

Package ‘diffcp’

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Type Package

Title Differentiating Through Cone Programs

Version 0.1.2

Description A port of the 'python' 'diffcp' package. Computes the derivative of the optimal solution map of a convex cone program, treating the program as an implicit function of its data (constraint matrix, offset, objective coefficients, and optionally a quadratic), mirroring Agrawal et al. (2019) <doi:10.48550/arXiv.1904.09043>.

URL <https://bnaras.github.io/diffcp/>

BugReports <https://github.com/bnaras/diffcp/issues>

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Encoding UTF-8

Imports cli, clarabel, Matrix, methods, Rcpp

LinkingTo Rcpp, RcppEigen

Suggests knitr, pkgdown, rmarkdown, scs, testthat (>= 3.0.0)

VignetteBuilder knitr

SystemRequirements C++17

Config/testthat/edition 3

RoxygenNote 7.3.3

NeedsCompilation yes

Author Balasubramanian Narasimhan [aut, cre],
Akshay Agrawal [aut],
Shane Barratt [aut],
Stephen Boyd [aut],
Enzo Busseti [aut],
Walaa Moursi [aut]

Maintainer Balasubramanian Narasimhan <naras@stanford.edu>

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parse_cone_dict	<i>Parse an SCS-style cone dictionary into an ordered list</i>
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Description

Mirrors diffcp.cones.parse_cone_dict.

Usage

parse_cone_dict(cone_dict)

Arguments

cone_dict A named list with keys among "z", "l", "q", "s", "ep", "ed". Values are scalar dimensions (for z, l, ep, ed) or integer vectors of dimensions (for q, s).

Value

A list of list(name, size) pairs, in the canonical SCS cone order (CONES).

pi	<i>Projection onto a Cartesian product of cones</i>
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Description

Mirrors diffcp.cones.pi.

Usage

pi(x, cones, dual = FALSE)

Arguments

x A numeric vector.
cones A list of list(name, size) pairs, as produced by parse_cone_dict.
dual If TRUE, project onto the dual cones.

Value

A numeric vector of the same length as x .

solve_and_derivative	<i>Solve a cone program and return forward / adjoint derivative operators</i>
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Description

Mirrors `diffcp.cone_program.solve_and_derivative`. Solves minimize $c^T x$ s.t. $Ax + s = b$, s in K (with optional QP $0.5 x^T P x$ term) and returns the optimal (x, y, s) together with closures D (forward) and DT (adjoint) that map perturbations of $(A, b, c, [P])$ to perturbations of (x, y, s) and vice versa.

Usage

```
solve_and_derivative(
  A,
  b,
  c,
  cone_dict,
  P = NULL,
  solve_method = "Clarabel",
  mode = "lsqr",
  warm_start = NULL,
  ...
)
```

Arguments

A	A sparse <code>dgCMatrix</code> constraint matrix.
b	A numeric offset vector.
c	A numeric objective coefficient vector.
<code>cone_dict</code>	A named list with cone sizes (keys among "z", "l", "q", "s", "ep", "ed").
P	Optional sparse <code>dgCMatrix</code> for QP objective.
<code>solve_method</code>	One of "Clarabel" (default) or "SCS".
<code>mode</code>	Differentiation mode: "lsqr" (default), "dense", or "lpqd".
<code>warm_start</code>	Optional warm-start list (x, y, s) .
<code>...</code>	Additional control parameters forwarded to the solver.

Value

A list with elements $x, y, s, \text{info}, D, DT$. `info` is the solver-status block returned by the underlying solver (`status, iter, solveTime, pobj, ...`); see `solve_only` for the same shape.

solve_only	<i>Solve a cone program (forward only)</i>
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Description

Mirrors `diffcp.cone_program.solve_only`. Solves minimize $c^T x (+ 0.5 x^T P x)$ subject to $Ax + s = b$, s in K and returns the optimal (x, y, s) . Unlike `solve_and_derivative` this function does not build the derivative closures.

Usage

```
solve_only(
  A,
  b,
  c,
  cone_dict,
  warm_start = NULL,
  solve_method = "Clarabel",
  P = NULL,
  ...
)
```

Arguments

<code>A</code>	A sparse <code>dgMatrix</code> constraint matrix.
<code>b</code>	A numeric offset vector.
<code>c</code>	A numeric objective coefficient vector.
<code>cone_dict</code>	A named list with cone sizes (keys among "z", "l", "q", "s", "ep", "ed").
<code>warm_start</code>	Optional warm-start list(x, y, s).
<code>solve_method</code>	One of "Clarabel" (default) or "SCS".
<code>P</code>	Optional sparse <code>dgMatrix</code> for QP objective.
<code>...</code>	Additional control parameters forwarded to the solver.

Value

A list with elements x, y, s, info .

unvec_symm	<i>Inverse of vec_symm</i>
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Description

Inverse of vec_symm

Usage

```
unvec_symm(x, dim)
```

Arguments

x	A numeric vector of length $n*(n+1)/2$.
dim	The matrix dimension n.

Value

The corresponding $n \times n$ symmetric matrix.

upstream_info	<i>Upstream Python diffcp pin</i>
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Description

Returns the upstream pin metadata for this R port: which cvxgrp/diffcp version / commit the R sources track, the date of that commit, and diffcp's own CVXPY runtime constraint. The authoritative record lives in inst/UPSTREAM.dcf and is read at call time.

Usage

```
upstream_info()
```

Value

A named character vector with one element per DCF field (Upstream, Version, Commit, ShortCommit, Date, URL, CVXPY, Snapshot, Notes).

Examples

```
upstream_info()
upstream_info()[["Version"]]
```

`vec_symm`*Symmetric vectorization (SCS convention)*

Description

Returns a vectorized representation of a symmetric matrix X , with off-diagonal entries scaled by $\sqrt{2}$ to make the SCS-style dot product $\langle \text{vec_symm}(A), \text{vec_symm}(B) \rangle = \text{trace}(A^T B)$ hold.

Usage

```
vec_symm(X)
```

Arguments

X A symmetric matrix.

Details

Mirrors `diffcp.cones.vec_symm` (Python).

Value

A numeric vector of length $n*(n+1)/2$.

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