

ECE661: Homework 6

Fall 2014

Deadline : October 28, 2014 , 1:30 pm

Turn in your hard-copy solution via Blackboard. Additional instructions can be found at [I]

1 Introduction

This assignment is based on using Otsu's algorithm to separate out the foreground from the background in images and, subsequently, on extracting the contour of the segmented output. You are provided with two test images to work with. They can be found at [I]. The foreground in one of the images is smooth and it lends itself well to segmentation with a straightforward application of Otsu's algorithm. The foreground in the second image is more complex and, if at all you have any success with it, it *may* be with applying Otsu's algorithm to texture-based characterizations of the pixels.

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 $N=3, 5, \text{ and } 7$. 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] <http://web.ics.purdue.edu/~bcomandu/ECE661/home/>