

Homework 2 Linear Filtering

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February 6, 2020

1 Question 1

1.1 Steps

1.1.1 Pad the image 4 by 4 image by 1 with values replicating the edge values.

Padded image.

$$\begin{bmatrix} 10 & 10 & 8 & -2 & 0 & 0 \\ 10 & 10 & 8 & -2 & 0 & 0 \\ 1 & 1 & 6 & 3 & 5 & 5 \\ 3 & 3 & 2 & -4 & 11 & 11 \\ 7 & 7 & -1 & 7 & 1 & 1 \\ 7 & 7 & -1 & 7 & 1 & 1 \end{bmatrix}$$

1.1.2 Sliding the filter over the padded image

To calculate the resultant image I center the kernel on the pixel which is to be calculated, e.g if 0,0 of the resultant image is to be calculated then I center the kernel on padded image to coincide with 1,1 of the padded image (as I pad the image with 1 on all the edges).

1.1.3 Calculating A

$$\begin{bmatrix} -2 & 0 & 0 \\ -2 & 0 & 0 \\ 3 & 5 & 5 \end{bmatrix} * \begin{bmatrix} -2 & 3 & -1 \\ 4 & -1 & 2 \\ 0 & 5 & 3 \end{bmatrix} = \begin{bmatrix} 4 & 0 & 0 \\ -8 & 0 & 0 \\ 0 & 25 & 15 \end{bmatrix} \text{ Summing up all the element.}$$

$$A = 36$$

Similarly,

$$B = 22, C = 40, D = 52$$

2 Question 2

2.1 Final Answer generated using Code

71	73	42	36
38	8	22	109
40	31	64	7
52	63	2	67

3 Question 3

3.1 Result



Figure 1: Filtered Image

4 Libraries/functions used

1. Numpy
2. CV2
1. `np.pad()` : it pads the given array with the number of padded bits, used with `mode = 'edge'` which repeats the values on the edge into the padded bits.
2. `cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)` : to convert the BGR channels of the image to Gray scale.