Package 'lppuw'

July 10, 2013

Version 1.0.2

Title LP based phase unwrapping

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Requires zernike, R (>= 2.14.0)

Description Linear programming based phase unwrappers

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`brcutpuw` *BRanch CUT algorithm for phase unwrapping*

Description

Branch cut algorithm for two dimensional phase unwrapping.

Usage

```
brcutpuw(phase, pen=0, details=FALSE)
```

Arguments

`phase`	A matrix of wrapped phase values
`pen`	Penalty to be added to "cost" of connecting a residue to an edge.
`details`	Return a map of the branch cuts?

Value

if `details==TRUE`, a list consisting of:

`puw`	A matrix of class "`pupil`" with the unwrapped wavefront.
`bcuts`	map of the branch cuts

If `!details` the unwrapped wavefront.

Warning

It is assumed that at least one row and one column on all sides of the input `phase` matrix is masked, i.e. has values `NA`. No check is performed for this and the function will return an error if the condition is not met.

Note

The current version now solves a variation of the assignment problem to minimize the length of branch cuts. If `pen == 0` the total length of all branch cuts is minimized subject to the constraint that each residue connects to exactly one residue of the opposite charge, or to the closest edge point.

Author(s)

M.L. Peck `<mpeck1@ix.netcom.com>`

References

Ghiglia, D.C., and Pritt, M.D., 1998, **Two-Dimensional Phase Unwrapping**, New York: Wiley & Sons, Inc., ISBN 0-471-24935-1.

See Also

`netflowpuw`

Examples

```
require(zernike)

# defined area must be surrounded by at least one
# row/column of NA's

ph <- matrix(NA, 27, 27)
ph[2:26,2:26] <- runif(25^2, -pi, pi)

x11(width=12, height=6)
par(mar=c(0,0,1,0))
split.screen(figs=c(1,2))
screen(1)

# show the wrapped phase map with corrupted pixels

mtext(rmap(ph, plot=TRUE))
ph.uw <- brcutpuw(ph)

screen(2)
```

```
# contour plot of unwrapped phase

plot(ph.uw, axes=FALSE)
close.screen(all.screens=T)
```

`jigsudoku` *Jigsaw Sudoku solver*

Description

Solve a 9 x 9 jigsaw (aka squiggly) Sudoku.

Usage

```
sudoku(givens, blocks)
```

Arguments

`givens`	Matrix of given values
`blocks`	Matrix identifying blocks

Details

Use 0 for cells without given values.

Value

Solution as a 9 x 9 matrix.

Author(s)

M.L. Peck <mpeck1@ix.netcom.com>

`lp` *Solve a linear program*

Description

Solves a generic linear program with continuous (not integer) variables using the lp_solve API (see references).

Usage

```
lp(dir = "min", objective, constr.mat, constr.dir, rhs)
```

Arguments

dir	direction of optimization: "min" or "max"
objective	Vector of objective function coefficients
constr.mat	Matrix of constraint coefficients
constr.dir	Vector of constraint directions
rhs	Vector of right hand side values

Details

constr.dir is a vector of strings. Recognized values are "<", "<=", "=", "==", ">", ">=". Anything else generates an error.

Value

objval	Objective function value
soln	Solution vector

Note

At present no check is made that lp_solve actually returned an optimal solution.

Author(s)

M.L. Peck <mpeck1@ix.netcom.com>

References

https://sourceforge.net/projects/lpsolve/

Examples

```
## A toy lp

lp("max", c(143,160), matrix(c(120,110,1,210,30,1),3,2),
  rep("<", 3), c(15000,4000,75))
```

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netflowpuw — *Minimum cost network flow model for two dimensional phase unwrapping.*

Description

Unwraps a 2D phase map using a minimum cost network flow model originally proposed by M. Constantini (http://www.geo.unizh.ch/rsl/fringe96/papers/costantini/).

Usage

```
netflowpuw(phase, wts=NULL, details = FALSE)
```

Arguments

`phase`	Matrix of wrapped phase values.
`wts`	Matrix of quality values for weighting.
`details`	Boolean: return details of solution?

Value

If `details` a list with items

`puw`	Unwrapped phase
`ex`	Phase discontinuities - x
`ey`	Phase discontinuities - y
`objval`	Objective function value

otherwise the unwrapped phase

Note

The current version minimizes the total absolute value of the discontinuities.

Author(s)

M.L. Peck <mpeck1@ix.netcom.com>

References

http://www.geo.unizh.ch/rsl/fringe96/papers/costantini/

See Also

brcutpuw

Examples

```
require(zernike)

# defined area must be surrounded by at least one
# row/column of NA's

ph <- matrix(NA, 27, 27)
ph[2:26,2:26] <- runif(25^2, -pi, pi)

x11(width=12, height=6)
par(mar=c(0,0,1,0))
split.screen(figs=c(1,2))
screen(1)

# show the wrapped phase map with corrupted pixels

mtext(rmap(ph, plot=TRUE))
ph.uw <- netflowpuw(ph)

screen(2)
```

```
# contour plot of unwrapped phase

plot(ph.uw, axes=FALSE)
close.screen(all.screens=T)
```

`sudoku` *Sudoku solver*

Description

Solve a standard 9 x 9 Sudoku.

Usage

```
sudoku(givens)
```

Arguments

`givens`	Matrix of given values

Details

Use 0 for cells without given values.

Value

Solution as a 9 x 9 matrix.

Author(s)

M.L. Peck <mpeck1@ix.netcom.com>

Examples

```
puzzle <- matrix(c(1, 0, 0, 0, 0, 8, 0, 6,
 0, 0, 8, 0, 0, 6, 0, 0, 0,
 0, 4, 0, 7, 8, 0, 0, 5, 0,
 4, 0, 0, 0, 6, 0, 0, 0, 8,
 7, 0, 2, 0, 3, 0, 1, 0, 5,
 9, 0, 0, 0, 5, 0, 0, 0, 7,
 0, 2, 0, 0, 1, 5, 0, 3, 0,
 0, 0, 0, 6, 0, 0, 2, 0, 0,
 3, 0, 9, 0, 0, 0, 0, 0, 1), 9, 9)
 puzzle
 sudoku(puzzle)
```

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