Activity 4 – Measuring Area from Images

Krishna Lyn Delima

National Institute of Physics, University of the Philippines Diliman, Quezon City, 1101

Corresponding author: krishnadelima19@gmail.com

1 Objectives

- To use image processing to measure total area from images

2 Results and Discussion

Black and white images were generated using GIMP. A circle, square, rectangle, and triangle in white (black background) were made to have their areas analytically known using Green's

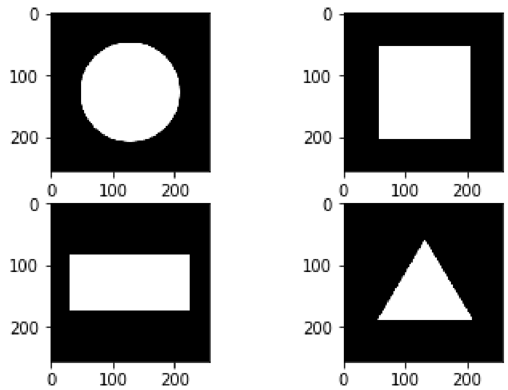

Figure 1: Black and white images of different shapes to be used for getting their respective areas

theorem as an algorithm. Their actual areas were calculated using their dimensions shown in GIMP. To code in Python language, the Jupyter notebook as used. The first step is to get the contour of each. From OpenCV, cv2.Canny was used to get the contour. After doing so, the coordinates of this contour taken were recorded and calibrated by subtracting the centroid of the shape. Note that the centroid of the shape was analytically known by getting the average pixel values of the image. After calibrating these coordinates, I used the function zip to compile the

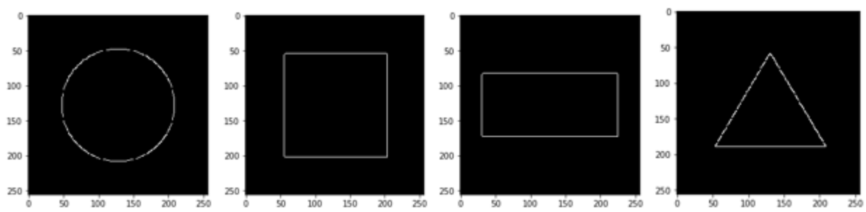

Figure 2: Canny Edge Detection

x and y values of the calibrated coordinates with their corresponding angle (done by converting these x and y values to polar coordinates) and converted this compilation into a single list. I then used the function sorted and defined it in such a way that the angle is sorted in an ascending order (refer to my code linked at the end of this document). These sorted x and y coordinates were then turned to their own arrays and used in implementing the Green's theorem. The Green's theorem was done by defining a function in getting the area. After extracting their experimental area, these were compared to their corresponding theoretical areas.

Table 1: Colors in order of being seen in the dark

Shape	Experimental Area (px^2)	Theroretical Area (px^2)	%error
Circle	20,872	20,358.306	2.46
Square	22,451.87414966	21,904	2.44
Rectangle	18,101.16932624	17,563	2.97
Triangle	10672.80809859	10,152.5	4.87

From Table 1, the results seem pretty accurate considering the minimal deviations from their actual areas. Therefore, this method of measuring the area through image processing is useful and accurate.
For the final part of the activity, I chose a place where I have always wanted to go - which is the Acropolis in Athens, Greece. I used google maps to generate the 2D map of the place. I

Figure 3: Acropolis from http://www.greece-is.com/acropolis/

then traced Acropolis using GIMP. After doing so, I got the pixel ratio by measuring the pixel value on the scale shown in the Google map. I found it to have 107 pixels per 50 meters. Using this relation, I converted the resulting area (using the same code previously) to sq. meters.

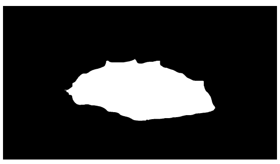

Figure 4: Outline of the Acropolis

I got 154250.21518987 sq. pixel for the experimental area. The theoretical is 30,400 meters

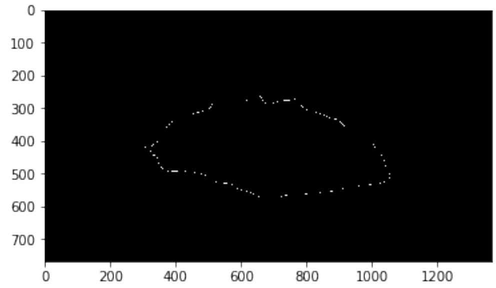

Figure 5: Canny edge detection

according to Wikipedia on Acropolis. Using the ratio form before, I ended up with 33,682.03 sq. m. - which has a 9.74%. A very impressive result.

I learned so much from this lesson and had so much fun.
Self- eval: TC = 5 QP = 5 In = 2 Total = 12/12

References

Soriano, Maricor. ”Applied Physics 186. A4 – Measuring Area from Images”.National Institute of Physics, UP Diliman, Quezon City. 2019