Morphology

BW

Functions - BW

applylut	Perform neighborhood operations using lookup tables
bwarea	Area of objects in binary image
bwareaopen	Binary area open; remove small objects
bwdist	Distance transform
bweuler	Euler number of binary image
bwfill	Fill background regions in binary image
bwhitmiss	Binary hit-miss operation
bwlabel	Label connected components in 2-D binary image
bwlabeln	Label connected components in N-D binary image.
bwmorph	Perform morphological operations on binary image
bwpack	Pack binary image
bwperim	Find perimeter of objects in binary image
bwselect	Select objects in binary image
bwulterode	Ultimate erosion
bwunpack	Unpack a packed binary image
imregionalmin	Regional minima of image
imtophat	Perform tophat filtering
makelut	Construct lookup table for use with applylut

Functions - Gray

conndef	Default connectivity array
imbothat	Perform bottom-hat filtering
imclearborder	Suppress light structures connected to image border
imclose	Close image
imdilate	Dilate image
imerode	Erode image
imextendedmax	Extended-maxima transform
imextendedmin	Extended-minima transform
imfill	Fill image regions
imhmax	H-maxima transform
imhmin	H-minima transform
imimposemin	Impose minima
imopen	Open image
imreconstruct	Perform morphological reconstruction
imregionalmax	Regional maxima of image
imregionalmin	Regional minima of image
imtophat	Perform tophat filtering
watershed	Find image watershed regions

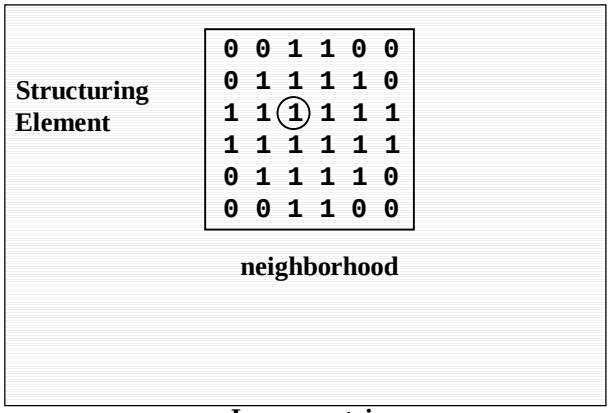
BW Morphology (1)

bw2 = dilate(bw1,se); % se general structuring element
bw2 = erode(bw1,se);
bw2 = bwmorph(bw1,opt,N) % opt defines a 3x3 se

```
'bothat'   Subtract the input image from its closing
'bridge'   Bridge previously unconnected pixels
'clean'    Remove isolated pixels
'close'    Perform binary closure
'diag'     Diagonal fill to eliminate 8-connectivity
'dilate'   Perform dilation
'erode'    Perform erosion
'fill'     Fill isolated interior pixels
'hbreak'   Remove H-connected pixels
'majority'
'open'     Perform binary opening
'remove'   findonly boundary pixels
'shrink'
'skel'     skeletonization
'spur'     Remove end points of lines
'thicken'
'thin'
'tophat'   Subtract the opening from the input image
```

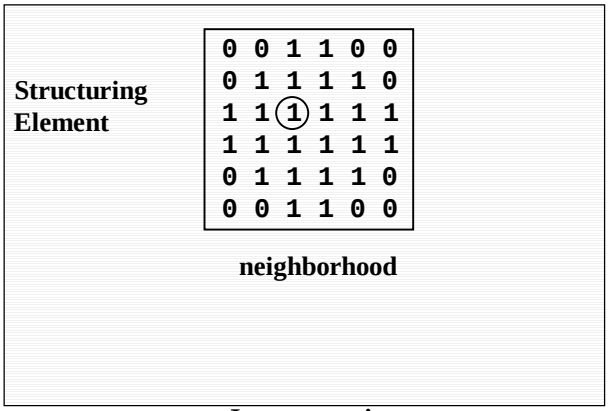
BW Morphology (2)

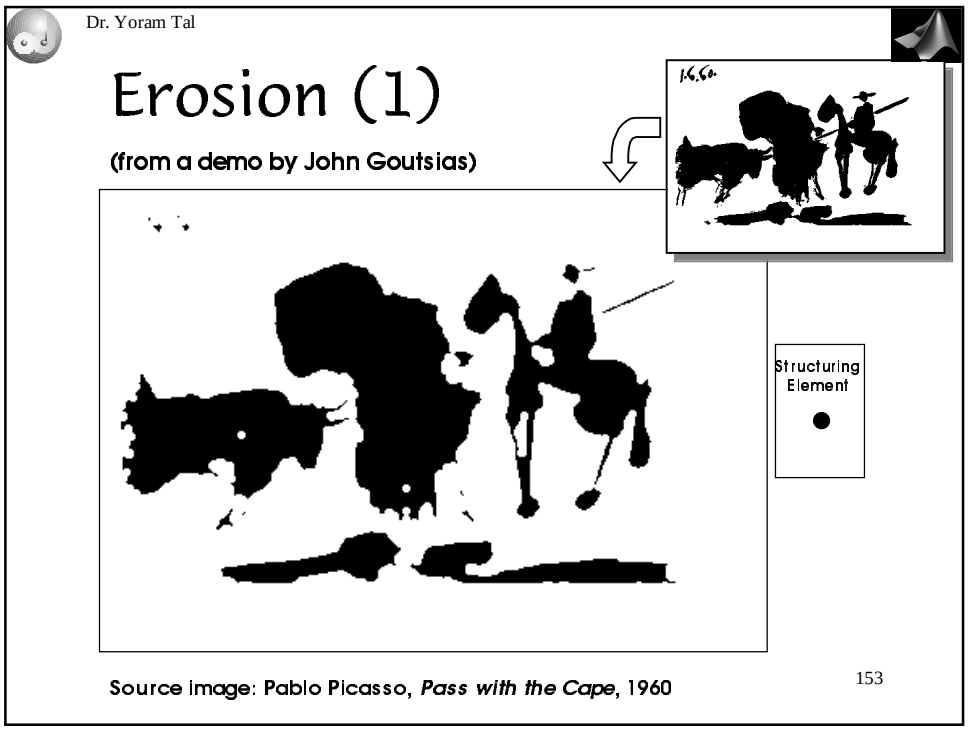
Dilation: replace the central pixel by 1 if the image neighborhood contains a 1.



BW Morphology (3)

Erosion: replace the central pixel by 0 if the image neighborhood contains a 0.




Dr. Yoram Tal
Erosion (1)
(from a demo by John Goutsias)
Structuring Element
Source image: Pablo Picasso, *Pass with the Cape*, 1960
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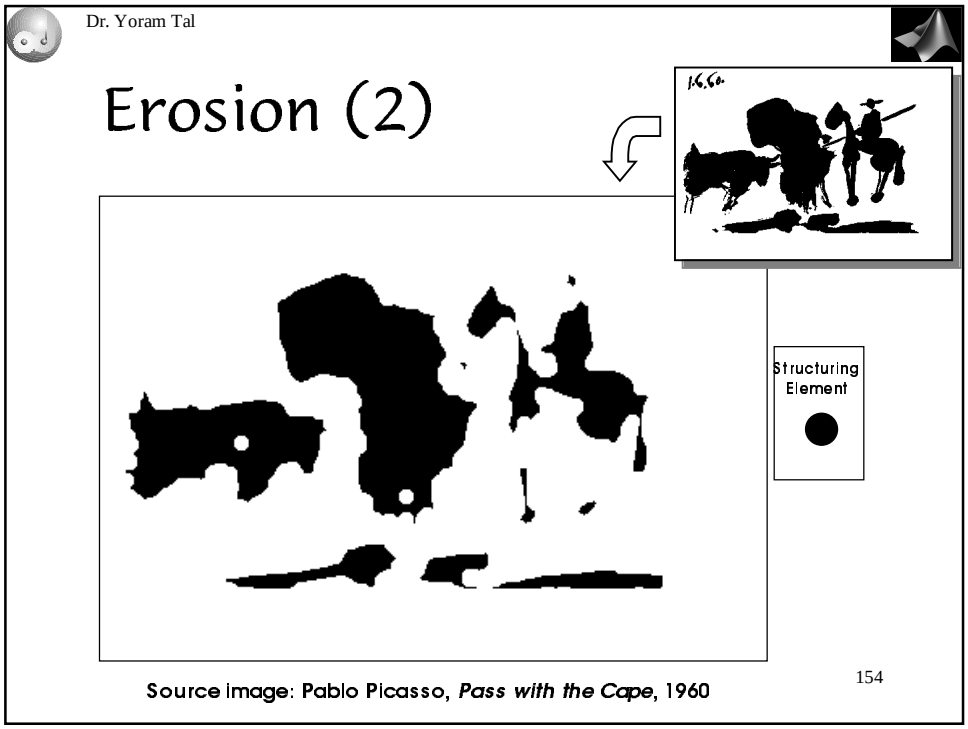
Dr. Yoram Tal
Erosion (2)
Structuring Element
Source image: Pablo Picasso, *Pass with the Cape*, 1960
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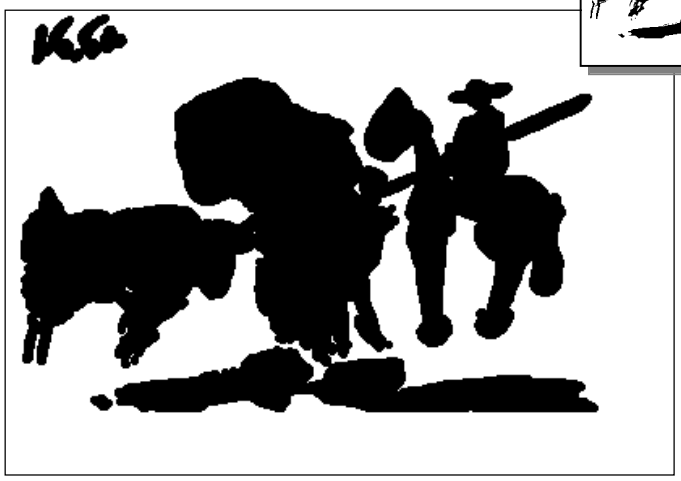
Dilation (1)



Structuring Element

Pablo Picasso, *Pass with the Cape*, 1960

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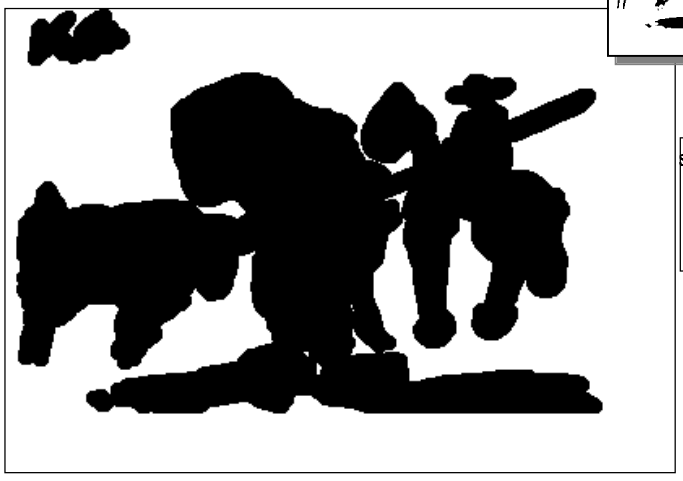
Dilation (2)



Structuring Element

Pablo Picasso, *Pass with the Cape*, 1960

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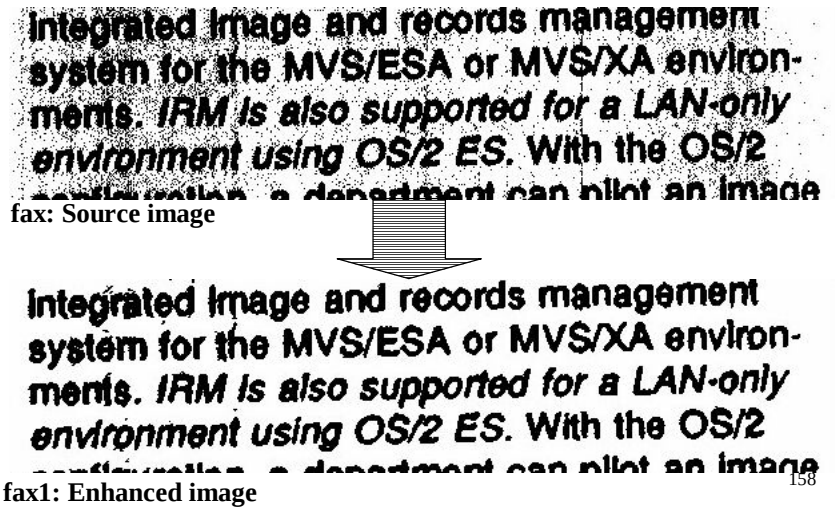
BW Morphology (4)

Closing: Dilation followed by Erosion

Opening: Erosion followed by Dilation

BW Morphology - Example

A Commercial fax-enhancement product



fax: Source image

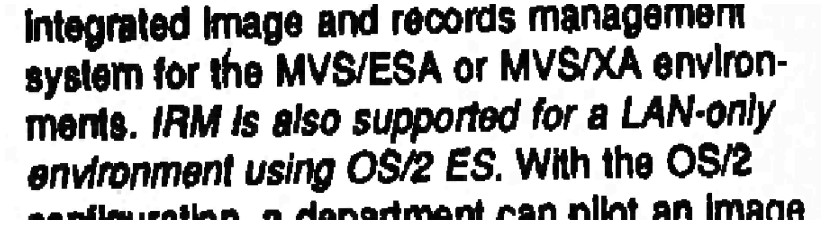
fax1: Enhanced image

Example (2)

```
fax - the image matrix
x = erode(fax,ones(3));
Y = dilate(x,ones(3));
```

open

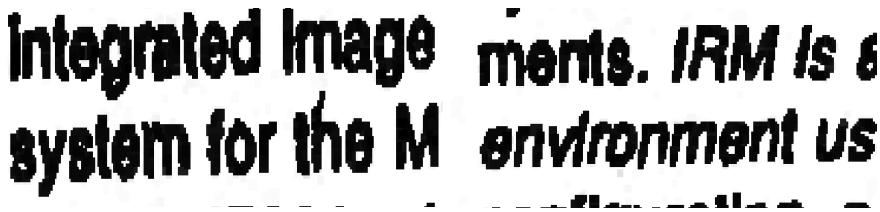
Y


integrated image and records management
system for the MVS/ESA or MVS/XA environ-
ments. *IRM is also supported for a LAN-only*
environment using OS/2 ES. With the OS/2

Note: black pixels are 1 s

Example (3)

fax1


integrated image ments. *IRM is a*
system for the M *environment us*

Y