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Assignment 3 Report

Purpose:

To Implement DCT based image compression and Color Based Image Segmentation.

Method:

Part A:

- i) Used this formula for calculating coefficients:

$$T_n(i, l) = \begin{cases} C_n(i, l) & = \sqrt{2/n} K_i \cos\left(\frac{i(l+1/2)\pi}{n}\right) \quad (DCT) \quad \forall i, l = 0, \dots, n-1 \\ \text{with } K_i & = 1/\sqrt{2} \text{ for } i = 0 \text{ and } 1 \text{ otherwise.} \end{cases}$$

- ii) a) For RGB to HSI, used following formula:

$$\begin{aligned} I &= \frac{1}{3}(R + G + B) \\ S &= 1 - \frac{3}{(R + G + B)}[\min(R, G, B)] \\ \text{if } B \leq G & \\ H &= \cos^{-1} \left[\frac{\frac{1}{2}[(R - G) + (R - B)]}{\sqrt{(R - G)^2 + (R - B)(G - B)}} \right] \\ \text{else, } H &= 360 - H \end{aligned}$$

- b) To obtain Intensity image, Assigned 0 values to hue and saturation components.

- c) For DCT compression used following formula:

$$DCT(i, j) = \frac{1}{\sqrt{2N}} C(i) C(j) \sum_{x=0}^{N-1} \sum_{y=0}^{N-1} \text{pixel}(x, y) \cos\left[\frac{(2x+1)i\pi}{2N}\right] \cos\left[\frac{(2y+1)j\pi}{2N}\right]$$
$$C(x) = \frac{1}{\sqrt{2}} \text{ if } x \text{ is 0, else } 1 \text{ if } x > 0$$

- d) Inverse DCT uses following formula:

$$f(i, j) = \frac{2}{N} \sum_{u=0}^{N-1} \sum_{v=0}^{N-1} C(u) C(v) F(u, v) \cos\left[\frac{(2x+1)u\pi}{2N}\right] \cos\left[\frac{(2y+1)v\pi}{2N}\right]$$

Part B: Color Based Image Segmentation:

Used Sobel operator to get edge image.

Results:

Part A:

Calculations:

For { 10 ,11 ,12 ,11 ,12 ,13 ,12 ,11 }:

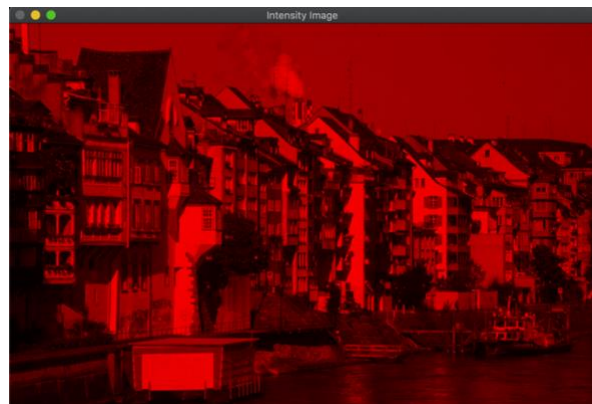
```
32.5269 -1.30079 -1.28591 0.430033 -1.39589 -0.317671 0.563237 0.229684
```

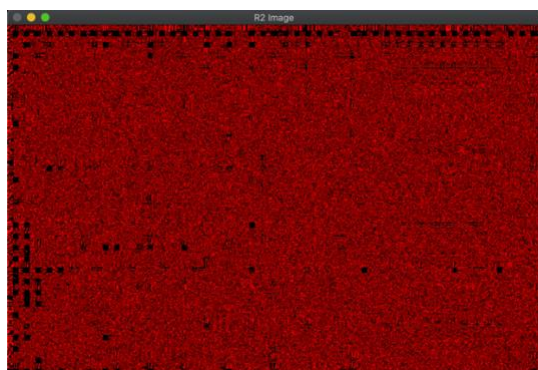
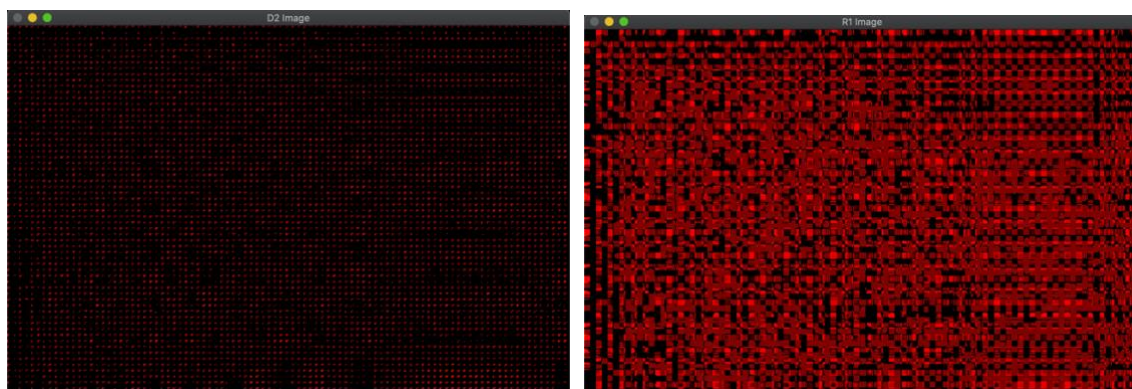
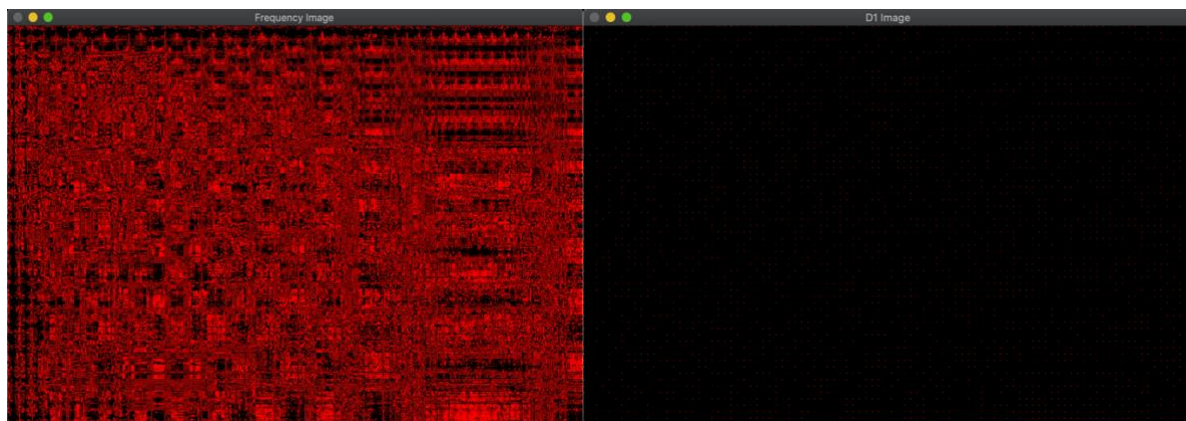
For {10,-10,8,-7,8,-8,7,-7}:

```
0.353553 4.25065 0.349531 5.04878 2.47635 8.38509 1.77059 20.4364
```

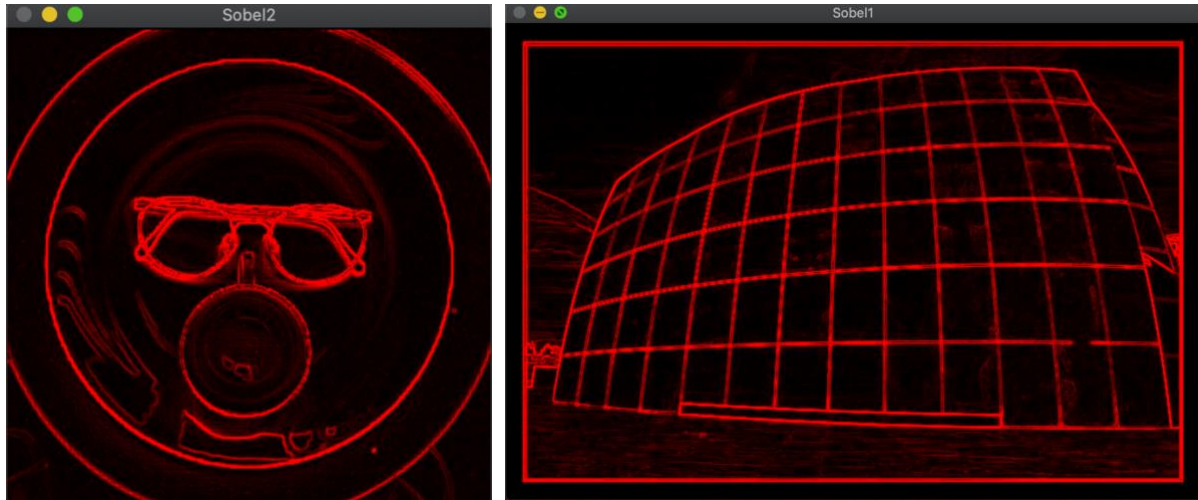
For {10,11,12,11,12,13,12,11,10,-10,8,-7,8,-8,7,-7}:

```
23.25 21.7687 -3.92549 -6.95095 -0.661966 6.03291 -3.26873 -2.5566 0.765283 3.13661 -6.14806 1.63799 1.64443 5.45134 -14.2708 13.7738
```





Part B:



Bugs:

For Part B: Edge detection done using Sobel Operator. Hough transform not implemented.

Optional part not done.

Steps to Execute:

- 1) Open Terminal
- 2) cd into project directory
- 3) Type following command: `g++ $(pkg-config --cflags --libs opencv4) -std=c++11 program_3.cpp`
- 4) Type: `./a.out`