Package 'sceua'

July 4, 2026

Title Shuffled Complex Evolution Algorithm for Optimization

Version 0.1.1

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/

Encoding UTF-8

Language en

Config/rextendr/version 0.3.1.9001

Config/build/bootstrap TRUE

Config/Needs/website altdoc, quarto, bench, rtop, SoilHyP, knitr, rmarkdown, rextendr, tomledit

SystemRequirements Cargo (Rust's package manager), rustc (>= 1.81)

Imports checkmate

Suggests testthat (>= 3.0.0)

Config/testthat/edition 3

Config/roxygen2/version 8.0.0

NeedsCompilation yes

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`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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