IMAGE PROCESSING ASSIGNMENT-1

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ABSTRACT

I have developed tool to perform the basic intensity transformation on the Images. Images here can be grey scale or color but only images of the type png,jpeg,jpg,xmp are accepted as input. Intensity transforms that can be performed on this images using the tool are Histogram Equalization, Gamma transform, Log transform, Blurring Image, Sharpening Image and Edge detection using Sobel operators is added as the additional transform. All of these transforms are applied on some of the images and the results are shown in this report.

1. INTRODUCTION

Main idea behind this tool is to implement various transformation techniques on any of the image.Images can be of many types like color, grey scale etc. Different Images have different underlying data representations like color images can be represented with 3 arrays if the pixel intensities are represented in RGB format, Same image if represented in HSV format will have arrays corresponding to H,S,V respectively each array element will be the value of Hue,Saturation and Value. Similarly grey scale is one in which the value of each pixel represents intensity information. This tool will convert any image given to it into its HSV data and performs all the operations on the Intensity(V) array and then merge it with the original Hue(H) and Saturation(S) arrays to get back the original image.

2. BACKGROUND READ

This tool is implemented using Python. I have used PyQt4 binding for implementing GUI it runs on Windows, Linux, Mac OS X and various UNIX platforms. It does not support Android and iOS. To handle color and grey scale images opencv library is used. Any image uploaded will be considered as color image and its HSV arrays are extracted. To perform operations on the Intensity values numpy library is used

3. APPROACH

Apart from transformations there are some file handling and operation control features in this tool. Every operation is associated with a button or scroll bar(only for sharpening image). Each button in turn when clicked calls the corresponding method to perform the operation on the image. Before any change is made to the data it is stored in a global variable so that the Undo functionality can be implemented easily. Each of the transform that is implemented by this tool and approach followed to implement it is listed below

3.1. Histogram Equalization

Histogram equalization is implemented by taking the CDF of the pixel intensities, for each intensity level number of such pixels in the image are found and this result is stored in a variable(CDF) and it is updated for every intensity level by adding the previous value also the new intensity is calculated by dividing it with the size of the image and then multiplying it with maximum intensityi.e.,255.

3.2. Gamma transform

Each intensity value of the original image is multiplied by a constant and raised to the power of gamma given by the user. In this tool constant for gamma transform is choosen to be 1.So if the user gives gamma to be less than 1 all the intensity values are reduced and the image appears darker. Similarly if gamma is greater than 1 image appears brighter.

3.3. Log transform

Each intensity value of the original image is multiplied by a constant and log of that value is taken as new intensity. In this tool constant for log transform is chosen to be 46 because the intensity range from images is from 0 to 255. log of these values would result in values from 0 to 5.54 to keep the range of intensities same constant is chosen to be 46.

3.4. Blurring Image

To blur an image blurring kernel is used. Gaussian kernel is used and the window size of the kernel is determined by the sigma(variance) value given by the user larger the sigma value more blurring happens and vice-verse. After sigma is taken from the user kernel of size $(2 * sigma, 2 * sigma)$ is formed and the image is convolved with the filter(kernel) to get the blurred image.

3.5. Sharpening Image

To Sharpen an image kernel is used. Laplacian kernel is used and the window size of the kernel $(3, 3)$ is formed and the image is convolved with the image to get the sharpened image. Extent of sharpening is controlled with the scroll bar minimum value of the scroll bar is 1 and maximum is 10. If scroll bar is set to 1 the resultant image is the sum of original image and convolved image. Similarly if the scroll bar is set to 10 the resultant image is sum of the original image and 10 times the convolved image.

3.6. Sobel operators(Horizontal and vertical edge detection)

To detect edges kernel is used. Here Sobel kernel is used and the window size of the kernel $(3, 3)$ is formed and the image is convolved with the image to get the sharpened image. Two kernels are used to detect 2 edges (horizontal and vertical) and the result of both of them is added to display the horizontal and vertical edges.

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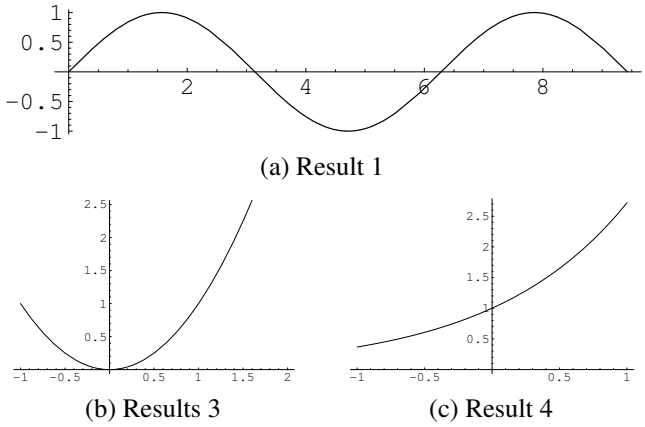

(a) Result 1

(b) Results 3

(c) Result 4

Fig. 1. Example of placing a figure with experimental results.

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12. REFERENCES

[1] A.B. Smith, C.D. Jones, and E.F. Roberts, "Article title," *Journal*, vol. 62, pp. 291–294, January 1920.

[2] C.D. Jones, A.B. Smith, and E.F. Roberts, "Article title," in *Proceedings Title*. IEEE, 2003, vol. II, pp. 803–806.