

Assignment 1

Submission Deadline: 01.05.2024

Based on a satellite image (`input_sat_image.jpg`) of low contrast, you are supposed to **extract the water surfaces** in the city area. That is, water surfaces are to be treated as the foreground, while all other surfaces represent the background of the image.

Task 1) Image Enhancement

Implement a function to **enhance the contrast** of an image. For that purpose, first convert your color image into a grayscale image (`imread`, `mean`, `rgb2gray`, ...).

- Visualize the initial image and the corresponding *histogram* (`figure`, `imshow`, `imhist`).
- Shortly describe the characteristics of the histogram.
- Enhance the image using *contrast stretching* (provide **self-written code**; built-in `min`, `max` are allowed).
- Shortly describe the differences to the initial histogram.
- Visualize the resulting enhanced image.

Task 2) Binarization

Write a function for **thresholding** the enhanced image of **Task 1)**

- Convert the enhanced image to a *binary mask*, where 0 = **background** and 1 = **foreground**, i.e. water surfaces in `input_sat_image.jpg` (`graythresh`, `im2bw`, `<`, `>`).
- Visualize the resulting binary mask (`~`).
- Test a number of different threshold values and describe the effects. Did you experience any difficulties while searching for an appropriate threshold value?

Task 3) Morphological Operators

Write a function for **morphological filtering** of the binary mask obtained in **Task 2)**

- Successively** apply morphological *opening* and *closing* on the mask (`imopen`, `imclose`).
- Visualize an overlay of the contrast enhanced image and the final filtered mask.

Task 4) Results Evaluation

Write a **main function** which sequentially executes the functions from **Tasks 1) to 3)**.

- Are the results satisfactory? What are the limitations of this approach for foreground-background separation?
- Test your main function with a **different low-contrast input image** of your choice. Do you notice a significant difference with respect to quality of the results for the different input images?

Sample results based on `input_sat_image.jpg`:

