Package 'covafillr'

July 22, 2025

Title Local Polynomial Regression of State Dependent Covariates in State-Space Models

Version 0.4.4

Date 2019-11-22

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Description Facilitates local polynomial regression for state dependent covariates in state-space models. The functionality can also be used from 'C++' based model builder tools such as 'Rcpp'/'inline', 'TMB', or 'JAGS'.

BugReports https://github.com/calbertsen/covafillr/issues

URL https://github.com/calbertsen/covafillr

Depends R (>= 3.0.0)

Imports methods, stats, Rcpp (>= 0.11.0)

LinkingTo RcppEigen

Suggests TMB, rjags, inline, ggplot2

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LazyData true

Biarch true

NeedsCompilation yes

RoxygenNote 7.0.0

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Repository CRAN

Date/Publication 2019-11-22 10:40:09 UTC

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`covafill-class` *A Reference Class for Local Polynomial Regression with covafill.*

Description

A Reference Class for Local Polynomial Regression with covafill.

Fields

`ptr` External pointer to the covafill C++ object

Methods

`getBandwith()` Get the bandwith.

`getDegree()` Get the polynomial degree.

`getDim()` Get the dimension of the coordinates.

`initialize(coord, obs, h = suggestBandwith(coord, p), p = 3L, ...)` Method to initialize the covafill. coord is a matrix of coordinates, obs is a vector of corresponding observations, h is a vector of bandwiths, and p is the polynomial degree.

`predict(coord, se.fit = FALSE)` Predict function value and derivatives with local polynomial regression at coord. If se.fit=TRUE a list is returned with estimates and their standard deviations.

`residuals(excludeRadius)` Get 'leave-neighborhood-out' residuals, i.e. local polynomial regression predictions excluding points within excludeRadius subtracted from the observation.

`setBandwith(h)` Set the bandwith to h.

Examples

```
getRefClass('covafill')
fn <- function(x) x ^ 4 - x ^ 2
x <- runif(2000,-3,3)
y <- fn(x) + rnorm(2000,0,0.1)
cf <- covafill(coord = x,obs = y,p = 5L)
cf$getDim()
cf$getDegree()
cf$getBandwith()
x0 <- seq(-1,1,0.1)
y0 <- cf$predict(x0)
par(mfrow=c(3,1))
plot(x0,y0[,1], main = "Function")
```

```
lines(x0,fn(x0))
plot(x0, y0[,2], main = "First derivative")
lines(x0, 4 * x0 ^ 3 - 2 * x0)
plot(x0, y0[,3], main = "Second derivative")
lines(x0, 3 * 4 * x0 ^ 2 - 2)
cf$setBandwith(1.0)
cf$getBandwith()
```

`covatree-class` *A Reference Class for Search Tree Approximated Local Polynomial Regression with covatree.*

Description

A Reference Class for Search Tree Approximated Local Polynomial Regression with covatree.

Fields

`ptr` External pointer to the covatree C++ object

Methods

`getDim()` Get the dimension of the coordinates.

`initialize( coord, obs, h = suggestBandwith(coord, p), p = 3L, minLeft = length(obs)/10, ... )` Method to initialize the covafill. coord is a matrix of coordinates, obs is a vector of corresponding observations, h is a vector of bandwiths, p is the polynomial degree, and minLeft is the minimum number of observations that will create a sub tree.

`predict(coord)` Predict function value and first order derivatives with search tree approximated local polynomial regression at coord.

Examples

```
getRefClass('covatree')
fn <- function(x) x ^ 4 - x ^ 2
x <- runif(2000,-3,3)
y <- fn(x) + rnorm(2000,0,0.1)
ct <- covatree(coord = x,obs = y,p = 5L, minLeft = 50)
ct$getDim()
x0 <- seq(-1,1,0.1)
y0 <- ct$predict(x0)
par(mfrow=c(2,1))
plot(x0,y0[,1], main = "Function")
lines(x0,fn(x0))
plot(x0, y0[,2], main = "First derivative")
lines(x0, 4 * x0 ^ 3 - 2 * x0)
```

cxxFlags *CXXFLAGS to compile with covafill*

Description

Get CXXFLAGS to compile with covafill

Usage

```
cxxFlags()
```

Value

Returns a string with the CXXFLAGS needed to compile C++ code using covafill.

Author(s)

Christoffer Moesgaard Albertsen

See Also

compile

Examples

```
## Not run:
if(require("TMB")){
   f <- system.file("examples","tmbtest","tmbtest.cpp", package='covafillr')
   TMB::compile(f,CXXFLAGS = cxxFlags())
}

## End(Not run)
```

kde *Kernel Density Estimation*

Description

Wrapper for the covafill reference class to do kernel density estimation.

Usage

```
kde(X, bw = suggestBandwith(X, -1), npred = 100, from = min(X), to = max(X))
```

Arguments

X	A numeric matrix or vector of data coordinates
bw	Bandwith used
npred	Number of coordinate wise equally spaced points at which the density is to be estimated. The numbers are repeated if the length is less than the dimension of the coordinates.
from	Coordinate wise lower bound of points at which the density is to be estimated. The numbers are repeated if the length is less than the dimension of the coordinates.
to	Coordinate wise upper bound of points at which the density is to be estimated. The numbers are repeated if the length is less than the dimension of the coordinates.

Value

a list of coordinates and corresponding density estimates

Author(s)

Christoffer Moesgaard Albertsen

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loadJAGSModule *load JAGS module.*

Description

Calls rjags::load.module with appropriate arguments to load the covafillr module.

Usage

```
loadJAGSModule()
```

Value

Nothing

Author(s)

Christoffer Moesgaard Albertsen

See Also

load.module

Examples

```
if(require("rjags") & covafillr:::.installed_with_jags)
   loadJAGSModule()
```

stat_covafill *Add a covafill smoother to an (x,y) plot*

Description

As an extention to the ggplot2 package, the function adds a covafill fit to an (x,y) plot. The fit is predicted to points on the interval range(x).

Usage

```
stat_covafill(
  mapping = NULL,
  data = NULL,
  geom = "smooth",
  position = "identity",
  na.rm = FALSE,
  show.legend = NA,
  inherit.aes = TRUE,
  n = 50,
  bandwith = NULL,
  polyDegree = 3L,
  level = 0.95,
  se = TRUE,
  ...
)
```

Arguments

mapping	Set of mappings created by 'aes' from the ggplot2 package. The same as ggplot2::stat_smooth.
data	The data to be displayed in this layer. The same as ggplot2::stat_smooth.
geom	The same as ggplot2::stat_smooth.
position	Position adjustments. The same as ggplot2::stat_smooth.
na.rm	Not used
show.legend	Should this legend be displayed? The same as ggplot2::stat_smooth.
inherit.aes	The same as ggplot2::stat_smooth.
n	Number of points to do prediction on.
bandwith	Bandwith used in covafill. Uses suggestBandwith by default.
polyDegree	Polynomial degree to use in covafill.
level	Level of confidence interval to use.
se	Should confidence intervals be displayed?
...	Other arguments passed to layer.

Value

A `ggplot2` `layer`.

Author(s)

Christoffer Moesgaard Albertsen

See Also

`stat_smooth`

`suggestBandwith` *Suggest bandwith for local polynomial regression*

Description

The bandwith is suggested coordinate wise to be

$$0.9\sqrt{5}\min\left(sd(x), \frac{IQR(x)}{1.349}\right) n^{-\frac{1}{d+4}}(p+1)$$

where p is the polynomial degree used and n is the number of coordinate points.

Usage

```
suggestBandwith(X, p)
```

Arguments

`X`	A numeric matrix or vector of data coordinates
`p`	Polynomial degree to base the suggestion on

Value

a vector or scalar of suggested bandwiths

Author(s)

Christoffer Moesgaard Albertsen

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