Package ‘osqp’

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Title Quadratic Programming Solver using the 'OSQP' Library

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Description Provides bindings to the 'OSQP' solver. The 'OSQP' solver is a numerical optimization package or solving convex quadratic programs written in 'C' and based on the alternating direction method of multipliers. See <arXiv:1711.08013> for details.

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Imports Rcpp (>= 0.12.14), methods, Matrix, R6

LinkingTo Rcpp

RoxygenNote 6.1.1

Collate 'RcppExports.R' 'osqp-package.R' 'solve.R' 'osqp.R' 'params.R'

NeedsCompilation yes

Suggests testthat

URL https://www.osqp.org

Author Bartolomeo Stellato [aut, ctb, cph],
Goran Banjac [aut, ctb, cph],
Paul Goulart [cre, aut, ctb, cph],
Stephen Boyd [aut, ctb, cph],
Eric Anderson [ctb]

Maintainer Paul Goulart <paul.goulart@eng.ox.ac.uk>

Repository CRAN

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R topics documented:

osqp *OSQP Solver object*

Description

OSQP Solver object

Usage

```
osqp(P = NULL, q = NULL, A = NULL, l = NULL, u = NULL,
  pars = osqpSettings())
```

Arguments

`P, A`	sparse matrices of class dgCMatrix or coercible into such, with P positive semidefinite.
`q, l, u`	Numeric vectors, with possibly infinite elements in l and u
`pars`	list with optimization parameters, conveniently set with the function `osqpSettings`. For `osqpObject$UpdateSettings(newPars)` only a subset of the settings can be updated once the problem has been initialized.

Details

Allows one to solve a parametric problem with for example warm starts between updates of the parameter, c.f. the examples. The object returned by `osqp` contains several methods which can be used to either update/get details of the problem, modify the optimization settings or attempt to solve the problem.

Value

An R6-object of class "osqp_model" with methods defined which can be further used to solve the problem with updated settings / parameters.

Usage

```
model = osqp(P=NULL, q=NULL, A=NULL, l=NULL, u=NULL, pars=osqpSettings())

model$Solve()
model$Update(q = NULL, l = NULL, u = NULL, Px = NULL, Px_idx = NULL, Ax = NULL, Ax_idx = NULL)
model$GetParams()
model$GetDims()
model$UpdateSettings(newPars = list())

model$GetData(element = c("P", "q", "A", "l", "u"))
model$WarmStart(x=NULL, y=NULL)

print(model)
```

Method Arguments

element a string with the name of one of the matrices / vectors of the problem

newPars list with optimization parameters

See Also

solve_osqp

Examples

```
## example, adapted from OSQP documentation
library(Matrix)

P <- Matrix(c(11., 0.,
              0., 0.), 2, 2, sparse = TRUE)
q <- c(3., 4.)
A <- Matrix(c(-1., 0., -1., 2., 3.,
              0., -1., -3., 5., 4.)
              , 5, 2, sparse = TRUE)
u <- c(0., 0., -15., 100., 80)
l <- rep_len(-Inf, 5)

settings <- osqpSettings(verbose = FALSE)

model <- osqp(P, q, A, l, u, settings)

# Solve
res <- model$Solve()

# Define new vector
q_new <- c(10., 20.)

# Update model and solve again
model$Update(q = q_new)
res <- model$Solve()
```

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osqpSettings *Settings for OSQP*

Description

For further details please consult the OSQP documentation: https://osqp.org/

Usage

```
osqpSettings(rho = 0.1, sigma = 1e-06, max_iter = 4000L,
  eps_abs = 0.001, eps_rel = 0.001, eps_prim_inf = 1e-04,
  eps_dual_inf = 1e-04, alpha = 1.6, linsys_solver = c(QDLDL_SOLVER =
```

```
0L), delta = 1e-06, polish = FALSE, polish_refine_iter = 3L,
verbose = TRUE, scaled_termination = FALSE,
check_termination = 25L, warm_start = TRUE, scaling = 10L,
adaptive_rho = 1L, adaptive_rho_interval = 0L,
adaptive_rho_tolerance = 5, adaptive_rho_fraction = 0.4)
```

Arguments

- `rho` ADMM step rho
- `sigma` ADMM step sigma
- `max_iter` maximum iterations
- `eps_abs` absolute convergence tolerance
- `eps_rel` relative convergence tolerance
- `eps_prim_inf` primal infeasibility tolerance
- `eps_dual_inf` dual infeasibility tolerance
- `alpha` relaxation parameter
- `linsys_solver` which linear systems solver to use, 0=QDLDL, 1=MKL Pardiso
- `delta` regularization parameter for polish
- `polish` boolean, polish ADMM solution
- `polish_refine_iter` iterative refinement steps in polish
- `verbose` boolean, write out progress
- `scaled_termination` boolean, use scaled termination criteria
- `check_termination` integer, check termination interval. If 0, termination checking is disabled
- `warm_start` boolean, warm start
- `scaling` heuristic data scaling iterations. If 0, scaling disabled
- `adaptive_rho` cboolean, is rho step size adaptive?
- `adaptive_rho_interval` Number of iterations between rho adaptations rho. If 0, it is automatic
- `adaptive_rho_tolerance` Tolerance X for adapting rho. The new rho has to be X times larger or 1/X times smaller than the current one to trigger a new factorization
- `adaptive_rho_fraction` Interval for adapting rho (fraction of the setup time)

solve_osqp *Sparse Quadratic Programming Solver*

Description

Solves

$$arg\min_x 0.5x'Px + q'x$$

s.t.

$$l_i < (Ax)_i < u_i$$

for real matrices P (nxn, positive semidefinite) and A (mxn) with m number of constraints

Usage

```
solve_osqp(P = NULL, q = NULL, A = NULL, l = NULL, u = NULL,
  pars = osqpSettings())
```

Arguments

`P, A`	sparse matrices of class dgCMatrix or coercible into such, with P positive semidefinite. Only the upper triangular part of P will be used.
`q, l, u`	Numeric vectors, with possibly infinite elements in l and u
`pars`	list with optimization parameters, conveniently set with the function `osqpSettings`

Value

A list with elements x (the primal solution), y (the dual solution), prim_inf_cert, dual_inf_cert, and info.

References

Stellato, B., Banjac, G., Goulart, P., Bemporad, A., Boyd and S. (2018). "OSQP: An Operator Splitting Solver for Quadratic Programs." *ArXiv e-prints*. 1711.08013.

See Also

`osqp`. The underlying OSQP documentation: `https://osqp.org/`

Examples

```
library(osqp)
## example, adapted from OSQP documentation
library(Matrix)

P <- Matrix(c(11., 0.,
              0., 0.), 2, 2, sparse = TRUE)
q <- c(3., 4.)
A <- Matrix(c(-1., 0., -1., 2., 3.,
```

```
              0., -1., -3., 5., 4.)
              , 5, 2, sparse = TRUE)
u <- c(0., 0., -15., 100., 80)
l <- rep_len(-Inf, 5)

settings <- osqpSettings(verbose = TRUE)

# Solve with OSQP
res <- solve_osqp(P, q, A, l, u, settings)
res$x
```

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