German University in Cairo

Media Engineering and Technology

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DMET 901: Computer Vision

Assignment 2, Deadline: 5th of August 2023

In this assignment, the main aim is to emphasize on the concept of kernel convolution from a practical side. More precisely, given a couple of input images (input1.jpg and input2.jpg) to experiment with, you will be asked to perform kernel convolution using different input kernels. Following that, comment on your findings in terms of describing the possible effect of the kernel on the image.

Q1: Required Kernels:

$$
1.\begin{bmatrix} 1/9 & 1/9 & 1/9 \\ 1/9 & 1/9 & 1/9 \\ 1/9 & 1/9 & 1/9 \end{bmatrix}
\qquad
2.\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}
$$

$$
3.\begin{bmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ -1 & -1 & -1 \end{bmatrix}
\qquad
4.\begin{bmatrix} 1 & 0 & -1 \\ 1 & 0 & -1 \\ 1 & 0 & -1 \end{bmatrix}
$$

$$
5.\begin{bmatrix} -1 & -1 & -1 \\ -1 & 9 & -1 \\ -1 & -1 & -1 \end{bmatrix}
\qquad
6.\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}
$$

$$
7.\begin{bmatrix} -2 & -1 & 0 \\ -1 & 0 & 1 \\ 0 & 1 & 2 \end{bmatrix}
\qquad
8.\begin{bmatrix} -2 & -1 & 0 \\ -1 & 1 & 1 \\ 0 & 1 & 2 \end{bmatrix}
$$

Q2: Image Enhancement: Perform contrast stretching and histogram equalization on Input3.jpg.
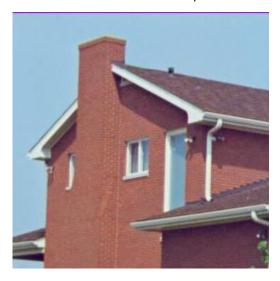
Assignment Requirements:

1. This assignment is to be implemented using Python over Google Colab.
2. You are allowed to use predefined functions in the OpenCV library.
3. In Q1, the eight test scenarios are to be performed (using image Input1.jpg and Input2.jpg), with displaying all output images.
4. Input images are loaded and operated on in the RGB color range.
5. Provide a brief discussion of each output demonstrating your analysis (visually) and findings performing these tests. This discussion is to be provided as a comment on your code.
6. Assignment is to be implemented individually, cheating detection will be applied.

Starter Code:

1. Imports:
   - `import cv2`: to import the library of OpenCV in order to use its pre-defined functions.
   - `from matplotlib import pyplot as plt`: used for the image display function demonstrated later.
2. Image Display:

```
def displayImages(imgs):
  r = len(imgs)//2
  if len(imgs) % 2 != 0:
    r+=1
  plt.subplots(nrows=r, ncols=2, figsize=(20, 20))
  for i in range (0, len(imgs)):
    plt.subplot(r,2,i+1)
    plt.imshow(imgs[i])
```

This function is used to display a set of images in a grid form of dimensions ($\frac{\#imgs}{2}$, 2).

For each of the required tests, each generated output image is to be generated then added to a list, which this method is to be invoked on.

Input1

Input2

Input3