

Description

The **MSSearch** function can be used to obtain an optimal multi-stratum experimental design considering one or more optimization criteria, up to a maximum of six criteria simultaneously.

This function implements the procedure MS-Opt proposed by Sambo, Borrotti, Mylona e Gilmour (2017) as an extension of the Coordinate-Exchange Algorithm for constructing exact optimal experimental designs. This innovative procedure, instead of minimizing a single objective function as in the CE algorithm, seeks to minimize the following scalarization of the objective functions for all criteria under consideration:

$$f_W = \sum_{c \in C} \alpha_c f_c(d; \eta) = \bar{\alpha} \cdot \bar{f},$$

with

$$\sum_c (\alpha_c) = 1$$

where c is the set of criteria to be minimized, f_c is the objective function for the c criterion and $\bar{\alpha}$ is the vector that controls the relative weights of the objective functions.

Usage

```
MSSearch(msopt, alpha, ...)
```

Arguments

msopt	A list as returned by the MSOpt function.
alpha	A vector of weights, whose elements must sum to one. length(alpha) must be equal to the number of criteria considered, that is, it must be equal to the length of the criteria element of the msopt argument.
...	optional arguments (see below).

Details

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Additional arguments can be specified as follows:

- **'Start', sol**: A string and a matrix, used in pair. They provide a starting solution (**sol**) or initial design to the algorithm. By default the initial solution is randomly generated following the *SampleDesign* procedure described in Sambo, Borrotti, Mylona and Gilmour (2017).
- **'Restarts', r**: A string and an integer, used in pair. When **r=1**, the default value, the procedure implemented in **MSSearch** results in a local search algorithm that optimizes the objective function f_W starting from one initial design in the design space. These parameters allows to restart the algorithm **r** times. If no initial design is passed a different starting solution is generated for each iteration, letting the probability to find a global minimum be higher. **Msssearch** returns the solution that minimizes f_W across all the **r** iterations.

- `'Normalize',c(CritTR,CritSC)`: A string and a vector, used in pair. By specifying the `CritTR` and `CritSC` vectors, the user can establish the normalization factors to be applied to each objective function before evaluating f_W . `CritTR` and `CritSC` are vectors of length equal to the number of criteria, whose default elements are 0 and 1 respectively.

Value

`MSSearch` returns a list, whose elements are:

- `optsol`: A design matrix. The best solution found.
- `optscore`: A vector containing the criteria scores for `optsol`.
- `feval`: An integer representing the number of score function evaluations (number of f_W evaluations over all iterations).
- `trend`: A vector of length `r`. The i -th element is the value that minimizes f_W for the i -th iteration.

References

M. Borrotti and F. Sambo and K. Mylona and S. Gilmour. A multi-objective coordinate-exchange two-phase local search algorithm for multi-stratum experiments. *Statistics & Computing*, 2017.