

Package: DiceView (via r-universe)

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Title Methods for Visualization of Computer Experiments Design and Surrogate

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Description View 2D/3D sections, contour plots, mesh of excursion sets for computer experiments designs, surrogates or test functions.

Depends methods, utils, stats, grDevices, graphics

Imports DiceDesign, R.cache, geometry, scatterplot3d, parallel, foreach

Suggests rlibkriging, DiceKriging, DiceEval, rgl, arrangements

License GPL-3

URL <https://github.com/IRSN/DiceView>

RoxygenNote 7.3.1

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Repository <https://irsn.r-universe.dev>

RemoteUrl <https://github.com/irsn/diceview>

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Apply.function	<i>Apply Functions Over Array Margins, using custom vectorization (possibly using parallel)</i>
----------------	---

Description

Emulate parallel apply on a function, from mclapply. Returns a vector or array or list of values obtained by applying a function to margins of an array or matrix.

Usage

```
Apply.function(
  FUN,
  X,
  MARGIN = 1,
  .combine = c,
  .lapply = parallel::mclapply,
  ...
)
```

Arguments

FUN	function to apply on X
X	array of input values for FUN
MARGIN	1 indicates to apply on rows (default), 2 on columns
.combine	how to combine results (default using c(.))
.lapply	how to vectorize FUN call (default is parallel::mclapply)
...	optional arguments to FUN.

Value

array of values taken by FUN on each row/column of X

Examples

```
X = matrix(runif(10),ncol=2);
rowSums(X) == apply(X,1,sum)
apply(X,1,sum) == Apply.function(sum,X)
```

```
X = matrix(runif(10),ncol=1)
rowSums(X) == apply(X,1,sum)
apply(X,1,sum) == Apply.function(sum,X)
```

```
X = matrix(runif(10),ncol=2)
f = function(X) X[1]/X[2]
apply(X,1,f) == Apply.function(f,X)
```

are_in.mesh

Checks if some points belong to a given mesh

Description

Checks if some points belong to a given mesh

Usage

```
are_in.mesh(X, mesh)
```

Arguments

X	points to check
mesh	mesh identifying the set which X may belong

Examples

```
X = matrix(runif(100),ncol=2);
inside = are_in.mesh(X,mesh=geometry::delauayn(matrix(c(0,0,1,1,0,0),ncol=2),output.options =TRUE))
print(inside)
plot(X,col=rgb(1-inside,0,0+inside))
```

branin	<i>This is a simple copy of the Branin-Hoo 2-dimensional test function, as provided in DiceKriging package. The Branin-Hoo function is defined here over [0,1] x [0,1], instead of [-5,0] x [10,15] as usual. It has 3 global minima : x1 = c(0.9616520, 0.15); x2 = c(0.1238946, 0.8166644); x3 = c(0.5427730, 0.15)</i>
--------	---

Description

This is a simple copy of the Branin-Hoo 2-dimensional test function, as provided in DiceKriging package. The Branin-Hoo function is defined here over [0,1] x [0,1], instead of [-5,0] x [10,15] as usual. It has 3 global minima : x1 = c(0.9616520, 0.15); x2 = c(0.1238946, 0.8166644); x3 = c(0.5427730, 0.15)

Usage

```
branin(x)
```

Arguments

x	a 2-dimensional vector specifying the location where the function is to be evaluated.
---	---

Value

A real number equal to the Branin-Hoo function values at x

combn.design	<i>Generalize expand.grid() for multi-columns data. Build all combinations of lines from X1 and X2. Each line may hold multiple columns.</i>
--------------	--

Description

Generalize expand.grid() for multi-columns data. Build all combinations of lines from X1 and X2. Each line may hold multiple columns.

Usage

```
combn.design(X1, X2)
```

Arguments

X1	variable values, possibly with many columns
X2	variable values, possibly with many columns combn.design(matrix(c(10,20),ncol=1),matrix(c(1,2,3,4,5,6),ncol=2)) combn.design(matrix(c(10,20,30,40),ncol=2),matrix(c(1,2,3,4,5,6),ncol=2))

contourview.function *Plot a contour view of a prediction model or function, including design points if available.*

Description

Plot a contour view of a prediction model or function, including design points if available.

Usage

```
## S3 method for class ``function``
contourview(
  fun,
  vectorized = FALSE,
  dim = NULL,
  center = NULL,
  lty_center = 2,
  col_center = "black",
  axis = NULL,
  npoints = 20,
  levels = 10,
  lty_levels = 3,
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels - 1) else
    col.levels("blue", levels - 1),
  col = NULL,
  col_fading_interval = 0.5,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  title = NULL,
  add = FALSE,
  ...
)

## S3 method for class 'matrix'
contourview(
  X,
  y,
  center = NULL,
  lty_center = 2,
  col_center = "black",
  axis = NULL,
  col_points = if (!is.null(col)) col else "red",
  col = NULL,
  bg_fading = 1,
  mfrow = NULL,
```

```

    Xlab = NULL,
    ylab = NULL,
    Xlim = NULL,
    title = NULL,
    add = FALSE,
    ...
)

## S3 method for class 'character'
contourview(eval_str, axis = NULL, mfrow = NULL, ...)

## S3 method for class 'km'
contourview(
  km_model,
  type = "UK",
  center = NULL,
  axis = NULL,
  npoints = 20,
  levels = pretty(km_model@y, 10),
  col_points = if (!is.null(col) & length(col) == 1) col else "red",
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else
    col.levels("blue", levels),
  col = NULL,
  conf_level = 0.5,
  conf_fading = 0.5,
  bg_fading = 1,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  title = NULL,
  add = FALSE,
  ...
)

## S3 method for class 'Kriging'
contourview(
  Kriging_model,
  center = NULL,
  axis = NULL,
  npoints = 20,
  levels = pretty(Kriging_model$y(), 10),
  col_points = if (!is.null(col) & length(col) == 1) col else "red",
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else
    col.levels("blue", levels),
  col = NULL,
  conf_level = 0.5,
  conf_fading = 0.5,

```

```
    bg_fading = 1,
    mfrow = NULL,
    Xlab = NULL,
    ylab = NULL,
    Xlim = NULL,
    title = NULL,
    add = FALSE,
    ...
)

## S3 method for class 'NuggetKriging'
contourview(
  NuggetKriging_model,
  center = NULL,
  axis = NULL,
  npoints = 20,
  levels = pretty(NuggetKriging_model$y(), 10),
  col_points = if (!is.null(col) & length(col) == 1) col else "red",
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else
    col.levels("blue", levels),
  col = NULL,
  conf_level = 0.5,
  conf_fading = 0.5,
  bg_fading = 1,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  title = NULL,
  add = FALSE,
  ...
)

## S3 method for class 'NoiseKriging'
contourview(
  NoiseKriging_model,
  center = NULL,
  axis = NULL,
  npoints = 20,
  levels = pretty(NoiseKriging_model$y(), 10),
  col_points = if (!is.null(col) & length(col) == 1) col else "red",
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else
    col.levels("blue", levels),
  col = NULL,
  conf_level = 0.5,
  conf_fading = 0.5,
  bg_fading = 1,
  mfrow = NULL,
```

```
Xlab = NULL,  
ylab = NULL,  
Xlim = NULL,  
title = NULL,  
add = FALSE,  
...  
)  
  
## S3 method for class 'glm'  
contourview(  
  glm_model,  
  center = NULL,  
  axis = NULL,  
  npoints = 20,  
  levels = pretty(glm_model$fitted.values, 10),  
  col_points = if (!is.null(col) & length(col) == 1) col else "red",  
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else  
    col.levels("blue", levels),  
  col = NULL,  
  conf_level = 0.5,  
  conf_fading = 0.5,  
  bg_fading = 1,  
  mfrow = NULL,  
  Xlab = NULL,  
  ylab = NULL,  
  Xlim = NULL,  
  title = NULL,  
  add = FALSE,  
  ...  
)  
  
## S3 method for class 'list'  
contourview(  
  modelFit_model,  
  center = NULL,  
  axis = NULL,  
  npoints = 20,  
  levels = pretty(modelFit_model$data$Y, 10),  
  col_points = if (!is.null(col) & length(col) == 1) col else "red",  
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else  
    col.levels("blue", levels),  
  col = NULL,  
  bg_fading = 1,  
  mfrow = NULL,  
  Xlab = NULL,  
  ylab = NULL,  
  Xlim = NULL,  
  title = NULL,
```



```

    add = FALSE,
    ...
)

contourview(...)

```

Arguments

fun	a function or 'predict()-like function that returns a simple numeric or mean and standard error: list(mean=...,se=...).
vectorized	is fun vectorized?
dim	input variables dimension of the model or function.
center	optional coordinates (as a list or data frame) of the center of the section view if the model's dimension is > 2.
lty_center	line type for the section center of the plot (if any).
col_center	color for the section center of the plot (if any).
axis	optional matrix of 2-axis combinations to plot, one by row. The value NULL leads to all possible combinations i.e. choose(D, 2).
npoints	an optional number of points to discretize plot of response surface and uncertainties.
levels	(number of) contour levels to display.
lty_levels	contour line type.
col_levels	color for the surface.
col	color of the object (use col_* for specific objects).
col_fading_interval	an optional factor of alpha (color channel) fading used to plot function output intervals (if any).
mfrow	an optional list to force par(mfrow = . . .) call. The default value NULL is automatically set for compact view.
Xlab	an optional list of string to overload names for X.
ylab	an optional string to overload name for y.
Xlim	an optional list to force x range for all plots. The default value NULL is automatically set to include all design points.
title	an optional overload of main title.
add	to print graphics on an existing window.
...	arguments of the contourview.km, contourview.glm, contourview.Kriging or contourview.function function
X	the matrix of input design.
y	the array of output values (two columns means an interval).
col_points	color of points.
bg_fading	an optional factor of alpha (color channel) fading used to plot design points outside from this section.

<code>eval_str</code>	the expression to evaluate in each subplot.
<code>km_model</code>	an object of class "km".
<code>type</code>	the kriging type to use for model prediction.
<code>conf_level</code>	confidence hulls to display.
<code>conf_fading</code>	an optional factor of alpha (color channel) fading used to plot confidence hull.
<code>Kriging_model</code>	an object of class "Kriging".
<code>NuggetKriging_model</code>	an object of class "Kriging".
<code>NoiseKriging_model</code>	an object of class "Kriging".
<code>glm_model</code>	an object of class "glm".
<code>modelFit_model</code>	an object returned by <code>DiceEval::modelFit</code> .

Details

If available, experimental points are plotted with fading colors. Points that fall in the specified section (if any) have the color specified `col_points` while points far away from the center have shaded versions of the same color. The amount of fading is determined using the Euclidean distance between the plotted point and center.

Author(s)

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See Also

[sectionview.function](#) for a section plot, and [sectionview3d.function](#) for a 2D section plot.
[sectionview.matrix](#) for a section plot, and [sectionview3d.matrix](#) for a 2D section plot.
[contourview.matrix](#) for a section plot.
[sectionview.km](#) for a section plot, and [sectionview3d.km](#) for a 2D section plot.
[sectionview.Kriging](#) for a section plot, and [sectionview3d.Kriging](#) for a 2D section plot.
[sectionview.NuggetKriging](#) for a section plot, and [sectionview3d.NuggetKriging](#) for a 2D section plot.
[sectionview.NoiseKriging](#) for a section plot, and [sectionview3d.NoiseKriging](#) for a 2D section plot.
[sectionview.glm](#) for a section plot, and [sectionview3d.glm](#) for a 2D section plot.
[sectionview.glm](#) for a section plot, and [sectionview3d.glm](#) for a 2D section plot.

Examples

```
x1 <- rnorm(15)
x2 <- rnorm(15)

y <- x1 + x2 + rnorm(15)
model <- lm(y ~ x1 + x2)
```

```

contourview(function(x) sum(x),
             dim=2, Xlim=cbind(range(x1),range(x2)), col='black')
points(x1,x2)

contourview(function(x) {
  x = as.data.frame(x)
  colnames(x) <- all.vars(model$call)[-1]
  predict.lm(model, newdata=x, se.fit=FALSE)
}, vectorized=TRUE, dim=2,
  Xlim=cbind(range(x1),range(x2)), add=TRUE)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

contourview(X, y)

x1 <- rnorm(15)
x2 <- rnorm(15)

y <- x1 + x2^2 + rnorm(15)
model <- glm(y ~ x1 + I(x2^2))

contourview(model)

contourview("abline(h=0.25,col='red')")
if (requireNamespace("DiceKriging")) { library(DiceKriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

model <- km(design = X, response = y, covtype="matern3_2")

contourview(model)

}

if (requireNamespace("rlikkriging")) { library(rlikkriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

model <- Kriging(X = X, y = y, kernel="matern3_2")

contourview(model)

}

if (requireNamespace("rlikkriging")) { library(rlikkriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin) + 5*rnorm(15)

```

```

model <- NuggetKriging(X = X, y = y, kernel="matern3_2")

contourview(model)

}

if (requireNamespace("rlikriging")) { library(rlikriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin) + 5*rnorm(15)

model <- NoiseKriging(X = X, y = y, kernel="matern3_2", noise=rep(5^2,15))

contourview(model)

}

x1 <- rnorm(15)
x2 <- rnorm(15)

y <- x1 + x2^2 + rnorm(15)
model <- glm(y ~ x1 + I(x2^2))

contourview(model)

if (requireNamespace("DiceEval")) { library(DiceEval)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

model <- modelFit(X, y, type = "StepLinear")

contourview(model)

}

## A 2D example - Branin-Hoo function
contourview(branin, dim=2, levels=30, col='black')

## Not run:
## a 16-points factorial design, and the corresponding response
d <- 2; n <- 16
design.fact <- expand.grid(seq(0, 1, length = 4), seq(0, 1, length = 4))
design.fact <- data.frame(design.fact); names(design.fact) <- c("x1", "x2")
y <- branin(design.fact); names(y) <- "y"

if (requireNamespace("DiceKriging")) { library(DiceKriging)
## model: km
model <- DiceKriging::km(design = design.fact, response = y)
contourview(model, levels=30)
contourview(branin, dim=2, levels=30, col='red', add=TRUE)
}

```

```

if (requireNamespace("rlikkriging")) { library(rlikkriging)
## model: Kriging
model <- Kriging(X = as.matrix(design.fact), y = as.matrix(y), kernel="matern3_2")
contourview(model, levels=30)
contourview(branin, dim=2, levels=30, col='red', add=TRUE)
}

## model: glm
model <- glm(y ~ 1+ x1 + x2 + I(x1^2) + I(x2^2) + x1*x2, data=cbind(y,design.fact))
contourview(model, levels=30)
contourview(branin, dim=2, levels=30, col='red', add=TRUE)

if (requireNamespace("DiceEval")) { library(DiceEval)
## model: StepLinear
model <- modelFit(design.fact, y, type = "StepLinear")
contourview(model, levels=30)
contourview(branin, dim=2, levels=30, col='red', add=TRUE)
}

## End(Not run)

```

EvalInterval.function *eval function and cast result to a list of y, y_low, y_up (possibly NA)*

Description

eval function and cast result to a list of y, y_low, y_up (possibly NA)

Usage

```
EvalInterval.function(fun, X, vectorized = FALSE, dim = ncol(X))
```

Arguments

fun	function to evaluate
X	matrix of input values for fun
vectorized	whether fun is vectorized or not
dim	dimension of input values for fun if

Value

list of y, y_low, y_up

expand.grids	<i>Create a Data Frame from all combinations of factor variables</i>
--------------	--

Description

Generalization of base::expand.grid to more than 2 variables.

Usage

```
expand.grids(d = length(list(...)), ...)
```

Arguments

d	number of variables (taken in following arguments with modulo)
...	variables to combine, as arrays of values

Value

data frame of all possible combinations of variables values

filledcontourview.function	<i>Plot a contour view of a prediction model or function, including design points if available.</i>
----------------------------	---

Description

Plot a contour view of a prediction model or function, including design points if available.

Usage

```
## S3 method for class ``function``
filledcontourview(
  fun,
  vectorized = FALSE,
  dim = NULL,
  center = NULL,
  lty_center = 2,
  col_center = "black",
  axis = NULL,
  npoints = 20,
  levels = 10,
  lty_levels = 1,
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels - 1) else
    col.levels("blue", levels - 1),
```

```
col = NULL,
col_fading_interval = 0.5,
mfrow = NULL,
Xlab = NULL,
ylab = NULL,
Xlim = NULL,
title = NULL,
add = FALSE,
...
)

## S3 method for class 'km'
filledcontourview(
  km_model,
  type = "UK",
  center = NULL,
  axis = NULL,
  npoints = 20,
  levels = pretty(km_model@y, 10),
  col_points = if (!is.null(col) & length(col) == 1) col else "red",
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else
    col.levels("blue", levels),
  col = NULL,
  conf_level = 0.5,
  conf_fading = 0.5,
  bg_fading = 1,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  title = NULL,
  add = FALSE,
  ...
)

## S3 method for class 'Kriging'
filledcontourview(
  Kriging_model,
  center = NULL,
  axis = NULL,
  npoints = 20,
  levels = pretty(Kriging_model$y(), 10),
  col_points = if (!is.null(col) & length(col) == 1) col else "red",
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else
    col.levels("blue", levels),
  col = NULL,
  conf_level = 0.5,
  conf_fading = 0.5,
```

```

    bg_fading = 1,
    mfrow = NULL,
    Xlab = NULL,
    ylab = NULL,
    Xlim = NULL,
    title = NULL,
    add = FALSE,
    ...
)

## S3 method for class 'NuggetKriging'
filledcontourview(
  NuggetKriging_model,
  center = NULL,
  axis = NULL,
  npoints = 20,
  levels = pretty(NuggetKriging_model$y(), 10),
  col_points = if (!is.null(col) & length(col) == 1) col else "red",
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else
    col.levels("blue", levels),
  col = NULL,
  conf_level = 0.5,
  conf_fading = 0.5,
  bg_fading = 1,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  title = NULL,
  add = FALSE,
  ...
)

## S3 method for class 'NoiseKriging'
filledcontourview(
  NoiseKriging_model,
  center = NULL,
  axis = NULL,
  npoints = 20,
  levels = pretty(NoiseKriging_model$y(), 10),
  col_points = if (!is.null(col) & length(col) == 1) col else "red",
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else
    col.levels("blue", levels),
  col = NULL,
  conf_level = 0.5,
  conf_fading = 0.5,
  bg_fading = 1,
  mfrow = NULL,

```



```
    Xlab = NULL,
    ylab = NULL,
    Xlim = NULL,
    title = NULL,
    add = FALSE,
    ...
)

## S3 method for class 'glm'
filledcontourview(
  glm_model,
  center = NULL,
  axis = NULL,
  npoints = 20,
  levels = pretty(glm_model$fitted.values, 10),
  col_points = if (!is.null(col) & length(col) == 1) col else "red",
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else
    col.levels("blue", levels),
  col = NULL,
  conf_level = 0.5,
  conf_fading = 0.5,
  bg_fading = 1,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  title = NULL,
  add = FALSE,
  ...
)

## S3 method for class 'list'
filledcontourview(
  modelFit_model,
  center = NULL,
  axis = NULL,
  npoints = 20,
  levels = pretty(modelFit_model$data$Y, 10),
  col_points = if (!is.null(col) & length(col) == 1) col else "red",
  col_levels = if (!is.null(col) & length(col) == 1) col.levels(col, levels) else
    col.levels("blue", levels),
  col = NULL,
  bg_fading = 1,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  title = NULL,
```

```

    add = FALSE,
    ...
)

filledcontourview(...)

```

Arguments

<code>fun</code>	a function or 'predict()' -like function that returns a simple numeric or mean and standard error: <code>list(mean=...,se=...)</code> .
<code>vectorized</code>	is fun vectorized?
<code>dim</code>	input variables dimension of the model or function.
<code>center</code>	optional coordinates (as a list or data frame) of the center of the section view if the model's dimension is > 2.
<code>lty_center</code>	line type for thesection center of the plot (if any).
<code>col_center</code>	color for the section center of the plot (if any).
<code>axis</code>	optional matrix of 2-axis combinations to plot, one by row. The value NULL leads to all possible combinations i.e. <code>choose(D, 2)</code> .
<code>npoints</code>	an optional number of points to discretize plot of response surface and uncertainties.
<code>levels</code>	(number of) contour levels to display.
<code>lty_levels</code>	contour line type.
<code>col_levels</code>	color for the surface.
<code>col</code>	color of the object (use <code>col_*</code> for specific objects).
<code>col_fading_interval</code>	an optional factor of alpha (color channel) fading used to plot function output intervals (if any).
<code>mfrow</code>	an optional list to force <code>par(mfrow = ...)</code> call. The default value NULL is automatically set for compact view.
<code>Xlab</code>	an optional list of string to overload names for X.
<code>ylab</code>	an optional string to overload name for y.
<code>Xlim</code>	an optional list to force x range for all plots. The default value NULL is automatically set to include all design points.
<code>title</code>	an optional overload of main title.
<code>add</code>	to print graphics on an existing window.
<code>...</code>	arguments of the <code>filledcontourview.km</code> , <code>filledcontourview.glm</code> , <code>filledcontourview.Kriging</code> or <code>filledcontourview.function</code> function
<code>km_model</code>	an object of class "km".
<code>type</code>	the kriging type to use for model prediction.
<code>col_points</code>	color of points.
<code>conf_level</code>	confidence hulls to display.

`conf_fading` an optional factor of alpha (color channel) fading used to plot confidence hull.
`bg_fading` an optional factor of alpha (color channel) fading used to plot design points outside from this section.
`Kriging_model` an object of class "Kriging".
`NuggetKriging_model` an object of class "Kriging".
`NoiseKriging_model` an object of class "Kriging".
`glm_model` an object of class "glm".
`modelFit_model` an object returned by `DiceEval::modelFit`.

Details

If available, experimental points are plotted with fading colors. Points that fall in the specified section (if any) have the color specified `col_points` while points far away from the center have shaded versions of the same color. The amount of fading is determined using the Euclidean distance between the plotted point and center.

Author(s)

Yann Richet, IRSN

See Also

[sectionview.function](#) for a section plot, and [sectionview3d.function](#) for a 2D section plot.
[sectionview.km](#) for a section plot, and [sectionview3d.km](#) for a 2D section plot.
[sectionview.Kriging](#) for a section plot, and [sectionview3d.Kriging](#) for a 2D section plot.
[sectionview.NuggetKriging](#) for a section plot, and [sectionview3d.NuggetKriging](#) for a 2D section plot.
[sectionview.NoiseKriging](#) for a section plot, and [sectionview3d.NoiseKriging](#) for a 2D section plot.
[sectionview.glm](#) for a section plot, and [sectionview3d.glm](#) for a 2D section plot.
[sectionview.glm](#) for a section plot, and [sectionview3d.glm](#) for a 2D section plot.

Examples

```

x1 <- rnorm(15)
x2 <- rnorm(15)

y <- x1 + x2 + rnorm(15)
model <- lm(y ~ x1 + x2)

filledcontourview(function(x) sum(x),
                  dim=2, Xlim=cbind(range(x1),range(x2)), col='black')
points(x1,x2)

filledcontourview(function(x) {

```

```

        x = as.data.frame(x)
        colnames(x) <- all.vars(model$call)[-1]
        predict.lm(model, newdata=x, se.fit=FALSE)
      }, vectorized=TRUE, dim=2,
      xlim=cbind(range(x1),range(x2)), add=TRUE)

if (requireNamespace("DiceKriging")) { library(DiceKriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

model <- km(design = X, response = y, covtype="matern3_2")

filledcontourview(model)

}

if (requireNamespace("rlikkriging")) { library(rlikkriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

model <- Kriging(X = X, y = y, kernel="matern3_2")

filledcontourview(model)

}

if (requireNamespace("rlikkriging")) { library(rlikkriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin) + 5*rnorm(15)

model <- NuggetKriging(X = X, y = y, kernel="matern3_2")

filledcontourview(model)

}

if (requireNamespace("rlikkriging")) { library(rlikkriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin) + 5*rnorm(15)

model <- NoiseKriging(X = X, y = y, kernel="matern3_2", noise=rep(5^2,15))

filledcontourview(model)

}

x1 <- rnorm(15)
x2 <- rnorm(15)

```

```

y <- x1 + x2^2 + rnorm(15)
model <- glm(y ~ x1 + I(x2^2))

filledcontourview(model)

if (requireNamespace("DiceEval")) { library(DiceEval)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

model <- modelFit(X, y, type = "StepLinear")

filledcontourview(model)

}

## A 2D example - Branin-Hoo function
filledcontourview(branin, dim=2, levels=30, col='black')

## Not run:
## a 16-points factorial design, and the corresponding response
d <- 2; n <- 16
design.fact <- expand.grid(seq(0, 1, length = 4), seq(0, 1, length = 4))
design.fact <- data.frame(design.fact); names(design.fact) <- c("x1", "x2")
y <- branin(design.fact); names(y) <- "y"

if (requireNamespace("DiceKriging")) { library(DiceKriging)
## model: km
model <- DiceKriging::km(design = design.fact, response = y)
filledcontourview(model, levels=30)
filledcontourview(branin, dim=2, levels=30, col='red', add=TRUE)
}

if (requireNamespace("rlikkriging")) { library(rlikkriging)
## model: Kriging
model <- Kriging(X = as.matrix(design.fact), y = as.matrix(y), kernel="matern3_2")
filledcontourview(model, levels=30)
filledcontourview(branin, dim=2, levels=30, col='red', add=TRUE)
}

## model: glm
model <- glm(y ~ 1+ x1 + x2 + I(x1^2) + I(x2^2) + x1*x2, data=cbind(y,design.fact))
filledcontourview(model, levels=30)
filledcontourview(branin, dim=2, levels=30, col='red', add=TRUE)

if (requireNamespace("DiceEval")) { library(DiceEval)
## model: StepLinear
model <- modelFit(design.fact, y, type = "StepLinear")
filledcontourview(model, levels=30)
filledcontourview(branin, dim=2, levels=30, col='red', add=TRUE)
}

## End(Not run)

```

is.mesh	<i>Checks if a mesh is valid</i>
---------	----------------------------------

Description

Checks if a mesh is valid

Usage

```
is.mesh(x)
```

Arguments

x	mesh to check
---	---------------

Value

TRUE if mesh is valid

is_in.mesh	<i>Checks if some point belongs to a given mesh</i>
------------	---

Description

Checks if some point belongs to a given mesh

Usage

```
is_in.mesh(x, mesh)
```

Arguments

x	point to check
mesh	mesh identifying the set which X may belong

Examples

```
is_in.mesh(-0.5, mesh=geometry::delaunayn(matrix(c(0,1), ncol=1), output.options =TRUE))
is_in.mesh(0.5, mesh=geometry::delaunayn(matrix(c(0,1), ncol=1), output.options =TRUE))

x =matrix(-.5, ncol=2, nrow=1)
is_in.mesh(x, mesh=geometry::delaunayn(matrix(c(0,0,1,1,0,0), ncol=2), output.options =TRUE))

x =matrix(.5, ncol=2, nrow=1)
is_in.mesh(x, mesh=geometry::delaunayn(matrix(c(0,0,1,1,0,0), ncol=2), output.options =TRUE))
```

is_in.p	<i>Test if points are in a hull</i>
---------	-------------------------------------

Description

Test if points are in a hull

Usage

```
is_in.p(x, p, h = NULL)
```

Arguments

x	points to test
p	points defining the hull
h	hull itself (built from p if given as NULL (default))

Examples

```
is_in.p(x=-0.5,p=matrix(c(0,1),ncol=1))
is_in.p(x=0.5,p=matrix(c(0,1),ncol=1))
is_in.p(x=matrix(-.5,ncol=2,nrow=1),p=matrix(c(0,0,1,1,0,0),ncol=2))
is_in.p(x=matrix(.25,ncol=2,nrow=1),p=matrix(c(0,0,1,1,0,0),ncol=2))
is_in.p(x=matrix(-.5,ncol=3,nrow=1),p=matrix(c(0,0,0,1,0,0,0,1,0,0,0,1),ncol=3,byrow = TRUE))
is_in.p(x=matrix(.25,ncol=3,nrow=1),p=matrix(c(0,0,0,1,0,0,0,1,0,0,0,1),ncol=3,byrow = TRUE))
```

Memoize.function	<i>Memoize a function</i>
------------------	---------------------------

Description

Before each call of a function, check that the cache holds the results and returns it if available. Otherwise, compute f and cache the result for next evaluations.

Usage

```
Memoize.function(fun)
```

Arguments

fun	function to memoize
-----	---------------------

Value

a function with same behavior than argument one, but using cache.

Examples

```
f=function(n) rnorm(n);
F=Memoize.function(f);
F(5); F(6); F(5)
```

mesh	<i>Builds a mesh from a design aor set of points</i>
------	--

Description

Builds a mesh from a design aor set of points

Usage

```
mesh(intervals, mesh.type = "seq", mesh.sizes = 11)
```

Arguments

intervals	bounds to inverse in, each column contains min and max of each dimension
mesh.type	function or "unif" or "seq" (default) or "LHS" to preform interval partition
mesh.sizes	number of parts for mesh (duplicate for each dimension if using "seq")

Value

delaunay mesh (list(p,tri,...) from geometry)

Examples

```
mesh = mesh(intervals=matrix(c(0,1,0,1),ncol=2),mesh.type="unif",mesh.sizes=10)
plot2d_mesh(mesh)
```

mesh_exsets	<i>Search excursion set of nD function, sampled by a mesh</i>
-------------	---

Description

Search excursion set of nD function, sampled by a mesh

Usage

```

mesh_exsets(
  f,
  vectorized = FALSE,
  threshold,
  sign,
  intervals,
  mesh.type = "seq",
  mesh.sizes = 11,
  maxerror_f = 1e-09,
  tol = .Machine$double.eps^0.25,
  ex_filter.tri = all,
  ...
)

```

Arguments

f	Function to inverse at 'threshold'
vectorized	boolean: is f already vectorized ? (default: FALSE) or if function: vectorized version of f.
threshold	target value to inverse
sign	focus at conservative for above (sign=1) or below (sign=-1) the threshold
intervals	bounds to inverse in, each column contains min and max of each dimension
mesh.type	"unif" or "seq" (default) or "LHS" to preform interval partition
mesh.sizes	number of parts for mesh (duplicate for each dimension if using "seq")
maxerror_f	maximal tolerance on f precision
tol	the desired accuracy (convergence tolerance on f arg).
ex_filter.tri	boolean function to validate a geometry::tri as considered in excursion : 'any' or 'all'
...	parameters to forward to roots_mesh(...) call

Examples

```

# mesh_exsets(function(x) x, threshold=.51, sign=1, intervals=rbind(0,1),
#   maxerror_f=1E-2,tol=1E-2) # for faster testing
# mesh_exsets(function(x) x, threshold=.50000001, sign=1, intervals=rbind(0,1),
#   maxerror_f=1E-2,tol=1E-2) # for faster testing
# mesh_exsets(function(x) sum(x), threshold=.51,sign=1, intervals=cbind(rbind(0,1),rbind(0,1)),
#   maxerror_f=1E-2,tol=1E-2) # for faster testing
# mesh_exsets(sin,threshold=0,sign="sup",interval=c(pi/2,5*pi/2),
#   maxerror_f=1E-2,tol=1E-2) # for faster testing

if (identical(Sys.getenv("NOT_CRAN"), "true")) { # too long for CRAN on Windows

  e = mesh_exsets(function(x) (0.25+x[1])^2+(0.5+x[2])^2 ,
    threshold =0.25,sign=-1, intervals=matrix(c(-1,1,-1,1),nrow=2),

```

```

maxerror_f=1E-2,tol=1E-2) # for faster testing

plot(e$p,xlim=c(-1,1),ylim=c(-1,1));
apply(e$tri,1,function(tri) polygon(e$p[tri,],col=rgb(.4,.4,.4)))

if (requireNamespace("rgl")) {
  e = mesh_exsets(function(x) (0.5+x[1])^2+(-0.5+x[2])^2+(0.+x[3])^2,
    threshold = .25,sign=-1, mesh.type="unif",
    intervals=matrix(c(-1,1,-1,1,-1,1),nrow=2),
    maxerror_f=1E-2,tol=1E-2) # for faster testing

  rgl::plot3d(e$p,xlim=c(-1,1),ylim=c(-1,1),zlim=c(-1,1));
  apply(e$tri,1,function(tri)rgl::lines3d(e$p[tri,]))
}
}

```

 mesh_level

Mesh level set of function

Description

Mesh level set of function

Usage

```
mesh_level(f, vectorized = FALSE, level = 0, intervals, mesh, ...)
```

Arguments

f	function to be evaluated on the mesh
vectorized	logical or function. If TRUE, f is assumed to be vectorized.
level	level/threshold value
intervals	matrix of intervals
mesh	mesh object or type
...	additional arguments passed to f

min_dist	<i>Minimal distance between one point to many points</i>
----------	--

Description

Minimal distance between one point to many points

Usage

```
min_dist(x, X, norm = rep(1, ncol(X)))
```

Arguments

x	one point
X	matrix of points (same number of columns than x)
norm	normalization vector of distance (same number of columns than x)

Value

minimal distance

Examples

```
min_dist(runif(3),matrix(runif(30),ncol=3))
```

optims	<i>Title Multi-local optimization wrapper for optim, using (possibly parallel) multistart.</i>
--------	--

Description

Title Multi-local optimization wrapper for optim, using (possibly parallel) multistart.

Usage

```
optims(
  pars,
  fn,
  fn.NaN = NaN,
  .apply = "mclapply",
  pars.eps = 1e-05,
  control = list(),
  ...
)
```

Arguments

pars	starting points for optim
fn	objective function, like in optim().
fn.NaN	replacement value of fn when returns NaN
.apply	loop/parallelization backend for multistart ("mclapply", "lapply" or "foreach")
pars.eps	minimal distance between two solutions to be considered different
control	control parameters for optim()
...	additional arguments passed to optim()

Value

list with best solution and all solutions

Author(s)

Yann Richet, IRSN

Examples

```
fn = function(x) ifelse(x==0,1,sin(x)/x)
# plot(fn, xlim=c(-20,20))
optim( par=5,                      fn,lower=-20,upper=20,method='L-BFGS-B')
optims(pars=t(t(seq(-20,20,,20))),fn,lower=-20,upper=20,method='L-BFGS-B')

# Branin function (3 local minimas)
f = function (x) {
  x1 <- x[1] * 15 - 5
  x2 <- x[2] * 15
  (x2 - 5/(4 * pi^2) * (x1^2) + 5/pi * x1 - 6)^2 + 10 * (1 - 1/(8 * pi)) * cos(x1) + 10
}
# expect to find 3 local minimas
optims(pars=matrix(runif(100),ncol=2),f,method="L-BFGS-B",lower=c(0,0),upper=c(1,1))
```

plot2d_mesh

Plot a two dimensional mesh

Description

Plot a two dimensional mesh

Usage

```
plot2d_mesh(
  mesh,
  color.nodes = "black",
  color.mesh = "darkgray",
  alpha = 0.4,
  ...
)
```

Arguments

mesh	2-dimensional mesh to draw
color.nodes	color of the mesh nodes
color.mesh	color of the mesh elements
alpha	transparency of the mesh elements & nodes
...	optional arguments passed to plot function

Examples

```
plot2d_mesh(mesh_exsets(f = function(x) sin(pi*x[1])*sin(pi*x[2]),
                        threshold=0,sign=1, mesh.type="unif",mesh.size=11,
                        intervals = matrix(c(1/2,5/2,1/2,5/2),nrow=2)))
```

plot3d_mesh	<i>Plot a three dimensional mesh</i>
-------------	--------------------------------------

Description

Plot a three dimensional mesh

Usage

```
plot3d_mesh(
  mesh,
  engine3d = NULL,
  color.nodes = "black",
  color.mesh = "darkgray",
  alpha = 0.4,
  ...
)
```

Arguments

mesh	3-dimensional mesh to draw
engine3d	3d framework to use: 'rgl' if installed or 'scatterplot3d' (default)
color.nodes	color of the mesh nodes
color.mesh	color of the mesh elements
alpha	transparency of the mesh elements & nodes
...	optional arguments passed to plot function

Examples

```

if (identical(Sys.getenv("NOT_CRAN"), "true")) { # too long for CRAN on Windows

  plot3d_mesh(mesh_exsets(function(x) (0.5+x[1])^2+(-0.5+x[2])^2+(0.+x[3])^2,
    threshold = .25,sign=-1, mesh.type="unif",
    maxerror_f=1E-2,tol=1E-2, # faster display
    intervals=matrix(c(-1,1,-1,1,-1,1),nrow=2)),
    engine3d='scatterplot3d')

  if (requireNamespace("rgl")) {
    plot3d_mesh(mesh_exsets(function(x) (0.5+x[1])^2+(-0.5+x[2])^2+(0.+x[3])^2,
      threshold = .25,sign=-1, mesh.type="unif",
      maxerror_f=1E-2,tol=1E-2, # faster display
      intervals=matrix(c(-1,1,-1,1,-1,1),nrow=2)),engine3d='rgl')
  }
}

```

plot_mesh

Plot a one dimensional mesh

Description

Plot a one dimensional mesh

Usage

```

plot_mesh(
  mesh,
  y = 0,
  color.nodes = "black",
  color.mesh = "darkgray",
  alpha = 0.4,
  ...
)

```

Arguments

mesh	1-dimensional mesh to draw
y	ordinate value where to draw the mesh
color.nodes	color of the mesh nodes
color.mesh	color of the mesh elements
alpha	transparency of the mesh elements & nodes
...	optional arguments passed to plot function

Examples

```

plot_mesh(mesh_exsets(function(x) x, threshold=.51, sign=1, intervals=rbind(0,1)))
plot_mesh(mesh_exsets(function(x) (x-.5)^2, threshold=.1, sign=-1, intervals=rbind(0,1)))

```

points_in.mesh	<i>Extract points of mesh which belong to the mesh triangulation (may not contain all points)</i>
----------------	---

Description

Extract points of mesh which belong to the mesh triangulation (may not contain all points)

Usage

```
points_in.mesh(mesh)
```

Arguments

mesh	mesh (list(p,tri,...) from geometry)
------	--------------------------------------

Value

points coordinates inside the mesh triangulation

points_out.mesh	<i>Extract points of mesh which do not belong to the mesh triangulation (may not contain all points)</i>
-----------------	--

Description

Extract points of mesh which do not belong to the mesh triangulation (may not contain all points)

Usage

```
points_out.mesh(mesh)
```

Arguments

mesh	(list(p,tri,...) from geometry)
------	---------------------------------

Value

points coordinates outside the mesh triangulation

 root

One Dimensional Root (Zero) Finding

Description

Search one root with given precision (on y). Iterate over uniroot as long as necessary.

Usage

```

root(
  f,
  lower,
  upper,
  maxerror_f = 1e-07,
  f_lower = f(lower, ...),
  f_upper = f(upper, ...),
  tol = .Machine$double.eps^0.25,
  convexity = FALSE,
  rec = 0,
  max.rec = NA,
  ...
)

```

Arguments

f	the function for which the root is sought.
lower	the lower end point of the interval to be searched.
upper	the upper end point of the interval to be searched.
maxerror_f	the maximum error on f evaluation (iterates over uniroot to converge).
f_lower	the same as f(lower).
f_upper	the same as f(upper).
tol	the desired accuracy (convergence tolerance on f arg).
convexity	the learned convexity factor of the function, used to reduce the boundaries for uniroot.
rec	counter of recursive level.
max.rec	maximal number of recursive level before failure (stop).
...	additional named or unnamed arguments to be passed to f.

Author(s)

Yann Richet, IRSN

Examples

```

f=function(x) {cat("f");1-exp(x)}; f(root(f,lower=-1,upper=2))
f=function(x) {cat("f");exp(x)-1}; f(root(f,lower=-1,upper=2))

.f = function(x) 1-exp(1*x)
f=function(x) {cat("f");y=.f(x);points(x,y,pch=20,col=rgb(0,0,0,.2));y}
plot(.f,xlim=c(-1,2)); f(root(f,lower=-1,upper=2))

.f = function(x) exp(10*x)-1
f=function(x) {cat("f");y=.f(x);points(x,y,pch=20);y}
plot(.f,xlim=c(-1,2)); f(root(f,lower=-1,upper=2))

.f = function(x) exp(100*x)-1
f=function(x) {cat("f");y=.f(x);points(x,y,pch=20);y}
plot(.f,xlim=c(-1,2)); f(root(f,lower=-1,upper=2))

f=function(x) {cat("f");exp(100*x)-1}; f(root(f,lower=-1,upper=2))

## Not run:

# Quite hard functions to find roots

## Increasing function
## convex
n.f=0
.f = function(x) exp(10*x)-1
f=function(x) {n.f<<-n.f+1;y=.f(x);points(x,y,pch=20);y}
plot(.f,xlim=c(-.1,.2)); f(root(f,lower=-1,upper=2))
print(n.f)
## non-convex
n.f=0
.f = function(x) 1-exp(-10*x)
f=function(x) {n.f<<-n.f+1;y=.f(x);points(x,y,pch=20);y}
plot(.f,xlim=c(-.1,.2)); f(root(f,lower=-1,upper=2))
print(n.f)

# ## Decreasing function
# ## non-convex
n.f=0
.f = function(x) 1-exp(10*x)
f=function(x) {n.f<<-n.f+1;y=.f(x);points(x,y,pch=20,col=rgb(0,0,0,.2));y}
plot(.f,xlim=c(-.1,.2)); f(root(f,lower=-1,upper=2))
print(n.f)
# ## convex
n.f=0
.f = function(x) exp(-10*x)-1
f=function(x) {n.f<<-n.f+1;y=.f(x);points(x,y,pch=20,col=rgb(0,0,0,.2));y}
plot(.f,xlim=c(-.1,.2)); f(root(f,lower=-1,upper=2))
print(n.f)

## End(Not run)

```

 roots

One Dimensional Multiple Roots (Zero) Finding

Description

Search multiple roots of 1D function, sampled/splitted by a (1D) mesh

Usage

```
roots(
  f,
  vectorized = FALSE,
  interval,
  maxerror_f = 1e-07,
  split = "seq",
  split.size = 11,
  tol = .Machine$double.eps^0.25,
  .lapply = parallel::mclapply,
  ...
)
```

Arguments

f	Function to find roots
vectorized	boolean: is f already vectorized ? (default: FALSE) or if function: vectorized version of f.
interval	bounds to inverse in
maxerror_f	the maximum error on f evaluation (iterates over uniroot to converge).
split	function or "unif" or "seq" (default) to preform interval partition
split.size	number of parts to perform uniroot inside
tol	the desired accuracy (convergence tolerance on f arg).
.lapply	control the loop/vectorization over different roots (defaults to multicore apply).
...	additional named or unnamed arguments to be passed to f.

Value

array of x, so $f(x)=\text{target}$

Examples

```
roots(sin,interval=c(pi/2,5*pi/2))
roots(sin,interval=c(pi/2,1.5*pi/2))

f=function(x)exp(x)-1;
f(roots(f,interval=c(-1,2)))
```

```
f=function(x)exp(1000*x)-1;
f(roots(f,interval=c(-1,2)))
```

roots_mesh	<i>Multi Dimensional Multiple Roots (Zero) Finding, sampled by a mesh</i>
------------	---

Description

Multi Dimensional Multiple Roots (Zero) Finding, sampled by a mesh

Usage

```
roots_mesh(
  f,
  vectorized = FALSE,
  intervals,
  mesh.type = "seq",
  mesh.sizes = 11,
  maxerror_f = 1e-07,
  tol = .Machine$double.eps^0.25,
  ...
)
```

Arguments

f	Function (one or more dimensions) to find roots of
vectorized	is f already vectorized ? (default: no)
intervals	bounds to inverse in, each column contains min and max of each dimension
mesh.type	function or "unif" or "seq" (default) to preform interval partition
mesh.sizes	number of parts for mesh (duplicate for each dimension if using "seq")
maxerror_f	the maximum error on f evaluation (iterates over uniroot to converge).
tol	the desired accuracy (convergence tolerance on f arg).
...	Other args for f

Value

matrix of x, so $f(x)=0$

Examples

```

roots_mesh(function(x) x-.51, intervals=rbind(0,1))
roots_mesh(function(x) sum(x)-.51, intervals=cbind(rbind(0,1),rbind(0,1)))
roots_mesh(sin,intervals=c(pi/2,5*pi/2))
roots_mesh(f = function(x) sin(pi*x[1])*sin(pi*x[2]),
           intervals = matrix(c(1/2,5/2,1/2,5/2),nrow=2))

r = roots_mesh(f = function(x) (0.25+x[1])^2+(0.5+x[2])^2 - .25,
              intervals=matrix(c(-1,1,-1,1),nrow=2), mesh.size=5)
plot(r,xlim=c(-1,1),ylim=c(-1,1))

r = roots_mesh(function(x) (0.5+x[1])^2+(-0.5+x[2])^2+(0.+x[3])^2 - .5,
              mesh.sizes = 11,
              intervals=matrix(c(-1,1,-1,1,-1,1),nrow=2))
scatterplot3d::scatterplot3d(r,xlim=c(-1,1),ylim=c(-1,1),zlim=c(-1,1))

roots_mesh(function(x)exp(x)-1,intervals=c(-1,2))
roots_mesh(function(x)exp(1000*x)-1,intervals=c(-1,2))

```

sectionview.function *Plot a section view of a prediction model or function, including design points if available.*

Description

Plot a section view of a prediction model or function, including design points if available.

Usage

```

## S3 method for class ``function``
sectionview(
  fun,
  vectorized = FALSE,
  dim = NULL,
  center = NULL,
  lty_center = 2,
  col_center = "black",
  axis = NULL,
  npoints = 100,
  col_fun = if (!is.null(col)) col else "blue",
  col = NULL,
  col_fading_interval = 0.5,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  ylim = NULL,
  title = NULL,

```

```
    add = FALSE,
    ...
)

## S3 method for class 'matrix'
sectionview(
  X,
  Y,
  center = NULL,
  lty_center = 2,
  col_center = "black",
  axis = NULL,
  col_points = if (!is.null(col)) col else "red",
  col = NULL,
  col_fading_interval = 0.5,
  bg_fading = 5,
  mfrow = NULL,
  Xlab = NULL,
  Ylab = NULL,
  Xlim = NULL,
  Ylim = NULL,
  title = NULL,
  add = FALSE,
  ...
)

## S3 method for class 'character'
sectionview(eval_str, axis = NULL, mfrow = NULL, ...)

## S3 method for class 'km'
sectionview(
  km_model,
  type = "UK",
  center = NULL,
  axis = NULL,
  npoints = 100,
  col_points = if (!is.null(col)) col else "red",
  col_fun = if (!is.null(col)) col else "blue",
  col = NULL,
  conf_level = 0.95,
  conf_fading = 0.5,
  bg_fading = 5,
  mfrow = NULL,
  Xlab = NULL,
  Ylab = NULL,
  Xlim = NULL,
  Ylim = NULL,
  title = NULL,
```

```
    add = FALSE,
    ...
)

## S3 method for class 'Kriging'
sectionview(
  Kriging_model,
  center = NULL,
  axis = NULL,
  npoints = 100,
  col_points = if (!is.null(col)) col else "red",
  col_fun = if (!is.null(col)) col else "blue",
  col = NULL,
  conf_level = 0.95,
  conf_fading = 0.5,
  bg_fading = 5,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  ylim = NULL,
  title = NULL,
  add = FALSE,
  ...
)

## S3 method for class 'NuggetKriging'
sectionview(
  NuggetKriging_model,
  center = NULL,
  axis = NULL,
  npoints = 100,
  col_points = if (!is.null(col)) col else "red",
  col_fun = if (!is.null(col)) col else "blue",
  col = NULL,
  conf_level = 0.95,
  conf_fading = 0.5,
  bg_fading = 5,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  ylim = NULL,
  title = NULL,
  add = FALSE,
  ...
)
```

```
## S3 method for class 'NoiseKriging'
sectionview(
  NoiseKriging_model,
  center = NULL,
  axis = NULL,
  npoints = 100,
  col_points = if (!is.null(col)) col else "red",
  col_fun = if (!is.null(col)) col else "blue",
  col = NULL,
  conf_level = 0.95,
  conf_fading = 0.5,
  bg_fading = 5,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  ylim = NULL,
  title = NULL,
  add = FALSE,
  ...
)
```

```
## S3 method for class 'glm'
sectionview(
  glm_model,
  center = NULL,
  axis = NULL,
  npoints = 100,
  col_points = if (!is.null(col)) col else "red",
  col_fun = if (!is.null(col)) col else "blue",
  col = NULL,
  conf_level = 0.95,
  conf_fading = 0.5,
  bg_fading = 5,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  ylim = NULL,
  title = NULL,
  add = FALSE,
  ...
)
```

```
## S3 method for class 'list'
sectionview(
  modelFit_model,
  center = NULL,
```

```

axis = NULL,
npoints = 100,
col_points = if (!is.null(col)) col else "red",
col_fun = if (!is.null(col)) col else "blue",
col = NULL,
bg_fading = 5,
mfrow = NULL,
Xlab = NULL,
ylab = NULL,
Xlim = NULL,
ylim = NULL,
title = NULL,
add = FALSE,
...
)

sectionview(...)

```

Arguments

fun	a function or 'predict()'-like function that returns a simple numeric, or an interval, or mean and standard error: list(mean=...,se=...).
vectorized	is fun vectorized?
dim	input variables dimension of the model or function.
center	optional coordinates (as a list or data frame) of the center of the section view if the model's dimension is > 2.
lty_center	line type for the section center of the plot (if any).
col_center	color for the section center of the plot (if any).
axis	optional matrix of 2-axis combinations to plot, one by row. The value NULL leads to all possible combinations i.e. choose(D, 2).
npoints	an optional number of points to discretize plot of response surface and uncertainties.
col_fun	color of the function plot.
col	color of the object (use col_* for specific objects).
col_fading_interval	an optional factor of alpha (color channel) fading used to plot confidence intervals.
mfrow	an optional list to force par(mfrow = . . .) call. The default value NULL is automatically set for compact view.
Xlab	an optional list of string to overload names for X.
ylab	an optional string to overload name for y.
Xlim	an optional list to force x range for all plots. The default value NULL is automatically set to include all design points.
ylim	an optional list to force y range for all plots.

<code>title</code>	an optional overload of main title.
<code>add</code>	to print graphics on an existing window.
<code>...</code>	arguments of the <code>sectionview.km</code> , <code>sectionview.glm</code> , <code>sectionview.Kriging</code> or <code>sectionview.function</code> function
<code>X</code>	the matrix of input design.
<code>y</code>	the array of output values (two columns means an interval).
<code>col_points</code>	color of points.
<code>bg_fading</code>	an optional factor of alpha (color channel) fading used to plot design points outside from this section.
<code>eval_str</code>	the expression to evaluate in each subplot.
<code>km_model</code>	an object of class "km".
<code>type</code>	the kriging type to use for model prediction.
<code>conf_level</code>	an optional list of confidence intervals to display.
<code>conf_fading</code>	an optional factor of alpha (color channel) fading used to plot confidence intervals.
<code>Kriging_model</code>	an object of class "Kriging".
<code>NuggetKriging_model</code>	an object of class "Kriging".
<code>NoiseKriging_model</code>	an object of class "Kriging".
<code>glm_model</code>	an object of class "glm".
<code>modelFit_model</code>	an object returned by <code>DiceEval::modelFit</code> .

Details

If available, experimental points are plotted with fading colors. Points that fall in the specified section (if any) have the color specified `col_points` while points far away from the center have shaded versions of the same color. The amount of fading is determined using the Euclidean distance between the plotted point and center.

Author(s)

Yann Richet, IRSN

See Also

[sectionview.function](#) for a section plot, and [sectionview3d.function](#) for a 2D section plot.
[sectionview.matrix](#) for a section plot, and [sectionview3d.matrix](#) for a 2D section plot.
[sectionview.matrix](#) for a section plot, and [sectionview3d.matrix](#) for a 2D section plot.
[sectionview.km](#) for a section plot, and [sectionview3d.km](#) for a 2D section plot.
[sectionview.Kriging](#) for a section plot, and [sectionview3d.Kriging](#) for a 2D section plot.
[sectionview.NuggetKriging](#) for a section plot, and [sectionview3d.NuggetKriging](#) for a 2D section plot.

[sectionview.NoiseKriging](#) for a section plot, and [sectionview3d.NoiseKriging](#) for a 2D section plot.

[sectionview.glm](#) for a section plot, and [sectionview3d.glm](#) for a 2D section plot.

[sectionview.glm](#) for a section plot, and [sectionview3d.glm](#) for a 2D section plot.

Examples

```
x1 <- rnorm(15)
x2 <- rnorm(15)

y <- x1 + x2 + rnorm(15)
model <- lm(y ~ x1 + x2)

sectionview(function(x) sum(x),
             dim=2, center=c(0,0), Xlim=cbind(range(x1),range(x2)), col='black')

sectionview(function(x) {
  x = as.data.frame(x)
  colnames(x) <- all.vars(model$call)[-1]
  p = predict.lm(model, newdata=x, se.fit=TRUE)
  cbind(p$fit-1.96 * p$se.fit, p$fit+1.96 * p$se.fit)
}, vectorized=TRUE, dim=2, center=c(0,0),
  Xlim=cbind(range(x1),range(x2)), add=TRUE)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

sectionview(X,y, center=c(.5,.5))

x1 <- rnorm(15)
x2 <- rnorm(15)

y <- x1 + x2^2 + rnorm(15)
model <- glm(y ~ x1 + I(x2^2))

sectionview(model, center=c(.5,.5))

sectionview("abline(h=5)")
if (requireNamespace("DiceKriging")) { library(DiceKriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

model <- km(design = X, response = y, covtype="matern3_2")

sectionview(model, center=c(.5,.5))

}

if (requireNamespace("rlikkriging")) { library(rlikkriging)

X = matrix(runif(15*2),ncol=2)
```

```
y = apply(X,1,branin)

model <- Kriging(X = X, y = y, kernel="matern3_2")

sectionview(model, center=c(.5,.5))

}

if (requireNamespace("rlikkriging")) { library(rlikkriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin) + 5*rnorm(15)

model <- NuggetKriging(X = X, y = y, kernel="matern3_2")

sectionview(model, center=c(.5,.5))

}

if (requireNamespace("rlikkriging")) { library(rlikkriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin) + 5*rnorm(15)

model <- NoiseKriging(X = X, y = y, kernel="matern3_2", noise=rep(5^2,15))

sectionview(model, center=c(.5,.5))

}

x1 <- rnorm(15)
x2 <- rnorm(15)

y <- x1 + x2^2 + rnorm(15)
model <- glm(y ~ x1 + I(x2^2))

sectionview(model, center=c(.5,.5))

if (requireNamespace("DiceEval")) { library(DiceEval)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

model <- modelFit(X, y, type = "StepLinear")

sectionview(model, center=c(.5,.5))

}

## A 2D example - Branin-Hoo function
sectionview(branin, center= c(.5,.5), col='black')

## Not run:
```

```

## a 16-points factorial design, and the corresponding response
d <- 2; n <- 16
design.fact <- expand.grid(seq(0, 1, length = 4), seq(0, 1, length = 4))
design.fact <- data.frame(design.fact); names(design.fact) <- c("x1", "x2")
y <- branin(design.fact); names(y) <- "y"

if (requireNamespace("DiceKriging")) { library(DiceKriging)
## model: km
model <- DiceKriging::km(design = design.fact, response = y)
sectionview(model, center= c(.5,.5))
sectionview(branin, center= c(.5,.5), col='red', add=TRUE)
}

if (requireNamespace("rlikkriging")) { library(rlikkriging)
## model: Kriging
model <- Kriging(X = as.matrix(design.fact), y = as.matrix(y), kernel="matern3_2")
sectionview(model, center= c(.5,.5))
sectionview(branin, center= c(.5,.5), col='red', add=TRUE)
}

## model: glm
model <- glm(y ~ 1+ x1 + x2 + I(x1^2) + I(x2^2) + x1*x2, data=cbind(y,design.fact))
sectionview(model, center= c(.5,.5))
sectionview(branin, center= c(.5,.5), col='red', add=TRUE)

if (requireNamespace("DiceEval")) { library(DiceEval)
## model: StepLinear
model <- modelFit(design.fact, y, type = "StepLinear")
sectionview(model, center= c(.5,.5))
sectionview(branin, center= c(.5,.5), col='red', add=TRUE)
}

## End(Not run)

```

sectionview3d.function

Plot a contour view of a prediction model or function, including design points if available.

Description

Plot a contour view of a prediction model or function, including design points if available.

Usage

```

## S3 method for class ``function``
sectionview3d(
  fun,
  vectorized = FALSE,

```

```
dim = NULL,  
center = NULL,  
axis = NULL,  
npoints = 20,  
col_fun = if (!is.null(col)) col else "blue",  
col = NULL,  
col_fading_interval = 0.5,  
mfrow = NULL,  
Xlab = NULL,  
ylab = NULL,  
Xlim = NULL,  
ylim = NULL,  
title = NULL,  
add = FALSE,  
engine3d = NULL,  
...  
)  
  
## S3 method for class 'matrix'  
sectionview3d(  
  X,  
  Y,  
  center = NULL,  
  axis = NULL,  
  col_points = if (!is.null(col)) col else "red",  
  col = NULL,  
  col_fading_interval = 0.5,  
  bg_fading = 1,  
  mfrow = NULL,  
  Xlab = NULL,  
  ylab = NULL,  
  Xlim = NULL,  
  ylim = NULL,  
  title = NULL,  
  add = FALSE,  
  engine3d = NULL,  
  ...  
)  
  
## S3 method for class 'character'  
sectionview3d(eval_str, axis = NULL, mfrow = NULL, ...)  
  
## S3 method for class 'km'  
sectionview3d(  
  km_model,  
  type = "UK",  
  center = NULL,  
  axis = NULL,
```

```
  npoints = 20,  
  col_points = if (!is.null(col)) col else "red",  
  col_fun = if (!is.null(col)) col else "blue",  
  col = NULL,  
  conf_level = 0.95,  
  conf_fading = 0.5,  
  bg_fading = 1,  
  mfrow = NULL,  
  Xlab = NULL,  
  ylab = NULL,  
  Xlim = NULL,  
  ylim = NULL,  
  title = NULL,  
  add = FALSE,  
  engine3d = NULL,  
  ...  
)
```

```
## S3 method for class 'Kriging'  
sectionview3d(  
  Kriging_model,  
  center = NULL,  
  axis = NULL,  
  npoints = 20,  
  col_points = if (!is.null(col)) col else "red",  
  col_fun = if (!is.null(col)) col else "blue",  
  col = NULL,  
  conf_level = 0.95,  
  conf_fading = 0.5,  
  bg_fading = 1,  
  mfrow = NULL,  
  Xlab = NULL,  
  ylab = NULL,  
  Xlim = NULL,  
  ylim = NULL,  
  title = NULL,  
  add = FALSE,  
  engine3d = NULL,  
  ...  
)
```

```
## S3 method for class 'NuggetKriging'  
sectionview3d(  
  NuggetKriging_model,  
  center = NULL,  
  axis = NULL,  
  npoints = 20,  
  col_points = if (!is.null(col)) col else "red",
```

```
col_fun = if (!is.null(col)) col else "blue",
col = NULL,
conf_level = 0.95,
conf_fading = 0.5,
bg_fading = 1,
mfrow = NULL,
Xlab = NULL,
ylab = NULL,
Xlim = NULL,
ylim = NULL,
title = NULL,
add = FALSE,
engine3d = NULL,
...
)

## S3 method for class 'NoiseKriging'
sectionview3d(
  NoiseKriging_model,
  center = NULL,
  axis = NULL,
  npoints = 20,
  col_points = if (!is.null(col)) col else "red",
  col_fun = if (!is.null(col)) col else "blue",
  col = NULL,
  conf_level = 0.95,
  conf_fading = 0.5,
  bg_fading = 1,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  ylim = NULL,
  title = NULL,
  add = FALSE,
  engine3d = NULL,
  ...
)

## S3 method for class 'glm'
sectionview3d(
  glm_model,
  center = NULL,
  axis = NULL,
  npoints = 20,
  col_points = if (!is.null(col)) col else "red",
  col_fun = if (!is.null(col)) col else "blue",
  col = NULL,
```

```

    conf_level = 0.95,
    conf_fading = 0.5,
    bg_fading = 1,
    mfrow = NULL,
    Xlab = NULL,
    ylab = NULL,
    Xlim = NULL,
    ylim = NULL,
    title = NULL,
    add = FALSE,
    engine3d = NULL,
    ...
)

## S3 method for class 'list'
sectionview3d(
  modelFit_model,
  center = NULL,
  axis = NULL,
  npoints = 20,
  col_points = if (!is.null(col)) col else "red",
  col_fun = if (!is.null(col)) col else "blue",
  col = NULL,
  bg_fading = 1,
  mfrow = NULL,
  Xlab = NULL,
  ylab = NULL,
  Xlim = NULL,
  ylim = NULL,
  title = NULL,
  add = FALSE,
  engine3d = NULL,
  ...
)

sectionview3d(...)

```

Arguments

fun	a function or 'predict()'-like function that returns a simple numeric, or an interval, or mean and standard error: list(mean=...,se=...).
vectorized	is fun vectorized?
dim	input variables dimension of the model or function.
center	optional coordinates (as a list or data frame) of the center of the section view if the model's dimension is > 2.
axis	optional matrix of 2-axis combinations to plot, one by row. The value NULL leads to all possible combinations i.e. choose(D, 2).

<code>npoints</code>	an optional number of points to discretize plot of response surface and uncertainties.
<code>col_fun</code>	color of the function plot.
<code>col</code>	color of the object (use <code>col_*</code> for specific objects).
<code>col_fading_interval</code>	an optional factor of alpha (color channel) fading used to plot confidence intervals.
<code>mfrow</code>	an optional list to force <code>par(mfrow = . . .)</code> call. The default value <code>NULL</code> is automatically set for compact view.
<code>Xlab</code>	an optional list of string to overload names for <code>X</code> .
<code>ylab</code>	an optional string to overload name for <code>y</code> .
<code>Xlim</code>	an optional list to force <code>x</code> range for all plots. The default value <code>NULL</code> is automatically set to include all design points (and their 1-99 percentiles).
<code>ylim</code>	an optional list to force <code>y</code> range for all plots. The default value <code>NULL</code> is automatically set to include all design points (and their 1-99 percentiles).
<code>title</code>	an optional overload of main title.
<code>add</code>	to print graphics on an existing window.
<code>engine3d</code>	3D view package to use. "rgl" if available, otherwise "scatterplot3d" by default.
<code>...</code>	arguments of the <code>sectionview3d.km</code> , <code>sectionview3d.glm</code> , <code>sectionview3d.Kriging</code> or <code>sectionview3d.function</code> function
<code>X</code>	the matrix of input design.
<code>y</code>	the array of output values (two columns means an interval).
<code>col_points</code>	color of points.
<code>bg_fading</code>	an optional factor of alpha (color channel) fading used to plot design points outside from this section.
<code>eval_str</code>	the expression to evaluate in each subplot.
<code>km_model</code>	an object of class "km".
<code>type</code>	the kriging type to use for model prediction.
<code>conf_level</code>	an optional list of confidence intervals to display.
<code>conf_fading</code>	an optional factor of alpha (color channel) fading used to plot confidence intervals.
<code>Kriging_model</code>	an object of class "Kriging".
<code>NuggetKriging_model</code>	an object of class "Kriging".
<code>NoiseKriging_model</code>	an object of class "Kriging".
<code>glm_model</code>	an object of class "glm".
<code>modelFit_model</code>	an object returned by <code>DiceEval::modelFit</code> .

Details

If available, experimental points are plotted with fading colors. Points that fall in the specified section (if any) have the color specified `col_points` while points far away from the center have shaded versions of the same color. The amount of fading is determined using the Euclidean distance between the plotted point and center.

Author(s)

Yann Richet, IRSN

See Also

[sectionview.function](#) for a section plot, and [sectionview3d.function](#) for a 2D section plot.

[sectionview.matrix](#) for a section plot, and [sectionview3d.matrix](#) for a 2D section plot.

[sectionview3d.matrix](#) for a section plot.

[sectionview.km](#) for a section plot, and [sectionview3d.km](#) for a 2D section plot.

[sectionview.Kriging](#) for a section plot, and [sectionview3d.Kriging](#) for a 2D section plot.

[sectionview.NuggetKriging](#) for a section plot, and [sectionview3d.NuggetKriging](#) for a 2D section plot.

[sectionview.NoiseKriging](#) for a section plot, and [sectionview3d.NoiseKriging](#) for a 2D section plot.

[sectionview.glm](#) for a section plot, and [sectionview3d.glm](#) for a 2D section plot.

[sectionview.glm](#) for a section plot, and [sectionview3d.glm](#) for a 2D section plot.

Examples

```
x1 <- rnorm(15)
x2 <- rnorm(15)

y <- x1 + x2 + rnorm(15)
model <- lm(y ~ x1 + x2)

DiceView:::open3d();
DiceView:::plot3d(x1,x2,y)
sectionview3d(function(x) sum(x),
              dim=2, Xlim=cbind(range(x1),range(x2)), add=TRUE, col='black')

sectionview3d(function(x) {
  x = as.data.frame(x)
  colnames(x) <- all.vars(model$call)[-1]
  p = predict.lm(model, newdata=x, se.fit=TRUE)
  list(mean=p$fit, se=p$se.fit)
}, vectorized=TRUE, dim=2,
      Xlim=cbind(range(x1),range(x2)), add=TRUE)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)
```

```
sectionview3d(X, y)

x1 <- rnorm(15)
x2 <- rnorm(15)

y <- x1 + x2^2 + rnorm(15)
model <- glm(y ~ x1 + I(x2^2))

sectionview3d(model)

sectionview3d("abline(h=0.25,col='red')")
if (requireNamespace("DiceKriging")) { library(DiceKriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

model <- km(design = X, response = y, covtype="matern3_2")

sectionview3d(model)

}

if (requireNamespace("rlikkriging")) { library(rlikkriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

model <- Kriging(X = X, y = y, kernel="matern3_2")

sectionview3d(model)

}

if (requireNamespace("rlikkriging")) { library(rlikkriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin) + 5*rnorm(15)

model <- NuggetKriging(X = X, y = y, kernel="matern3_2")

sectionview3d(model)

}

if (requireNamespace("rlikkriging")) { library(rlikkriging)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin) + 5*rnorm(15)

model <- NoiseKriging(X = X, y = y, kernel="matern3_2", noise=rep(5^2,15))

sectionview3d(model)
```

```

}

x1 <- rnorm(15)
x2 <- rnorm(15)

y <- x1 + x2^2 + rnorm(15)
model <- glm(y ~ x1 + I(x2^2))

sectionview3d(model)

if (requireNamespace("DiceEval")) { library(DiceEval)

X = matrix(runif(15*2),ncol=2)
y = apply(X,1,branin)

model <- modelFit(X, y, type = "StepLinear")

sectionview3d(model)

}

## A 2D example - Branin-Hoo function
sectionview3d(branin, dim=2, col='black')

## Not run:
## a 16-points factorial design, and the corresponding response
d <- 2; n <- 16
design.fact <- expand.grid(seq(0, 1, length = 4), seq(0, 1, length = 4))
design.fact <- data.frame(design.fact); names(design.fact) <- c("x1", "x2")
y <- branin(design.fact); names(y) <- "y"

if (requireNamespace("DiceKriging")) { library(DiceKriging)
## model: km
model <- DiceKriging::km(design = design.fact, response = y)
sectionview3d(model)
sectionview3d(branin, dim=2, col='red', add=TRUE)
}

if (requireNamespace("rlikkriging")) { library(rlikkriging)
## model: Kriging
model <- Kriging(X = as.matrix(design.fact), y = as.matrix(y), kernel="matern3_2")
sectionview3d(model)
sectionview3d(branin, dim=2, col='red', add=TRUE)
}

## model: glm
model <- glm(y ~ 1+ x1 + x2 + I(x1^2) + I(x2^2) + x1*x2, data=cbind(y,design.fact))
sectionview3d(model)
sectionview3d(branin, dim=2, col='red', add=TRUE)

if (requireNamespace("DiceEval")) { library(DiceEval)
## model: StepLinear
model <- modelFit(design.fact, y, type = "StepLinear")

```

```

sectionview3d(model)
sectionview3d(branin, dim=2, col='red', add=TRUE)
}

## End(Not run)

```

Vectorize.function *Vectorize a multidimensional Function*

Description

Vectorize a d-dimensional (input) function, in the same way that base::Vectorize for 1-dimensional functions.

Usage

```

Vectorize.function(
  fun,
  dim,
  .combine = rbind,
  .lapply = parallel::mclapply,
  ...
)

```

Arguments

fun	'dim'-dimensional function to Vectorize
dim	dimension of input arguments of fun
.combine	how to combine results (default using c(.))
.lapply	how to vectorize FUN call (default is parallel::mclapply)
...	optional args to pass to 'Apply.function()', including .combine, .lapply, or optional args passed to 'fun'.

Value

a vectorized function (to be called on matrix argument, on each row)

Examples

```

f = function(x)x[1]+1; f(1:10); F = Vectorize.function(f,1);
F(1:10); #F = Vectorize(f); F(1:10);

f2 = function(x)x[1]+x[2]; f2(1:10); F2 = Vectorize.function(f2,2);
F2(cbind(1:10,11:20));

f3 = function(x)list(mean=x[1]+x[2],se=x[1]*x[2]); f3(1:10); F3 = Vectorize.function(f3,2);
F3(cbind(1:10,11:20));

```

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