Package: SLHD (via r-universe)

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Type Package

Title Maximin-Distance (Sliced) Latin Hypercube Designs

Version 2.1-1

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Description Generate the optimal Latin Hypercube Designs (LHDs) for
computer experiments with quantitative factors and the optimal
Sliced Latin Hypercube Designs (SLHDs) for computer experiments
with both quantitative and qualitative factors. Details of the
algorithm can be found in Ba, S., Brenneman, W. A. and Myers,
W. R. (2015), ``Optimal Sliced Latin Hypercube Designs,''
Technometrics. Important function in this package is
``maximinSLHD''.

License LGPL-2.1

NeedsCompilation yes

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Repository https://shanbatr.r-universe.dev

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Contents

SLHD-package   *Sliced Latin hypercube design*

Description

Generate the optimal Latin hypercube designs and the optimal sliced Latin hypercube designs for computer experiments.

Details

Package:	SLHD
Type:	Package
Version:	2.1-1
Date:	2015-01-26
License:	LGPL-2.1

This package contains functions for generating the optimal Latin hypercube designs (LHDs) when $t = 1$ and the optimal sliced Latin hypercube designs (SLHDs) when $t > 1$. The maximin distance criterion is adopted as the optimality criterion.

When $t = 1$, the maximin-distance LHD is popularly used for designing computer experiments with quantitative factors.

When $t > 1$, the maximin-distance SLHD is a special class of LHD which can be partitioned into several slices (blocks), each of which is also a LHD of smaller size. The optimal SLHD structure guarantees the uniformity (space-filling property) in each slice as well as in the whole design. The SLHD is very important in designing computer experiments with quantitative and qualitative factors, where each slice is used as a design for quantitative factors under one of the t different level combinations of qualitative factors.

Important function in this package is `maximinSLHD`.

Author(s)

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References

Ba, S., Brenneman, W. A. and Myers, W. R. (2015), "Optimal Sliced Latin Hypercube Designs," *Technometrics*.

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maximinSLHD *Maximin-Distance (Sliced) Latin Hypercube Designs*

Description

Generate the optimal Latin hypercube designs when $t = 1$ and the optimal sliced Latin hypercube designs when $t > 1$ for computer experiments. The maximin distance criterion is adopted as the optimality criterion.

Usage

```
maximinSLHD(t, m, k, power = 15, nstarts = 1, itermax = 100, total_iter = 1e+06)
```

Arguments

t	The number of slices. If $t = 1$, it leads to a standard space-filling Latin hypercube design
m	The number of design points (runs) in each slice. When $t = 1$, the number of design points for the whole design is just m; when $t > 1$, the number of design points for the whole design is mt
k	The number of input factors (variables)
power	Optional, default is "15". The power parameter r in the average reciprocal inter-point distance measure. When $r \to \infty$, minimizing the average reciprocal inter-point distance measure is equivalent to maximizing the minimum distance among the design points.
nstarts	Optional, default is "1". The number of random starts
itermax	Optional, default is "100". The maximum number of non-improving searches allowed under each temperature. Lower this parameter if you want the algorithm to converge faster
total_iter	Optional, default is "1e+06".The maximum total number of iterations. Lower this number if the design is prohibitively large and you want to terminate the algorithm prematurely to report the best design found so far.

Details

This function utilizes a version of the simulated annealing algorithm and several computational shortcuts to efficiently generate the optimal Latin Hypercube Designs (LHDs) and the optimal Sliced Latin Hypercube Designs (SLHDs). The maximin distance criterion is adopted as the optimality criterion. Please refer to Ba et al. (2015) for details of the algorithm.

When $t = 1$, the maximin-distance LHD is popularly used for designing computer experiments with quantitative factors.

When $t > 1$, the maximin-distance SLHD is a special class of LHD which can be partitioned into several slices (blocks), each of which is also a LHD of smaller size. The optimal SLHD structure ensures the uniformity (space-filling property) in each slice as well as in the whole design. The SLHD is very important in designing computer experiments with quantitative and qualitative

factors, where each slice is used as a design for quantitative factors under one of the t different level combinations of qualitative factors.

Value

The value returned from the function is a list containing the following components:

Design	The optimal design matrix. When $t = 1$, it is a maximin-distance LHD; when $t > 1$, it is a maximin-distance SLHD with the first column representing the slice number.
measure	The average reciprocal inter-point distance measure
StandDesign	The optimal design matrix after standardizing each continuous variable into (0,1) scale
temp0	Initial temperature
time_rec	Time to complete the search

Author(s)

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References

Ba, S., Brenneman, W. A. and Myers, W. R. (2015), "Optimal Sliced Latin Hypercube Designs," *Technometrics*.

Examples

```
#Maximin-distance Latin hypercube design
D1<-maximinSLHD(t = 1, m = 10, k = 3)
D1$Design
D1$StandDesign

#Maximin-distance sliced Latin hypercube designs
D2<-maximinSLHD(t = 3, m = 4, k = 2)
D2$Design
D2$StandDesign
```

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