Package: sceua (via r-universe)

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Title Shuffled Complex Evolution Algorithm for Optimization

Version 0.1.0

Description Provides an 'R' interface to a 'Rust' implementation of the Shuffled Complex Evolution - University of Arizona (SCE-UA) global optimization algorithm (Duan et al., 1992). SCE-UA combines simplex search, competitive evolution, and complex shuffling to solve nonlinear, non-convex, continuous parameter estimation problems. The method is commonly used for calibrating hydrological and environmental models and follows the algorithm proposed by Duan et al. (1992) <doi:10.1029/91WR02985>.

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URL https://github.com/atsyplenkov/sceua/, https://atsyplenkov.github.io/sceua/

BugReports https://github.com/atsyplenkov/sceua/issues/

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Contents

`sceua` *Minimize a function with SCE-UA*

Description

Find the parameter set that minimizes an objective function using the Shuffled Complex Evolution - University of Arizona (SCE-UA) algorithm (Duan et al., 1992).

Usage

```
sceua(
  fn,
  lower,
  upper,
  initial = NULL,
  max_evaluations = 10000L,
  kstop = 5L,
  pcento = 0.01,
  complexes = 2L,
  points_per_complex = NULL,
  simplex_size = NULL,
  evolution_steps = NULL,
  min_complexes = NULL,
  parameter_epsilon = 0.001,
  ...
)
```

Arguments

`fn`	Function to minimize. Must accept a single numeric vector of parameters and return a scalar numeric value.
`lower`	Numeric vector of lower bounds. Must have the same length as `upper`.

upper	Numeric vector of upper bounds. Must have the same length as lower.
initial	Optional initial parameter vector. If provided, it is included in the initial population.
max_evaluations	Maximum number of function evaluations.
kstop	Number of shuffling loops over which the objective value must change by pcento before convergence.
pcento	Objective convergence threshold.
complexes	Number of complexes in the initial population.
points_per_complex	Number of points in each complex. Defaults to 2 * n + 1 where n is the number of parameters.
simplex_size	Number of points in each sub-complex. Defaults to n + 1.
evolution_steps	Number of evolution steps allowed for each complex before shuffling. Defaults to points_per_complex.
min_complexes	Minimum number of complexes required. Defaults to complexes.
parameter_epsilon	Parameter convergence threshold.
...	Additional arguments passed to fn.

Details

The R wrapper draws the internal SCE-UA seed from R's global random number generator. Call set.seed() before sceua() for reproducible results.

Value

An object of class sceua: a list with components:

- par: best parameter vector.
- value: objective value at par.
- counts: number of function evaluations.
- iterations: number of shuffling loops.
- termination: reason for termination.
- history: a data.frame with one row per shuffling loop.

References

Duan, Q., Sorooshian, S., and Gupta, V.K., 1992. Effective and efficient global optimization for conceptual rainfall-runoff models. Water Resour. Res. 28 (4), 1015-1031.

Examples

```
set.seed(1234)
# Two-dimensional sphere
result <- sceua(
  fn = function(x) sum(x^2),
  lower = c(-5, -5),
  upper = c(5, 5),
  max_evaluations = 5000,
  kstop = 5,
  pcento = 1e-8,
  complexes = 5
)
result
```

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