Assignment 3a

Due by October 24, 2019

This project is to implement image convolution with different kernels. The convolution of the function f with a *kernel* w is defined as

$$g(x,y) = (w * f)(x,y) = \sum_{s=-a}^{a} \sum_{t=-b}^{b} w(s,t) f(x-s, y-t) \tag{1}$$

Let $f(x,y),\ 0 \le x \le m,\ 0 \le y \le n$ be a gray image and $w_1(s,t),\ w_2(s,t),\ w_3(s,t),\ -1 \le s,t \le 1$ be three 3×3 kernels defined as follows.

$$w_1 = \begin{bmatrix} 1 & 0 & -1 \\ 0 & 0 & 0 \\ -1 & 0 & 1 \end{bmatrix}, \quad w_2 = \begin{bmatrix} 1 & 0 & 1 \\ 0 & -4 & 0 \\ 1 & 0 & 1 \end{bmatrix}, \quad w_3 = \begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$$

Do image convolution with the above three kernels on images described below.

(a) 480×480 arrayR.raw (a microarray image)
(b) 480×640 gelm1.raw (an electrophoresis gel image)
(c) 512×512 mandrill.raw
(d) 512×512 peppers.raw

Report each image associated with the results of 3 convolution results by slightly and uniformly rescaled the results.

You have to turn in image displays together with part of source codes, for example, C/C++, Matlab, Java, Python, and etc.