

ECE/OPTI 532, Spring 2023  
Homework 1 Assignment  
Due Tue. Jan. 31

Write a computer program (MATLAB, Python, or C/C++) to perform rms filtering. (There are better methods for image filtering, but this is a good introduction to image processing programming.)

Let  $x(r, c)$  be the input image. For each pixel, calculate the output pixel value to be the square root of the mean of the squared pixel values within a radius of  $R$  pixels.

Specifically, define a “circular” disk neighborhood  $N_R(r, c)$  centered at coordinates  $(r, c)$  and having radius  $R$ . Pixel  $(m, n)$  is an element of  $N_R(r, c)$  if the Euclidean distance from  $(m, n)$  to  $(r, c)$  is less than or equal to  $R$ . Let  $\# \{N_R(r, c)\}$  be the number of pixels in  $N_R(r, c)$ . Calculate the output as

$$y(r, c) = \sqrt{\frac{1}{\# \{N_R(r, c)\}} \sum_{(r, c) \in N_R(r, c)} x^2(r, c)}$$

Replication padding or symmetric (mirror-image) padding is recommended, but not required. If you do not use array padding, then you must do bounds checking to ensure that you exclude out-of-bounds pixels from the calculation.

Run your program on the provided cman image using  $R = 6$ .

For comparison, apply a 13-by-13 local average filter to blur the cman image.

Submit the following:

- Your source code in a file format that allows it to be compiled and executed.
- Numerical pixel values of your rms filtered output for the following region:
  - If your array origin is at  $(r, c) = (0, 0)$ , show the numerical output pixel values for  $309 \leq r \leq 313$ ,  $309 \leq c \leq 313$  in a square array arrangement to facilitate grading.
  - If you are using MATLAB with array origin at  $(r, c) = (1, 1)$ , show the numerical output pixel values for  $310 \leq r \leq 314$ ,  $310 \leq c \leq 314$  in a square array arrangement to facilitate grading.
- Numerical pixel values of the 13-by-13 local average output for the same region.