ECE661: Homework 7

Fall 2014

Deadline : November 4, 2014 , 1:30 pm

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

1 Introduction

This assignment asks you to carry out shape-based recognition of the characters
of the English alphabet. You will need to pull together the following programs
(that you have already written for the most part) : image segmentation with
Otsu's algorithm, component labeling, boundary detection as in your Homework
6, and curvature measurement of the boundary pixels.

2 Tasks

Your assignment consists of the following steps:

2.1 Extracting Representative Shape Vectors for each Letter

- Apply Otsu's algorithm to the provided image file 'Training.jpg' (Figure 1)
  and extract the pixels corresponding to the different letters of the alphabet
  in that image.

- Separate out the letters with your own component labeling program.

- Extract the boundary pixels of each extracted letter.

- For each letter, follow the boundary and project points of high curvature
  on to a **unit** circle, as shown in Figure 2 below.

- Measure the arc lengths on the circle between consecutive projections of
  the points of high curvature and construct a vector from these arc lengths.
  IMPORTANT: This will be your shape vector that characterizes each
  letter of the alphabet.

2.2 Character Recognition

- Now apply the previous steps to the test images that are in the directory
  'Testing Data'. Try to recognize each letter extracted from each of the test
  images on the basis of the Euclidean distance between the shape vectors.

Note that for such comparison, you'll have to carry out a circular rotation of one of the vectors for a rotationally invariant attempt at recognition.

2.3 Performance Measures

- Present a table indicating the recognition accuracy per letter across all test images.

- Calculate your average recognition accuracy for each test image and your overall recognition accuracy.

- In addition show the extracted curvature points for at least five representative letters in a suitable figure.
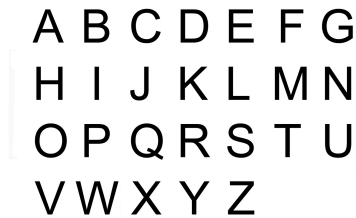
A B C D E F G
H I J K L M N
O P Q R S T U
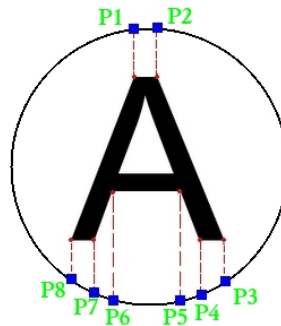V W X Y Z

Figure 1: Training.jpg

Figure 2: Projected points of high curvature

2.4 Note

1. You must write your own implementations for image segmentation, contour extraction, contour tracing and curvature point extraction.

2. You must address all tasks in the question.

3 Submission

You can download the images from [I].

1. Turn in a typed pdf of your report via Blackboard.

2. Your pdf must include

   - A good description how you extracted the contours, implemented component labeling and extracted the shape vectors for the letters.
   - Your observations on the performance of your image recognition system.
   - The output of your image segmentation step, and contour extraction for the images.
   - Your performance measures as described above.
   - Your source code.

References

[**I**] http://web.ics.purdue.edu/~bcomandu/ECE661/home/