Package ‘quadprog’

November 20, 2019

Type Package

Title Functions to Solve Quadratic Programming Problems

Version 1.5-8

Date 2019-11-20

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Description This package contains routines and documentation for
solving quadratic programming problems.

Depends R (>= 3.1.0)

License GPL (>= 2)

NeedsCompilation yes

Repository CRAN

Date/Publication 2019-11-20 08:20:02 UTC

R topics documented:

`solve.QP` *Solve a Quadratic Programming Problem*

Description

This routine implements the dual method of Goldfarb and Idnani (1982, 1983) for solving quadratic programming problems of the form $\min(-d^T b + 1/2 b^T D b)$ with the constraints $A^T b >= b_0$.

Usage

```
solve.QP(Dmat, dvec, Amat, bvec, meq=0, factorized=FALSE)
```

Arguments

`Dmat`	matrix appearing in the quadratic function to be minimized.
`dvec`	vector appearing in the quadratic function to be minimized.
`Amat`	matrix defining the constraints under which we want to minimize the quadratic function.
`bvec`	vector holding the values of b_0 (defaults to zero).
`meq`	the first `meq` constraints are treated as equality constraints, all further as inequality constraints (defaults to 0).
`factorized`	logical flag: if `TRUE`, then we are passing R^{-1} (where $D = R^T R$) instead of the matrix D in the argument `Dmat`.

Value

a list with the following components:

`solution`	vector containing the solution of the quadratic programming problem.
`value`	scalar, the value of the quadratic function at the solution
`unconstrained.solution`	vector containing the unconstrained minimizer of the quadratic function.
`iterations`	vector of length 2, the first component contains the number of iterations the algorithm needed, the second indicates how often constraints became inactive after becoming active first.
`Lagrangian`	vector with the Lagragian at the solution.
`iact`	vector with the indices of the active constraints at the solution.

References

D. Goldfarb and A. Idnani (1982). Dual and Primal-Dual Methods for Solving Strictly Convex Quadratic Programs. In J. P. Hennart (ed.), Numerical Analysis, Springer-Verlag, Berlin, pages 226–239.

D. Goldfarb and A. Idnani (1983). A numerically stable dual method for solving strictly convex quadratic programs. *Mathematical Programming*, **27**, 1–33.

See Also

`solve.QP.compact`

Examples

```
##
## Assume we want to minimize: -(0 5 0) %*% b + 1/2 b^T b
## under the constraints:      A^T b >= b0
## with b0 = (-8,2,0)^T
## and      (-4  2  0)
##      A = (-3  1 -2)
##          ( 0  0  1)
## we can use solve.QP as follows:
##
Dmat       <- matrix(0,3,3)
diag(Dmat) <- 1
dvec       <- c(0,5,0)
Amat       <- matrix(c(-4,-3,0,2,1,0,0,-2,1),3,3)
bvec       <- c(-8,2,0)
solve.QP(Dmat,dvec,Amat,bvec=bvec)
```

`solve.QP.compact` *Solve a Quadratic Programming Problem*

Description

This routine implements the dual method of Goldfarb and Idnani (1982, 1983) for solving quadratic programming problems of the form $\min(-d^T b + 1/2 b^T D b)$ with the constraints $A^T b >= b_0$.

Usage

```
solve.QP.compact(Dmat, dvec, Amat, Aind, bvec, meq=0, factorized=FALSE)
```

Arguments

`Dmat`	matrix appearing in the quadratic function to be minimized.
`dvec`	vector appearing in the quadratic function to be minimized.
`Amat`	matrix containing the non-zero elements of the matrix A that defines the constraints. If m_i denotes the number of non-zero elements in the i-th column of A then the first m_i entries of the i-th column of `Amat` hold these non-zero elements. (If $maxmi$ denotes the maximum of all m_i, then each column of `Amat` may have arbitrary elements from row $m_i + 1$ to row $maxmi$ in the i-th column.)
`Aind`	matrix of integers. The first element of each column gives the number of non-zero elements in the corresponding column of the matrix A. The following entries in each column contain the indexes of the rows in which these non-zero elements are.
`bvec`	vector holding the values of b_0 (defaults to zero).
`meq`	the first `meq` constraints are treated as equality constraints, all further as inequality constraints (defaults to 0).
`factorized`	logical flag: if `TRUE`, then we are passing R^{-1} (where $D = R^T R$) instead of the matrix D in the argument `Dmat`.

Value

a list with the following components:

- `solution` vector containing the solution of the quadratic programming problem.
- `value` scalar, the value of the quadratic function at the solution
- `unconstrained.solution` vector containing the unconstrained minimizer of the quadratic function.
- `iterations` vector of length 2, the first component contains the number of iterations the algorithm needed, the second indicates how often constraints became inactive after becoming active first.
- `Lagrangian` vector with the Lagragian at the solution.
- `iact` vector with the indices of the active constraints at the solution.

References

D. Goldfarb and A. Idnani (1982). Dual and Primal-Dual Methods for Solving Strictly Convex Quadratic Programs. In J. P. Hennart (ed.), Numerical Analysis, Springer-Verlag, Berlin, pages 226–239.

D. Goldfarb and A. Idnani (1983). A numerically stable dual method for solving strictly convex quadratic programs. *Mathematical Programming*, **27**, 1–33.

See Also

`solve.QP`

Examples

```
##
## Assume we want to minimize: -(0 5 0) %*% b + 1/2 b^T b
## under the constraints:      A^T b >= b0
## with b0 = (-8,2,0)^T
## and      (-4  2  0)
##      A = (-3  1 -2)
##          ( 0  0  1)
## we can use solve.QP.compact as follows:
##
Dmat       <- matrix(0,3,3)
diag(Dmat) <- 1
dvec       <- c(0,5,0)
Aind       <- rbind(c(2,2,2),c(1,1,2),c(2,2,3))
Amat       <- rbind(c(-4,2,-2),c(-3,1,1))
bvec       <- c(-8,2,0)
solve.QP.compact(Dmat,dvec,Amat,Aind,bvec=bvec)
```

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