

Clemson University
ECE 4310: Computer Vision
Lab 3: Letters
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Due: September 29, 2020

Purpose:

The purpose of this lab is an extension on the last lab and is to detect the letter 'e' throughout a certain given picture of text and to see if thinning and identifying branchpoints and endpoints to calculate the false positive rate and true positive rates is more accurate. Using the original image, it was thinned and tested for endpoints and branchpoints. To detect a certain letter, you can compare it to the number of branchpoints and end points. For example, an 'e' has one branchpoint and one endpoint. If the 9x15 template image (from the original image) had 1 endpoint and 1 breakpoint, then it was marked as an 'e'. Those were then compared to the ground truth file to calculate the roc (false positives vs. true positives).

Input:

Preparation for parenthood is not just a matter of reading books and decorating the nursery. Here are some tests for expectant parents to take to prepare themselves for the real-life experience of being a mother or father.

4. Can you stand the mess children make? To find out, smear peanut butter onto the sofa and jam onto the curtains. Hide a fish finger behind the stereo and leave it there all summer. Stick your fingers in the flowerbeds then rub them on the clean walls. Cover the stains with crayons. How does that look?

5. Dressing small children is not as easy as it seems. First buy an octopus and a string bag. Attempt to put the octopus into the string bag so that none of the arms hang out. Time allowed for this - all morning.

7. Forget the Miata and buy a Mini Van. And don't think you can leave it out in the driveway spotless and shining. Family cars don't look like that. Buy a chocolate ice cream bar and put it in the glove compartment. Leave it there. Get a quarter. Stick it in the cassette player. Take a family-size packet of chocolate cookies. Mash them down the back seats. Run a garden rake along both sides of the car. There!.. Perfect!

9. Always repeat everything you say at least five times.

11. Hollow out a melon. Make a small hole in the side. Suspend it from the ceiling and swing it from side to side. Now get a bowl of soggy Froot Loops and attempt to spoon it into the swaying melon by pretending to be an airplane. Continue until half of the Froot Loops are gone. Tip the rest into your lap, making sure that a lot of it falls on the floor. You are now ready to feed a 12-month old baby.

Figure 1: Input Image

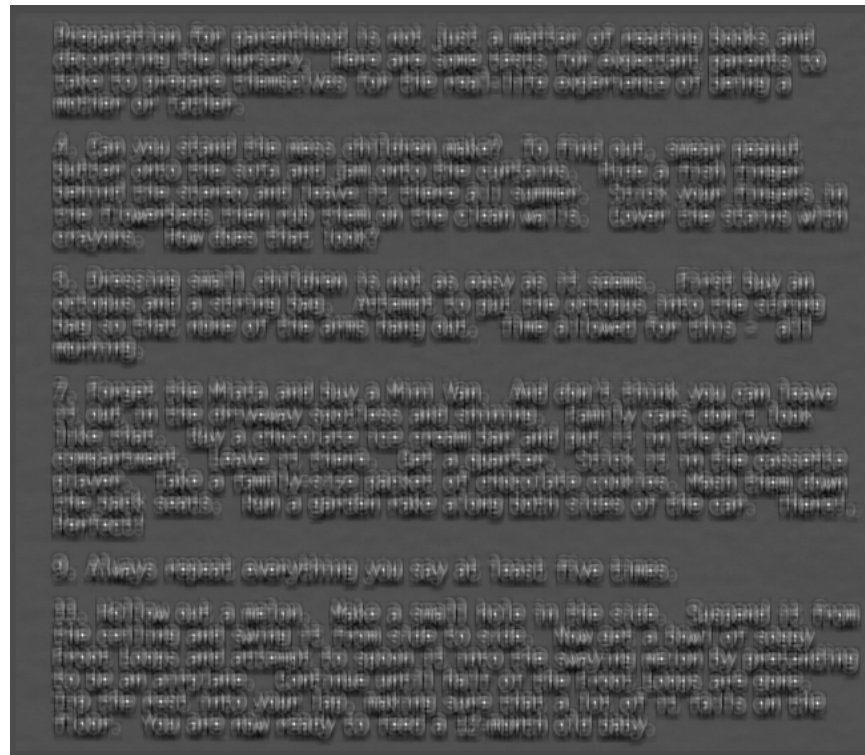


Figure 2: MSF Image from Lab 2

Results/Output:

Below are the results that I received from the output of the program:

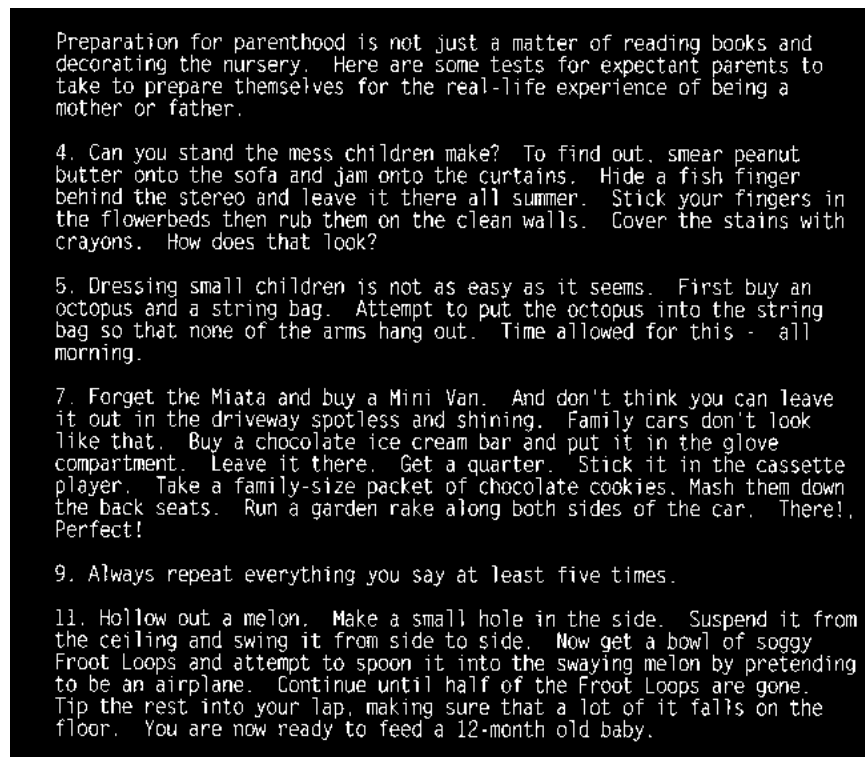


Figure 3: Original Image at 128 Threshold (Binary) Inverted

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Figure 4: Thinned Out image

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Figure 5: Thinned with the endpoints and branchpoints



Figure 6: Endpoints and Branchpoints detected

Table 1: ROC Calculations

Threshold	TP	FP	FN	TN	TPR	FPR	PPV
0	145	166	6	945	0.96	0.15	0.53
5	145	166	6	945	0.96	0.15	0.53
10	145	166	6	945	0.96	0.15	0.53
15	145	166	6	945	0.96	0.15	0.53
20	145	166	6	945	0.96	0.15	0.53
25	145	166	6	945	0.96	0.15	0.53
30	145	166	6	945	0.96	0.15	0.53
35	145	166	6	945	0.96	0.15	0.53
40	145	166	6	945	0.96	0.15	0.53
45	145	166	6	945	0.96	0.15	0.53
50	145	166	6	945	0.96	0.15	0.53
55	145	166	6	945	0.96	0.15	0.53
60	145	166	6	945	0.96	0.15	0.53
65	145	166	6	945	0.96	0.15	0.53
70	145	166	6	945	0.96	0.15	0.53
75	145	166	6	945	0.96	0.15	0.53

80	145	166	6	945	0.96	0.15	0.53
85	145	166	6	945	0.96	0.15	0.53
90	145	166	6	945	0.96	0.15	0.53
95	145	166	6	945	0.96	0.15	0.53
100	145	166	6	945	0.96	0.15	0.53
105	145	166	6	945	0.96	0.15	0.53
110	145	166	6	945	0.96	0.15	0.53
115	145	166	6	945	0.96	0.15	0.53
120	145	166	6	945	0.96	0.15	0.53
125	145	166	6	945	0.96	0.15	0.53
130	145	166	6	945	0.96	0.15	0.53
135	145	166	6	945	0.96	0.15	0.53
140	145	166	6	945	0.96	0.15	0.53
145	145	166	6	945	0.96	0.15	0.53
150	145	166	6	945	0.96	0.15	0.53
155	145	166	6	945	0.96	0.15	0.53
160	145	166	6	945	0.96	0.15	0.53
165	145	166	6	945	0.96	0.15	0.53
170	145	165	6	946	0.96	0.15	0.53
175	145	157	6	954	0.96	0.14	0.52
180	145	134	6	977	0.96	0.12	0.48
185	145	99	6	1012	0.96	0.09	0.41
190	145	61	6	1050	0.96	0.05	0.3
195	145	36	6	1075	0.96	0.03	0.2
200	145	20	6	1091	0.96	0.02	0.12
205	142	8	9	1103	0.94	0.01	0.05
210	138	2	13	1109	0.91	0	0.01
215	129	0	22	1111	0.85	0	0
220	117	0	34	1111	0.77	0	0
225	96	0	55	1111	0.64	0	0
230	73	0	78	1111	0.48	0	0
235	47	0	104	1111	0.31	0	0
240	31	0	120	1111	0.21	0	0
245	16	0	135	1111	0.11	0	0
250	5	0	146	1111	0.03	0	0

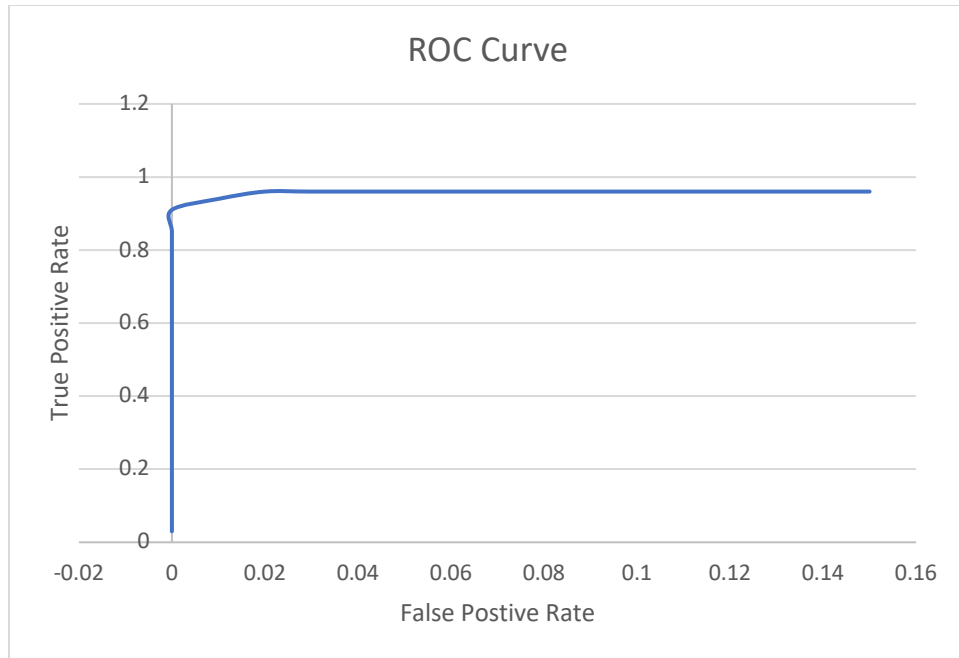


Figure 5: ROC Curve

Conclusion:

The purpose of this lab was to create a program that thins an image, identifies branchpoint and endpoints, and determine the ROC curve. I found the best threshold with the lowest false positive and the highest true positives was 200. After thinning and identifying the amount of branchpoints and endpoints the program found: number of endpoints is 2548 and number of branchpoints is 730. The ROC curve was much different for this lab compared to the pervious lab. For the ROC curve for this lab, the results were much better (less false positives) than that compared to the last lab. Overall, thinning and identifying branchpoints and endpoints shows to be more accurate than using an MSF filter.