

Package ‘ROI.plugin.alabama’

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Title 'alabama' Plug-in for the 'R' Optimization Infrastructure

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Description Enhances the R Optimization Infrastructure ('ROI') package with the 'alabama' solver for solving nonlinear optimization problems.

Imports methods, stats, utils, ROI (>= 0.3-0), alabama (>= 1.0.1)

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URL <http://roi.r-forge.r-project.org/>,
<https://r-forge.r-project.org/projects/roi/>

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control	<i>alabama</i>
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Description

This package provides a **ROI** plugin to the **alabama** package. The following description of the control parameters is mostly copied from the **alabama** manual.

- [start:] The initial values for the parameter vector.
- [method:] Unconstrained optimization algorithm for inner loop optimization. Allowed values are "Nelder-Mead", "BFGS", "CG", "L-BFGS-B", "SANN", "Brent" and "nlinb".
- [lam0:] Initial value for the Lagrangian parameter.
- [sig0:] A scaling parameter for penalty term that is augmented to the Lagrangian.
- [tol:] Tolerance for convergence of outer iterations of the barrier and/or augmented Lagrangian algorithm
- [max_iter:] Maximum number of outer iterations.
- [ilack.max:] Maximum number of outer iterations where no change in parameters is tolerated.
- [verbose:] A logical variable indicating whether information on outer iterations should be printed out. If TRUE, at each outer iteration information is displayed on: (i) how well the inequality and equalities are satisfied, (ii) current parameter values, and (iii) current objective function value.
- [NMinit:] A logical variable indicating whether "Nelder-Mead" algorithm should be used for the first outer iteration.
- [i.scale:] A vector of length equal to number of inequalities that may be used to scale the inequalities or it can be a scalar in which case all the inequalities are scaled by the same value.
- [e.scale:] A vector of length equal to number of equalities that may be used to scale the equalities or it can be a scalar in which case all the equalities are scaled by the same value.
- [kkt2.check:] A logical variable (TRUE/FALSE) indicating whether the second-order KKT condition should be checked. Default is TRUE. It may be set to FALSE in problems where the Hessian computation can be time consuming.
- [control.optim:] A list of control parameters to be used by the unconstrained optimization algorithm in the inner loop. Identical to that used in **optim** or in **nlinb**.

References

Ravi Varadhan (2015). *alabama: Constrained Nonlinear Optimization*. R package version 2015.3-1. <https://CRAN.R-project.org/package=alabama>

Examples

```
library(ROI)

n <- 2L
x <- OP(F_objective(sum, n = n),
       bounds = V_bound(nobj = 2, ld = -1, ud = 1))

control_optim <- list(trace = 0, fnscale = 1, parscale = rep.int(1, n),
                    ndeps = rep.int(0.001, n), maxit = 100L, abstol = -Inf,
                    reltol = sqrt(.Machine$double.eps), alpha = 1,
```

```

beta = 0.5, gamma = 2, REPORT = 10, type = 1, lmm = 5,
factr = 1e+07, pgtol = 0, tmax = 10, temp = 10)

control <- list(start = c(0, 0), method = "BFGS", lam0 = 10, sig0 = 100,
               tol = 1e-07, max_iter = 50, verbose = FALSE, NMinit = FALSE,
               ilack.max = 6, i.scale = 1, e.scale = 1, kkt2.check = TRUE,
               control.optim = control_optim)

s <- ROI_solve(x, solver = "alabama", control)

```

Example-1

Banana

Description

The following example is also known as Rosenbrock's banana function (https://en.wikipedia.org/wiki/Rosenbrock_function).

$$\text{minimize } f(x) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$$

Solution: c(1, 1)

Examples

```

library(ROI)

f <- function(x) {
  return( 100 * (x[2] - x[1]^2)^2 + (1 - x[1])^2 )
}

f.gradient <- function(x) {
  return( c( -400 * x[1] * (x[2] - x[1] * x[1]) - 2 * (1 - x[1]),
            200 * (x[2] - x[1] * x[1])) )
}

x <- OP(objective = F_objective(f, n = 2L, G = f.gradient),
        bounds = V_bound(li = 1:2, ui = 1:2, lb = c(-3, -3), ub = c(3, 3)))

nlp <- ROI_solve(x, solver = "alabama", start = c(-2, 2.4), method = "BFGS")
nlp
## Optimal solution found.
## The objective value is: 3.049556e-23
solution(nlp)
## [1] 1 1

```

 Example-2

Hock-Schittkowski-Collection Problem 16

Description

The following example solves problem 16 from the Hock-Schittkowski-Collection.

$$\text{minimize } f(x) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$$

$$\text{subject to: } x_1 + x_2^2 \geq 0 \quad x_1^2 + x_2 \geq 0$$

$$-2 \geq x_1 \geq 0.5 \quad x_2 \geq 1$$

Solution: c(0.5, 0.25)

Examples

```

library(ROI)

f <- function(x) {
  return( 100 * (x[2] - x[1]^2)^2 + (1 - x[1])^2 )
}

f.gradient <- function(x) {
  return( c( -400 * x[1] * (x[2] - x[1] * x[1]) - 2 * (1 - x[1]),
            200 * (x[2] - x[1] * x[1])) )
}

x <- OP( objective = F_objective(f, n=2L, G=f.gradient),
         constraints = c(F_constraint(F=function(x) x[1] + x[2]^2, ">=", 0,
                                   J=function(x) c(1, 2*x[2])),
                       F_constraint(F=function(x) x[1]^2 + x[2], ">=", 0,
                                   J=function(x) c(2*x[1], x[2]))),
         bounds = V_bound(li=1:2, ui=1:2, lb=c(-2, -Inf), ub=c(0.5, 1)) )

nlp <- ROI_solve(x, solver="alabama", start=c(-2, 1))
nlp
## Optimal solution found.
## The objective value is: 2.499999e-01
solution(nlp)
## [1] 0.5000001 0.2499994
  
```

Description

The following example solves example 36 from the Hock-Schittkowski-Collection.

$$\begin{aligned} & \text{minimize} \quad -x_1x_2x_3 \\ & \text{subject to} \quad x_1 + 2x_2 + x_3 \leq 72 \\ & \quad \quad \quad 0 \leq x_1 \leq 20, \quad 0 \leq x_2 \leq 11, \quad 0 \leq x_3 \leq 42 \end{aligned}$$

Examples

```
library(ROI)

hs036_obj <- function(x) {
  -x[1] * x[2] * x[3]
}

hs036_con <- function(x) {
  x[1] + 2 * x[2] + 2 * x[3]
}

x <- OP( objective = F_objective(hs036_obj, n = 3L),
        constraints = F_constraint(hs036_con, "<=", 72),
        bounds = V_bound(ub = c(20, 11, 42)) )

nlp <- ROI_solve(x, solver = "alabama", start = c(10, 10, 10))
nlp
## Optimal solution found.
## The objective value is: -3.300000e+03
solution(nlp, "objval")
## [1] -3300
solution(nlp)
## [1] 20 11 15
```

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