
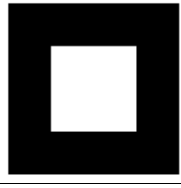





Measuring Area from Images

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This activity-when executed properly-allows us to measure the area of objects in an image. We use Green's Theorem to calculate the area from the edges of the object, which means the effectivity of your program would depend on the effectivity of your chosen edge detection algorithm. According to Maini and Aggarwal¹, the top 3 edge detection algorithms for noise cancellation are Canny, Law of Gaussian (LoG), and Robert decreasing consecutively. In Table 1, I have compared these three algorithms to be able to conclude which is best for area calculation.

Table 1. Measured area for five different shapes using Canny, LoG, and Robert edge detection algorithms. Least % error is in bold letters.

Shape	Theoretical Area (px)	Canny		LoG		Robert	
		Area (px)	% Error	Area (px)	% Error	Area (px)	% Error
	1963.5 px	1896 px	3.44 %	1844 px	6.08 %	1915.5 px	2.44 %
	2500	2452.5	1.9	2404	3.84	2487.5	0.5
	2400	2418.5	0.77	2317	3.46	2414	0.58
	3200	3214.5	0.45	3126.5	2.23	3169.5	0.95
	2231.75	2178	2.4	2124	4.8	2201.5	1.35

¹ Maini, R. & Aggarwal, H. Study and Comparison of Various Image Detection Techniques. *International Journal of Image Processing*, 3(1).

I wrote the script for area calculation in Matlab, as well as generating the binary images: circle, square, triangle, diamond, and squircle (the combination of a semicircle and a half-square). Their theoretical areas were calculated using the area formula of these geometric shapes. As seen in Table 1, the Robert algorithm measured the least percent error consistently except for one, Canny came second, which was the one that bested Robert for that one shape, and LoG consistently last. I, therefore, conclude the Robert algorithm is best for area calculation using Green's Theorem.

Using Google Earth Pro, I recorded the area of the University of the Philippines Visayas – Tacloban College (UPVTC) Campus to be 83 898.6 sq. m. Without adjusting the scale of the map, I took a screenshot of the whole surrounding (Fig.1 (left)) and saved it as a PNG file. Using GIMP, I measured the pixel length and its corresponding actual length of one side to derive the pixel-to-meter ratio: $2.002 \frac{px}{m}$. I created a binary mask of the image with the same image dimension of the screenshot (Fig. 1 (right)) and calculated its area using the Robert algorithm. I was able to measure 82 105.95 sq. m which gives an error of 2.1 %.

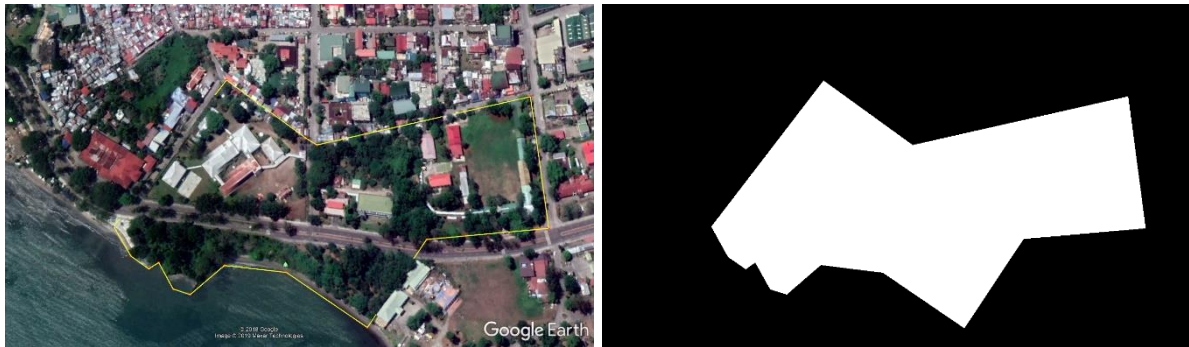


Figure 1. (left) Google Earth Pro screenshot of UPVTC (right) Binary mask for UPVTC area.

I give myself a grade of 11/10 for accomplishing all the requirements and comparing multiple edge detection algorithms to be able to use the best for area estimation using Green's Theorem.