

FIRST PRACTICAL WORK

MASSIVE COMPUTATION

2022

DATA SCIENCE AND ENGINEERING

DESIGN OF AN IMAGE FILTER FUNCTION, PARALLELIZABLE AND SCALABLE

1)

You have to design and implement a filter function, in an independent module, which complains the follow characteristics:

<code>def image_filter(image: numpy array,</code>
<code>filter_mask: numpy array 2D,</code>
<code>numprocessors: int</code>
<code>filtered_image: multiprocessing.Array)</code>

- Receive an original image, a filter definition (filter mask) and the number of processes in which the filter must be parallelized, and shared memory variable.
- The image must be shared between parallel processes using global read/only memory data.
- The filtered image must be stored in a shared read/write memory witch locks, to avoid any race condition possible.
- The filter shape could be variable: 5x5, 5x1, 1x5, 3x3, 3x1, 1x3.
 - You should take care in the image boundaries and borders. When you evaluate the first or last columns or rows, and if the filter exceeds the boundaries, the last available row or column must be repeated.
 - The filters will be provided by the tester. The sum of all terms in the filter will not exceed 1 and could have positive and negative values.
- The images shape will be variable. Could have 1 or 3 layers. The values will be positive integer values, between 0 and 255.
- The output image must be a filtered image, with the same shape and values between 0 and 255 and stored in the shared memory space.

2)

<code>def filters_execution(image: numpy array,</code>
<code>filter_mask1: numpy array 2D,</code>
<code>filter_mask2: numpy array 2D,</code>
<code>numprocessors: int</code>
<code>filtered_image1: multiprocessing.Array,</code>
<code>filtered_image2: multiprocessing.Array)</code>

You have to write a second module, which implements a function which invokes 2 different parallel processes, each process will execute a filter, with different filter definition, one half of the processors supplied, and two shared memory definitions. The function must invoke the previous defined function and must wait to both filters finished before return the control.

3)

You have to fill the provided a notebook, following the instructions, and filled the cells to load your module or modules, and invokes you functions, using the provided example images and filter masks.

The code must be well commented, indicating the different steps you are executing.

You can change the images and filters definitions, to test the stability of your code.

Your code will be tested with different images and filters in order to get your grade.