**Package ‘geoFourierFDA’**

October 27, 2021

**Title**  Ordinary Functional Kriging Using Fourier Smoothing and Gaussian Quadrature

**Version**  0.1.0

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**Description**  Implementation of the ordinary functional kriging method proposed by Giraldo (2011) <doi:10.1007/s10651-010-0143-y>. This implements an alternative method to estimate the trace-variogram using Fourier Smoothing and Gaussian Quadrature.

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**Depends**  R (>= 3.5.0)

**Encoding**  UTF-8

**LazyData**  true

**RoxygenNote**  7.1.2

**LinkingTo**  Rcpp, RcppArmadillo

**Imports**  Rcpp, stats, magrittr, orthopolynom

**NeedsCompilation**  yes

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**Repository**  CRAN

**Date/Publication**  2021-10-27 14:10:08 UTC

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canada

Time series from 35 weather stations of Canada.

Description

A dataset containing time series from 15 weather stations (The Pas station and more 34 stations to estimate the temperature curve at the Pas station). This dataset is present in the fda package.

Usage

data(canada)

Format

A list with four matrices:

- **m_data**: A matrix with 14 columns where each column is a weather station
- **m_coord**: A matrix with 14 rows where each row is a weather station
- **ThePas_coord**: Coordinate of the The Pas station
- **ThePas_ts**: Observed time series of the station The Pas

Source

https://weather.gc.ca

References


calc_fourier

This function computes minimum square estimates for Fourier coefficients.

Description

This function computes minimum square estimates for Fourier coefficients.

Usage

calc_fourier(f, m)

Arguments

- **f**: A time series to be smoothed.
- **m**: Order of the Fourier polynomial. Default value is computed using the Sturje's rule.
Value

A vector with the fourier coefficients.

Examples

data(canada)

coef_fourier(canada$ThePas_ts)

Description

This function the smoothed curve

Usage

fourier_b(coef, x)

Arguments

coef Fourier coefficients.

x a time series to evaluate the smoothed curve.

Value

a time series with the smoothed curve.

Examples

data(canada)

coeffs <- coef_fourier(canada$ThePas_ts)
y_hat <- fourier_b(coefs)
**geo_fda**

*Geostatistical estimates for function-valued data.*

**Description**

`geo_fda` finds the ordinary kriging estimate for spatial functional data using the model proposed by Giraldo(2011).

**Usage**

```r
geo_fda(
  m_data,
  m_coord,
  new_coord,
  m,
  n_quad = 20,
  t = seq(from = -pi, to = pi, length.out = 1000)
)
```

**Arguments**

- `m_data`: a matrix where each column is a time series in a location
- `m_coord`: a matrix with coordinates (first column is latitude and second column longitude)
- `new_coord`: a vector with a new coordinate (first column is latitude and second longitude)
- `m`: order of the Fourier polynomial
- `n_quad`: a scalar with number of quadrature points. Default value `nquad = 20`.
- `t`: a vector with points to evaluate from $-\pi$ to $\pi$. Default `t = seq(from = -pi, to = pi, length.out = 1e+3)`.

**Details**

`geo_fda` is similar to the model proposed by `giraldo2011ordinary`. The main difference is that we have used Gauss-Legendre quadrature to estimate the trace-variogram. Using Gauss-Legendre quadrature gives estimates with smaller mean square error than the trace-variogram estimates from Giraldo(2011).

For now, we have used Fourier's series to smooth the time series.

**Value**

A list with three components

- `curve`: estimate curve at `t` points
- `lambda`: weights in the linear combination in the functional kriging
- `x`: points where the curve was evaluated
geo_model

References


See Also

ccoef_fourier, fourier_b

Examples

data(canada)

y_hat <- geo_fda(canada$m_data, canada$m_coord, canada$ThePas_coord, 
n_quad = 2)

ggeo_model

EStimates the parameters of the exponential model.

Description

ggeo_model finds the maximum likelihood estimate for the parameters in the geostatistical exponential model.

Usage

ggeo_model(v_data, m_coord)

Arguments

v_data a numeric vector with the data
m_coord a matrix with two column. The first column must be the latitude and the second column must be the longitude.

Value

a list with components

mean mean of the process
phi range of exponential model
sigma sq total sill of exponential model
convergence convergence as specified in the function nlminb

Examples

data(canada)

v_data <- canada$m_data[1, ]
geo_model(v_data, canada$m_coord)
logLik

\textit{Log-likelihood function multiplied by -1.}

\textbf{Description}

This function computes the likelihood function used at geo_model.

\textbf{Arguments}

- \texttt{mDist}  \hspace{1cm} distance matrix;
- \texttt{s2}  \hspace{1cm} variance from the covariance model;
- \texttt{phi}  \hspace{1cm} variance from the covariance model;
- \texttt{vDiff}  \hspace{1cm} column vector of data (subtracted the mean vector)

\textbf{Value}

log-likelihood value multiplied by -1.
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