GRAYSCALE THINNING Reference Manual

0.1

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Contents

Chapter 1

GRAYSCALE THINNING File Index

1.1 GRAYSCALE THINNING File List

Here is a list of all documented files with brief descriptions:

Chapter 2

GRAYSCALE THINNING File Documentation

2.1 alpha.c File Reference

computes the connecivity number alpha for each image voxel

2.1.1 Detailed Description

computes the connecivity number alpha for each image voxel

Usage: alpha in out

Description: Computes the connecivity number alpha (as defined in ref. BEC97) for each image voxel.

Types supported: byte 3D

Category: topogray

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "`Image segmentation through operators based upon topology`", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "`Topological operators for grayscale image processing`", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Author:

Michel Couprie

2.2 asftndg.c File Reference

alternate sequential filter controled by topology

2.2.1 Detailed Description

alternate sequential filter controled by topology

Usage: asftndg in.pgm <c.pgm cc.pgm|null null> connex rmax out.pgm

Description: Alternate sequential filter controled by topology for multilevel images. Disc- or Ball-shaped structuring elements of increasing radius, ranging from 1 to **rmax**, are generated. Let D1...Dn be these structuring elements, sorted by increasing radius. Let I(0) = **in.pgm**, the ith intermediate result I(i) is obtained by the homotopic pseudo-closing of the homotopic pseudo-opening of I(i-1) by the structuring element Di. Two images **c.pgm** and **cc.pgm** can be given to serve as constraints. The image **c.pgm** must be 0 except for the points x that are to be preserved, which can be set to 255 or to I[x]. The image **cc.pgm** must be 255 except for the points x that are to be preserved, which can be set to 0 or to I[x]. The result **out.pgm** contains the final result I(n).

Types supported: byte 2d, byte 3d

Category: morpho, topogray ,

Author:

Michel Couprie

2.3 crestrestoration.c File Reference

crest restoration algorithm

2.3.1 Detailed Description

crest restoration algorithm

Usage: crestrestoration im.pgm <imcond.pgm|null> connex niter fileout.pgm [condout.pgm]

Description: Crest restoration algorithm, as described in ref. CBB01. The input image **im.pgm** must be a "thin" grayscale image, as the output of the operator **hthin**. The parameter **connex** indicates the connectivity used for the minimal regions. The parameter **niter** gives the number of iterations. The optional parameter **imcond.pgm** is a binary image (a set C) which indicates the points in the neighborhood of which the extensible points will be searched. The points which are modified by the algorithm will be dynamically added to C. The optional parameter **condout.pgm** is an output file containing the final state of the set C.

Reference:

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2D

Category: topogray

Author:

Michel Couprie

2.4 deletepeaks.c File Reference

deletes peaks in a grayscale image

2.4.1 Detailed Description

deletes peaks in a grayscale image

Usage: deletepeaks filein.pgm [mask] connexmin fileout.pgm

Description: Deletes peaks in a grayscale image. A point p is a peak if T+(p) = 0 (see ref. [BEC97]).

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "Image segmentation through operators based upon topology", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

Types supported: byte 2d, byte 3d

Category: topogray

Author:

Michel Couprie

2.5 deletewells.c File Reference

deletes wells in a grayscale image

2.5.1 Detailed Description

deletes wells in a grayscale image

Usage: deletewells filein.pgm [mask] connexmin fileout.pgm

Description: Deletes wells in a grayscale image. A point p is a well if T-(p) = 0 (see ref. [BEC97]).

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "Image segmentation through operators based upon topology", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

Types supported: byte 2d, byte 3d

Category: topogray

Author:

Michel Couprie

2.6 grayskel.c File Reference

grayscale homotopic skeleton

2.6.1 Detailed Description

grayscale homotopic skeleton

Usage: grayskel in.pgm <imcond.pgm|null> connex lambda out.pgm

Description: Skeleton, either homotopic (**lambda** = 0) or non-homotopic, for 2D grayscale images The skeleton is obtained by iterative lowering of lambda-destructible points (see [CBB01]).

Reference:

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2d

Category: topogray

Author:

Michel Couprie

2.7 hthick.c File Reference

grayscale homotopic thickening

2.7.1 Detailed Description

grayscale homotopic thickening

Usage: hthick in.pgm <imcond.pgm|null> connex niter out.pgm

Description: Grayscale homotopic thickening (refs. [BEC97, CBB01]). The parameter **connex** gives the connectivity used for the minima; possible choices are 4, 8 in 2D and 6, 26 in 3D. Let F be the function corresponding to the input image **in.pgm**. Let G be the function corresponding to the input image **imcond.pgm**, or the blanck function (constant 255) if the keyword **null** is used. The algorithm is the following:

```
Repeat niter times:
    L = {(p,d) such that p is constructible for F and d = delta+(p,F)}
    While L not empty
       extract a couple (p,d) from L
       F(p) = min{ d, delta+(p,F), G(p) }
Result: F
```

If **niter** is set to -1, then the operator iterates until stability.

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "Image segmentation through operators based upon topology", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2D, byte 3D.

Category: topogray

Author:

Michel Couprie

2.8 hthin.c File Reference

grayscale homotopic thinning

2.8.1 Detailed Description

grayscale homotopic thinning

Usage: hthin in.pgm <imcond.pgm|null> connex niter out.pgm

Description: Grayscale homotopic thinning (refs. [BEC97, CBB01]). The parameter **connex** gives the connectivity used for the minima; possible choices are 4, 8 in 2D and 6, 26 in 3D. Let F be the function corresponding to the input image **in.pgm**. Let G be the function corresponding to the input image **imcond.pgm**, or the null function if the keyword **null** is used. The algorithm is the following:

```
Repeat niter times:
    L = {(p,d) such that p is destructible for F and d = delta-(p,F)}
    While L not empty
       extract a couple (p,d) from L
       F(p) = max{ d, delta-(p,F), G(p) }
Result: F
```

If **niter** is set to -1, then the operator iterates until stability.

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "Image segmentation through operators based upon topology", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2D, byte 3D.

Category: topogray

Author:

Michel Couprie

2.9 htkern.c File Reference

grayscale ultimate homotopic thinning

2.9.1 Detailed Description

grayscale ultimate homotopic thinning

Usage: htkern in.pgm <imcond.pgm|null> connex out.pgm

Description: Grayscale ultimate homotopic thinning (refs. [BEC97, CBB01]). The parameter **connex** gives the connectivity used for the minima; possible choices are 4, 8 in 2D and 6, 26 in 3D. Let F be the function corresponding to the input image **in.pgm**. Let G be the function corresponding to the input image **imcond.pgm**, or the null function if the keyword **null** is used. The algorithm is the following:

```
Repeat until stability:
    select p destructible for F such that F(p) is minimal
    F(p) = max{ delta-(p,F), G(p) }
Result: F
```

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "Image segmentation through operators based upon topology", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2D, byte 3D.

Category: topogray

Author:

Michel Couprie

2.10 htkernu.c File Reference

grayscale ultimate homotopic thickening

2.10.1 Detailed Description

grayscale ultimate homotopic thickening

Usage: htkernu in.pgm <imcond.pgm|null> connex out.pgm

Description: Grayscale ultimate homotopic thickening (refs. [BEC97, CBB01]). The parameter **connex** gives the connectivity used for the minima; possible choices are 4, 8 in 2D and 6, 26 in 3D. Let F be the function corresponding to the input image **in.pgm**. Let G be the function corresponding to the input image **imcond.pgm**, or the null function if the keyword **null** is used. The algorithm is the following:

```
Repeat until stability:
    select p constructible for F such that F(p) is maximal
    F(p) = min{ delta+(p,F), G(p) }
Result: F
```

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "Image segmentation through operators based upon topology", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2D, byte 3D.

Category: topogray

Author:

Michel Couprie

2.11 lambdalthin.c File Reference

grayscale filtered leveling

2.11.1 Detailed Description

grayscale filtered leveling

Usage: lambdalthin in.pgm <imcond.pgm|null> connex niter h out.pgm

Description: Filtered leveling for 2D grayscale images.

Types supported: byte 2d

Category: topogray

Author:

Michel Couprie

2.12 lambdaskel.c File Reference

grayscale filtered topological skeleton

2.12.1 Detailed Description

grayscale filtered topological skeleton

Usage: lambdaskel in.pgm <imcond.pgm|null> connex lambda out.pgm

Description: Filtered topological skeleton for 2D grayscale images. The parameter **connex** gives the connectivity used for the minima; possible choices are 4 and 8. The parameter **lambda** is a contrast parameter (positive integer). Let F be the function corresponding to the input image **in.pgm**. The parameter **imcond.pgm** is a constraint function G. The algorithm is the following:

```
Repeat until stability:
    Select a point p which is lambda-destructible for F or a peak
        such that F(p) > G(p) and such that F(p) is minimal
    F(p) = alpha-(p,F)
Result: F
```

Reference:

M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2d

Category: topogray

Author:

Michel Couprie

2.13 lambdathin.c File Reference

grayscale homotopic and filtered thinning

2.13.1 Detailed Description

grayscale homotopic and filtered thinning

Usage: lambdathin in.pgm <imcond.pgm|null> connex niter h out.pgm

Description: Homotopic thinning for 2D grayscale images.

Types supported: byte 2d

Category: topogray

Author:

Michel Couprie

2.14 lthick.c File Reference

grayscale leveling thickening

2.14.1 Detailed Description

grayscale leveling thickening

Usage: lthick in.pgm <imcond.pgm|null> connex niter out.pgm

Description: Grayscale leveling thickening (refs. [BEC97, CBB01]). The parameter **connex** gives the connectivity used for the minima; possible choices are 4, 8 in 2D and 6, 26 in 3D. Let F be the function corresponding to the input image **in.pgm**. Let G be the function corresponding to the input image **imcond.pgm**, or the blanck function (constant 255) if the keyword **null** is used. The algorithm is the following:

```
Repeat niter times:
    L = {(p,a) such that T++(p,F) = 1 and a = alpha+(p,F)}
    While L not empty
       extract a couple (p,a) from L
       F(p) = min{ a, alpha+(p,F), G(p) }
Result: F
```

If **niter** is set to -1, then the operator iterates until stability.

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "Image segmentation through operators based upon topology", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2D, byte 3D.

Category: topogray

Author:

Michel Couprie

2.15 lthin.c File Reference

grayscale leveling thinning

2.15.1 Detailed Description

grayscale leveling thinning

Usage: lthin in.pgm <imcond.pgm|null> connex niter out.pgm

Description: Grayscale leveling thinning (refs. [BEC97, CBB01]). The parameter **connex** gives the connectivity used for the minima; possible choices are 4, 8 in 2D and 6, 26 in 3D. Let F be the function corresponding to the input image **in.pgm**. Let G be the function corresponding to the input image **imcond.pgm**, or the null function if the keyword **null** is used. The algorithm is the following:

```
Repeat niter times:
    L = {(p,a) such that T--(p,F) = 1 and a = alpha-(p,F)}
    While L not empty
       extract a couple (p,a) from L
       F(p) = max{ a, alpha-(p,F), G(p) }
Result: F
```

If **niter** is set to -1, then the operator iterates until stability.

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "Image segmentation through operators based upon topology", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2D, byte 3D.

Category: topogray

Author:

Michel Couprie

2.16 lvkern.c File Reference

grayscale ultimate leveling thinning

2.16.1 Detailed Description

grayscale ultimate leveling thinning

Usage: lvkern in.pgm <imcond.pgm|null> connex out.pgm

Description: Grayscale ultimate leveling thinning (refs. [BEC97, CBB01]). The parameter **connex** gives the connectivity used for the minima; possible choices are 4, 8 in 2D and 6, 26 in 3D. Let F be the function corresponding to the input image **in.pgm**. Let G be the function corresponding to the input image **imcond.pgm**, or the null function if the keyword **null** is used. The algorithm is the following:

```
Repeat until stability:
    select p such that T--(p,F) = 1 and such that F(p) is minimal
    F(p) = max{ delta-(p,F), G(p) }
Result: F
```

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "Image segmentation through operators based upon topology", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2D, byte 3D.

Category: topogray

Author:

Michel Couprie

2.17 lvkernu.c File Reference

grayscale ultimate leveling thickening

2.17.1 Detailed Description

grayscale ultimate leveling thickening

Usage: lvkernu in.pgm <imcond.pgm|null> connex out.pgm

Description: Grayscale ultimate leveling thickening (refs. [BEC97, CBB01]). The parameter **connex** gives the connectivity used for the minima; possible choices are 4, 8 in 2D and 6, 26 in 3D. Let F be the function corresponding to the input image **in.pgm**. Let G be the function corresponding to the input image **imcond.pgm**, or the blanck function (constant 255) if the keyword **null** is used. The algorithm is the following:

```
Repeat until stability:
    select p such that T++(p,F) = 1 and such that F(p) is maximal
    F(p) = min{ delta+(p,F), G(p) }
Result: F
```

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "Image segmentation through operators based upon topology", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2D, byte 3D.

Category: topogray

Author:

Michel Couprie

2.18 maxima.c File Reference

regional maxima

2.18.1 Detailed Description

regional maxima

Usage: in.pgm connex out.pgm

Description: Selects the regional maxima of a grayscale image with connexity **connex**.

Types supported: byte 2d, int32_t 2d, byte 3d, int32_t 3d

Category: connect, topogray ,

Author:

Michel Couprie

2.19 minima.c File Reference

regional minima

2.19.1 Detailed Description

regional minima

Usage: in.pgm connex out.pgm

Description: Selects the regional minima of a grayscale image with connexity **connex**.

Types supported: byte 2d, int32_t 2d, byte 3d, int32_t 3d

Category: connect, topogray ,

Author:

Michel Couprie

2.20 nbtopo.c File Reference

connectivity numbers

2.20.1 Detailed Description

connectivity numbers

Usage: nbtopo filein.pgm connex <PP|P|M|MM> fileout.pgm

Description: For each point p of the input grayscale image, compute the connectivity number T++, T+, T- or T– according to the given option (resp. PP, P, M, MM). Refs: [BEC97, CBB01].

Types supported: byte 2D, byte 3D

Category: topogray

Author:

Michel Couprie

2.21 pgm2raw.c File Reference

suppress the header from a pgm file

2.21.1 Detailed Description

suppress the header from a pgm file

Usage: pgm2raw in.pgm out.raw

Description: suppress the header from a pgm file

Types supported: byte 2d, byte 3d

Category: convert

Author:

Michel Couprie

2.22 ptextensible.c File Reference

detects extensible points in a grayscale image

2.22.1 Detailed Description

detects extensible points in a grayscale image

Usage: ptextensible im.pgm <imcond.pgm|null> connex fileout.pgm

Description: Extensible point detection. The input image **im.pgm** must be a "thin" grayscale image, as the output of the operator **hthin**. The parameter **connex** indicates the cconnectivity used for the minimal regions. The optional parameter **imcond.pgm** is a binary image which indicates the points in the neighborhood of which the extensible points will be searched.

Reference:

M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Types supported: byte 2D

Category: topogray

Author:

Michel Couprie

2.23 ptselectgray.c File Reference

detects points in a 2D or 3D grayscale image corresponding to a given criterion

2.23.1 Detailed Description

detects points in a 2D or 3D grayscale image corresponding to a given criterion

Usage: ptselectgray in.pgm connex t+min t+max t–min t–max out.pgm

Description:

Select all points p such that t+min <= T+(p) <= t+max and t–min <= T–(p) <= t–max

Types supported: byte 2d, byte 3d

Category: topogray

Author:

Nicolas Combaret 2006

2.24 ptseparating.c File Reference

detects separating points in a 2D or 3D binary image

2.24.1 Detailed Description

detects separating points in a 2D or 3D binary image

Usage: ptseparating in.pgm connex out.pgm

Description: A separating point is a white point x such that Tb_n[x] >= 2 (n = 4,8 in 2D or n = 6,18,26 in 3D, as set by the parameter **connex**)

Types supported: byte 2d, byte 3d

Category: topobin

Author:

Michel Couprie 2002

2.25 ptseparatinggray.c File Reference

detects separating points in a grayscale image

2.25.1 Detailed Description

detects separating points in a grayscale image

Usage: ptseparatinggray in.pgm connex out.pgm

Description: A separating point is a point p, which is separating (in the binary sense) for a section h of F, with h <= F(p).

Types supported: byte 2d

Category: topogray

Author:

Michel Couprie 2002

2.26 raw2pgm.c File Reference

converts from raw format into pgm format

2.26.1 Detailed Description

converts from raw format into pgm format

Usage: in.raw rs cs ds headersize nbytespervox littleendian [xdim ydim zdim] out.pgm

Description: Converts from raw format into pgm format.

Parameters:

- **in.pgm** : source file in raw format
- **rs** (int32_t): row size (number of voxels in a row)
- **cs** (int32_t): column size (number of voxels in a column)
- **ds** (int32_t): number of planes
- **headersize** (int32_t): size of the header in bytes (information in the header will be ignored)
- **nbytespervox** (int32_t): number of bytes per voxel (1, 2 or 4)
- **littleendian** (int32_t) 1: littleendian, 0: bigendian. Usual choice is 0.
- **xdim** (float, optional) : gap (in the real world) between two adjacent voxels in a row.
- **ydim** (float, optional) : gap (in the real world) between two adjacent voxels in a column.
- **zdim** (float, optional) : gap (in the real world) between two adjacent planes.

Types supported: byte 3D, int16_t 3D, int32_t 3D

Warning:

Signed integers are not supported.

Category: convert

Author:

Michel Couprie

2.27 taf.c File Reference

topological alternating filter

2.27.1 Detailed Description

topological alternating filter

Usage: taf in.pgm connexmin r [lambdap [lambdaw]] out.pgm

Description: Topological alternating filter. Performs alternatively topological upper filter (tuf) and topological lower filter (tlf) with increasing radius until radius **r**.

If given, parameter **lambdap** (resp. **lambdaw**) is an integer which indicates that peaks (resp. wells) of height greater than this value must be preserved.

Types supported: byte 2d

Category: topogray

Author:

Michel Couprie

2.28 tlf.c File Reference

topological lower filter

2.28.1 Detailed Description

topological lower filter

Usage: tlf in.pgm connexmin r out.pgm

Description: Topological lower filter. Performs the homotopic thickening controlled by a radius **r**, followed by a well deletion, and a homotopic reconstruction over the original image.

Types supported: byte 2d

Category: topogray

Author:

Michel Couprie

2.29 toposhrinkgray.c File Reference

topologically controled grayscale shrinking (one step)

2.29.1 Detailed Description

topologically controled grayscale shrinking (one step)

Usage: toposhrinkgray in.pgm connex t+min t+max t–min t–max <0|a|d> [inhibit] out.pgm

Description: Topologically controled grayscale shrinking (one step).

The parameter <0|a|d> indicates the action performed on the selected point p:

- 0: it is lowered down to 0;
- a: it is lowered down to alpha-(p,F) where F denotes the original image;
- d: it is lowered down to delta-(p,F) where F denotes the original image.

The parameter **connex** indicates the connectivity of the binary object. Possible choices are 4, 8 in 2D and 6, 18, 26 in 3D.

If the parameter **inhibit** is given and is a binary image name, then the points of this image (set Y) will be left unchanged.

```
For all points p, not in Y, and such that
    t+min <= T+(p) <= t+max and t--min <= T--(p) <= t--max
  lower p according to the chosen strategy
```

Types supported: byte 2d, byte 3d

Category: topogray

References:

[BEC97] G. Bertrand, J. C. Everat and M. Couprie: "Image segmentation through operators based upon topology", *Journal of Electronic Imaging*, Vol. 6, No. 4, pp. 395-405, 1997.

[CBB01] M. Couprie, F.N. Bezerra, Gilles Bertrand: "Topological operators for grayscale image processing", *Journal of Electronic Imaging*, Vol. 10, No. 4, pp. 1003-1015, 2001.

Author:

Nicolas Combaret 2006

2.30 tuf.c File Reference

topological upper filter

2.30.1 Detailed Description

topological upper filter

Usage: tuf in.pgm connexmin r out.pgm

Description: Topological upper filter. Performs the homotopic thinning controlled by a radius **r**, followed by a peak deletion, and a homotopic reconstruction under the original image.

Types supported: byte 2d

Category: topogray

Author:

Michel Couprie

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