CMPE-460 Laboratory Exercise 3

Characterization of OPB745

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Contents

Abstract

The purpose of this exercise was to develop an understanding behind the functionality and various functional parameters of the OPB745 photo-transducer. In order to test its ability to perform as an opto-isolator, a tube with an adjustable reflective surface was created, and the OPB745 was placed inside in order to isolate any external light source. With the following implemented, the Opto-Isolator functioned accordingly yielding the expected results.

Design Methodology

Design methodology goes here. Follow lab report guidelines. Remember to introduce Figure 2 before it appears in the document. Make sure that your figure labels are below the figure itself and that they have a title.

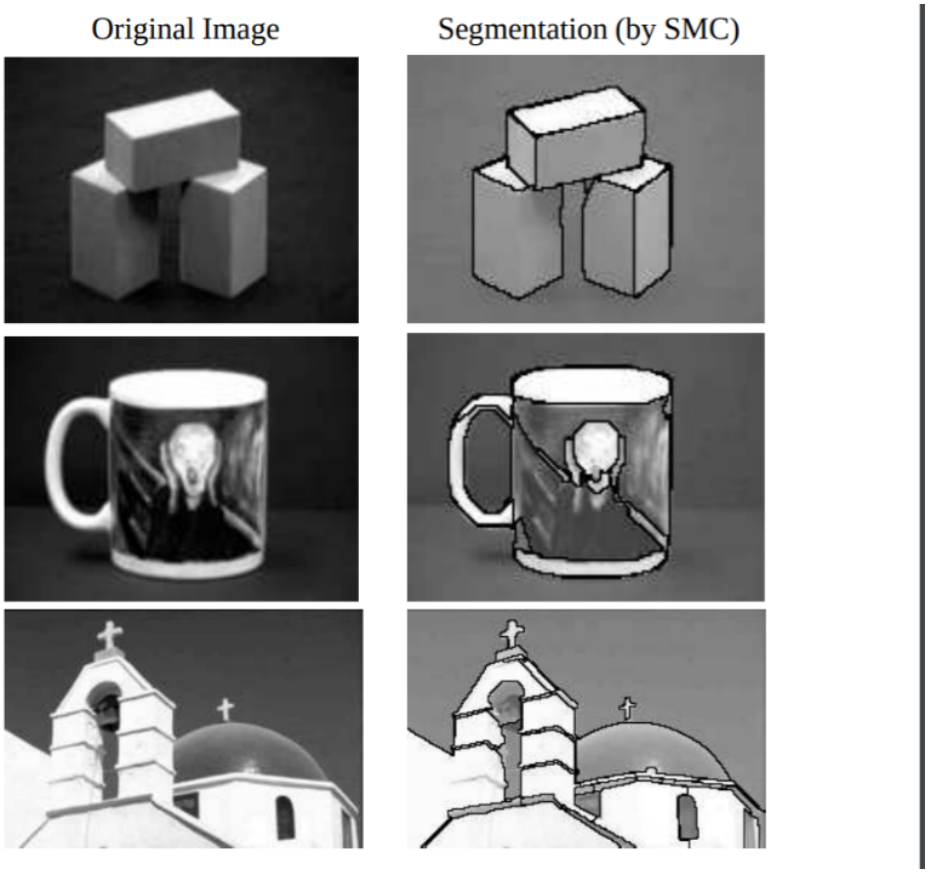

Figure 1: Image Segmentation Examples

Note that unlike mere edge detection, the edges of image segments must form closed regions within the image.

You must cite other works if you are using information from them. However, this is not the case for most laboratory exercises.[2] Another nice feature of LaTeX is how easy it is to put

equations in-line with text. Given an image consisting of N pixels, the number of pixels per superpixel is $\frac{N}{K}$. Furthermore, it follows that the dimension ("step size") of each superpixel is $\sqrt{\frac{N}{K}}$. An example of a numbered list follows this paragraph.

1. Initialize cluster centers by sampling pixels at regular grid steps S
2. Repeat 10 times:
   (a) For each cluster center, do:
      i. Assign the best matching pixels from a $2S \times 2S$ square neighborhood around the cluster center according to the distance measured as a function of both position and color.
   (b) Recalculate cluster centers
3. Enforce connectivity (Merge small regions into large neighboring regions)

Below are some equations. These must be labeled and numbered like figures. Also like figures, they must be introduced first. In this implementation, these parameters were weighted according to the number of superpixels and the segment size. This distance is computed using equations (1) through (3). Note that this algorithm operates over the Lab color space, which is perceptually uniform over the entire range of visible light.

$$d_{lab} = \sqrt{(l_1 - l_0)^2 + (a_1 - a_0)^2 + (b_1 - b_0)^2} \tag{1}$$

$$d_{xy} = \sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2} \tag{2}$$

$$distance = \sqrt{\frac{d_{lab}^2}{num\_clusters} + \frac{d_{xy}^2}{step\_size}} \tag{3}$$

Design Methodology is usually the most tedious part of the lab report.

Results & Analysis

Results and Analysis go here. Follow lab report guidelines. Remember to introduce Figures (2) through (5 before they appear in the document. Make sure that your figure labels are below the figure itself and that they have a title.

Figure 2: Dog (420×240, 76800 pixels)

Figure 3: Elephants (481×321, 154401 pixels)

Figure 4: Toucan (960×640, 614400 pixels)

Figure 5: Lindbloom (148×95, 14060 pixels)

A pair of exemplary segmentations are illustrated in Figures (6) and (7), corresponding to the CPU and GPU implementations respectively. Note that the images are identical.

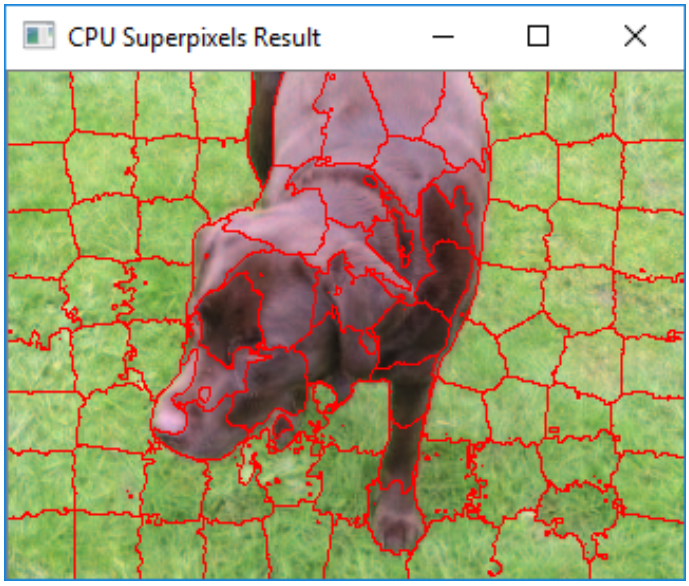

Figure 6: CPU Dog Segmentation, 100 Superpixels

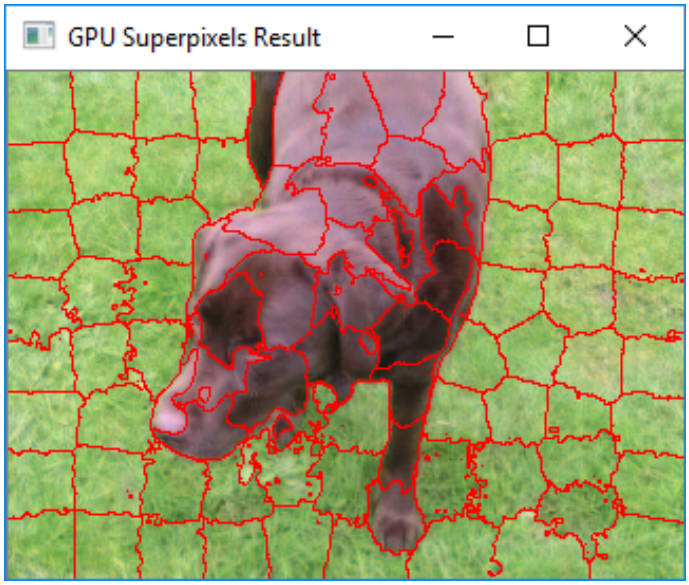

Figure 7: GPU Dog Segmentation, 100 Superpixels

Graphs are very helpful if you're trying to show a trend to the reader. Figures (8), (9), and (10) plot the CPU and GPU execution times of the segmentation of the images of different sizes, with 24, 100, and 400 superpixels respectively. Note that not only does the GPU consistently provide a speedup ¿1, but that the speedup improves with an increasing image size. Moreover, speedup also improves with an increased superpixel size.

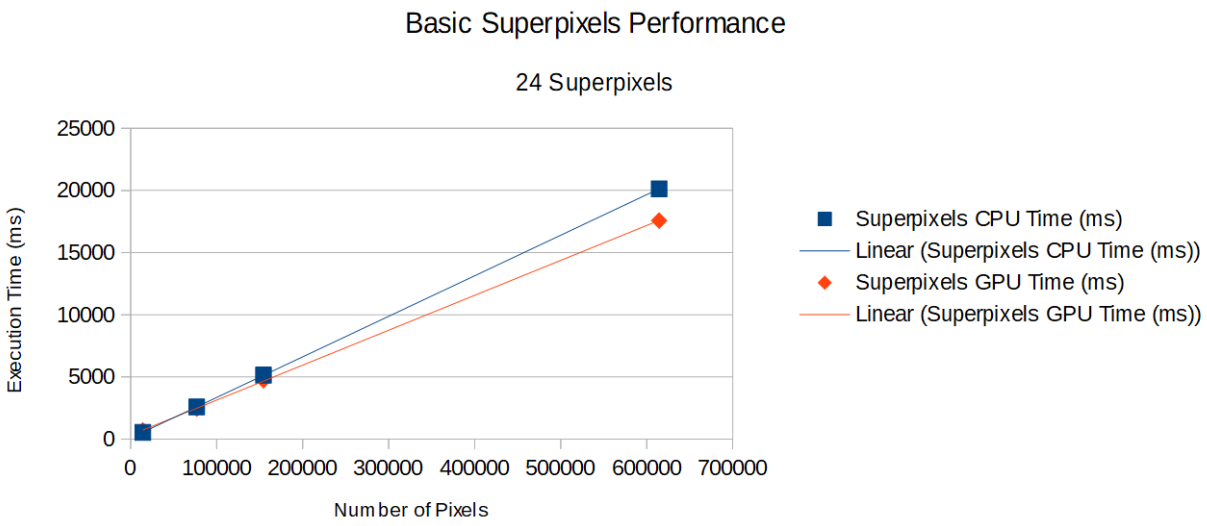

Figure 8: Basic Superpixels Performance, 24 Superpixels

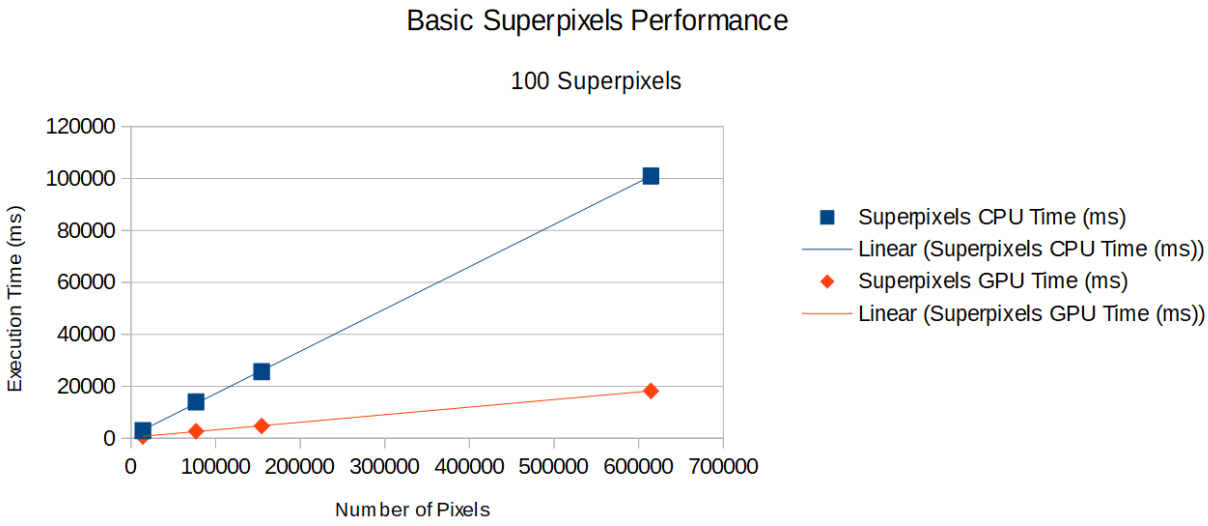

Figure 9: Basic Superpixels Performance, 100 Superpixels

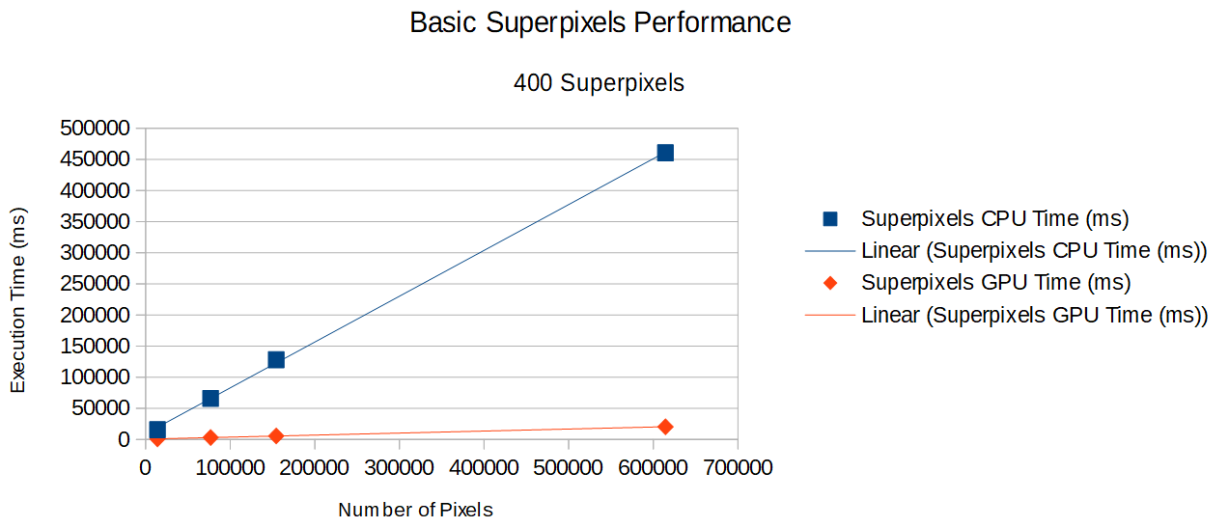

Figure 10: Basic Superpixels Performance, 400 Superpixels

Results and Analysis are also pretty tedious :)

Conclusions

Conclusions go here. Follow lab report guidelines.