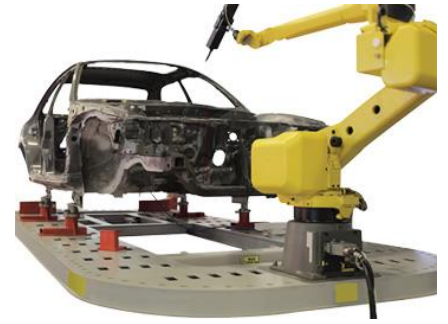


Image Segmentation

Laboratory

Outline

- Part 1
- Part 2
- Sempre 1 figura almeno per slide (a bassa risoluzione!!!!!!)



Segmentation examples

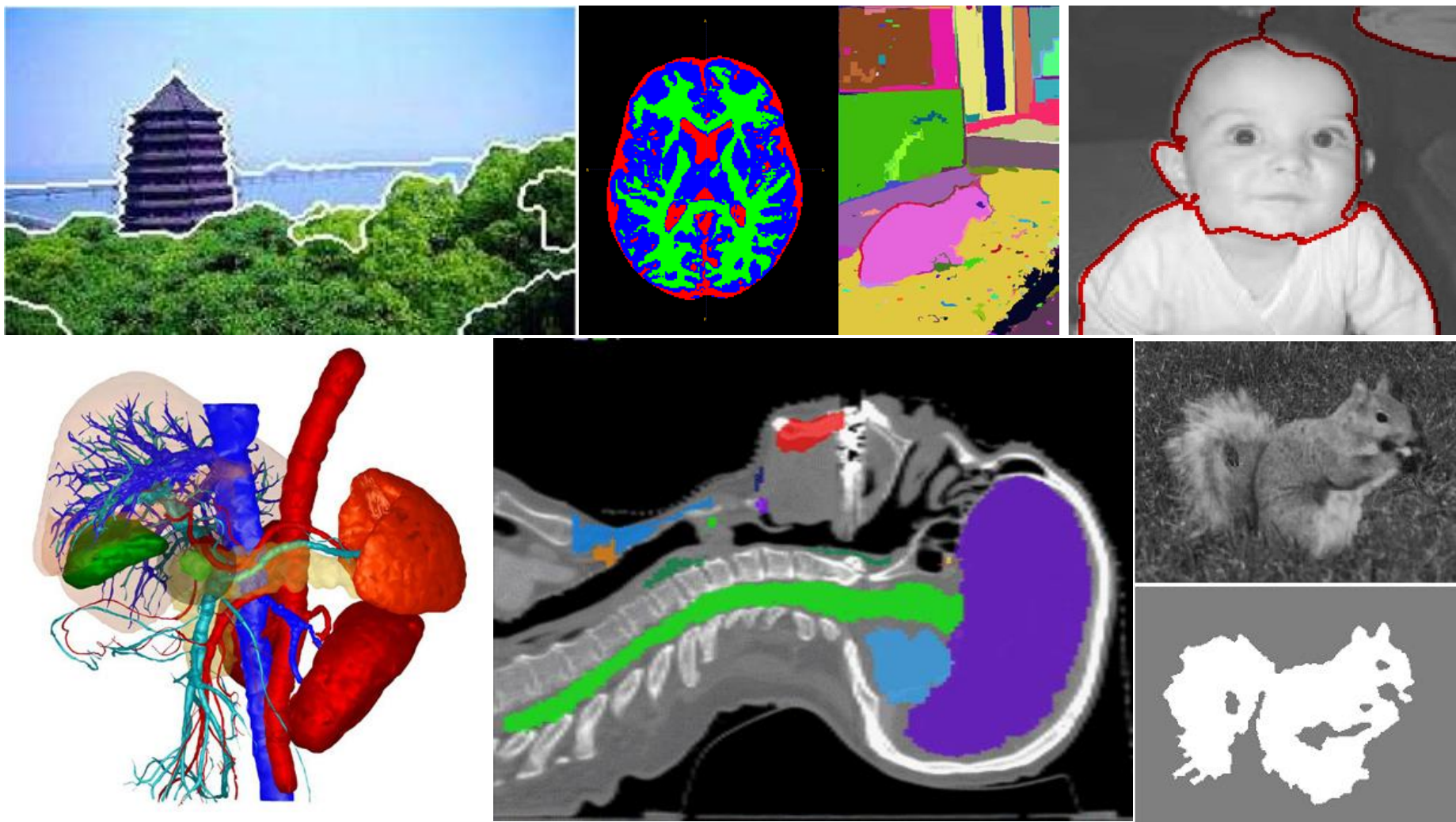
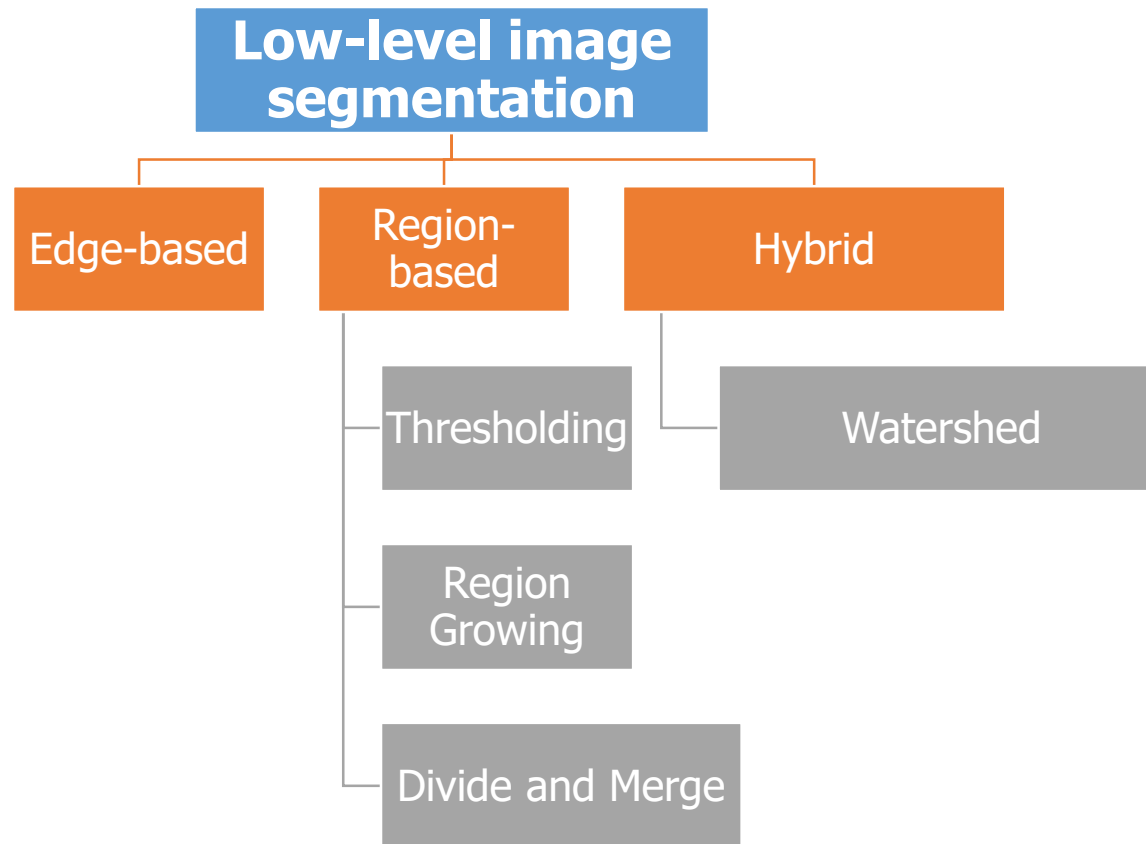


Image segmentation algorithms



Thresholding

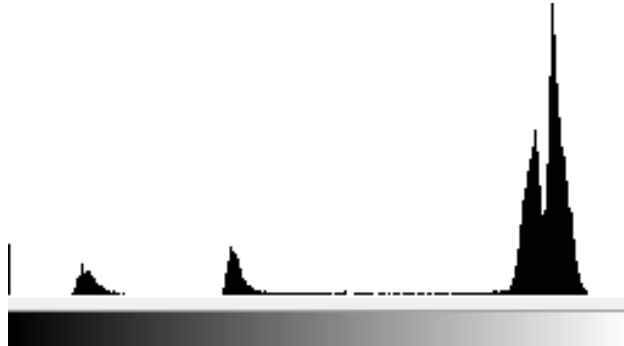
- Thresholding is usually the first step in any segmentation approach

$$O(x, y) = \begin{cases} 1 & \text{if } I(x, y) > t \\ 0 & \text{if } I(x, y) \leq t \end{cases}$$

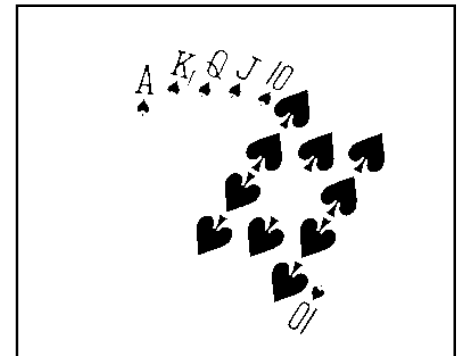
$I(x, y)$



t

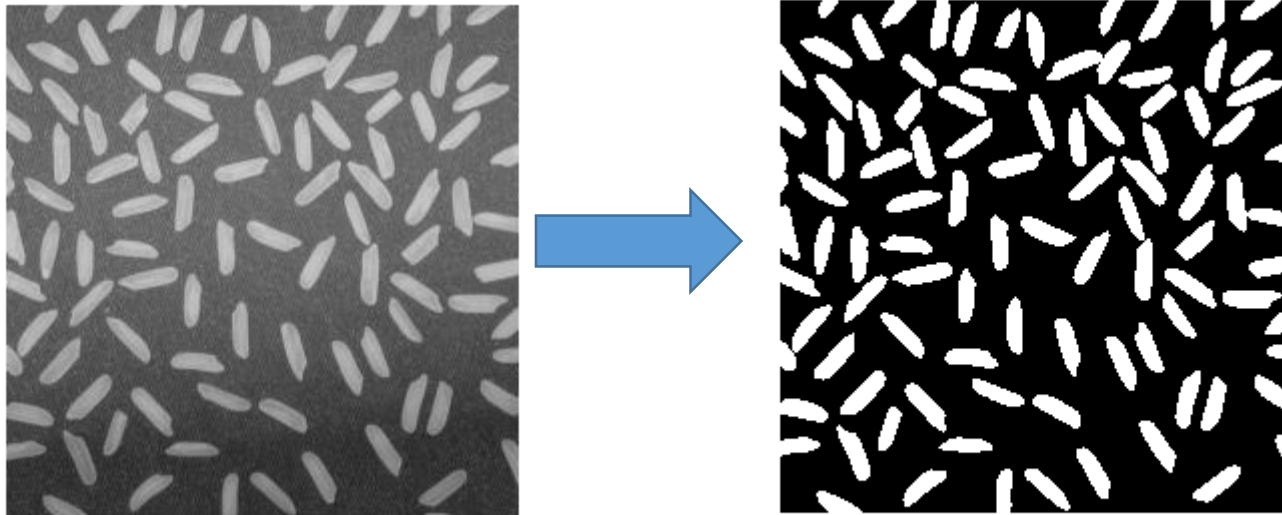


$O(x, y)$



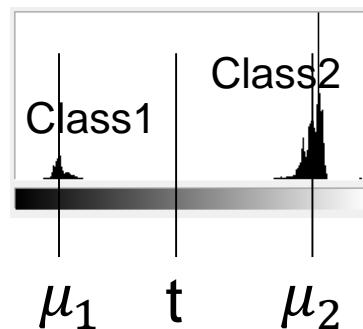
Thresholding exercise

- `I = imread('rice.png');`



Otsu's method

- It calculates the optimum threshold separating those two classes so that *it is minimal their combined spread* (intra-class variance).
- In Otsu's method we exhaustively search for the threshold that *minimizes the intra-class variance*, defined as a weighted sum of variances of the two classes.



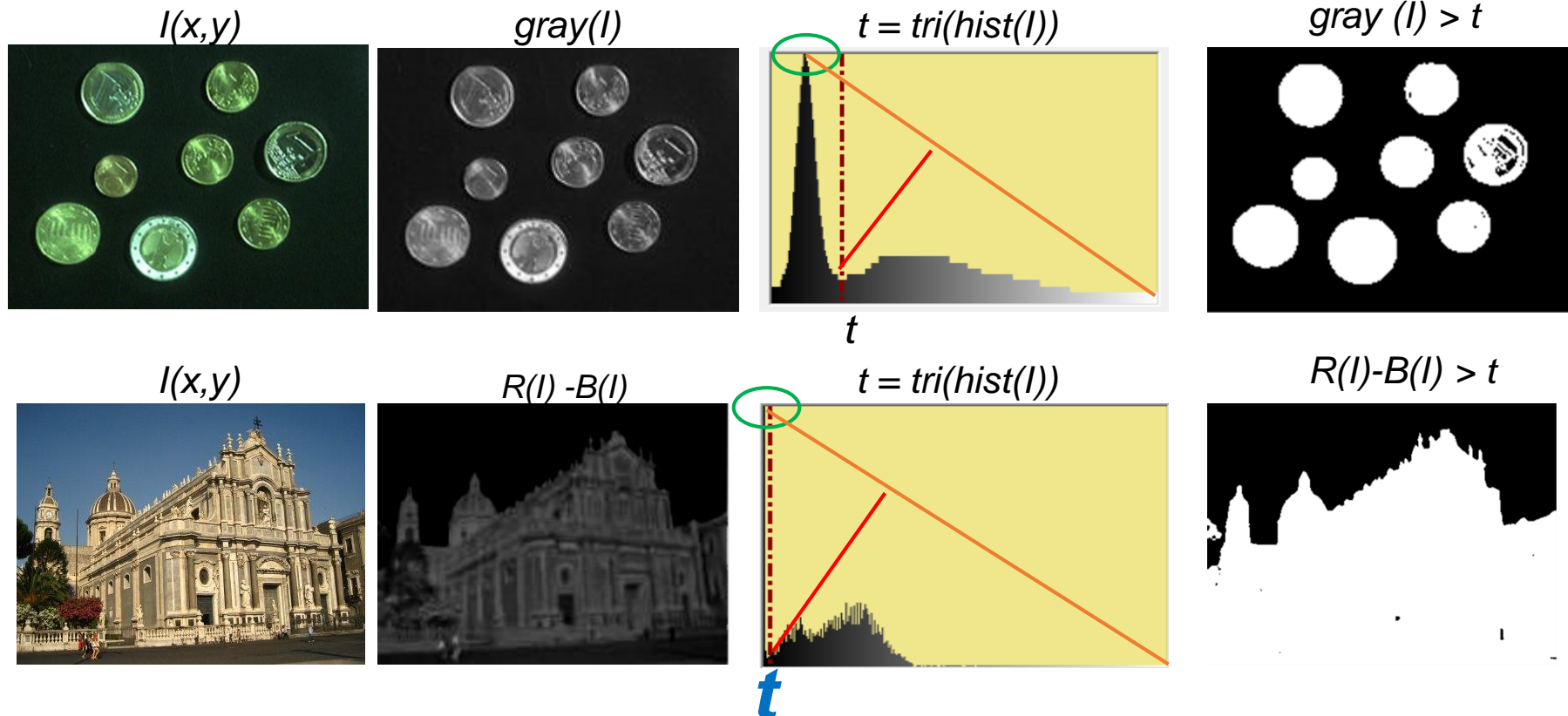
Otsu N., [A threshold selection method from gray-level histogram](#), IEEE Trans. Syst. Man Cybern. 9:62-66;1979

Otsu's method: exercise

- <https://it.mathworks.com/help/images/examples/correcting-nonuniform-illumination.html>

Triangular histogram thresholding

- Simple and robust method! Work
- Working hypothesis:
 - Uniform and large background (in case, with some processing...)

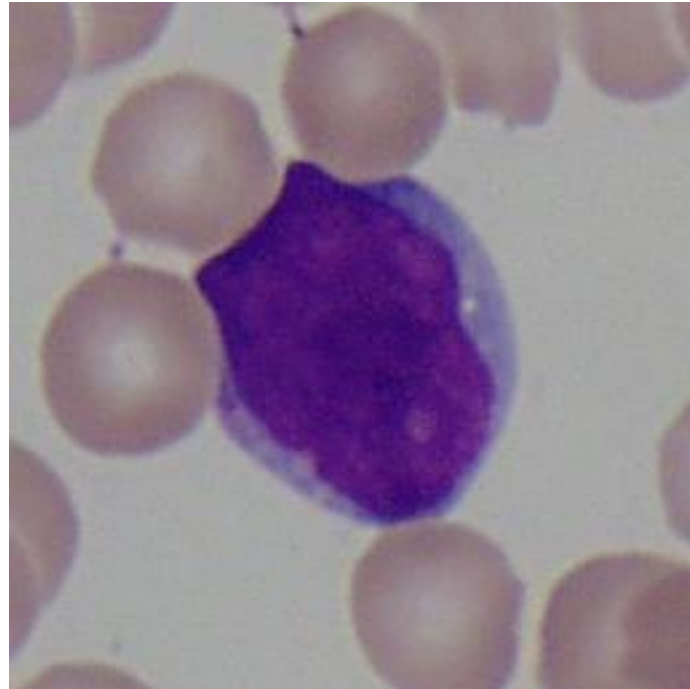
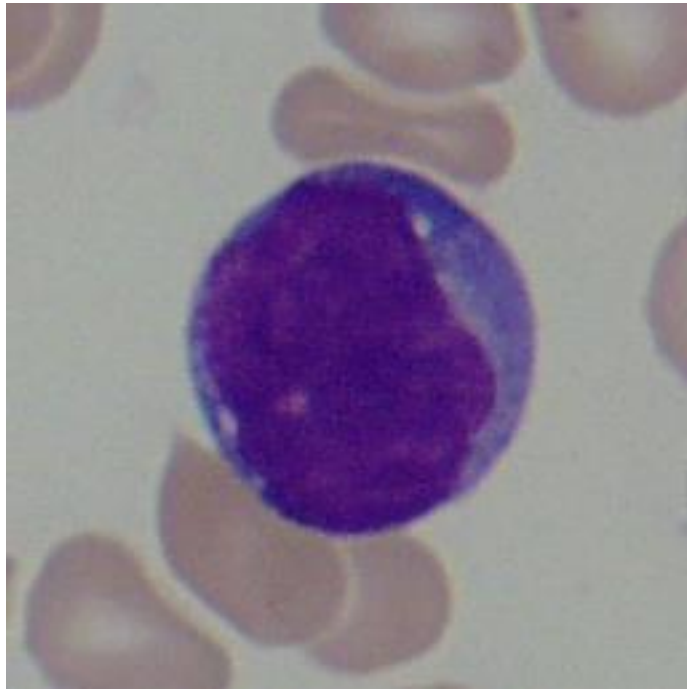


Triangular histogram thresholding: exercise

- <https://it.mathworks.com/matlabcentral/fileexchange/28047-gray-image-thresholding-using-the-triangle-method>

Percentiles of the histogram

- Exercise



Color-based segmentation using k-means clustering

- <https://it.mathworks.com/help/images/examples/color-based-segmentation-using-k-means-clustering.html>

Edge-based segmentation

- <https://it.mathworks.com/help/images/ref/edge.html>
- <https://it.mathworks.com/help/images/edge-detection.html#buh9y1p-13>
- <https://it.mathworks.com/help/images/examples/detecting-a-cell-using-image-segmentation.html>

Watershed segmentation

- <https://it.mathworks.com/company/newsletters/articles/the-watershed-transform-strategies-for-image-segmentation.html>
- <https://it.mathworks.com/help/images/examples/marker-controlled-watershed-segmentation.html?prodcode=IP&language=en>

Previous knowledge

- Detect circles with various radii in grayscale image via Hough Transform
- <https://it.mathworks.com/matlabcentral/fileexchange/9168-detect-circles-with-various-radii-in-grayscale-image-via-hough-transform>

Exercise

- Images acquired in our laboratory