Purpose

The purpose of this project was for us to implement an rbg to hsi transformation. Another thing we did for this project was DCT or discrete cosine transformation. This project also required us to implement the inverse of DCT. The project also wanted us to discover region of interests somehow.

Compile with make and run with ./assign3

Method

DCT uses cosine and sin to approximate the curve of data. Each number represents a coefficient used for the formula that approximates the curve. The inverse is used to reverse the DCT. The algorithm is a lossy algorithm because it loses information after being passed. Here is the formula for the function

$$\mathrm{DCT(i,\ j)} = \frac{1}{\sqrt{2N}}\,\mathrm{C(i)\ C(j)} \sum_{x=0}^{N-1} \sum_{y=0}^{N-1} \mathrm{pixel(x,\ y)\ COS}\left[\frac{(2x+1)i\pi}{2N}\right] \mathrm{COS}\left[\frac{(2y+1)j\pi}{2N}\right]$$

$$\mathrm{C(x)} = \frac{1}{\sqrt{2}} \text{ if x is 0, else 1 if x} > 0$$

Here is the formula for IDCT

$$S_8(u) = \frac{C_u}{2} \cdot \sum_{x=0}^{7} f(x) \cdot \cos\frac{(2x+1)\,\pi u}{16} = \frac{C_u}{2} \cdot \sum_{x=0}^{7} f(x) \cos\left[\frac{2x\pi u}{16} + \frac{\pi u}{16}\right]$$

$$= \frac{C_u}{2} \cdot \sum_{x=0}^{7} f(x) \cos(\alpha + \beta) = \frac{C_u}{2} \cdot \sum_{x=0}^{7} f(x) \cdot \cos H$$

The HSI transformation is important because it makes certain things easier to compare rather than using rgb space. For example it is easier to create regions for the image Disk.bmp using hue rather than intensity. Mostly because the differences in regions are more obvious than if you compare by intensity. Similarly thresholding in the rbg space is more complicated.

$$I = \frac{1}{3}(R + G + B)$$

$$H = \cos^{-1}\left\{\frac{\frac{1}{2}[(R-G)+(R-B)]}{[(R-G)^2+(R-B)(G-B)]^{1/2}}\right\}$$

$$S = 1 - \frac{3}{(R+G+B)}[\min(R,G,B)]$$

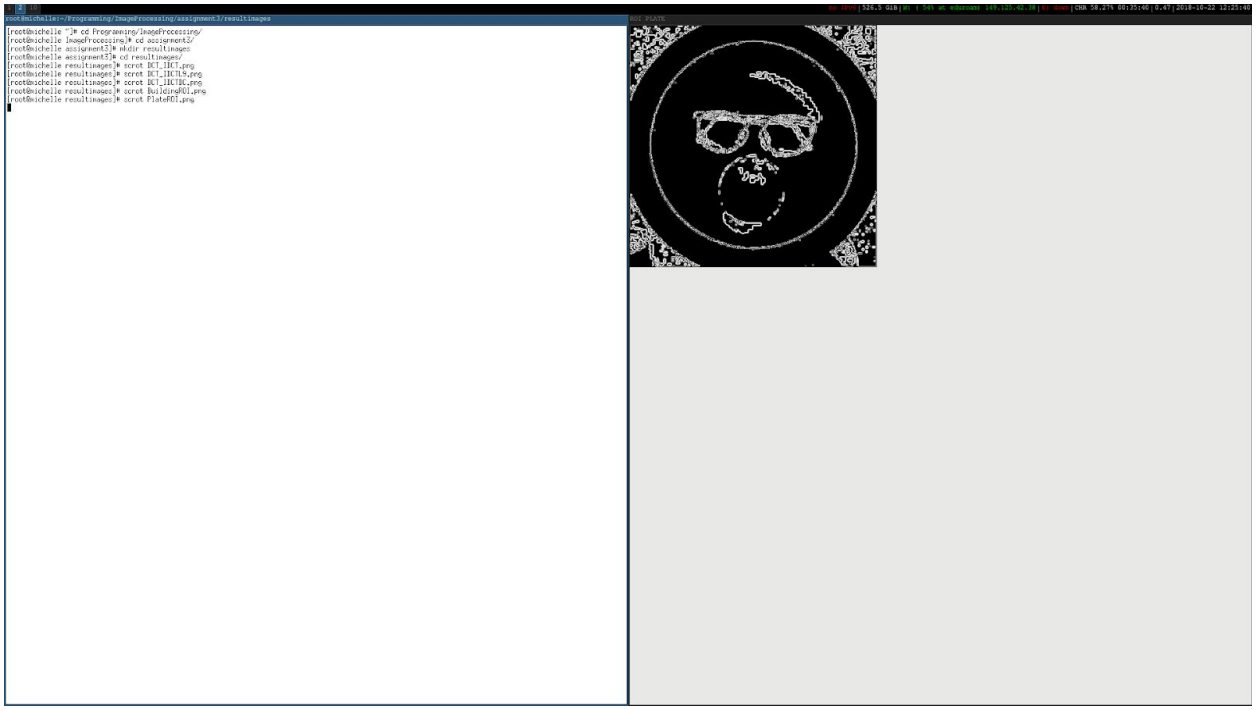
For the sobel edge detection uses 2 3 by 3 kernels to change the original image. There a mask that represent derivatives in the x direction and y direction. The reason the derivatives are important because they helped detect color change.

$$\mathbf{G}_x = \begin{bmatrix} +1 & 0 & -1 \\ +2 & 0 & -2 \\ +1 & 0 & -1 \end{bmatrix} * \mathbf{A} \quad \text{and} \quad \mathbf{G}_y = \begin{bmatrix} +1 & +2 & +1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix} * \mathbf{A}$$

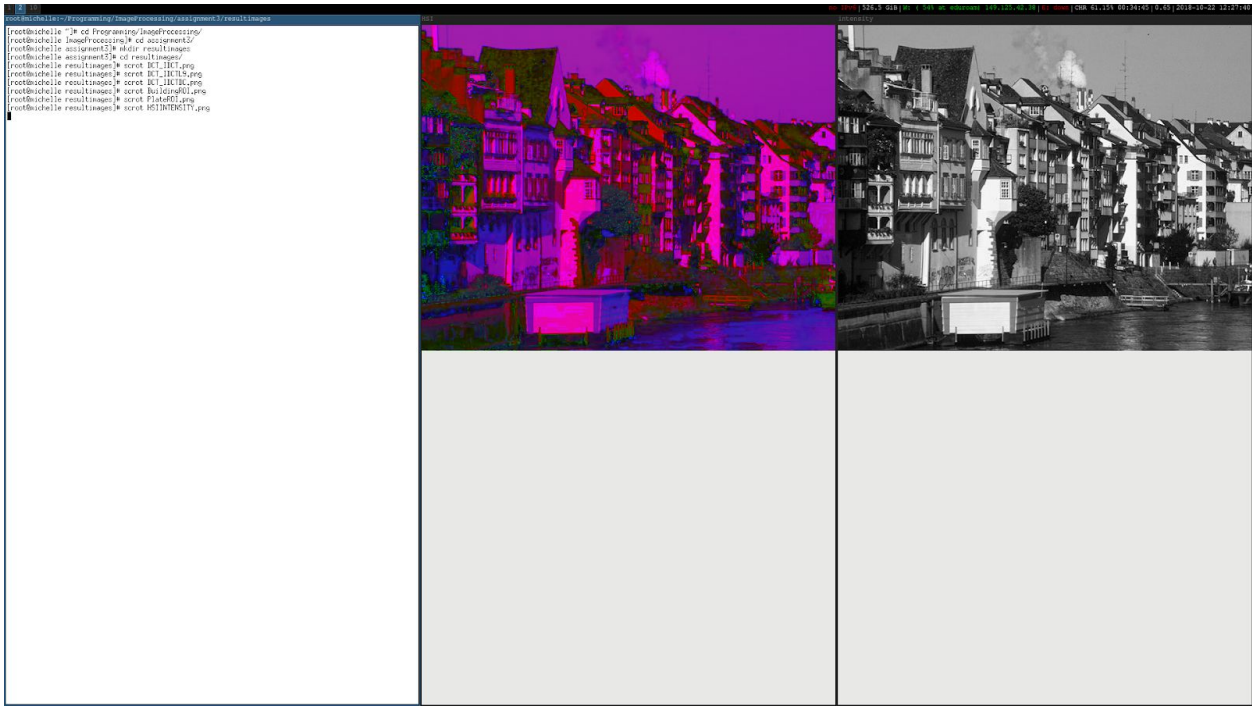
$$\mathbf{G} = \sqrt{\mathbf{G}_x^{\,2} + \mathbf{G}_y^{\,2}}$$

Results

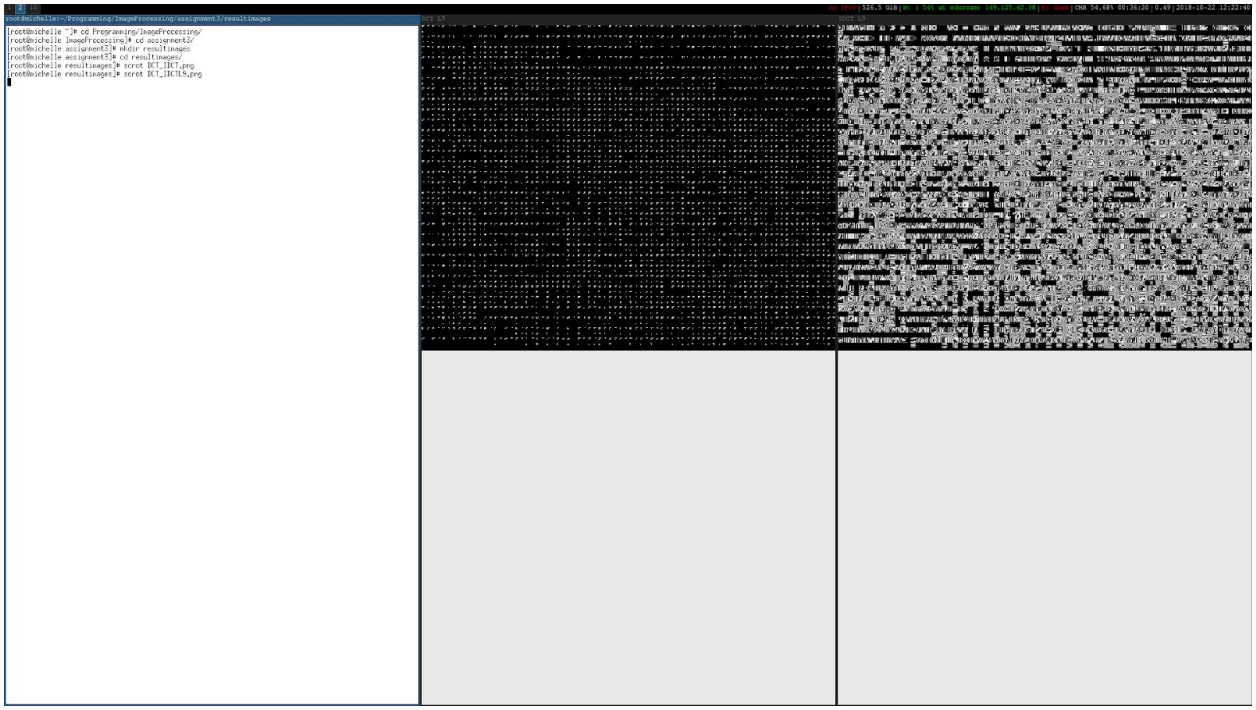
Region of interests of the plate using hue



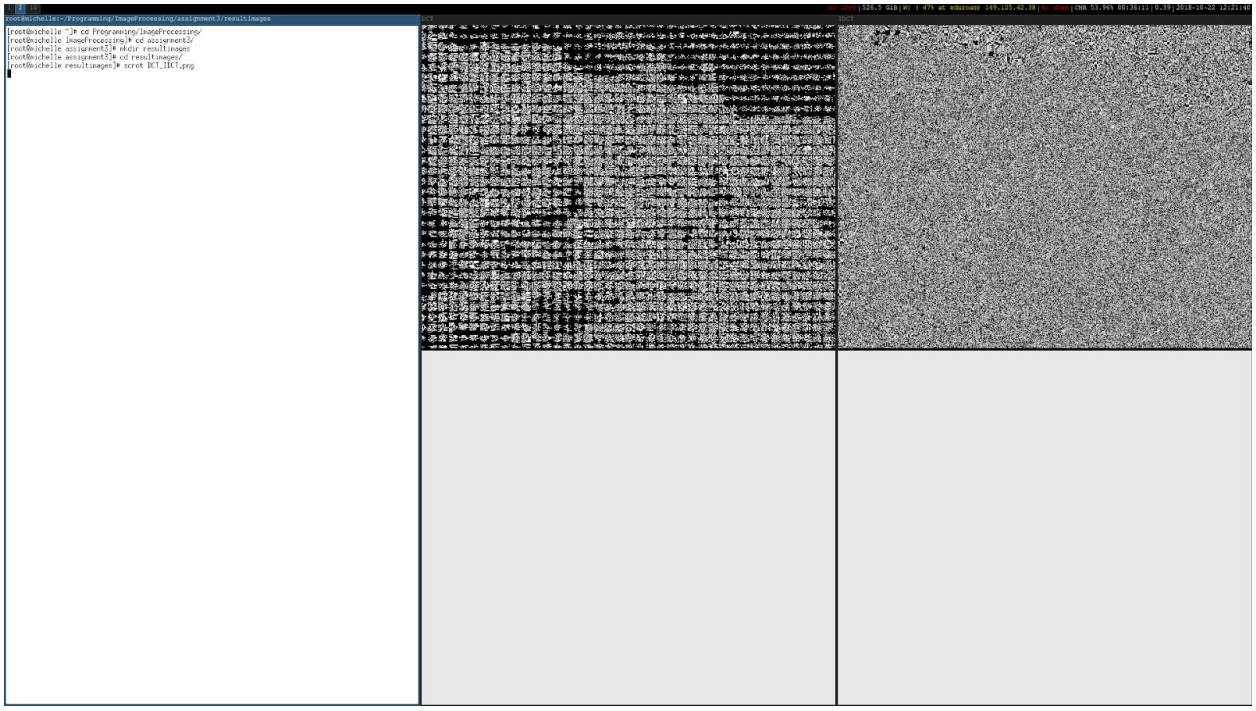
Rgb to Hsi and intensity images



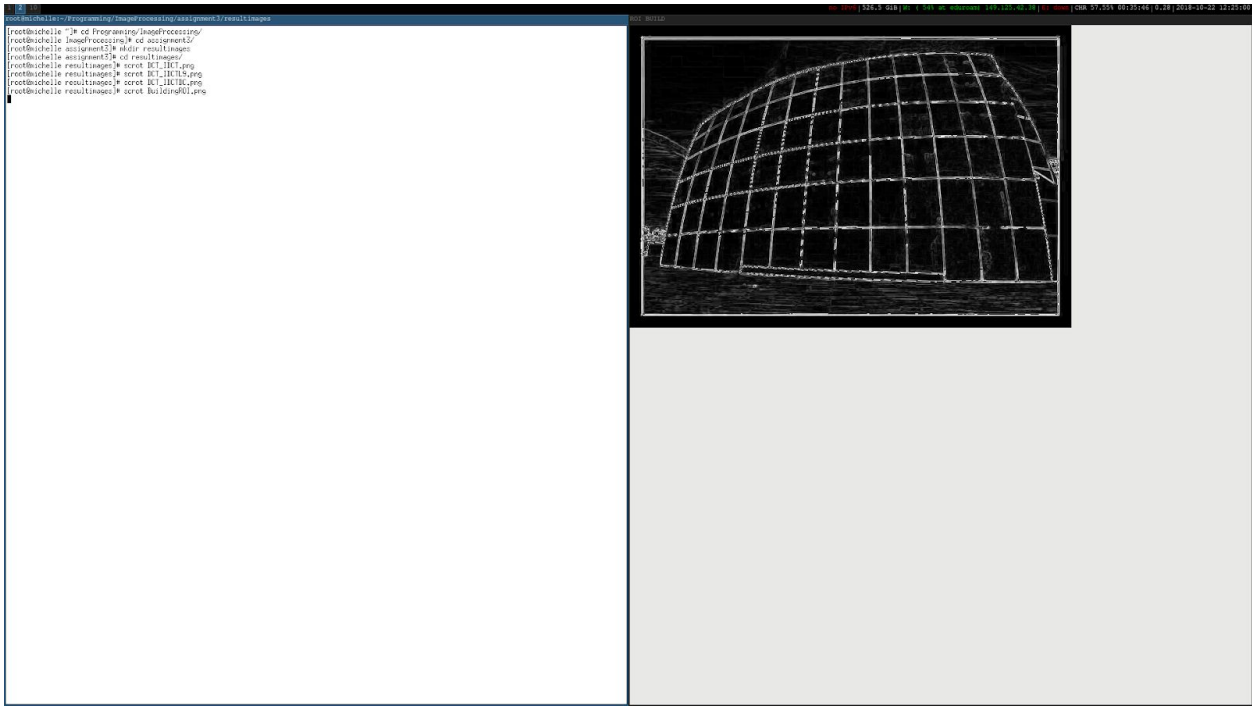
DCT_IDCT L9



DCT_IDCT


[root@michelle ~]# cd Programming/ImageProcessing/
[root@michelle ImageProcessing]# cd assignment3/
[root@michelle assignment3]# mkdir resultimages
[root@michelle assignment3]# cd resultimages/
[root@michelle resultimages]# scrot DCT_IDCT.png

Region of interests of the plate using hue



DCT_IDCT DC