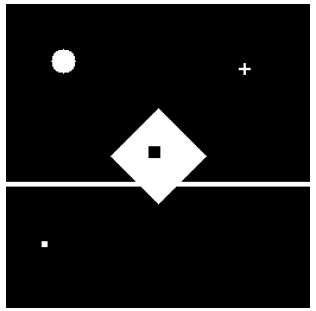
Practical session on mathematical morphology

using Image Processing Toolbox of Matlab

Binary mathematical morphology



- Download the image test.tif: http://www3.hi.is/~yut2/files/MMImage/test.tif

- For the considered image:
  - Test elementary morphological operators (erosion and dilation) with different structuring elements: horizontal segments (line) or vertical segments (column), square, cross

Help:

- *IM2 = imdilate(IM, SE)* performs dilation of image IM by a structuring element SE.
- Function *se = strel(shape, parameters)* constructs structuring elements with a variety of shapes and sizes. Examples:
  SE = strel('line', LEN, DEG)
  SE = strel('square', W)
- To perform erosion, use function *imerode*.

Binary mathematical morphology

- For the considered image:
  - Combine elementary operators to construct the following operations:
    - Opening (erosion followed by dilation with the same structuring element, for example line or square) and closing (dilation followed by erosion). What is the effect of these filters?
    - "Top-hat" (initial image minus opening). How this operator can be useful?

Help:

- Opening and closing are implemented in Image Processing Toolbox of Matlab with functions *imopen* and *imclose*.
- Top-hat filtering can be performed using function *IM2 = imtophat(IM,SE)* or function *imsubtract* together with opening function.

Binary mathematical morphology

- For the considered image:
  - ➢ With the help of different morphological operators:
    - Try to isolate pixels belonging to one or another structure of the image (diamond formation, circle, line, cross, black square or white square)
    - Delete the white line, preserving all the other structures intact
  - ➢ Implement and test different morphological gradients (dilation-image, image-erosion, dilation-erosion)
    - Which differences do you observe between these gradients (finesse, localisation)?
    - What is the influence of the structuring element (size and shape)?

Binary mathematical morphology

- You can investigate the influence of these different operators for the “natural” binary images obtained by thresholding of grey-scale images

MM for grey-scale images

- Download grey-scale images femme.tif and chaise.tif:
  http://www3.hi.is/~yut2/files/MMImage/femme.tif
  http://www3.hi.is/~yut2/files/MMImage/chaise.tif
  You can also use any other grey-scale images

- Repeat, for the grey-scale images, the study fulfilled for the binary images:
  - Erosion (minimum value of the image in the window defined by the structuring element)
  - Dilation (maximum value of the image in the window defined by the structuring element)
  - And combinations of these operators
    - Opening and closing
    - “Top-hat” operator
    - Morphological gradients