Package 'ao'

September 29, 2023

Title Alternating Optimization

Version 0.2.7

Description Alternating optimization of (high-dimensional) functions is an iterative procedure for optimizing jointly over all parameters by alternately optimizing parameter subsets.

URL https://loelschlaeger.de/ao/, https://github.com/loelschlaeger/ao/

BugReports https://github.com/loelschlaeger/ao/issues

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Encoding UTF-8

RoxygenNote 7.2.3

Imports checkmate

Suggests knitr, rmarkdown, testthat (>= 3.0.0)

Config/testthat/edition 3

VignetteBuilder knitr

Depends R (>= 4.0.0), optimizeR (>= 0.3.3)

NeedsCompilation no

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Repository CRAN

Date/Publication 2023-09-29 08:30:02 UTC

R topics documented:

ao *Alternating Optimization*

Description

This function performs alternating optimization of the function `f`.

Usage

```
ao(
  f,
  p,
  ...,
  partition = as.list(1:length(p)),
  base_optimizer = optimizeR::optimizer_optim(),
  iterations = 10,
  tolerance = 1e-06,
  f_partition = vector(mode = "list", length = length(partition)),
  joint_end = FALSE,
  verbose = FALSE
)
```

Arguments

`f`	A `function` to be optimized, returning a single `numeric`. The first argument of `f` must be a `numeric` of the same length as `p` followed by any other arguments specified by the `...` argument.
`p`	A `numeric` vector, the starting parameter values for the optimization.
`...`	Additional arguments to be passed to `f`.
`partition`	A `list` of vectors of indices of `p`, specifying the partition in the alternating optimization process. The default is `as.list(1:length(p))`, i.e. each parameter is optimized separately. Parameter indices can be members of multiple subsets.
`base_optimizer`	An `optimizer` object, which can be specified via `define_optimizer`. It numerically solves the optimization problems in the partitions. The default optimizer is `optimizer_optim`.
`iterations`	An `integer`, the maximum number of iterations through `partitions` before the alternating optimization process is terminated. Can also be `Inf`, in which case `tolerance` is responsible for the termination. The default is `10`.
`tolerance`	A non-negative `numeric`. The alternating optimization terminates prematurely (i.e., before `interations` is reached) if the euclidean distance between the current estimate and the one from the last iteration is smaller than `tolerance`. The default is `1e-6`.
`f_partition`	A `list` of the same length as `partition`. The `i`-th element can be a `function` that computes the value of `f` for the `i`-th parameter set defined in `partition`. The `function` must be of the form `function(theta_part, theta_rest, ...)`, where

- `theta_part` receives the parameter set for the current partition (this argument can be named differently),
- `theta_rest` receives the remaining parameters (this argument must be named `theta_rest`),
- `...` receives the additional arguments to `f`. Alternatively, it can be `NULL`, in which case `f` is used.

`joint_end` If `TRUE`, the parameter set is optimized jointly after the alternating optimization process is terminated. The default is `FALSE`.

`verbose` If `TRUE`, full tracing details are printed during the alternating optimization process. The default is `FALSE`.

Value

A `list` with the elements

- `estimate`, the optimal parameter vector found,
- `value`, the value of `f` at `estimate`,
- `sequence`, a `data.frame` of the function values, estimates and computation times in the single iterations and partitions,
- and `seconds`, the overall computation time in seconds.

Examples

```
### minimization of the Himmelblau function
### alternating optimization separately for x_1 and x_2
### parameter restriction: -5 <= x_1, x_2 <= 5
himmelblau <- function(x) (x[1]^2 + x[2] - 11)^2 + (x[1] + x[2]^2 - 7)^2
ao(
  f = himmelblau, p = c(0, 0), partition = list(1, 2), iterations = Inf,
  base_optimizer = optimizeR::optimizer_optim(
    lower = -5, upper = 5, method = "L-BFGS-B"
  )
)
```

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