Package ‘SDALGCP’

February 28, 2020

Title  Spatially Discrete Approximation to Log-Gaussian Cox Processes for Aggregated Disease Count Data

Version  0.3.0


Depends  R (>= 3.4.0)

License  GPL-2 | GPL-3

Encoding  UTF-8

LazyData  true

Imports  pdist(>= 1.2), Matrix(>= 1.2.14), PrevMap(>= 1.4.1), raster(>= 2.6.7), sp(>= 1.2.7), spatstat(>= 1.55.1), splanca(>= 2.1.40), maptools(>= 0.9.2), progress(>= 1.1.2), methods, spacetime(>= 1.2.2), mapview(>= 2.6.0), geoR(>= 1.7-5.2.1)

RoxygenNote  7.0.0

Suggests  knitr, rmarkdown

VignetteBuilder  knitr

NeedsCompilation  no

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Repository  CRAN

Date/Publication  2020-02-28 16:40:02 UTC
Confidence Intervals for SDALGCP Model Parameters

Description

Computes confidence intervals for one or more parameters in a fitted SDALGCP model from the object of class "SDALGCP", based on asymptotic normality.

Usage

```r
## S3 method for class 'SDALGCP'
confint(object, parm, level = 0.95, dp = 3, ...)
```

Arguments

- **object**: an object of class "SDALGCP" obtained as result of a call to `SDALGCPMCML`.
- **parm**: a specification of which parameters are to be given confidence intervals, either a vector of numbers or a vector of names. If missing, all parameters are considered.
- **level**: the confidence level required.
- **dp**: the number of decimal places for the result
- **...**: additional argument(s) for methods.
controlmcmcSDA 3

Value

A matrix (or vector) with columns giving lower and upper confidence limits for each parameter. These will be labelled as (1-level)/2 and 1 - (1-level)/2 in

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See Also

confint.lm, confint.default, SDALGCPMCMC

Description

This function helps to define the number of iteration, burn-in, thinning, and the tuning parameters of the adaptive MALA

Usage

controlmcmcSDA(n.sim, burnin, thin, h, c1.h, c2.h)

Arguments

n.sim the number of iteration
burnin The number of burn-in
thin the number of thinning
h tuning parameter of the proposal distribution used in the Langevin-Hastings MCMC algorithm (see Laplace.sampling); default is h=NULL and then set internally as 1.65/n(1/6), where n is the dimension of the random effect.
c1.h value of c1 used in the adaptive scheme for h; default is c1.h=0.01. See also 'Details' in PrevMap package
c2.h value of c2 used in the adaptive scheme for h; default is c2.h=1e-04. See also 'Details' in PrevMap package

Details

To be used as one of the arguments of SDALGCPMCMC

Value

A list with processed arguments to be passed to the main function.
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See Also

control.mcmc.MCML

Examples

n <- 545
h <- 1.65/(n^(1/6))
control.mcmc <- controlmcmcSDA(n.sim = 10000, burnin = 2000,
thin= 8, h=h, c1.h = 0.01, c2.h = 1e-04)
str(control.mcmc)

PBCshp  PBC count data and index of multiple deprivation data.

Description

A dataset containing PBC count and Index of multiple deprivation

Usage

data(PBCshp)

Format

A SpatialPolygonsDataFrame of object containing the PBC cases count for each LSOA in Newcastle upon Tyne, UK, as well as the index of multiple deprivation.

X  PBC count
pop  population count
LSOA04CD  LSOA ID
pop  population count
males  number of males
females  number of females
propmale  proportion of males
IMD  index of multiple deprivation score
Income  proportion of the population experiencing income deprivation
Employment  proportion of the population experiencing employment deprivation
Health  deprivation due to Health
**phiCI**

- **Education** deprivation due to education
- **Barriers** barriers to housing and services
- **Crime** deprivation due to crime
- **Environment** living environment deprivation ...

**References**


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**phiCI**

*Plot of the deviance to derive the confidence interval of the scale parameter, phi*

**Description**

This function computes the confidence interval of phi

**Usage**

phiCI(obj, coverage = 0.95, plot = TRUE)

**Arguments**

- **obj** object of class "SDALGCP" from the call to function SDALGCPMCML
- **coverage** the coverage probability, default is 0.95
- **plot** logical, to plot the deviance curve. default is TRUE

**Details**

This function computes the confidence interval of phi

**Value**

return the deviance plot and the corresponding confidence interval of the scale parameter phi

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**See Also**

SDALGCPMCML
plot.Pred.SDALGCP

Description

Simple plotting function for both discrete and continuous prediction from the object of class "Pred.SDALGCP".

Usage

```r
## S3 method for class 'Pred.SDALGCP'
plot(
  x,
  type = "relrisk",
  continuous = NULL,
  thresholds = NULL,
  bound = NULL,
  overlay = FALSE,
  ...
)
```

Arguments

- **x**: an object of class "Pred.SDALGCP" obtained as result of a call to `SDALGCPPred`.
- **type**: Character string: what type of plot to produce. For discrete inference choices are "incidence" (=exp(mu+S)); "SEincidence" (standard error of incidence); "CovAdjRelRisk" (=exp(S)); or "SECovAdjRelRisk" (standard error of covariate adjusted relative risk); while for continuous inference, choices are "relrisk" (=exp(S)); "SErelrisk" (standard error of the relative risk).
- **continuous**: logical; TRUE for spatially continuous relative risk and FALSE for region specific relative risk. default is TRUE
- **thresholds**: optional; (only used if you want to plot the exceedance probability) either a vector of numbers or a vector of single value.
- **bound**: optional; it gives the boundary of the region, only useful when the predictive location is supplied in `SDALGCPPred`
- **overlay**: optional; a logical operation to indicate either to add a base map.
- **...**: further arguments passed to `plot`.

Details

This function plots the inference from `SDALGCPPred` function. It plots for region-specific inference; incidence and covariate adjusted relative risk while for spatially continuous inference it plots the relative risk. It can as well plot the exceedance probability for spatially discrete and continuous inference.
Value

The function does not return any value.

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See Also

SDALGCPred, plot_continuous, plot_discrete, plot_SDALGCPexceedance, SDALGCPexceedance

Examples

### Prepare the input of the model
data(PBCshp)
data <- as.data.frame(PBCshp@data) # get the data
### Write the formula of the model
FORM <- X ~ propmale + Income + Employment + Education + Barriers + Crime + Environment + offset(log(pop))
### set the discretised phi
phi <- seq(500, 1700, length.out = 20)
#### get the initial parameter
model <- glm(formula=FORM, family="poisson", data=data)
beta.start <- coef(model)
sigma2.start <- mean(model$residuals^2)
phi.start <- median(phi)
par0 <- c(beta.start, sigma2.start, phi.start)
# setup the control arguments for the MCMC
n <- 545
h <- 1.65/(n^(1/6))
control.mcmc <- controlmcmcSDA(n.sim = 10000, burnin = 2000,
thin= 8, h=h, c1.h = 0.01, c2.h = 1e-04)
### Run the model
my_est <- SDALGCPMCML(formula=FORM, data=data, my_shp=PBCshp, delta=100, phi=phi, method=1,
weighted=FALSE, plot=TRUE, par0=NULL, control.mcmc=control.mcmc)
Con_pred <- SDALGCPPred(para_est=my_est, cellsize=300, continuous=TRUE)
# to plot the spatially continuous relative risk
plot(Con_pred, type="relrisk")
# to plot the incidence
plot(Con_pred, type="incidence", continuous=FALSE)
# to plot the exceedance probability of the relative risk
plot(Con_pred, type="relrisk", thresholds= 2)
# to plot the exceedance probability of the incidence
plot(Con_pred, type="incidence", continuous=FALSE, thresholds= 0.001)
plot.Pred.SDALGCPST  

plot.Pred.SDALGCPST function

Description

Simple plotting function for both discrete and continuous prediction from the object of class "Pred.SDALGCPST".

Usage

```r
## S3 method for class 'Pred.SDALGCPST'
plot(
x, type = "relrisk", continuous = NULL,
thresholds = NULL,
bound = NULL,
overlay = FALSE,
...
)
```

Arguments

- **x**: an object of class "Pred.SDALGCPST" obtained as result of a call to `SDALGCPPred_ST`.
- **type**: Character string: what type of plot to produce. For discrete inference choices are "incidence" (=exp(mu+S)); "SEincidence" (standard error of incidence); "CovAdjRelRisk" (=exp(S)); or "SECovAdjRelRisk" (standard error of covariate adjusted relative risk); while for continuous inference, choices are "relrisk" (=exp(S)); "SRelrisk" (standard error of the relative risk).
- **continuous**: logical; TRUE for spatially continuous relative risk and FALSE for region specific relative risk. default is TRUE.
- **thresholds**: optional; (only used if you want to plot the exceedance probability) either a vector of numbers or a vector of single value.
- **bound**: optional; it gives the boundary of the region, only useful when the predictive location is supplied in `SDALGCPPred_ST`.
- **overlay**: optional; a logical operation to indicate either to add a base map.
- **...</a>

Details

This function plots the inference from `SDALGCPPred` function. It plots for region-specific inference; incidence and covariate adjusted relative risk while for spatially continuous inference it plots the relative risk. It can as well plot the exceedance probability for spatially discrete and continuous inference.
Value

The function does not return any value.

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See Also

SDALGCPPred_ST, plot_continuousST, plot_discreteST, plot_SDALGCPexceedanceST, SDALGCPexceedanceST

Examples

# check vignette for examples

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pop_den  Population density raster shapefile of Newcastle Upon Tyne in the UK.

Description

A dataset containing the population density of Newcastle upon Tyne of 300 X 300 metres

Usage

data(pop_den)

Format

This is a raster file of population density, 300 X 300 meters.

References

Description

The SDALGCP package provides four main functions: SDALGCPMCML, SDALGCPMCML_ST, SDALGCPPred and SDALGCPPred_ST.

SDALGCP functions

The SDALGCPMCML function uses Monte Carlo Maximum Likelihood to estimate the parameter of a poisson log-linear model with spatially continuous random effect for static spatial case.

The SDALGCPPred function delivers spatially discrete prediction of the incidence and the covariate adjusted relative risk and spatially continuous prediction of the covariate adjusted relative risk for static spatial case.

The SDALGCPMCML_ST function uses Monte Carlo Maximum Likelihood to estimate the parameter of a poisson log-linear model with spatially continuous random effect for spatio-temporal case.

The SDALGCPPred_ST function delivers spatially discrete prediction of the incidence and the covariate adjusted relative risk and spatially continuous prediction of the covariate adjusted relative risk for spatio-temporal case.

Functions such as summary, confint and print also can be applied to the output.

Author(s)

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References


Parameter estimation for SDA-LGCP Using Monte Carlo Maximum likelihood

Description

This function provides the maximum likelihood estimation of the parameter given a set of values of scale parameter of the Gaussian process, phi.

Usage

SDALGCPMCML(
  formula,
  data,
  my_shp,
  delta,
  phi = NULL,
  method = 1,
  pop_shp = NULL,
  weighted = FALSE,
  par0 = NULL,
  control.mcmc = NULL,
  plot = FALSE,
  plot_profile = TRUE,
  rho = NULL,
  giveup = NULL,
  messages = FALSE
)

Arguments

formula an object of class formula (or one that can be coerced to that class): a symbolic description of the model to be fitted.
data data frame containing the variables in the model.
my_shp A SpatialPolygons or SpatialPolygonsDataFrame object containing the polygons (i.e each regions).
delta distance between points
phi the discretised values of the scale parameter phi. if not supplied, it uses the default, which is 20 phis’ which ranges from size of the smallest region to the one-tenth of the size of the entire domain.
method To specify which method to use to sample the points, the options are 1 for Simple Sequential Inhibition (SSI) process, 2 for Uniform sampling and 3 for regular grid. 1 is the default
pop_shp Optional, The raster of population density map for population weighted approach
weighted  To specify if you want to use the population density, default to FALSE, i.e population density is not used.

par0  the initial parameter of the fixed effects beta, the variance sigmasq and the scale parameter phi, specified as c(beta, sigma2, phi). Default; beta, the estimates from the glm; sigma2, variance of the residual; phi, the median of the supplied phi.

control.mcmc  list from PrevMap package to define the burnin, thining, the number of iteration and the turning parameters see controlmcmcsDA.

plot  To display the plot of the points inside the polygon, default to TRUE

plot_profile  logical; if TRUE the profile-likelihood is plotted. default is FALSE

rho  Optional, the packing density, default set to 0.55

giveup  Optional, number of rejected proposals after which the algorithm should terminate, default set to 1000

messages  logical; if messages=TRUE, it prints the results objective function and the parameters at every phi iteration. Default is FALSE.

Details
This function performs parameter estimation for a SDALGCP Model **Monte Carlo Maximum likelihood.** The Monte Carlo maximum likelihood method uses conditional simulation from the distribution of the random effect \( T(x) = d(x)' \beta + S(x) \) given the data \( y \), in order to approximate the high-dimensional intractable integral given by the likelihood function. The resulting approximation of the likelihood is then maximized by a numerical optimization algorithm which uses analytic expression for computation of the gradient vector and Hessian matrix. The functions used for numerical optimization are \( \text{nlinmb} \). The first stage of estimation is generating locations inside the polygon, followed by precomputing the correlation matrices, then optimising the likelihood.

Value
An object of class "SDALGCP". The function \( \text{summary.SDALGCP} \) is used to print a summary of the fitted model. The object is a list with the following components:

D: matrix of covariates.

y: the count, response observations.

m: offset

beta_opt: estimates of the fixed effects of the model.

sigma2_opt: estimates of the variance of the Gaussian process.

phi_opt: estimates of the scale parameter phi of the Gaussian process.

cov: covariance matrix of the MCML estimates.

Sigma_mat_opt: covariance matrix of the Gaussian process that corresponds to the optimal value

llike_val_opt: maximum value of the log-likelihood.

mu: mean of the linear predictor

all_para: the entire estimates for the different values of phi.

all_cov: the entire covariance matrix of the estimates for the different values of phi.
par0: the initial parameter of the fixed effects beta and the variance sigmasq used in the estimation
control.mcmc: the burnin, thining, the number of iteration and the turning parameters used see
call: the matched call.

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References

Statistical Software, 78(8), 1-29. doi:10.18637/jss.v078.i08
of Computational and Graphical Statistics 13, 702-718.

See Also

Aggregated_poisson_log_MCML, Laplace.sampling, summary.SDALGCP

Examples

```r
### Prepare the input of the model
data(PBCshp)
data <- as.data.frame(PBCshp@data) #get the data
### Write the formula of the model
FORM <- X ~ propmale + Income + Employment + Education + Barriers + Crime +
Environment + offset(log(pop))
### set the discretised phi
phi <- seq(500, 1700, length.out = 20)
#### get the initial parameter
model <- glm(formula=FORM, family="poisson", data=data)
beta.start <- coef(model)
sigma2.start <- mean(model$residuals^2)
phi.start <- median(phi)
par0 <- c(beta.start, sigma2.start, phi.start)
# setup the control arguments for the MCMC
n <- 545
h <- 1.65/(n^(1/6))
control.mcmc <- controlmcmcSDA(n.sim = 10000, burnin = 2000,
    thin= 8, h=h, c1.h = 0.01, c2.h = 1e-04)
###Run the model
my_est <- SDALGCPMCML(formula=FORM, data=data, my_shp=PBCshp, delta=100, phi=phi, method=1,
    weighted=FALSE, plot=TRUE, par0=par0, control.mcmc=control.mcmc)
```
Parameter estimation for spatio-temporal SDA-LGCP Using Monte Carlo Maximum likelihood

Description

This function provides the maximum likelihood estimation of the parameter given a set of values of scale parameter of the Gaussian process, phi.

Usage

SDALGCPMCMCML_ST(
  formula,
  st_data,
  delta,
  phi = NULL,
  method = 1,
  pop_shp = NULL,
  kappa = 0.5,
  weighted = FALSE,
  par0 = NULL,
  control.mcmc = NULL,
  plot = FALSE,
  plot_profile = TRUE,
  rho = NULL,
  giveup = NULL,
  messages = FALSE
)

Arguments

formula: an object of class formula (or one that can be coerced to that class): a symbolic description of the model to be fitted.

st_data: data frame containing the variables in the model and the polygons of the region, which of class spacetime.

delta: distance between points

phi: the discretised values of the scale parameter phi. if not supplied, it uses the default, which is 20 phis’ which ranges from size of the smallest region to the one-tenth of the size of the entire domain.

method: To specify which method to use to sample the points, the options are 1 for Simple Sequential Inhibition (SSI) process, 2 for Uniform sampling and 3 for regular grid. 1 is the default

pop_shp: Optional. The raster of population density map for population weighted approach
SDALGCPMCMCML_ST

kappa  the smoothness parameter of the matern correlation function assumed for the
temporal correlation, default to 0.5 which corresponds to exponential correlation
function.

weighted  To specify if you want to use the population density, default to FALSE, i.e pop-
ulation density is not used.

par0  the initial parameter of the fixed effects beta, the variance sigmasq and the scale
parameter phi, specified as c(beta, sigma2, phi). Default; beta, the estimates
from the glm; sigma2, variance of the residual; phi, the median of the supplied
phi.

ccontrol.mcmc  list from PrevMap package to define the burnin, thining, the number of iteration
and the turning parameters see controlmcmcSDA.

plot  To display the plot of the points inside the polygon, default to TRUE

plot_profile  logical; if TRUE the profile-likelihood is plotted. default is FALSE

rho  Optional, the packing density, default set to 0.55

giveup  Optional, number of rejected proposals after which the algorithm should termi-
nate, default set to 1000

messages  logical; if messages=TRUE, it prints the results objective function and the pa-
rameters at every phi iteration. Default is FALSE.

Details

This function performs parameter estimation for a SDALGCP Model Monte Carlo Maximum
likelihood. The Monte Carlo maximum likelihood method uses conditional simulation from the
distribution of the random effect \( T(x) = d(x)\beta + S(x) \) given the data \( y \), in order to approximate the
high-dimensional intractable integral given by the likelihood function. The resulting approximation
of the likelihood is then maximized by a numerical optimization algorithm which uses analytic
expression for computation of the gradient vector and Hessian matrix. The functions used for
numerical optimization are \texttt{nlminb}. The first stage of estimation is generating locations inside the
polygon, followed by precomputing the correlation matrices, then optimising the likelihood.

Value

An object of class "SDALGCP". The function \texttt{summary.SDALGCPST} is used to print a summary of
the fitted model. The object is a list with the following components:

\( D \): matrix of covariates.

\( y \): the count, response observations.

\( m \): offset

\texttt{beta_opt}: estimates of the fixed effects of the model.

\texttt{sigma2_opt}: estimates of the variance of the Gaussian process.

\texttt{phi_opt}: estimates of the scale parameter phi of the Gaussian process.

\texttt{cov}: covariance matrix of the MCML estimates.

\texttt{Sigma_mat_opt}: covariance matrix of the Gaussian process that corresponds to the optimal value
\texttt{llike_val_opt}: maximum value of the log-likelihood.
mu: mean of the linear predictor
all_para: the entire estimates for the different values of phi.
all_cov: the entire covariance matrix of the estimates for the different values of phi.
par0: the initial parameter of the fixed effects beta and the variance sigmasq used in the estimation
control.mcmc: the burnin, thining, the number of iteration and the turning parameters used see controlmcmcSDA.
call: the matched call.

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References


See Also

Aggregated_poisson_log_MCML, Laplace.sampling, summary.SDALGCPST

Examples

# check vignette for examples
Usage

SDALGCPMCML_ST2(
  formula,
  st_data,
  delta,
  phi = NULL,
  method = 1,
  pop_shp = NULL,
  kappa = 0.5,
  weighted = FALSE,
  par0 = NULL,
  control.mcmc = NULL,
  plot = FALSE,
  plot_profile = TRUE,
  rho = NULL,
  giveup = NULL,
  messages = FALSE,
  nu.start = NULL
)

Arguments

formula an object of class formula (or one that can be coerced to that class): a symbolic
description of the model to be fitted.

st_data data frame containing the variables in the model and the polygons of the region,
which of class spacetime.

delta distance between points

phi the discretised values of the scale parameter phi. if not supplied, it uses the
default, which is 20 phis’ which ranges from size of the smallest region to the
one-tenth of the size of the entire domain.

method To specify which method to use to sample the points, the options are 1 for Simple
Sequential Inhibition (SSI) process, 2 for Uniform sampling and 3 for regular
grid. 1 is the default

pop_shp Optional. The raster of population density map for population weighted ap-
proach

kappa the smoothness parameter of the matern correlation function assumed for the
temporal correlation, default to 0.5 which corresponds to exponential correlation
function.

weighted To specify if you want to use the population density, default to FALSE, i.e pop-
ulation density is not used.

par0 the initial parameter of the fixed effects beta, the variance sigmasq and the scale
parameter phi, specified as c(beta, sigma2, phi). Default; beta, the estimates
from the glm; sigma2, variance of the residual; phi, the median of the supplied
phi.

control.mcmc list from PrevMap package to define the burnin, thining, the number of iteration
and the turning parameters see controlmcmcSDA.
plot: To display the plot of the points inside the polygon, default to TRUE
plot_profile: logical; if TRUE the profile-likelihood is plotted. default is FALSE
rho: Optional, the packing density, default set to 0.55
giveup: Optional, number of rejected proposals after which the algorithm should terminate, default set to 1000
messages: logical; if messages=TRUE, it prints the results objective function and the parameters at every phi iteration. Default is FALSE.
nu.start: the initial value of the time parameter, default is null

Details
This function performs parameter estimation for a SDALGCP Model Monte Carlo Maximum likelihood. The Monte Carlo maximum likelihood method uses conditional simulation from the distribution of the random effect $T(x) = d(x)' \beta + S(x)$ given the data $y$, in order to approximate the high-dimensional intractable integral given by the likelihood function. The resulting approximation of the likelihood is then maximized by a numerical optimization algorithm which uses analytic expression for computation of the gradient vector and Hessian matrix. The functions used for numerical optimization are \texttt{nlminb}. The first stage of estimation is generating locations inside the polygon, followed by precomputing the correlation matrices, then optimising the likelihood.

Value
An object of class "SDALGCP". The function \texttt{summary.SDALGCPST} is used to print a summary of the fitted model. The object is a list with the following components:

- $D$: matrix of covariates.
- $y$: the count, response observations.
- $m$: offset
- beta_opt: estimates of the fixed effects of the model.
- sigma2_opt: estimates of the variance of the Gaussian process.
- phi_opt: estimates of the scale parameter phi of the Gaussian process.
- cov: covariance matrix of the MCML estimates.
- Sigma_mat_opt: covariance matrix of the Gaussian process that corresponds to the optimal value
- llike_val_opt: maximum value of the log-likelihood.
- mu: mean of the linear predictor
- all_para: the entire estimates for the different values of phi.
- all_cov: the entire covariance matrix of the estimates for the different values of phi.
- par0: the initial parameter of the fixed effects beta and the variance sigmasq used in the estimation
- control.mcmc: the burnin, thining, the number of iteration and the turning parameters used see \texttt{controlmcmcSDA}.
- call: the matched call.
Author(s)

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References


See Also

Aggregated_poisson_log_MCML, Laplace.sampling, summary.SDALGCPST

Examples

# check vignette for examples

SDALGCPPred

Spatial prediction using plug-in of MCML estimates

Description

This function performs spatial continuous and discrete prediction, fixing the model parameters at the Monte Carlo maximum likelihood estimates of a SDALGCP model.

Usage

SDALGCPPred(
  para_est,
  cellsize,
  continuous = TRUE,
  control.mcmc = NULL,
  pred.loc = NULL,
  divisor = 1,
  plot.correlogram = F,
  messages = TRUE,
  parallel = FALSE
)
**Arguments**

- **para_est**: an object of class "SDALGCP" obtained as a result of a call to `SDALGCMCML`.
- **cellsize**: the size of the computational grid.
- **continuous**: logical; to choose which prediction to do perform, discrete or continuous. the default is continuous.
- **control.mcmc**: output from `controlmcmcSDA`, if not provided, it uses the values used for the parameter estimation.
- **pred.loc**: optional, the dataframe of the predictive grid.
- **divisor**: optional, the value to use to convert the dimension of the polygon, default is 1 which implies no conversion.
- **plot.correlogram**: logical; if `plot.correlogram=TRUE` the autocorrelation plot of the conditional simulations is displayed.
- **messages**: logical; if `messages=TRUE` then status messages are printed on the screen (or output device) while the function is running. Default is `messages=TRUE`.
- **parallel**: to parallelize some part of the function.

**Details**

The function perform prediction of the spatially discrete incidence and covariate adjusted relative risk, and spatially continuous relative risk. The discrete inference uses the Metropolis-Adjusted Langevin Hasting sampling from `Laplace.sampling`. And the continuous inference is typically change of support inference.

**Value**

- **pred.draw**: the samples of the prediction
- **pred**: the prediction of the relative risk
- **predSD**: the standard error of the prediction
- **Pred.loc**: The coordinates of the predictive locations

**Author(s)**

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**References**


**See Also**

- `plot.Pred.SDALGCP`
- `SDAContinuousPred`
- `SDADiscretePred`
- `plot_continuous`
- `plot_discrete`
### Prepare the input of the model
```r
data(PBCshp)
data <- as.data.frame(PBCshp@data)  # get the data
```

### Write the formula of the model
```r
FORM <- X ~ propmale + Income + Employment + Education + Barriers + Crime + Environment + offset(log(pop))
```

### set the discretised phi
```r
phi <- seq(500, 1700, length.out = 20)
```

#### get the initial parameter
```r
model <- glm(formula=FORM, family="poisson", data=data)
beta.start <- coef(model)
sigma2.start <- mean(model$residuals^2)
phi.start <- median(phi)
par0 <- c(beta.start, sigma2.start, phi.start)
```

# setup the control arguments for the MCMC
```r
n <- 545
h <- 1.65/(n^(1/6))
control.mcmc <- controlmcmcSDA(n.sim = 10000, burnin = 2000, thin= 8, h=h, c1.h = 0.01, c2.h = 1e-04)
```

### Run the model
```r
my_est <- SDALGCPMCML(formula=FORM, data=data, my_shp=PBCshp, delta=100, phi=phi, method=1, weighted=FALSE, plot=TRUE, par0=par0, control.mcmc=control.mcmc)
Con_pred <- SDALGCPPred(para_est=my_est, cellsize=300, continuous=TRUE)
```

### SDALGCPPred_ST

**Spatial prediction using plug-in of MCML estimates**

This function performs spatial continuous and discrete prediction, fixing the model parameters at the Monte Carlo maximum likelihood estimates of a SDALGCP model.

#### Usage
```r
SDALGCPPred_ST(
  para_est,
  cellsize,
  continuous = TRUE,
  control.mcmc = NULL,
  pred.loc = NULL,
  divisor = 1,
  plot.correlogram = F,
  messages = TRUE,
  parallel = FALSE,
  n.window = 1
)
```
**Arguments**

- **para_est**: an object of class "SDALGCPST" obtained as a result of a call to `SDALGCPMCMC_ST`.
- **cellsize**: the size of the computational grid.
- **continuous**: logical; to choose which prediction to do perform, discrete or continuous, the default is continuous.
- **control.mcmc**: output from `controlmcmcSDA`, if not provided, it uses the values used for the parameter estimation.
- **pred.loc**: optional, the dataframe of the predictive grid.
- **divisor**: optional, the value to use to convert the dimension of the polygon, default is 1 which implies no conversion.
- **plot.correlogram**: logical; if `plot.correlogram = TRUE` the autocorrelation plot of the conditional simulations is displayed.
- **messages**: logical; if `messages=TRUE` then status messages are printed on the screen (or output device) while the function is running. Default is `messages=TRUE`.
- **parallel**: to parallelize some part of the function.
- **n.window**: the number of partitions to use for prediction. This is basically stratifying the predictive grid into fewer pieces.

**Details**

The function perform prediction of the spatially discrete incidence and covariate adjusted relative risk, and spatially continuous relative risk. The discrete inference uses the Metropolis-Adjusted Langevin Hasting sampling from `Laplace.sampling`. And the continuous inference is typically change of support inference.

**Value**

- **pred.draw**: the samples of the prediction
- **pred**: the prediction of the relative risk
- **predSD**: the standard error of the prediction
- **Pred.loc**: The coordinates of the predictive locations

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**References**

See Also

plot.Pred.SDALGCPST, SDAContinuousPred, SDADiscretePred, plot_continuous, plot_discrete

Examples

# check vignette for examples

SDALGCPPred_ST2

Spatial prediction using plug-in of MCML estimates

Description

This function performs spatial continuous and discrete prediction, fixing the model parameters at
the Monte Carlo maximum likelihood estimates of a SDALGCP model.

Usage

SDALGCPPred_ST2(
  para_est,
  cellsize,
  continuous = TRUE,
  control.mcmc = NULL,
  pred.loc = NULL,
  divisor = 1,
  plot.correlogram = F,
  messages = TRUE,
  parallel = FALSE,
  n.window = 1
)

Arguments

para_est an object of class "SDALGCPST" obtained as a result of a call to SDALGCPMCML_ST.
cellsize the size of the computational grid.
continuous logical; to choose which prediction to do perform, discrete or continuous, the
default is continuous.
control.mcmc output from controlmcmcSDA, if not provided, it uses the values used for the
parameter estimation.
pred.loc optional, the dataframe of the predictive grid.
divisor optional, the value to use to convert the dimension of the polygon, default is 1
which implies no conversion.
plot.correlogram logical; if plot.correlogram = TRUE the autocorrelation plot of the conditional
simulations is displayed.
messages logical; if messages=TRUE then status messages are printed on the screen (or output device) while the function is running. Default is messages=TRUE.

parallel to parallelize some part of the function.

n.window the number of partitions to use for prediction. This is basically stratifying the predictive grid into fewer pieces

Details

The function perform prediction of the spatially discrete incidence and covariate adjusted relative risk, and spatially continuous relative risk. The discrete inference uses the Metropolis-Adjusted Langevin Hasting sampling from Laplace.sampling. And the continuous inference is typically change of support inference.

Value

pred.draw: the samples of the prediction
pred: the prediction of the relative risk
predSD: the standard error of the prediction
Pred.loc: The coordinates of the predictive locations

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References


See Also

plot.Pred.SDALGCPST, SDAContinuousPred, SDADiscretePred, plot_continuous, plot_discrete

Examples

# check vignette for examples
SDAProfilePhi

plot profile likelihood of phi

Description
This function plots the profile likelihood of phi

Usage
SDAProfilePhi(obj)

Arguments
obj the output of SDALGCPMCML of class "SDALGCP"

Details
To be used to view the value of the likelihood versus the scale parameter phi

Value
A plot

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summary.SDALGCP

Summarizing the parameter estimates of SDALGCP model

Description
summary method for the class "SDALGCP" that computes the standard errors and p-values of SDALGCP.

Usage
## S3 method for class 'SDALGCP'
summary(object, ...)

Arguments
object an object of class "SDALGCP" obtained as result of a call to SDALGCPMCML.
... further arguments passed to or from other methods.
Value

A list with the following components

- `parameter_estimate_result`: the parameter of the SDALGCP model
- `phi`: the scale parameter of the Gaussian process
- `ll`: value of likelihood function at the maximum likelihood estimates.
- `call`: matched call.

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Summary

Summarizing the parameter estimates of SDALGCP model

Description

summary method for the class "SDALGCPST" that computes the standard errors and p-values of SDALGCPST.

Usage

```r
## S3 method for class 'SDALGCPST'
summary(object, ...)
```

Arguments

- `object`: an object of class "SDALGCPST" obtained as result of a call to `SDALGCPMCML`.
- `...`: further arguments passed to or from other methods.

Value

A list with the following components

- `parameter_estimate_result`: the parameter of the SDALGCP model
- `phi`: the scale parameter of the Gaussian process
- `ll`: value of likelihood function at the maximum likelihood estimates.
- `call`: matched call.

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