006, submitted

`sim.weed`	*Simulate weed exact count data and a covariate*

Description

The data simulated are of two kinds: exact weed counts and image derived indexes. The counts w arise from a transformed Gaussian model with Gamma marginal. The image indexes i relate to w as $i(s) = \lambda w(s) * \epsilon(s)$, where ϵ is a spatially uncorrelated noise. The simulation is carried out on the unit square.

Usage

```
sim.weed(nx, ny, nxy, nz, param.cov, mu, sigma, lambda, tau, nbin, true.field = FAI
```

Arguments

`nx`	number of sites where only w is observed
`ny`	number of sites where only i is observed
`nxy`	number of sites where w and i are observed
`nz`	number of sites where w will be predicted. If `z.on.grid=TRUE`, `nz` should be a square.
`param.cov`	Vector of parameters of the underlying Gaussian randomFields. The simulation of the Gaussian random fields performed assuming an exponential covariance function. The vector of parameters should have four components, namely: mea, variance, nugget, scale and should be given as e.g.:`c(mean=0,variance=1,nugget=0,scale=.1` See the documentation of `GaussRF` in package `RandomFields` for details.
`mu`	Mean of w
`sigma`	Variance of w
`lambda`	Scaling factor relating w and i
`tau`	Variance of ϵ
`nbin`	Number of bins for the binned data
`true.field`	Logical: shoud values on a dense grid be given
`npix`	A vector giving the number of pixels horizontally and vertically of the grid if `true.field=TRUE`
`z.on.grid`	Logical: set TRUE if sites of prediction z are required on a grid; then`nz` should be a square.

Details

Value

`x`	Coordinates of sites where weed counts only are given
`xy`	Coordinates of sites where weeds and images are given
`y`	Coordinates of sites where image indexes only are given
`z`	Coordinates of sites where predcited values are sought
`coord.grid`	Logical telling whether all the realisation of the weed random field is also given on a grid
`wx`	Weed values at sites `x`
`wy`	Weed values at sites `y`
`wxy`	Weed values at sites `xy`
`wz`	Weed values at sites `z`
`vx`	Binned weed values at sites `x`
`vxy`	Binned weed values at sites `xy`
`i`	Image values at sites `xy` and `y`. Values are concatenated in the same vector in this order
`wgrid`	Weed counts values at the node of a grid
`igrid`	Image index values at the node of a grid
`bin`	Binning of the weed counts
`param.cov`	Parameters of the covariance function of the underlying Gaussian random field
`mu`	Mean of `w`
`sigma`	Variance of `w`
`alpha`	Shape parameter of `w`
`beta`	Scale parameter of `w`
`lambda`	Scaling parameter relating `w` and `i` as $i = \lambda w \epsilon$
`tau`	Variance of noise $epsilon$
`npix`	number of pixel in the horizontal direction (same value is assumed for the vertical direction)

Author(s)

Gilles Guillot

References

G. Guillot, N. Loren, M. Rudemo, Bayesian spatial prediction of weed intensities from exact count data and picture based indexes, 2006, submitted

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