ECE 558

Digital Imaging Systems

Project #1

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Q1>

(b)

In the given image of 1024 × 1024, where we have zeros everywhere and 1 at [512, 512].

When we apply Convolution with box filter

$$K = \frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$, we get

	510	511	512	513	514
510	0	0	0	0	0
511	0	0	0	0	0
512	0	0	255	0	0
513	0	0	0	0	0
514	0	0	0	0	0

So, when kernal reaches as shown in the above figure, we get convoluted value at the position [511, 511] as shown by a circle in the above figure. Similarly, we get the convoluted images as below.

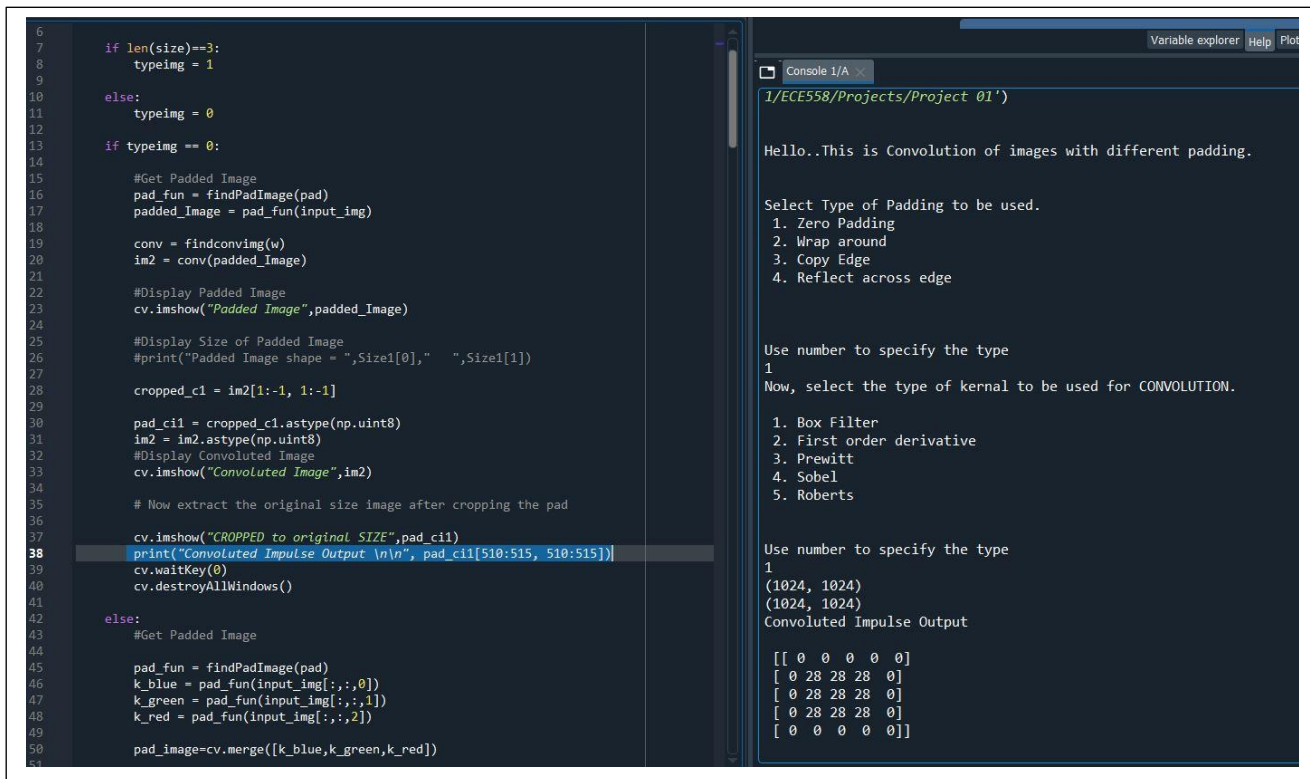|	510	511	512	513	514
510	0	0	0	0	0
511	0	28	28	28	0
512	0	28	28	28	0
513	0	28	28	28	0
514	0	0	0	0	0

figure (2)

Average Value =

$$\frac{1}{9}\times 0 + \frac{1}{9}\times 0 + \frac{1}{9}\times 0 + \frac{1}{9}\times 0 + \frac{1}{9}\times 0 + \frac{1}{9}\times 0 +$$

$$\frac{1}{9}\times 0 + \frac{1}{9}\times 0 + \frac{1}{9}\times 255$$

$$= 28.3 \approx 28$$

In the next figure (2), we can see the position of the last cell (513, 513) which will be convoluted by this kernal.

All the result images are attached inside "Q1_images" folder in the zipped file.

In the output window, we can see that pixel values are changed to 28. This proves that the algorithm is performing convolution.

Question 2

Python code "Q2.py" inside "hshukla_codes" folder which is attached in the zip folder.

Results are attached inside "Q2_images" folder in the zipped file.