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ECE6310-1, #3

In this project the student was to implement thinning, branch point, and endpoint detection in order to recognize letters in an image of a text. The student was provided with an input image "parenthood.ppm", template image of desired character to be found "parenthood_e_template.ppm", ground truth file "ground_truth.txt", and was required to use Match-Spatial Filter (MSF) image from laboratory 2 "msf_e.ppm". All these images were used to determine if the desired letter was recognized from the MSF.

All the below steps have been performed in the attached code

Step 1: *Read in "parenthood.ppm" and "parenthood_e_template.ppm" code & "msf_e.ppm":*

Read in "parenthood_gt.txt" code:

Step 2:

Threshold "parenthood.ppm" PPM file

STEP 3

Thinning thresholded image down to pixel-wide components as per the instructions mentioned in the lab manual. Also, note that The Thinning is done till there no pixel was not deleted in the last run. This helps to thin all the edges.

STEP 4

In this step we have determined all the end points and branch points and store it on a binary image as per the directions from the lab3 manual. Branchpoints and Endpoints are detected for all the pixels in skeletonized image.

STEP 5

Here, we have thresholded the MSF image with different values of T and determined if letter is an "e" based on location given in the ground truth text file. Also, we have checked if "e" is getting detected with constraint of only one branch point and one end point, and finally have saved all the TP, FP, TF, TN, FPR, TPN, and PPV.
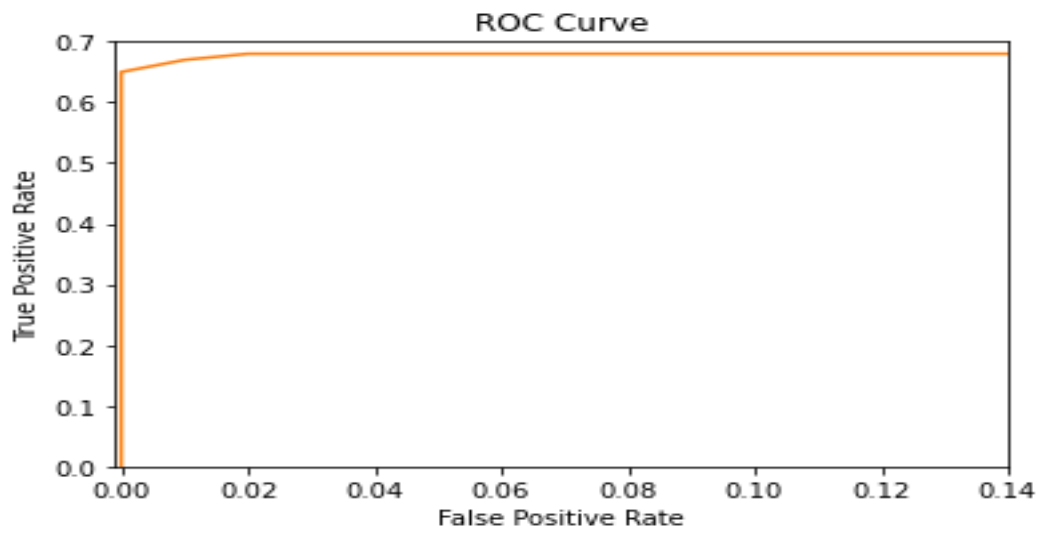
RESULTS

Input Image with threshold of 128, Thinned Image & Final image with branch ppoints and endpoints are shown below:

Truth Table:

Threshold	TP	FP	TPR	FPR	Threshold	TP	FP	TPR	FPR
0	102	154	0.68	0	145	102	154	0.68	145
5	102	154	0.68	5	150	102	151	0.68	150
10	102	154	0.68	10	155	102	149	0.68	155
15	102	154	0.68	15	160	102	149	0.68	160
20	102	154	0.68	20	165	102	146	0.68	165
25	102	154	0.68	25	170	102	143	0.68	170
30	102	154	0.68	30	175	102	130	0.68	175
35	102	154	0.68	35	180	102	108	0.68	180
40	102	154	0.68	40	185	102	78	0.68	185
45	102	154	0.68	45	190	102	45	0.68	190
50	102	154	0.68	50	195	102	25	0.68	195
55	102	154	0.68	55	200	101	12	0.67	200
60	102	154	0.68	60	205	98	5	0.65	205
65	102	154	0.68	65	210	95	1	0.63	210
70	102	154	0.68	70	215	90	0	0.6	215
75	102	154	0.68	75	220	80	0	0.53	220
80	102	154	0.68	80	225	69	0	0.46	225
85	102	154	0.68	85	230	48	0	0.32	230
90	102	154	0.68	90	235	30	0	0.2	235
95	102	154	0.68	95	240	21	0	0.14	240
100	102	154	0.68	100	245	10	0	0.07	245
105	102	154	0.68	105	250	0	0	0	250
110	102	154	0.68	110	255	0	0	0	255
115	102	154	0.68	115					
120	102	154	0.68	120					
125	102	154	0.68	125					
130	102	154	0.68	130					
135	102	154	0.68	135					
140	102	154	0.68	140					

Received Operating Characteristics (ROC) :

ROC Curve

Based on the ROC graph, the best thresholds in which the found/not found for letter "e" is at 205.We can say that the optimal threshold is between 200 to 210