

TP4

November 9, 2023

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Imagerie Numérique 2023 Automne

November 10, 2023

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TP Class N°4 - Histograms and point operations

Instructions :

- This TP should be completed and uploaded on Moodle before **Thursday 23 November 2023, 23h59**.
- The name of the file you upload should be **TP4_name_surname.ipynb**.
- If you need to include attached files to you TP, please archive them together in a folder named **TP4_name_surname.zip**.

0.1 Exercise 1. Exposure analysis

You are given 3 images: *img_1.png*, *img_2.png* and *img_3.png*.

- (a) Plot the histograms of these images using the *histogram(.)* function from the *skimage* package.

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- (b) Try to detect if these images have problems with exposure. If yes, identify the reasons of these problems via histogram analysis.

Answer here

- (c) Suggest an automatic procedure for detection of under/over-exposure in images.

Answer here

0.2 Exercise 2. Contrast analysis

You are given 3 images: *img_4.png*, *img_5.png* and *img_6.png*.

Detect and identify contrast problems in these images, if any. Justify your answer based on the analysis of the histograms.

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0.3 Exercise 3. Contrast adjustment

Important! For color images, the histogram analysis should be performed individually on each color channel.

- (a) Write a function that performs an image contrast adjustment (stretching). For more details see Theme 4.

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- (b) Apply your contrast adjustment function to the image *img_9.png*. Show image histogram before and after adjustment. Explain the result.

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- (c) Apply the *rescale_intensity(.)* function from the *skimage* package to the original image. Compare the result with the results of your function. Explain the differences in image quality, if any.

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- (d) Perform the sub-exercise (c) with *in_range* parameter defined by using *np.percentile(.)* with *q* parameter equals to (5, 95). Explain the difference between (c) and (d).

Hint : `start, end = np.percentile(image, (5, 95))` adjusted image = `rescale_intensity(image, in range=(start, end))`

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0.4 Exercise 4. Histogram equalization

- (a) Perform histogram equalization to the image *img_11.png* by using *equalize_hist(.)* function from the *skimage* package.

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- (b) Display the image histogram before and after equalization. Explain what the histogram equalization does.

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0.5 Exercise 5. Histogram matching

- (a) Apply the function *match_histograms(.)* from *skimage* package to *img_4.png* using *img_2.png* as a reference.

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- (b) Display the histograms of *img_2.png*, *img_4.png* before transformation and *img_4.png* after transformation.

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(c) Answer to the following questions:

- What does this function do ?
- How does this function work ?
- What can we use it for ?

Answer here

0.6 Exercise 6. Gamma Correction

(a) Write a function that performs image gamma correction. For more details see Theme 4.

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(b) Apply your function to *img_3.png*, for various gamma values. Try to determine the gamma value that best improves the visual image quality.

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(c) Visualize the image before and after correction. Explain the result.

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0.7 Exercise 7. Digital negatives

(a) Write a function that transforms an image into its digital negative.

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(b) Choose 2 images from *img_1.png* to *img_8.png* and compute their digital negative. Visualize both the original and negative images.

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(c) Explain in which situation this transformation could be useful.

Answer here

0.8 Exercise 8. Image masking

You are given the image *img_10.png*.

(a) Perform image thresholding to obtain a binary segmentation mask. Display the results for various choices of threshold values.

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(b) Perform a pixel-wise multiplication between the original image and the various segmentation masks to obtain masked versions of the original image at different threshold. Display the results.

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(c) Which threshold value works best for the segmentation of the statuette ?

Answer here

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