L-Università ta' Malta

Morphology - Tutorial

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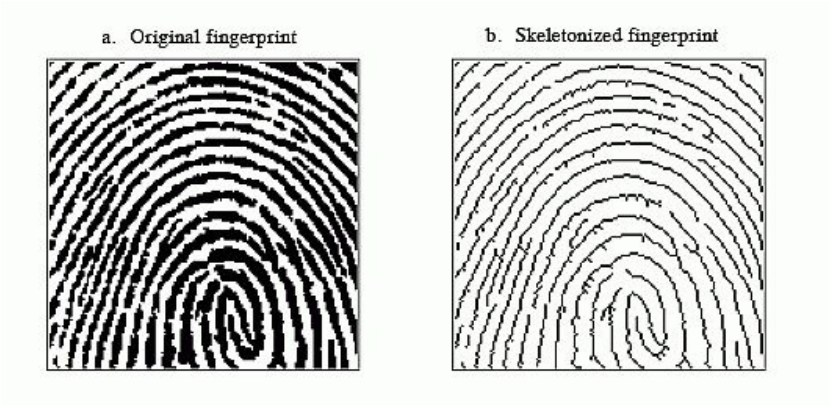
Agenda

- Connected Components (Pixel Connectivity)
- Dilation
- Erosion
- Opening
- Closing
- Segmentation Exercise

Mathematical Morphology

Mathematical morphology (MM) is a theoretical model for digital images built upon lattice theory and topology. It is the foundation of morphological image processing, which is based on shift-invariant (translation invariant) operators.Originally developed for binary images it has now been successfully extend to grey scale images.

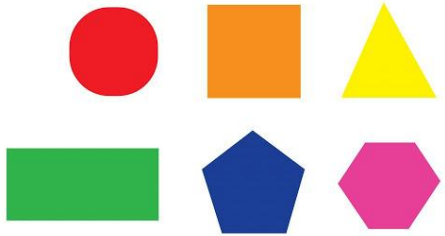


Exercise 1 - Connected Components

Using opencv research how to use `connectedComponents()` function.

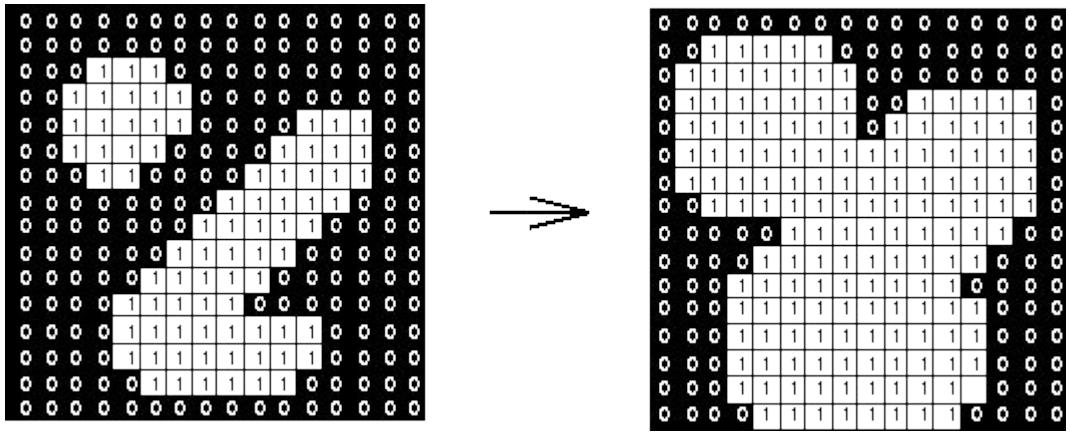
Download image shapes.jpg and euro_coins.jpg. Apply the connected components function to segment the objects in the image. You can if you want also use the `findContour()` opencv method to extract the ROI (seperate shapes as new images). Vary the connectivity value (4 or 8) and document results.

Do not forget to convert the image to binary, your objects should be white.



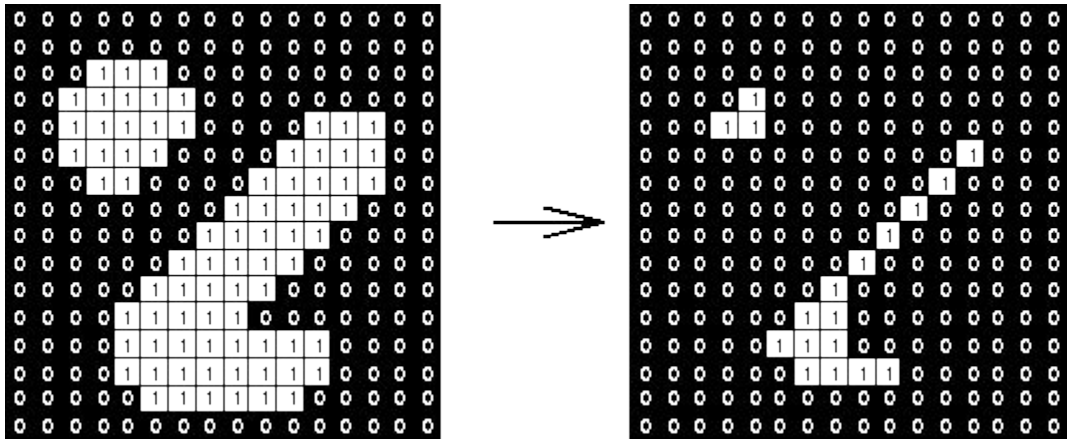
Exercise 2 - Dilation

Download the image file handwritten text.png from VLE. Apply the opencv method for dilation (`dilate()`). Vary the dilation filter and compare results using histograms. What can you observe?



Exercise 3 - Erosion

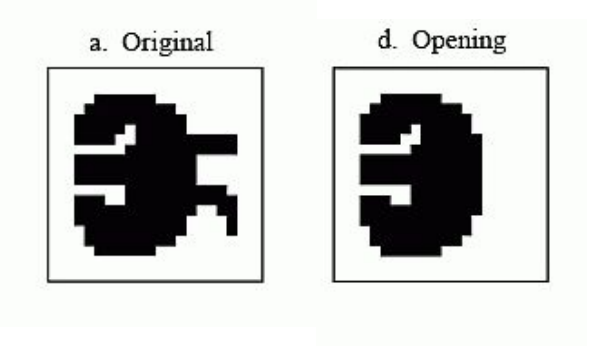
Using the same text based image from the previous exercise apply the opencv method for erosion (`erode()`). Vary the erosion filter and compare results using histograms. What can you observe?



Exercise 4 - Opening

Opening is an applied process of erosion followed by dilation. It is typically used to segment neck parts of shapes found within an image. It is also used in Text segmentation to seperate lines and words and sometimes characters.

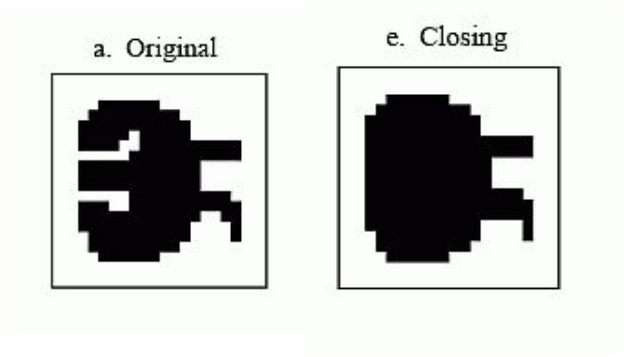
Using the same text image from previous exercises apply this process of opening to visually separate lines words and characters.



Exercise 5 - Closing

Closing is an applied process of dilation followed by erosion. It is typically used to fill in shapes found within an image. It is also used in Text segmentation to reinforce eroded characters.

Using the same text image from previous exercises apply this process of opening to visually separate lines words and characters.



Exercise 6 - Segmentation

Using histograms, apply any of the morphological techniques used in the previous exercises to try and segment the text into seperate lines. The lines do not not have to be perfect.

References

Academic Reference

- Lecture Slides
- Serra, Jean, and Pierre Soille, eds. Mathematical morphology and its applications to image processing. Vol. 2. Springer Science & Business Media, 2012.