Package ‘kernopt’

March 19, 2025

Title Estimating Count Data Distributions with Discrete Optimal Symmetric Kernel

Version 1.0.0

Maintainer Thomas Fillon <thomas.fillon@univ-ubs.fr>

Description Implementation of Discrete Symmetric Optimal Kernel for estimating count data distributions, as described by T. Senga Kiessé and G. Durrieu (2024) <doi:10.1016/j.spl.2024.110078>.The nonparametric estimator using the discrete symmetric optimal kernel was illustrated on simulated data sets and a real-word data set included in the package, in comparison with two other discrete symmetric kernels.

License GPL (>= 3)

Encoding UTF-8

RoxygenNote 7.3.2

Imports stats

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

Config/testthat/edition 3

VignetteBuilder knitr

Depends R (>= 2.10)

LazyData true

URL https://thomasfillon.github.io/kernopt/,
https://github.com/thomasfillon/kernopt

BugReports https://github.com/thomasfillon/kernopt/issues

NeedsCompilation no

Author Tristan Senga Kiesse [aut] (<https://orcid.org/0000-0003-2710-5825>),
Gilles Durrieu [aut] (<https://orcid.org/0000-0003-0375-912X>),
Thomas Fillon [aut, cre] (<https://orcid.org/0000-0003-1207-8414>),
INRAE, Institut Agro, CNRS - UMR SAS [cph],
Université de Bretagne Sud, CNRS - UMR 6205 LMBA [cph]

Repository CRAN

Date/Publication 2025-03-19 13:20:05 UTC

Contents

`cv_bandwidth` *Cross-Validation function for bandwidth parameter selection of discrete kernel*

Description

Cross-Validation function for bandwidth parameter selection of discrete kernel

Usage

```
cv_bandwidth(
  kernel = c("optimal", "triang", "epanech", "binomial"),
  v,
  h,
  k = NULL
)
```

Arguments

`kernel`	the type of kernel. Currently supported kernels are limited to: "optimal", "triang", "epanech" and "binomial"
`v`	the vector of observations
`h`	the list of bandwidth parameters to test in cross validation
`k`	Optional: the integer (positive) parameter that defined the support of the kernel function (corresponds to parameter 'a' for triangular kernel). It is only used for optimal and triangular kernel

Value

the optimal bandwidth value

Examples

```
n <- 250
mu <- 2 # Mean
y <- sort(rpois(n, mu))
# kernel support parameter
k <- 1
H <- seq((max(y) - min(y)) / 200, (max(y) - min(y)) / 2, length.out = 50)
hcv <- cv_bandwidth(kernel = "optimal", y, h = H, k = k)
```

---

discrete_binomial *Discrete binomial kernel*

Description

Discrete binomial kernel

Usage

```
discrete_binomial(x, z, h)
```

Arguments

x	the target point at which the density is calculated
z	the vector of observations
h	the bandwidth (or smoothing parameter) which should match the condition 0<= h < 1

Value

Returns the value of the associated kernel function according to the target x and the bandwidth h.

Examples

```
# Basic usage of discrete_binomial() to compute a Discrete Binomial Kernel
discrete_binomial(x = 25, z = 1:50, h = 0.5)
```

`discrete_epanech` *Discrete Epanechnikov kernel*

Description

Discrete Epanechnikov kernel

Usage

```
discrete_epanech(x, z, h)
```

Arguments

`x`	the target point at which the density is calculated
`z`	the vector of observations
`h`	the bandwidth (or smoothing parameter)

Value

Returns the value of the associated kernel function according to the target x and the bandwidth h.

Examples

```
# Basic usage of discrete_epanech() to compute a discrete Epanechnikov kernel
discrete_epanech(x = 25, z = 1:50, h = 20)
```

`discrete_kernel` *Discrete kernel function*

Description

Discrete kernel function

Usage

```
discrete_kernel(
  kernel = c("optimal", "triang", "epanech", "binomial"),
  x,
  z,
  h,
  k = NULL
)
```

Arguments

kernel	the type of kernel. Currently supported kernels are limited to: "optimal", "triang", "epanech" and "binomial"
x	the target point at which the density is calculated
z	the vector of observations
h	the bandwidth (or smoothing parameter)
k	Optional: the integer (positive) parameter that defined the support of the kernel function (corresponds to parameter 'a' for triangular kernel). It is only used for optimal and triangular kernel

Value

Returns the value of the associated kernel function

See Also

discrete_optimal(), discrete_triang(), discrete_epanech(), discrete_binomial() which this function wraps.

Examples

```
discrete_kernel(kernel = "optimal", x = 25, z = 1:50, h = 0.9, k = 20)
discrete_kernel(kernel = "triang", x = 25, z = 1:50, h = 10, k = 20)
discrete_kernel(kernel = "epanech", x = 25, z = 1:50, h = 20)
discrete_kernel(kernel = "binomial", x = 25, z = 1:50, h = 0.5)
```

---

discrete_optimal *Discrete optimal kernel*

Description

Discrete optimal kernel

Usage

```
discrete_optimal(x, z, h, k)
```

Arguments

x	the target point at which the density is calculated
z	the vector of observations
h	the bandwidth (or smoothing parameter), which should match the condition (3 / 5) * (1 - 1 / k)) < h < 1
k	the integer (positive) parameter that defined the support of the kernel function

Value

Returns the value of the associated kernel function according to the target x and the bandwidth h.

Examples

```
discrete_optimal(x = 25, z = 1:50, h = 0.9, k = 20)
```

`discrete_triang` *Discrete triangular kernel*

Description

Discrete triangular kernel

Usage

```
discrete_triang(x, z, h, a)
```

Arguments

x	the target point at which the density is calculated
z	the vector of observations
h	the bandwidth (or smoothing parameter)
a	the integer (positive) parameter that defined the support of the kernel function

Value

Returns the value of the associated kernel function according to the target x and the bandwidth h.

Examples

```
# Basic usage of discrete_triang() to compute a Discrete triangular kernel
discrete_triang(x = 25, z = 1:50, h = 10, a = 20)
```

`estim_kernel` *Discrete Kernel Density Estimator*

Description

Discrete Kernel Density Estimator

Usage

```
estim_kernel(
  kernel = c("optimal", "triang", "epanech", "binomial"),
  x,
  h,
  v,
  k = NULL
)
```

Arguments

kernel	the type of kernel. Currently supported kernels are limited to: "optimal", "triang", "epanech" and "binomial"
x	the list of target points at which the density is calculated
h	the bandwidth (or smoothing parameter)
v	the vector of observations
k	Optional: the integer (positive) parameter that defined the support of the kernel function (corresponds to parameter 'a' for triangular kernel). It is only used for optimal and triangular kernel

Value

The estimated discrete kernel density values

Examples

```
n <- 250
mu <- 2 # Mean
x <- 0:10 # target values
y <- sort(rpois(n, mu)) # simulated Poisson observations
# kernel parameters
kernel <- "optimal"
k <- 1
# Cross Validation
H <- seq((max(y) - min(y)) / 200, (max(y) - min(y)) / 2, length.out = 50)
hcv <- cv_bandwidth(kernel = kernel, y, h = H, k = k)
# Kernel estimation
fn_opt_k <- estim_kernel(kernel = kernel, x = x, h = hcv, v = y, k = k)
```

fish_data *Fish dataset from the SIMTAP project*

Description

The SIMTAP project (Self-sufficient Integrated Multi-Trophic AquaPonic systems) aimed to develop sustainable aquaculture production system that, in particular, contributes to reduce fish feed inputs and resources consumption. We used data from an experiment in which gilthead seabream (sparus aurata) were stocked in 1.6 m3 tanks at a density of 1.5 kg·m-3 . Fish were reared for 46 days in a single recirculating aquaculture system composed of three rearing tanks. At the beginning of the experiment, a number n =200 of the fish were individually weighed (dg), and their length at the caudal fork (mm) was measured.

Usage

```
fish_data
```

Format

`fish_data`**:**

A data frame with 200 rows and 2 columns:

length Length in mm

weight Weight in dg ...

Source

https://www.simtap.eu

Index