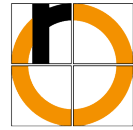


A2I2 – Basic Image Processing Exercise

Summer 2020
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Filter

1. The following values represent a row of pixels of a grayscale image:

1, 0, 2, 2, 2, 8, 2, 3, 6, 6, 6

Compute the convolution (filter) of this image row using a 1D filter mask:

- mask $\frac{1}{3}$ [1 1 1]
- mask [1 0 -1]
- use a 1x3 sized Median filter

2. The following table shows a small grayscale image. Filter the image and fill in the result in the empty tables below.

1	1	4	4
1	1	4	4
1	1	4	4
1	1	4	4

- a. apply a 3x3 mean filter

- b. apply a 3x3 Median

- [illegible]

- [illegible]

- [illegible]

Programming Exercise – Python / scikit-image

A small Python-program loading/filtering a test image and displaying the result is provided for download in the Learning Campus. You can either run it using a local installation of Python/scikit-image, or copy/paste the code to an Azure-Python-Notebook.

You will find an overview over other built-in test images here:

https://scikit-image.org/docs/stable/auto_examples/data/plot_general.html#sphx-glr-auto-examples-data-plot-general-py

- a) The example code filters the converted grayscale image using a Gaussian low-pass filter and a mean low-pass filter. What is the influence of the “stddev” parameter on the resulting image? What is the “morpho.square()” function good for? Which other options are available instead of “square()”?
- b) Add a Median filter, horizontal/vertical Sobel, combined Sobel, and Laplace filter. (Always filter the original grayscale image)
- c) What are the data ranges of the pixel values in the original grayscale image compared to the filtered images?
- d) How can you apply a user-defined filter mask?
Hint: This is not possible within scikit-image, as it extends (but does not duplicate) the functionality of SciPy – go looking there for a convolution operation and implement the application of a 3x3 Gaussian filter mask as presented in the lecture slides.
- e) Concatenate filters: First apply a low-pass (e.g. Gaussian, Mean) with increasing filter sizes, followed by Sobel. What is the effect of the filtering?
- f) Try the morphological operations erosion, dilation, opening, closing; use a binary test image like `binary_blobs` for this exercise.