Package 'geoFKF'

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Title Kriging Method for Spatial Functional Data

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Description A Kriging method for functional datasets with spatial dependency. This functional Kriging method avoids the need to estimate the trace-variogram, and the curve is estimated by minimizing a quadratic form. The curves in the functional dataset are smoothed using Fourier series. The functional Kriging of this package is a modification of the method proposed by Giraldo (2011) <doi:10.1007/s10651-010-0143-y>.

Imports numDeriv, stats, Rcpp

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Encoding UTF-8

LazyData true

RoxygenNote 7.1.1

URL https://github.com/gilberto-sassi/geoFKF

BugReports https://github.com/gilberto-sassi/geoFKF/issues

LinkingTo Rcpp, RcppArmadillo

NeedsCompilation yes

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coef_fourier *Computing coefficients Fourier.*

Description

This function computes minimum square estimates for Fourier coefficients.

Usage

```
coef_fourier(f, m)
```

Arguments

f	A time series to be smoothed.
m	Order of the Fourier polynomial. Default value is computed using the Sturge's rule.

Value

A vector with the fourier coefficients.

Examples

```
x <- seq(from = -pi, to = pi, by = 0.01)
y <- x^2 + rnorm(length(x), sd = 0.1)
v_coef <- coef_fourier(y)
```

datasetCanada *Temperature datasets from Canada.*

Description

Temperature time series from 35 weather stations from Canada. This dataset is a classic one and was used in famous package `fda`. We have made a few changes in this dataset.

Usage

```
data("datasetCanada")
```

Format

A list with two entries: `m_cood` and `m_data`.

`m_coord` a `tibble` with latitude, logitude and the name of stations.

m_data a `tibble` where each column is the time series from a weather station.

Source

the CanadianWeather dataset from the R package fda.

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fourier_b *Smoothed curve in Fourier Series.*

Description

This function computes the smoothed curve using Fourier coefficients.

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

```
v_coef <- rnorm(23)
fourier_b(v_coef)
```

---

geo_fkf *Kriging method for Spatial Functional Data.*

Description

geo_fkf implements the kriging method for spatial functional datasets.

Usage

```
geo_fkf(m_data, m_coord, new_loc, p, t = seq(from = -pi, to = pi, by = 0.01))
```

Arguments

m_data	a tibble where each column or variable is data from a station
m_coord	a tibble with two columns: latitude and longitude
new_loc	a tible with one observation, where the columns or variables are latitude and longitude
p	order in the Fourier Polynomial
t	a time series with values belonging to $[pi, \pi]$ to evaluate the estimate curve

Value

a list with three entries: `estimates`, `Theta` and `cov_params`

estimates the estimate curve

Theta weights (matrices) of the linear combination

cov_params estimate σ^2, ϕ and ρ

Examples

```
data("datasetCanada")

m_data <- as.matrix(datasetCanada$m_data)
m_coord <- as.matrix(datasetCanada$m_coord[, 1:2])
pos <- sample.int(nrow(m_coord), 1)
log_pos <- !(seq_len(nrow(m_coord)) %in% pos)
new_loc <- m_coord[pos, ]
m_coord <- m_coord[log_pos, ]
m_data <- m_data[, log_pos]

geo_fkf(m_data, m_coord, new_loc)
```

`logLikMultiNorm` *Log likelihood function for multivariate normal with spatial dependency.*

Description

Log likelihood function for multivariate normal with spatial dependency.

Arguments

`mCoef`	coefficient matrix. Each column is the coefficient from a curve;
`mDist`	distance matris;
`s2`	variance from the covariance model;
`phi`	variance from the covariance model;
`rho`	variance from the covariance model;

log_lik_rf *Maximum likelihood estimate for σ^2, ϕ and ρ.*

Description

This function maximum likelihood estimate for σ^2, ϕ and ρ in the random field model for the covariance.

Usage

```
log_lik_rf(m_coef, m_coord)
```

Arguments

m_coef	Matrix where each column is an observed vector
m_coord	Matrix where each observation contains the latitude and longitude

Value

Return a list with

par A vector with the estimates of σ^2, ϕ and ρ.

m_cov A matrix of covariances of the estimates.

Examples

```
data("datasetCanada")

m_data <- as.matrix(datasetCanada$m_data)
m_coord <- as.matrix(datasetCanada$m_coord[, 1:2])

p <- ceiling(1 + log2(nrow(m_data)))
m_coef <- sapply(seq_len(nrow(m_coord)), function(i) {
    coef_fourier(m_data[, i], p)
})
log_lik_rf(m_coef, m_coord)
```

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