Package 'BayesSPsurv'

September 7, 2020

Type Package

Title Bayesian Spatial Split Population Survival Model

Version 0.1.8

Author Brandon L. Bolte [aut], Nicolas Schmidt [aut, cre], Nguyen K. Huynh [aut], Minnie M. Joo [aut], Sergio Bejar[aut], Bumba Mukherjee [aut]

Description
Bayesian parametric spatial split-populiation survival models for clustered event processes. The models account for both structural and spatial heterogeneity among ``at risk" and ``immune" populations, and incorporates time-varying covariates.
This package currently implements Weibull, Exponential and Loglogistic forms for the duration component. It allows for the creation of spatial weights matrix objects
from point patterns by distance and presents a series of diagnostic tests and plots for easy visual diagnostics of convergence and spatial effects.

License MIT + file LICENSE

Encoding UTF-8

LazyData true

Depends R (>= 3.6.0)

RoxygenNote 7.1.0

LinkingTo Rcpp,
RcppArmadillo

Imports MCMCpack,
FastGP,
stats,
Rcpp,
RcppArmadillo,
coda,
dplyr,
reshape2

Suggests spduration

R topics documented:

`capdist` *Gleditsch and Ward Distance data*

Description

Dyadic dataset extracted from Gleditsch and Ward (2001). The dataset contains information on the distace between capital cities among independent nation-states.

Usage

```
data(capdist)
```

Format

A data frame with 41006 rows and 6 variables

Details

numa COW code – country A.

ida Three letter ISO code – country A.

numb COW code – country B.

idb Three letter ISO code – country B.

kmdist Distance between capital cities in the kilometers.

midist Minimal distance between capital cities in the kilometers.

Source

Gleditsch, Kristian S., and Michael D. Ward. (2001). "Measuring Space: A Minimum-Distance Database and Applications to International Studies." Journal of Conflict Resolution 38(6): 739-758.

`exchangeSPsurv` *exchangeSPsurv*

Description

Markov Chain Monte Carlo (MCMC) to run Bayesian split population survival model with exchangeable frailties.

Returns a summary of a exchangeSPsurv object via `summary.mcmc`.

Print method for a `exchangeSPsurv` x.

Returns a plot of a exchangeSPsurv object via `plot.mcmc`.

Usage

```
exchangeSPsurv(
  duration,
  immune,
  Y0,
  LY,
  S,
  data,
  N,
  burn,
  thin,
  w = c(1, 1, 1),
  m = 10,
  form = c("Weibull", "exponential", "loglog"),
  prop.var
)

## S3 method for class 'frailtySPsurv'
summary(object, parameter = c("betas", "gammas", "lambda"), ...)

## S3 method for class 'frailtySPsurv'
print(x, ...)

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

Arguments

duration	survival stage equation written in a formula of the form Y ~ X1 + X2 + ... where Y is duration until failure or censoring.
immune	split stage equation written in a formula of the form C ~ Z1 + Z2 + ... where C is a binary indicator of immunity.
Y0	the elapsed time since inception until the beginning of time period (t-1).
LY	last observation year (coded as 1; 0 otherwise) due to censoring or failure.
S	spatial information (e.g. district ID) for each observation that matches the spatial matrix row/column information.
data	data.frame.
N	number of MCMC iterations.
burn	burn-in to be discarded.
thin	thinning to prevent from autocorrelation.
w	size of the slice in the slice sampling for (betas, gammas, rho). Write it as a vector. E.g. c(1,1,1).
m	limit on steps in the slice sampling. A vector of values for beta, gamma, rho.
form	type of parametric model (Weibull, Exponential, or Log-Logistic).
prop.var	proposed variance for Metropolis-Hastings.
object	an object of class `frailtySPsurv`, the output of `exchangeSPsurv`.
parameter	one of three parameters of the pooledSPsurv output. Indicate either "betas," "gammas," or "lambda."

...	additional parameter.
x	an object of class `frailtySPsurv`, the output of `exchangeSPsurv`.

Value

chain of the variables of interest.

list. Empirical mean, standard deviation and quantiles for each variable.

list. Empirical mean, standard deviation and quantiles for each variable.

Examples

```
walter <- spduration::add_duration(Walter_2015_JCR,"renewed_war",
                                   unitID = "id", tID = "year",
                                   freq = "year", ongoing = FALSE)

# add S
walter <- spatial_SA(data = walter, var_ccode = "ccode", threshold = 800L)

set.seed(123456)

model <-
    exchangeSPsurv(
           duration = duration ~ fhcompor1 + lgdpl + comprehensive + victory +
           instabl + intensityln + ethfrac + unpko,
           immune   = cured ~ fhcompor1 + lgdpl + victory,
           Y0       = 't.0',
           LY       = 'lastyear',
           S        = 'sp_id' ,
           data     = walter[[1]],
           N        = 100,
           burn     = 10,
           thin     = 10,
           w        = c(1,1,1),
           m        = 10,
           form     = "loglog",
           prop.var = 1e-05
)

print(model)

summary(model, parameter = "betas")

plot(model)
```

Description

Markov Chain Monte Carlo (MCMC) to run Bayesian split population survival model with no frailties.

Returns a summary of a SPsurv object via summary.mcmc.

Print method for a pooledSPsurv x.

Returns a plot of a pooledSPsurv object via plot.mcmc.

Usage

```
pooledSPsurv(
  duration,
  immune,
  Y0,
  LY,
  data,
  N,
  burn,
  thin,
  w = c(1, 1, 1),
  m = 10,
  form = c("Weibull", "exponential", "loglog")
)

## S3 method for class 'SPsurv'
summary(object, parameter = c("betas", "gammas", "lambda"), ...)

## S3 method for class 'SPsurv'
print(x, ...)

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

Arguments

duration	survival stage equation written in a formula of the form Y ~ X1 + X2 + ... where Y is duration until failure or censoring.
immune	split stage equation written in a formula of the form C ~ Z1 + Z2 + ... where C is a binary indicator of immunity.
Y0	the elapsed time since inception until the beginning of time period (t-1).
LY	last observation year (coded as 1; 0 otherwise) due to censoring or failure.
data	data.frame.
N	number of MCMC iterations.
burn	burn-in to be discarded.
thin	thinning to prevent from autocorrelation.
w	size of the slice in the slice sampling for (betas, gammas, rho). Write it as a vector. E.g. c(1,1,1).
m	limit on steps in the slice sampling. A vector of values for beta, gamma, rho.
form	type of parametric model (Weibull, Exponential, or Log-Logistic).

object	an object of class SPsurv, the output of pooledSPsurv.
parameter	one of three parameters of the pooledSPsurv output. Indicate either "betas," "gammas," or "lambda."
...	additional parameter.
x	an object of class SPsurv, the output of pooledSPsurv.

Value

chain of the variables of interest

list. Empirical mean, standard deviation and quantiles for each variable.

list. Empirical mean, standard deviation and quantiles for each variable.

Examples

```
walter <- spduration::add_duration(Walter_2015_JCR,"renewed_war",
                                   unitID = "id", tID = "year",
                                   freq = "year", ongoing = FALSE)

set.seed(123456)

model <-
    pooledSPsurv(
        duration = duration ~ fhcompor1 + lgdpl + comprehensive + victory +
            instabl + intensityln + ethfrac + unpko,
        immune   = cured ~ fhcompor1 + lgdpl + victory,
        Y0       = 't.0',
        LY       = 'lastyear',
        data     = walter,
        N        = 100,
        burn     = 10,
        thin     = 10,
        w        = c(1,1,1),
        m        = 10,
        form     = "Weibull"
    )


print(model)

summary(model, parameter = "betas")

plot(model)
```

---

spatialSPsurv *spatialSPsurv*

Description

Markov Chain Monte Carlo (MCMC) to run time-varying Bayesian split population survival model with spatial frailties.

Returns a summary of a exchangeSPsurv object via `summary.mcmc`.

Print method for a `spatialSPsurv` x.

Returns a plot of a spatialSPsurv object via `plot.mcmc`.

Usage

```
spatialSPsurv(
  duration,
  immune,
  Y0,
  LY,
  S,
  A,
  data,
  N,
  burn,
  thin,
  w = c(1, 1, 1),
  m = 10,
  form = c("Weibull", "exponential", "loglog"),
  prop.var
)

## S3 method for class 'spatialSPsurv'
summary(object, parameter = c("betas", "gammas", "lambda"), ...)

## S3 method for class 'spatialSPsurv'
print(x, ...)

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

Arguments

`duration`	survival stage equation written in a formula of the form Y ~ X1 + X2 + ... where Y is duration until failure or censoring.
`immune`	split stage equation written in a formula of the form C ~ Z1 + Z2 + ... where C is a binary indicator of immunity.
`Y0`	the elapsed time since inception until the beginning of time period (t-1).
`LY`	last observation year (coded as 1; 0 otherwise) due to censoring or failure.
`S`	spatial information (e.g. district ID) for each observation that matches the spatial matrix row/column information.
`A`	an a times a spatial weights matrix where a is the number of unique spatial units (S) load as a separate file.
`data`	data.frame.
`N`	number of MCMC iterations.

burn	burn-in to be discarded.
thin	thinning to prevent from autocorrelation.
w	size of the slice in the slice sampling for (betas, gammas, rho). Write it as a vector. E.g. c(1,1,1).
m	limit on steps in the slice sampling. A vector of values for beta, gamma, rho.
form	type of parametric model (Weibull, Exponential, or Log-Logistic).
prop.var	proposal variance for Metropolis-Hastings.
object	an object of class spatialSPsurv, the output of spatialSPsurv.
parameter	one of three parameters of the pooledSPsurv output. Indicate either "betas," "gammas," or "lambda."
...	additional parameter.
x	an object of class spatialSPsurv, the output of spatialSPsurv.

Value

chain of the variables of interest.

list. Empirical mean, standard deviation and quantiles for each variable.

list. Empirical mean, standard deviation and quantiles for each variable.

Examples

```
walter <- spduration::add_duration(Walter_2015_JCR,"renewed_war",
                                   unitID = "id", tID = "year",
                                   freq = "year", ongoing = FALSE)

walter <- spatial_SA(data = walter, var_ccode = "ccode", threshold = 800L)

set.seed(123456)

model <-
    spatialSPsurv(
        duration = duration ~ fhcompor1 + lgdpl + comprehensive + victory +
                   instabl + intensityln + ethfrac + unpko,
        immune   = cured ~ fhcompor1 + lgdpl + victory,
        Y0       = 't.0',
        LY       = 'lastyear',
        S        = 'sp_id' ,
        data     = walter[[1]],
        N        = 500,
        burn     = 10,
        thin     = 10,
        w        = c(1,1,1),
        m        = 10,
        form     = "Weibull",
        prop.var = 1e-05,
        A        = walter[[2]]
    )

print(model)
```

```
summary(model, parameter = "betas")

plot(model)
```

---

spatial_SA *spatial_SA*

Description

matrix A and sp_id (S)

Usage

```
spatial_SA(data, var_ccode, threshold = 800L)
```

Arguments

data	data.frame.
var_ccode	name of the variable that contains the country codes.
threshold	distance in kilometers.

Value

list. Contains database with variable sp_id (S) and matrix A.

Examples

```
walter <- spduration::add_duration(Walter_2015_JCR,"renewed_war",
                                   unitID = "id",
                                   tID = "year",
                                   freq = "year",
                                   ongoing = FALSE)

walter <- spatial_SA(data = walter,
                     var_ccode = "ccode",
                     threshold = 800L)
```

SPstats *SPstats*

Description

A function to calculate the deviance information criterion (DIC) and Log-likelihood for fitted model outputs of pooled, exchangeable, and spatial Split Population survival models for which a log-likelihood can be obtained, according to the formula *DIC = -2 * (L - P)*, where *L* is the log likelihood of the data given the posterior means of the parameter and *P* is the estimate of the effective number of parameters in the model.

Usage

```
SPstats(object)
```

Arguments

`object`	An object of the output of pooled, exchangeable, or spatial Split Population survival model .

Value

List.

Walter_2015_JCR *Walter_2015_JCR*

Description

Subsetted version of a time-series-cross-sectional (TSCS) dataset used in Walter (2015). It has data on duration of post-war peace as well as information on other relevant economic and political data. The variables duration, cured, t.0 and lastyear added by the authors of this package using the function add_duration.

Usage

```
data(Walter_2015_JCR)
```

Format

A data frame with 1237 rows and 8 variables

Details

fhcompor1 Freedom House civil liberties index.

lgdpl log of per capita GDP in 2005 dollars.

comprehensive combatants signed comprehensive peace agreement.

victory end of previous war with outright victory.

instabl dummy that indicates whether there was a positive or negative change in the Polity 2 score in the previous country-year.

intensityln deaths per year – logged.

ethfrac index of ethnic fractionalization.

unpko number of UN peacekeepers on the ground.

Source

Walter, Barbara F. (2015), Why Bad Governance Leads to Repeat Civil War, Journal of Conflict Resolution 59(7), 1242 - 1272.

Index