Package: sinar (via r-universe)

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Title Conditional Least Squared (CLS) Method for the Model SINAR(1,1)

Version 0.1.0

Description Implementation of the Conditional Least Square (CLS) estimates and its covariance matrix for the first-order spatial integer-valued autoregressive model (SINAR(1,1)) proposed by Ghodsi (2012) <doi:10.1080/03610926.2011.560739>.

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BugReports `https://github.com/gilberto-sassi/sinar/issues`

Repository https://gilberto-sassi.r-universe.dev

RemoteUrl https://github.com/gilberto-sassi/sinar

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`carabidae` *Counts of arthropods in a grid-sampled wheat field*

Description

A matrix with the counts of arthropods (carabidae) in a grid-sampled wheat field

Usage

```
data("carabidae")
```

Format

A matrix where each row and column is a count of carabidae species at the first cell.

Source

Kevin Wright (2020). agridat: Agricultural Datasets. R package version 1.17. https://CRAN.R-project.org/package=agridat

`cls` *Conditional least square estimates for a SINAR(1,1) process.*

Description

`cls` computes the conditional least square for a process described by

$$X_{i,j} = a_{10}X_{i-1,j} + a_{01}X_{i,j-1} + a_{11}X_{i-1,j-1} + \epsilon_{i,j}$$

where $\epsilon_{i,j}$ is an iid process with poison distribution. Note the a_{10}, a_{01}, a_{11} must belong to the interval $[0, 1]$. We obtain estimates for a_{10}, a_{01}, a_{11} and μ_ϵ. We do not make any asumption about the distribution of the innovation in the process.

Usage

```
cls(X)
```

Arguments

`X`	A integer matrix where each cell is the observed value in the regular lattice.

Value

a vector with the estimates of $a_{10}, a_{01}, a_{11}, \mu$.

Examples

```
data("nematodes")
cls(nematodes)
```

emp_cov — *Empirical estimate for the Covariance matrix in the Klimko-Nelson.*

Description

Σ is the covariance matrix in the Klimko-Nelson seminal paper. Basically, we know

$$\sqrt{n}(\hat{a}_{10} - a_{10}, \hat{a}_{01} - a_{01}, \hat{a}_{11} - a_{11}, \hat{\mu}_\epsilon - \mu_\epsilon)^\top \sim MNV(0, \Sigma)$$

where

$$\Sigma = V^{-1} W V^{-1}.$$

For more details, check Klimko and Nelson (1978).

Usage

```
emp_cov(X)
```

Arguments

`X`	A integer matrix where each cell is the observed value in the regular lattice.

Value

The covariance matrix estimated empirically.

Examples

```
data("nematodes")
emp_cov(nematodes)
```

emp_V — *Empirical estimate for the matrix V in the Klimko-Nelson.*

Description

`emp_V` is the matrix in the Klimko-Nelson seminal paper. Basically, we know

$$\sqrt{n}(\hat{a}_{10} - a_{10}, \hat{a}_{01} - a_{01}, \hat{a}_{11} - a_{11}, \hat{\mu}_\epsilon - \mu_\epsilon)^\top \sim MNV(0, \Sigma)$$

where

$$\Sigma = V^{-1} W V^{-1}.$$

For more details, check Klimko and Nelson (1978).

Usage

```
emp_V(X)
```

Arguments

`X` A integer matrix where each cell is the observed value in the regular lattice.

Value

The matrix V estimated empirically.

Examples

```
data("nematodes")
emp_V(nematodes)
```

`emp_W` *Empirical estimate for the matrix W in the Klimko-Nelson.*

Description

`emp_W` is the matrix in the Klimko-Nelson seminal paper. Basically, we know

$$\sqrt{n}(\hat{a}_{10} - a_{10}, \hat{a}_{01} - a_{01}, \hat{a}_{11} - a_{11}, \hat{\mu}_\epsilon - \mu_\epsilon)^\top \sim MNV(0, \Sigma)$$

where

$$\Sigma = V^{-1} W V^{-1}.$$

For more details, check Klimko and Nelson (1978).

Usage

```
emp_W(X)
```

Arguments

`X` A integer matrix where each cell is the observed value in the regular lattice.

Value

The matrix `W` estimated empirically.

Examples

```
data("nematodes")
emp_V(nematodes)
```

nematodes — *A matrix of counting data with 15 rows and 15 columns.*

Description

A matrix of counting data with 15 rows and 15 columns.

Usage

```
data("nematodes")
```

Format

Dataset of 15×15 regular grid on counts of cereal cyst-nematode (Heterodera avenae collected in soil core).

Source

PERRY, J. N. et al. SADIE: software to measure and model spatial pattern. Aspects of applied biology, v. 46, p. 95-102, 1996.

sinar_pois — *Simulating SINAR(1,1) process with innovations from a poison distribution.*

Description

`sinar_pois` returns a matrix representing a simulated regular lattice from a SINAR(1,1) process with innovations from a poison distribution.

Usage

```
sinar_pois(n_row, n_col, a10, a01, a11, l)
```

Arguments

`n_row`	Number of rows in the simulated lattice.
`n_col`	Number of columns in the simulated lattice.
`a10`	Coefficient from the element $X_{i-1,j}$.
`a01`	Coefficient from the element $X_{i,j-1}$.
`a11`	Coefficient from the element $X_{i-1,j-1}$.
`l`	Mean of the poison distribution used as innovations.

Details

This function simulates a regular lattice from the model

$$X_{i,j} = a_{10}X_{i-1,j} + a_{01}X_{i,j-1} + a_{11}X_{i-1,j-1} + \epsilon_{i,j}$$

where $\epsilon_{i,j}$ is an iid process with poison distribution. Note the a_{10}, a_{01}, a_{11} must belong to the interval $[0, 1]$.

Value

A integer matrix.

Examples

```
n_row <- 20
n_col <- 50
a10 <- 0.2
a01 <- 0.2
a11 <-  0.5
l <- 1
sinar_pois(n_row, n_col, a10, a01, a11, l)
```

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teo_V *Compute the value of matrix V using the coefficients.*

Description

V is the theoretical matrix from Klimko-Nelson for the SINAR(1,1) model. Basically, we know

$$\sqrt{n}(\hat{a}_{10} - a_{10}, \hat{a}_{01} - a_{01}, \hat{a}_{11} - a_{11}, \hat{\mu}_\epsilon - \mu_\epsilon)^\top \sim MNV(0, \Sigma)$$

where

$$\Sigma = V^{-1}WV^{-1}.$$

For more details, check Klimko and Nelson (1978).

Usage

```
teo_V(a10, a01, a11, mu_e, s2_e)
```

Arguments

a10	is the parameter in the equation $X[i,j]a_{10}X[i-1,j]+a_{01}X[i,j-1]+a_{11}X[i-1,j-1]+\epsilon_{i,j}$
a01	is the parameter in the equation $X[i,j]a_{10}X[i-1,j]+a_{01}X[i,j-1]+a_{11}X[i-1,j-1]+\epsilon_{i,j}$
a11	is the parameter in the equation $X[i,j]a_{10}X[i-1,j]+a_{01}X[i,j-1]+a_{11}X[i-1,j-1]+\epsilon_{i,j}$
mu_e	is the mean of the innovations $\epsilon_{i,j}$
s2_e	is the standar deviation of the innovations $\epsilon_{i,j}$

Value

The matrix V estimated empirically.

Examples

```
n_row <- 20
n_col <- 50
a10 <- 0.2
a01 <- 0.2
a11 <-  0.5
l <- 1 # mean and variance for poison innovations

teo_V(a10, a01, a11, l, sqrt(l))
```

`var_hat_sigma` *Variance of standard deviation of epsilon.*

Description

$\hat{\sigma}_\epsilon$ is the standard deviation of $SINAR(1,1)$ model.

Usage

```
var_hat_sigma(X)
```

Arguments

`X`	A integer matrix where each cell is the observed value in the regular lattice.

Value

The variance of standard deviation of the estimate of σ_ϵ.

Examples

```
data("nematodes")
var_hat_sigma(nematodes)
```

var_sinar *Empirical estimate for the variance of innovations.*

Description

σ_ϵ^2 is the variance the innovations for the $SINAR(1,1)$ model.

Usage

```
var_sinar(X)
```

Arguments

X	A integer matrix where each cell is the observed value in the regular lattice.

Value

The estimated standard deviation in the $SINAR(1,1)$.

Examples

```
data("nematodes")
var_sinar(nematodes)
```

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