Package 'AGPRIS'

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Title AGricultural PRoductivity in Space

Version 2.0

Description
Functionalities to simulate space-time data and to estimate dynamic-spatial panel data models. Estimators implemented are the BCML (Elhorst (2010), <doi:10.1016/j.regsciurbeco.2010.03.003>), the MML (Elhorst (2010) <doi:10.1016/j.regsciurbeco.2010.03.003>) and the INLA Bayesian estimator (Lindgren and Rue, (2015) <doi:10.18637/jss.v063.i19>; Bivand, Gomez-Rubio and Rue, (2015) <doi:10.18637/jss.v063.i20>) adapted to panel data. The package contains functions to replicate the analyses of the scientific article entitled ``Agricultural Productivity in Space'' (Baldoni and Esposti (2021), <doi:10.1111/ajae.12155>)).

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Encoding UTF-8

LazyData true

RoxygenNote 7.1.1

Depends R (>= 2.10)

Imports methods, Matrix, plyr, sp, spdep, spacetime, matrixcalc, maxLik

Suggests INLA, terra

NeedsCompilation no

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Contents

`bcml` *BCML estimator*

Description

This function estimates a space time linear model according to the specified formula. It implements the BCML (or BCLSDV) estimator as in Elhorst (2010) doi:10.1016/j.regsciurbeco.2010.03.003.

Usage

```
bcml(
  dataset,
  yearStart,
  yearEnd,
  var.agg = "Cod_Provincia",
  eq,
  spatial = NULL,
  estimation = "analytical",
  corrBIAS = TRUE,
  WMAT = NULL
)
```

Arguments

`dataset`	STFDF with the data
`yearStart`	First year considered in the estimation
`yearEnd`	Last Anno considered in the estimation
`var.agg`	Index of the spatial units
`eq`	Formula to be estimated. It excludes the spatial lag
`spatial`	Radius to define neighbors

estimation	Either 'analytical' or 'numerical'. If 'analytical' is specified the concentrated maximum likelihood is estimated and then the other parameters are obtained analytically. Otherwise, all parameters are obtained through numerical maximization of the log-likelihood function.
corrBIAS	Boolean. If TRUE, the bias correction is applied.
WMAT	The spatial weight matrix

Value

A list with two objects. The first object is the estimates table. The second object is the log-likelihood evaluated at its maximum

Examples

```
library(maxLik)
library(matrixcalc)

set.seed(123)
sd = sim_data_fe(dataset=regsamp,N=100,TT=8,
                 spatial = 80,Tau = -0.2,Rho = 0.4,
                 Beta = 2,sdDev = 2,startingT = 10,
                 LONGLAT = TRUE)
est_bcml = bcml(dataset = sd[[1]],yearStart = 3,yearEnd = 9,
                var.agg = 'Cod_Provincia',eq = Y~X1,
                  estimation = 'analytical',corrBIAS = TRUE,WMAT = sd[[2]])
est_bcml
```

---

distOte *Matrix of technological distance*

Description

A matrix of agricultural technological distance of NUTS3. It is used to weight the geographical distance of NUTS3 regions.

Usage

```
distOte
```

Format

A 106x106 matrix

`inla.st` *Space-time bayesian INLA estimator*

Description

This function estimates a space time linear model using the bayesian INLA. It is a wrapper of the INLA::inla function (Lindgren and Rue (2015) doi:10.18637/jss.v063.i19; Bivand, Gomez-Rubio and Rue (2015) doi:10.18637/jss.v063.i20) adapted to panel data.

Usage

```
inla.st(
  formula,
  d,
  W,
  RHO,
  PHI,
  var.agg,
  normalization = FALSE,
  improve = TRUE,
  fhyper = NULL,
  probit = FALSE,
  ...
)
```

Arguments

`formula`	Formula of the model to be estimated
`d`	Data frame
`W`	Spatial matrix
`RHO`	Parameter of spatial dependence
`PHI`	Parameter of temporal dependence
`var.agg`	Indexes of the panel dimensions. The first argument is the spatial dimension, the second argument is the temporal dimension.
`normalization`	Boolean. If TRUE the data are normalized before estimation
`improve`	Please refer to the documentation of the INLA package
`fhyper`	Plase refer to the documentation of the INLA package
`probit`	Plase refer to the documentation of the INLA package
`...`	additional parameters. Please, refer to the documentation of the INLA package

Value

Returns a model of class "inla". Please, refer to the documentation of the INLA package for additional information

Examples

```
library(terra)
set.seed(123)
sd = sim_data_fe(dataset=regsamp,N=100,TT=8,spatial = 80,
                 Tau = -0.2,Rho = 0.4, Beta = 2,sdDev = 2,
                 startingT = 10,LONGLAT = TRUE)
est_inla = inla.st(formula = Y~-1+X1,d = sd[[1]]@data,
               W = sd[[2]],PHI=-0.2,RHO=0.4,
               var.agg=c('Cod_Provincia','Anno'),
               family='gaussian',
               improve=TRUE,
               normalization=FALSE,
               control.family = list(hyper = list(prec=list(initial=25,fixed=TRUE))),
               control.predictor = list(compute = TRUE),
               control.compute = list(dic = TRUE, cpo = TRUE),
               control.inla = list(print.joint.hyper = TRUE))
summary(est_inla)
```

---

map1 *Cropland grid of Northen Italy (20km x 20km squares)*

Description

SpatialPolygonsDataFrame object with croplands of Northern Italy approximated with 20km x 20km squared polygons. It is based on croplands data contained in the Corine Land Cover 2012 raster map.

Usage

```
map1
```

Format

SpatialPolygonsDataFrame object

Source

https://land.copernicus.eu/pan-european/corine-land-cover/clc-2012

map2 *Cropland grid of Northen Italy (40km x 40km squares)*

Description

SpatialPolygonsDataFrame object with croplands of Northern Italy approximated with 40km x 40km squared polygons. It is based on croplands data contained in the Corine Land Cover 2012 raster map.

Usage

```
map2
```

Format

SpatialPolygonsDataFrame object

Source

https://land.copernicus.eu/pan-european/corine-land-cover/clc-2012

map3 *Cropland grid of Northen Italy (60km x 60km squares)*

Description

SpatialPolygonsDataFrame object with croplands of Northern Italy approximated with 60km x 60km squared polygons. It is based on croplands data contained in the Corine Land Cover 2012 raster map.

Usage

```
map3
```

Format

SpatialPolygonsDataFrame object

Source

https://land.copernicus.eu/pan-european/corine-land-cover/clc-2012

map4 *Cropland grid of Northen Italy (100km x 100km squares)*

Description

SpatialPolygonsDataFrame object with croplands of Northern Italy approximated with 100km x 100km squared polygons. It is based on croplands data contained in the Corine Land Cover 2012 raster map.

Usage

```
map4
```

Format

SpatialPolygonsDataFrame object

Source

https://land.copernicus.eu/pan-european/corine-land-cover/clc-2012

mml *MML estimator*

Description

This function estimates a space time linear model according to the specified formula using the ML estimator as in Elhorst (2010) doi:10.1016/j.regsciurbeco.2010.03.003. The estimator maximizes the full log-likelihood function in which the parameter of spatial dependence is constrained.

Usage

```
mml(Rho, ff, dataset, wmat, var.agg, m = 10)
```

Arguments

Rho	the constrained parameter of spatial dependence
ff	Formula of the linear model. It excludes the spatial lag
dataset	Data frame with the data
wmat	Spatial weight matrix
var.agg	Spatial index of the data frame
m	How many time periods have passed since the beginning of the space-time process

Value

The estimates tables

Examples

```
set.seed(123)
sd = sim_data_fe(dataset=regsamp,N=50,TT=6,
                 spatial = 80,Tau = -0.2,Rho = 0.4,
                 Beta = 2,sdDev = 2,startingT = 10,
                 LONGLAT = TRUE);sd[[1]]$X2 = stats::rnorm(nrow(sd[[1]]@data))
est_mml = mml(dataset = sd[[1]]@data,Rho = 0.4,
              ff = Y~X1+X2,
              wmat = sd[[2]],var.agg = c('Anno','Cod_Provincia'),
              m = 10)
est_mml
```

---

r100km *Cropland grid of Italy (100km x 100km squares)*

Description

SpatialPolygonsDataFrame object with croplands of Italy approximated with 100km x 100km squared polygons. It is based on croplands data contained in the Corine Land Cover 2012 raster map.

Usage

```
r100km
```

Format

SpatialPolygonsDataFrame object

Source

https://land.copernicus.eu/pan-european/corine-land-cover/clc-2012

r20km *Cropland grid of Italy (20km x 20km squares)*

Description

SpatialPolygonsDataFrame object with croplands of Italy approximated with 20km x 20km squared polygons. It is based on croplands data contained in the Corine Land Cover 2012 raster map.

Usage

```
r20km
```

Format

SpatialPolygonsDataFrame object

Source

https://land.copernicus.eu/pan-european/corine-land-cover/clc-2012

r40km *Cropland grid of Italy (40km x 40km squares)*

Description

SpatialPolygonsDataFrame object with croplands of Italy approximated with 40km x 40km squared polygons. It is based on croplands data contained in the Corine Land Cover 2012 raster map.

Usage

```
r40km
```

Format

SpatialPolygonsDataFrame object

Source

https://land.copernicus.eu/pan-european/corine-land-cover/clc-2012

r60km *Cropland grid of Italy (60km x 60km squares)*

Description

SpatialPolygonsDataFrame object with croplands of Italy approximated with 60km x 60km squared polygons. It is based on croplands data contained in the Corine Land Cover 2012 raster map.

Usage

```
r60km
```

Format

SpatialPolygonsDataFrame object

Source

https://land.copernicus.eu/pan-european/corine-land-cover/clc-2012

regsamp *Coordinates of simulated farms in Northern Italy*

Description

SpatialPointsDataFrame object with 1000 SpatialPoints to represent simulated farms in the simulation exercise

Usage

```
regsamp
```

Format

SpatialPointsDataFrame object

sel_regioni *Merged NUTS3 for simulation exercise*

Description

SpatialPolygons object with merged NUTS3 regions of Northern Italy used in the simulation exercise

Usage

```
sel_regioni
```

Format

SpatialPolygons object

Source

ISTAT

sim_data_fe *Simulate space-time stochastic process with fixed-effect*

Description

This function simulates a space-time stochastic process according to the defined spatial structure and input paramters. It simulates data of a dynamic spatial lag model. It includes one exogenous variable and a fixed-effect correlated with the exogenous variable.

Usage

```
sim_data_fe(
  dataset,
  N,
  TT,
  spatial = 100,
  Tau = -0.14,
  Rho = 0.67,
  Beta = 1,
  sdDev = 5,
  startingT = 11,
  LONGLAT = TRUE
)
```

Arguments

dataset	SpatialObject with the spatial units for which the data will be simulated
N	How many spatial units will be used
TT	Time dimension of the simulated process
spatial	Radius that defines the scope of spatial dependence
Tau	Autocorrelation parameter
Rho	Spatial dependence parameter
Beta	Coefficient associated to the exogenous variable
sdDev	Standard Deviation of the (gaussian) error term
startingT	The number of time periods after which the simulated data will be recorded
LONGLAT	Boolean. If the projection is longlat

Value

A list with two objects. The first object is the STFDF with the simulated data. The second object is the spatial weight matrix

Examples

```
library(spacetime)
library(sp)
library(spdep)


set.seed(123)
sd = sim_data_fe(dataset=regsamp,N=100,TT=8,
                 spatial = 80,Tau = -0.2,Rho = 0.4,
                 Beta = 2,sdDev = 2,startingT = 10,
                 LONGLAT = TRUE)
stplot(sd[[1]][,,'Y'])
dev.new()
plot(sel_regioni)
points(coordinates(sd[[1]]@sp))
plot(mat2listw(sd[[2]]),coordinates(sd[[1]]@sp),add=TRUE,col=2)
```

---

tabSard *Neighbors of NUTS3 of Sardinia*

Description

A table containing the link of NUTS3 in Sardinia with NUTS3 of mainland Italy

Usage

```
tabSard
```

Format

A data frame with the links

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