ECE 493/693 Introduction to Computer Vision

Lab #3 – letters

In this project each student must implement thinning, branchpoint and endpoint detection to recognize letters in an image of text.

This lab builds upon the previous lab and should use part of its result along with the same original materials:

<table>
<thead>
<tr>
<th>parenthood.ppm</th>
<th>input image</th>
</tr>
</thead>
<tbody>
<tr>
<td>parenthood_e_template.ppm</td>
<td>template image</td>
</tr>
<tr>
<td>parenthood_gt.txt</td>
<td>ground truth</td>
</tr>
<tr>
<td>msf_e.ppm</td>
<td>your result from matched spatial filtering</td>
</tr>
</tbody>
</table>

Your result from matched spatial filtering should be stored in a ppm image and available for reading for this lab.

Your program should perform the following steps:

1. Read the input image, your msf image, and ground truth file.
2. Loop through the following steps for a range of T:
   a. Create an empty image with all pixels having a value of zero.
   b. For every pixel in the MSF image that is \( \geq T \), copy an area from the original input image to the empty image. The area should be the size of the \( e \)-template image (9 x 15 pixels), centered on the middle point of the e-template image. This will create a partial duplicate of the original image, where only areas detected in the MSF are visible.
   c. Threshold the copied image at 128 to create a binary image.
   d. Thin the thresholded image down to single-pixel wide components.
   e. Check all remaining pixels to determine if they are branchpoints or endpoints.
   f. For each letter in the ground truth, determine how many branchpoints and endpoints are within a 9x15 window centered at the ground truth location. If the letter is an “e” it must have 1 branchpoint and 1 endpoint to be considered a TP, else it is a FN. If the letter is not an “e”, it must have 0 branchpoints and 0 endpoints to be considered a TN, else it is a FP.
   g. Output the total TP and FP for each T.

Using any desired program, you must create an ROC curve from the program output.

You must write a brief report that includes the code and the ROC curve. Show an example of your image copy (step b or c above), the thinned image (step d), and the detection of branchpoints and endpoints (step e). In order to be clearly visible you may have to zoom in and show part of an image, or use color or overlay symbols to highlight the detected branchpoints and endpoints. Identify the optimal threshold and its corresponding TP and FP values.

The report is due date is given at the web site. Reports will be collected in class.