Style Swap - Assignment 1

Gaurav Kumar Rampuria

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1 Introduction

The first assignment was on edge detection and we perform edge detection on any image entered by the user using convolution. We use 3 kernels / operators for this:-

- Robert Operator
- Sobel Feldman Operator
- Scharr Operator

The basic steps involved are:-

2 Basic Setup

We import the necessary dependencies - cv2, numpy, matplotlib, and a google colab dependency 'files' to input images from the user. We then upload the image from the user end, read the filename, read the image in grayscale and then display it. **We scale the pixels of the image from 0 to 255, to 0 to 1, by dividing by 255.**

3 Convolver Class

Now we create a convolver class which has the kernel and the image as attributes. We declare the final shape of the image (assuming stride = 1 and padding = 0), and create an initial zero matrix of that shape. We declare the relu activation function, wherein any negative element of a matrix becomes 0 while the non negative numbers stay the same. This is to deal with non negative pixels. Next, we declare a function to normalise the functions for which we use the formula:

$$\frac{value - min}{\max - min}$$

We now create the convolver function - it emulates the process of convolution with the filter sliding over the image and performing matrix multiplication to generate the required matrix. We call relu and norm on this matrix and then return it.

4 Blurring the image

We blur the image using the normalized box filter. We use a 5 x 5 kernel, filled with ones, divided by 25 as our kernel.

Now we apply each of the edge detectors. In each operator we calculate the the 2 matrices after convolution, and then take the square root of the sum of squares of each pixel to get the final superimposed image, which is then displayed on screen.

5 Robert Operator

The two pairs of Robert Operator are:

0	1
-1	0

Robert X

1	0
0	-1

Robert Y

6 Sobel Feldman Operator

The two pairs of the Sobel Feldman Operator are:

-1	0	1
-2	0	2
-1	0	1

Sobel Feldman X

-1	-2	-1
0	0	0
1	2	1

Sobel Feldman Y

7 Scharr Operator

The two pairs of the Scharr Operator are:

-3	0	3
-10	0	10
-3	0	3

Scharr X

-3	-10	-3
0	0	0
3	10	3

Scharr Y