Package 'sfd'

January 8, 2024

Title Space-Filling Design Library

Version 0.1.0

Description A collection of pre-optimized space-filling designs, for up to ten parameters, is contained here. Functions are provided to access designs described by Husslage et al (2011) <doi:10.1007/s11081-010-9129-8> and Wang and Fang (2005) <doi:10.1142/9789812701190_0040>. The design types included are Audze-Eglais, MaxiMin, and uniform.

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Depends R (>= 2.10), tibble

Imports cli, rlang

Suggests ggplot2, spelling, testthat (>= 3.0.0)

Config/testthat/edition 3

Encoding UTF-8

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LazyData true

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NeedsCompilation no

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R topics documented:

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get_design   *Retrieve a Space-Filling Design*

Description

Obtain a space-filling design (if possible) based on how many characteristics (i.e. parameters) and size (i.e., number of grid points).

Usage

```
get_design(num_param, num_points, type = "any")
```

Arguments

num_param   An integer between two and ten for the number of characteristics/factors/parameters in the design.

num_points   An integer for the number of grid points requested. If there is no corresponding design, an error is given (when using get_design())

type   A character string with possible values> "any", "audze_eglais", "max_min_l1", "max_min_l2", and "uniform". A value of "any" will choose the first design available (in alphabetical order).

Details

The "audze_eglais", "max_min_l1", and "max_min_l2" designs are from https://www.spacefillingdesigns. nl/.

The uniform designs were pre-computed using mixtox::unidTab() using the method of Wang and Fang (2005) using the C2 criterion.

Value

A tibble (data frame) with columns named X1 to X{num_param}. Each column is an integer for the ordered value of the real parameter values.

References

https://www.spacefillingdesigns.nl/, Husslage, B. G., Rennen, G., Van Dam, E. R., & Den Hertog, D. (2011). Space-filling Latin hypercube designs for computer experiments. *Optimization and Engineering*, 12, 611-630. Wang, Y., & Fang, K. (2005). Uniform design of experiments with mixtures. In *Selected Papers Of Wang Yuan*, 468-479.

Examples

```
if (rlang::is_installed("ggplot2")) {
 library(ggplot2)

 two_param_l2 <- get_design(2, 100, type = "audze_eglais")

 ggplot(two_param_l2, aes(X1, X2)) +
   geom_point() +
   coord_equal()
}

no_design <- try(get_design(2, 1000), silent = TRUE)
cat(as.character(no_design))
```

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sfd_available   *Is a Space-Filling Design Available?*

Description

Determine if a design from <https://www.spacefillingdesigns.nl/> is available in this package based on how many characteristics (i.e. parameters), size (i.e., number of grid points), and type.

Usage

```
sfd_available(num_param, num_points, type = "any")
```

Arguments

num_param	An integer between two and ten for the number of characteristics/factors/parameters in the design.
num_points	An integer for the number of grid points requested. If there is no corresponding design, an error is given (when using get_design())
type	A character string with possible values> "any", "audze_eglais", "max_min_l1", "max_min_l2", and "uniform". A value of "any" will choose the first design available (in alphabetical order).

Value

A logical

Examples

```
sfd_available(2, 10)
sfd_available(2, 10^5)
```

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sfd_lib   *Space-Filling Designs*

Description

This data object is a list of designs originating from <https://www.spacefillingdesigns.nl/>.
While the original website offers no guarantee or license, they do state that "All these designs have
been compared and the best designs are collected on this website. They can be downloaded for free
and used in your specific simulation environment".

Details

The available designs in this package are for experiments where the number of parameters ranges
from two to ten of types "audze_eglais", "max_min_l1", or "max_min_l2". See Husslage *et al*
(2011).

The format is a list with nine elements for dimensions of two to ten experimental factors/parameters.
The designs are concatenated with columns of design type and number of points. The values are
integers between one and the number of design points.

Value

sfd_lib   a list of tibble

Source

<https://www.spacefillingdesigns.nl/> Husslage, B. G., Rennen, G., Van Dam, E. R., & Den
Hertog, D. (2011). Space-filling Latin hypercube designs for computer experiments. *Optimization
and Engineering*, 12, 611-630.

Examples

```
data(sfd_lib)

if (rlang::is_installed("ggplot2")) {
 library(ggplot2)

 two_params <- sfd_lib[[1]]
 two_params <- two_params[two_params$num_points == 25,]

 ggplot(two_params, aes(X1, X2, col = type)) +
   geom_point() +
   facet_wrap(~ type, nrow = 1) +
   coord_equal()
}
```

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update_values   *Update the Values of a Design*

Description

For a set of values, this function inserts the actual values of the design produced by [get_design()](#).

Usage

```
update_values(design, values)
```

Arguments

design   A tibble produced by [get_design()](#). The column values should be unmodified.

values   A list of vectors containing the possible values for each parameter. There should
                be as many values (of any type) as there are rows in design. For numeric data,
                it is preferable that the values are equally spaced.

Value

An updated tibble.

Examples

```
des <- get_design(3, 6)
des

vals <- list(1:6, letters[1:6], seq(20, 21, length.out = 6))

des_2 <- update_values(des, vals)
des_2
```

Index