

# *CENG466 Programming*

## *Homework IV*

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### I. INTRODUCTION

I implemented an image processing program that segments two given images. The sea and water and the yachts elements are segmented using two approaches, namely, Region Based and Edge Based segmentation. The program has a GUI that enables the user to choose input images, the area they want to segment and the approach. Then the output image is shown to user on the GUI. The segmentation is implemented on 'coast1.PNG' and 'coast2.PNG'.

### II. BACKGROUND

**Image Segmentation:** Is the process of partitioning a digital image based on the intensity values of the pixels or texture etc. It is used to locate the object boundaries and make the image more meaningful and easy to analyse. There are two approaches for image segmentation.

**Edge Based Image Segmentation:** There are two steps used in edge based segmentation one of which is the edge detection. First an operator such as Gradient, Laplacian or LoG is applied to image to detect the edges in it. The obtained edges are often disconnected, therefore we need a second step which is edge linking. We use the edges to detect the contours of the regions. Edge based segmentation uses discontinuities in an image.

**Region Based Image Segmentation:** In contrast to edge based segmentation, region based segmentation makes use of the similarities in an image. Pixels that are similar in many ways like intensity values or texture are grouped together to form a region. There are different region based approaches like region growing or merging. The one that is used in this program is region growing.

### III. METHODOLOGY

#### *A. Region Growing*

I used region growing technique implementing region based segmentation. My implementation of region growing is as follows. First I converted the input images to

double. A seed pixel is chosen from the input image according to the area that we want to segment. For segmenting yachts, the pixel (188, 425) is used as a seed pixel for 'coast1.PNG' and (380, 635) for 'coast2.PNG'. The intensity value of the seed pixel is my initial intensity mean of the region. I continued with the neighboring pixels of the seed and add one if the difference between its intensity value and the region mean is below a certain threshold. Thresholds used for the two images are 0.07 and 0.05 respectively. The difference is computed using Euclidean Distance formula. Everytime I added a new pixel to the segmented region, I updated the intensity mean of the region. The seed pixels and the threshold values used for segmenting land and water are (2, 280), 0.1 and (642, 688), 0.2, respectively. I segmented the water and the rest of the image was land for both images. I used a helper function and painted the desired segments in the output images.

### *B. Edge Based Segmentation*

For edge based segmentation, I used the built-in 'edge' function of Matlab. I extracted the edges of the images using Sobel method. After I determined them, the edges needed a little refinement because there were a lot of thin edges that can not be differentiated. I did that with the help of morphological operation, dilation. After refining edges I used the built-in 'imfill' function to fill the holes in the edges. Filling edge image made all the yachts visible in both images.

For the case of segmenting water and land, I repeated this process. That is, I applied the 'edge' function to the filled-edge image and got rid of the extra details in between the edges. Because the edges between water and land in both images are the ones that are most notable. Then I applied 'imfill' and 'edge' function to those images. In the end I was left with the lines that encircle the land and the yachts. I wrote a helper function to mark only the lines encircling the lands in the output images. The helper function scans the edge image from left to right and marks the first and white pixels in every line of the edge image, being the edges that encircle the water and land.

Before I decided upon implementing this method, I tried different opening and closing operations on edge images but they worked not as good as mine when it comes to distinguish the yachts and wharfs. Moreover, I did not want to lean much on morphology.

## **IV. RESULTS**

Region based segmentation gave better results when both segmenting the water and land and the yachts. Results of edge based segmentation were less certain as every object in the scene has edges and it is a hard task to distinguish which belongs to which. Whereas in the case of region based segmentation, we segment images using pixel similarity other than difference. Thus, it is more likely to segment objects more clearly.

My results can be seen below.

Region  
based land  
and water  
segmentation  
of  
'coast1.PNG'



Edge based  
segmentation  
of land and  
water for  
'coast1.PNG'



Region  
based land  
and water  
segmentation  
of  
'coast2.PNG'



Edge based  
segmentation  
of land and  
water for  
'coast2.PNG'





Region based  
segmentation  
of yachts  
'coast2.PNG'



Edge based  
segmentation  
of yachts  
'coast2.PNG'





Edge based  
segmentation  
of yachts  
'coast1.PNG'



Region based  
segmentation  
of yachts for  
'coast1.PNG'



## V. CONCLUSION

I have learned the two different techniques of image segmentation. I implemented region growing and edge based image segmentation. I understood that it is quite a hard task to segment the image perfectly and detect the different objects. Region based segmentation was a little bit better than the edge based one in my experiments.