

# Package: interpolation (via r-universe)

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**Type** Package

**Title** Interpolation of Bivariate Functions

**Version** 0.1.1

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**Description** Provides two different methods, linear and nonlinear, to interpolate a bivariate function, scalar-valued or vector-valued. The interpolated data are not necessarily gridded. The algorithms are performed by the 'C++' library 'CGAL' (<<https://www.cgal.org/>>).

**License** GPL-3

**URL** <https://github.com/stla/interpolation>

**BugReports** <https://github.com/stla/interpolation/issues>

**Imports** Rcpp (>= 1.0.10)

**LinkingTo** Rcpp, RcppCGAL, BH

**Encoding** UTF-8

**RoxygenNote** 7.2.3

**SystemRequirements** C++ 17, gmp

**NeedsCompilation** yes

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**Repository** CRAN

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## Contents

interfun . . . . .	2
<b>Index</b>	<b>4</b>

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interpfun	<i>Interpolation function</i>
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### Description

Generates a function  $f(x,y)$  that interpolates the known function values at some given  $(x,y)$ -coordinates.

### Usage

```
interpfun(x, y, z, method = "linear")
```

### Arguments

x, y	two numeric vectors of the same size
z	a numeric vector or matrix of the same size as x and y, with two or three columns if it is a matrix
method	method of interpolation, either "linear" or "sibson"; the "sibson" method is not available for vector-valued functions, i.e. if z is a matrix

### Details

The new pairs of coordinates must be in the convex hull of the points  $(x, y)$ . If a new pair is outside the convex hull, the interpolating function returns NA for this pair. The linear method is exact for a function of the form  $f(x, y) = a + bx*x + by*y$ . The Sibson method is exact for a function of the form  $f(x, y) = a + bx*x + by*y + c*(x^2 + y^2)$ . This method estimates the gradient of the function and this can fail if the data are insufficient, in which case NA is returned.

### Value

A function whose graph interpolates the data  $((x, y), z)$ .

### Examples

```
library(interpolation)
a <- 0.2; bx <- 0.3; by <- -0.4
x0 <- y0 <- seq(1, 10, by = 1)
Grid <- expand.grid(X = x0, Y = y0)
x <- Grid$X; y <- Grid$Y
z <- a + bx*x + by*y
xnew <- ynew <- seq(2.5, 8.5, by = 1)
fun <- interpfun(x, y, z, "linear")
# computed values:
( znew <- fun(xnew, ynew) )
# true values:
a + bx*xnew + by*ynew

# a vector-valued example #####
```

```
x <- y <- c(-5, -4, -3, -2, 2, 3, 4, 5)
From <- as.matrix(expand.grid(x0 = x, y0 = y))
f <- function(x0y0) {
  d <- c(-10, -5) - x0y0
  x0y0 + 0.8 * d / sqrt(c(crossprod(d)))
}
To <- t(apply(From, 1L, f))
x0 <- From[, "x0"]; y0 <- From[, "y0"]
x1 <- To[, 1L]; y1 <- To[, 2L]
# plot data
plot(
  x0, y0, asp = 1, pch = 19, xlab = "x", ylab = "y"
)
arrows(x0, y0, x1, y1, length = 0.1)
# interpolate
library(interpolation)
fun <- interpfun(x0, y0, To, method = "linear")
From_new <- rbind(
  as.matrix(expand.grid(x0 = c(-1, 0, 1), y0 = (-5):5)),
  as.matrix(expand.grid(x0 = c(-5, -4, -3, -2), y0 = c(-1, 0, 1))),
  as.matrix(expand.grid(x0 = c(2, 3, 4, 5), y0 = c(-1, 0, 1)))
)
To_new <- fun(From_new)
x0 <- From_new[, "x0"]; y0 <- From_new[, "y0"]
x1 <- To_new[, 1L]; y1 <- To_new[, 2L]
points(x0, y0, pch = 19, col = "red")
arrows(x0, y0, x1, y1, length = 0.1, col = "red")
```

# Index

interpfun, 2