Package 'ibs'

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Type Package

Title Integral of B-Spline Functions

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Description Calculate B-spline basis functions with a given set of knots and order, or a B-spline function with a given set of knots and order and set of de Boor points (coefficients), or the integral of a B-spline function.

License GPL (>= 2)

Imports Rcpp (>= 0.12.17)

LinkingTo Rcpp

NeedsCompilation yes

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R topics documented:

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ibs-package   *A short title line describing what the package does*

Description

Evaluate the integral of a B-spline function, or the B-spline function itself, or the B-spline basis functions.

Details

The function bsbases calculates the values of the B-spline basis functions defined by knots knots and order ord at sites x. The function bspline evaluates the B-spline function defined by knots knots, order ord, and coefficients coef at sites x. The function ibs calculates the integrals of the B-spline function defined by knots knots, order ord, and coefficients coef from the smallest knot to each of the values in x.

Author(s)

Creator: Feng Chen

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References

de Boor, C. (2001) A Practical Guide to Splines. Revised Edition. Springer: New York.

See Also

splineDesign

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bsbases   *B-spline bases*

Description

Evaluate the B-spline basis function at the x value(s).

Usage

```
bsbases(x, knots, ord)
```

Arguments

x	Numerical value or vector. The value(s) at which to evaluate the B spline bases.
knots	Numerical vector. The knot positions/sites of the B-spline bases.
ord	An integer >=1. The order of the B-spline bases. Equals degree plus 1.

Value

A numerical matrix of `length(x)` rows and `length(knots)-ord` columns.

Note

In contrast to the implementation based on the `splineDesign` function from the `splines` package, this version of the B-spline basis functions are left-continuous at the rightmost knot.

Author(s)

Feng Chen <feng.chen@unsw.edu.au>

References

de Boor, C. (2001) A Practical Guide to Splines. Revised Edition. Springer: New York.

See Also

[splineDesign](#)

Examples

```
kns <- c(rep(0,4),1:4*0.2,rep(1,4))
round(bsbases(0:5/5,kns,2),10)
round(splines::splineDesign(kns,0:5/5,2),10)
```

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bspline	*B-spline function*

Description

Evaluate the value of the B-spline function with knots `knots`, order `ord`, and coefficients `coef` at value(s) `x`.

Usage

```
bspline(x, knots, ord, coef = rep(1, length(knots) - ord))
```

Arguments

x	Numerical value or vector. The value(s) at which to evaluate the B-spline.
knots	Numerical vector. The knot positions/sites of the B-spline function.
ord	An integer >=1. The order of the B-spline function. Equals degree plus 1.
coef	A numerical vector. The coefficients (de Boor points) defining the B-spline function.

Value

A scalar or a vector of length equal to that of x.

Note

In contrast to the implementation based on the splineDesign function from the splines package, this version of the B-spline function is left-continuous at the rightmost knot site.

Author(s)

Feng Chen <feng.chen@unsw.edu.au>

References

de Boor, C. (2001) A Practical Guide to Splines. Revised Edition. Springer: New York.

See Also

[splineDesign](#)

Examples

```
kns <- c(rep(0,4),1:4*0.2,rep(1,4))
bspline(0:10/10,kns,3,rep(1,length(kns)-3))
splines::splineDesign(kns,0:10/10,3)%*%rep(1,length(kns)-3)
```

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ibs   *Integratal of a B-spline function*

Description

Calculate the integral of a B-spline function.

Usage

```
ibs(x, knots, ord=4, coef = rep(1, length(knots) - ord))
```

Arguments

x	Numerical value or vector. The value(s) at which to evaluate the integral of the B-spline; must be in the interval bewteen the smallest knot to the (nknots-ord)th largest knot.
knots	Numerical vector. The knot positions/sites of the B-spline function to be integrated.
ord	An integer >=1. The order of the B-spline integrand function to be integrated. Equals degree plus 1.
coef	A numerical vector. The coefficients (de Boor points) defining the B-spline integrand function.

Details

The function returns the integral(s) of the B-spline function specified by knots `knots`, order `ord`, and coefficients `coef`, from the minimum knot position to each `x` value. The evaluation is based on a closed form expression of the integral in terms of higher order B-splines, given on page 128 of de Boor (2001).

Value

A numerical equal to the integral(s).

Author(s)

Feng Chen <feng.chen@unsw.edu.au>

References

de Boor, C (2001) A Practical Guide to Splines. Revised Edition. Springer: New York.

See Also

bspline

Examples

```
kns <- c(rep(0,4),1:4*0.2,rep(1,4))
co <- rnorm(length(kns)-3)
integrate(bspline,knots=kns,ord=3,coef=co,0,0.95)
integrate(function(x)bsbases(x,kns,3) %*% co,0,0.95)
ibs(0.95,kns,3,co)
```

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