

ECE661: Homework 6

Fall 2018

Deadline : October 23, 2018 , 1:30 pm

Turn in your solution via Blackboard. Additional instructions given at [1].

1 Introduction

The homework deals with image segmentation. In particular, you are provided with three images and you need to separate out the foreground from the background in these images. Subsequently, you will extract the contour of the segmented output. The dataset images can be found at [1].

For each image you need to know what is the desired foreground that we would like you to segment out of the image. The foreground for the first image is the red lighthouse. The foreground for the second image is the head and body of the cute baby. The foreground for the third image is the whole body of the jumping man.



(a)



(b)



(c)

Figure 1

2 Tasks

2.1 Image segmentation using RGB values

When applying Otsu's method to RGB color images, a common practice is to apply the algorithm to each color channel separately and to then logically 'AND' the results for final segmentation. You should also know that sometimes you get superior results if you use Otsu's algorithm in an iterative manner in which you apply the algorithm to just the foreground returned by its previous invocation.

2.2 Texture based segmentation

Another approach to image segmentation consists of characterizing the pixels with texture-based features and then applying Otsu's algorithm to these features.

Although there now exist different kinds of texture operators, you are expected to use the following simplest possible approach for this homework: As you scan an image, place a window of size $N \times N$ at each pixel and compute the variance of the pixels in the window (don't forget to subtract the mean). Do this for at least three values of N , say, for $N=3, 5,$ and 7 . The three variances together at each pixel would constitute a texture measure at that pixel. Now, for the purpose of segmentation, treat this 3-dimensional characterization of a pixel just as you treated the RGB characterization for color.

2.3 Contour Extraction

After image segmentation, apply your own contour extraction algorithm on the segmented output.

2.4 Note

1. You must write your own implementations for Otsu's algorithm and for contour extraction.
2. Convert the color images into grayscale images for the purpose of texture characterization. If you don't know how to do that, see the answer to Question 9 at the following Color FAQ:

http://homepages.inf.ed.ac.uk/rbf/CVonline/LOCAL_COPIES/POYNTON1/ColorFAQ.html

3 Submission

1. Turn in a typed pdf of your report via Blackboard.
2. Your pdf must include
 - A good description of your implementation of Otsu's algorithm and how you applied it to the color images.
 - A good description of how you extracted the texture-based features and how you applied image segmentation in this texture space.
 - Your observations on the performance of your segmentation algorithm and the usefulness of the features used.
 - The output of your image segmentation step and the final output after contour extraction.
 - Your source code.

References

[1] https://engineering.purdue.edu/RVL/ECE661_2018