Clemson University
ECE 4310: Computer Vision
Lab 2: Optical Character Recognition
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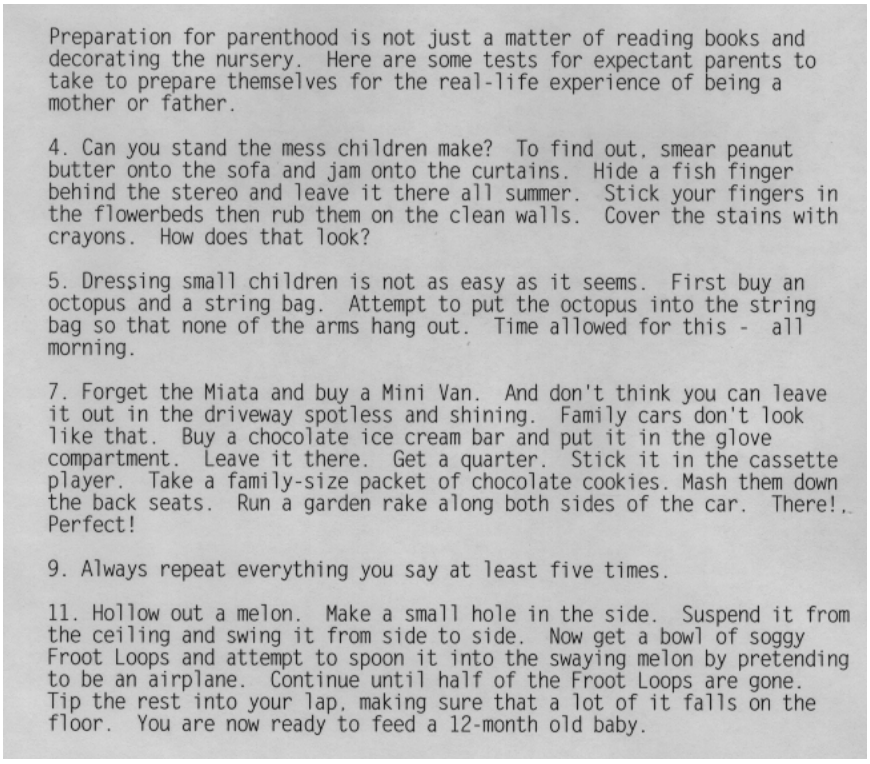
Due: September 15, 2020

Purpose:
The purpose of this lab is to create a matched filter that reads an image and identifies a certain smaller image within it. Also, to calculate the matched spatial filter (MSF) and normalized the image to 8-bits. It must also calculate the ROC curve with all of proper calculations stored somewhere (I stored mine in a csv file). With this ROC curve, determine a threshold and calculate the true positives, false positives, true negatives, and the false negatives using the ground truth file given.

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: Template Image

Output:

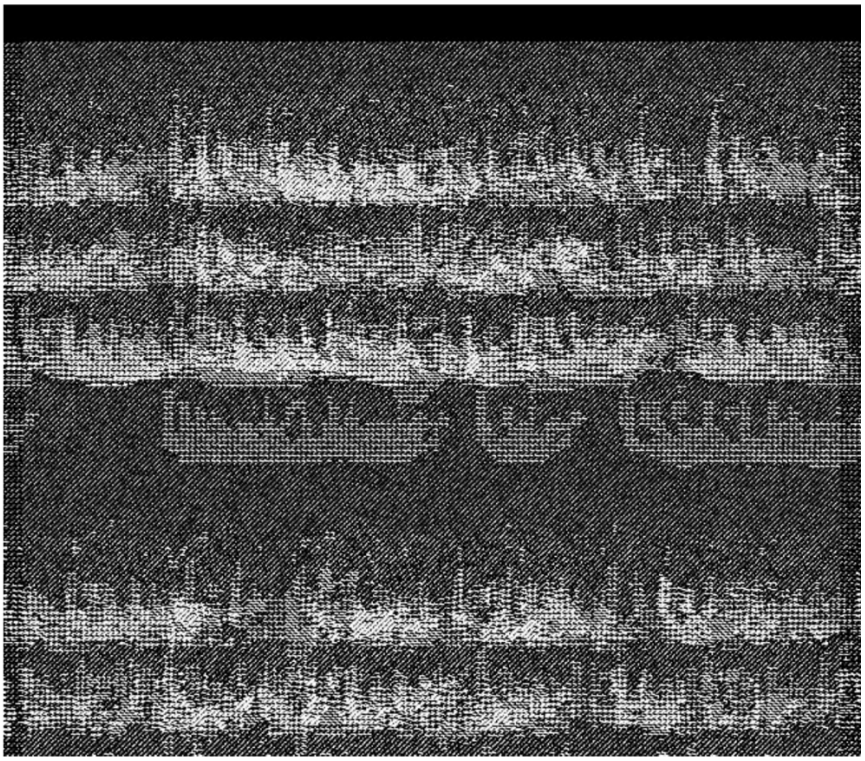


Figure 3: MSF Image (not 8-bit)

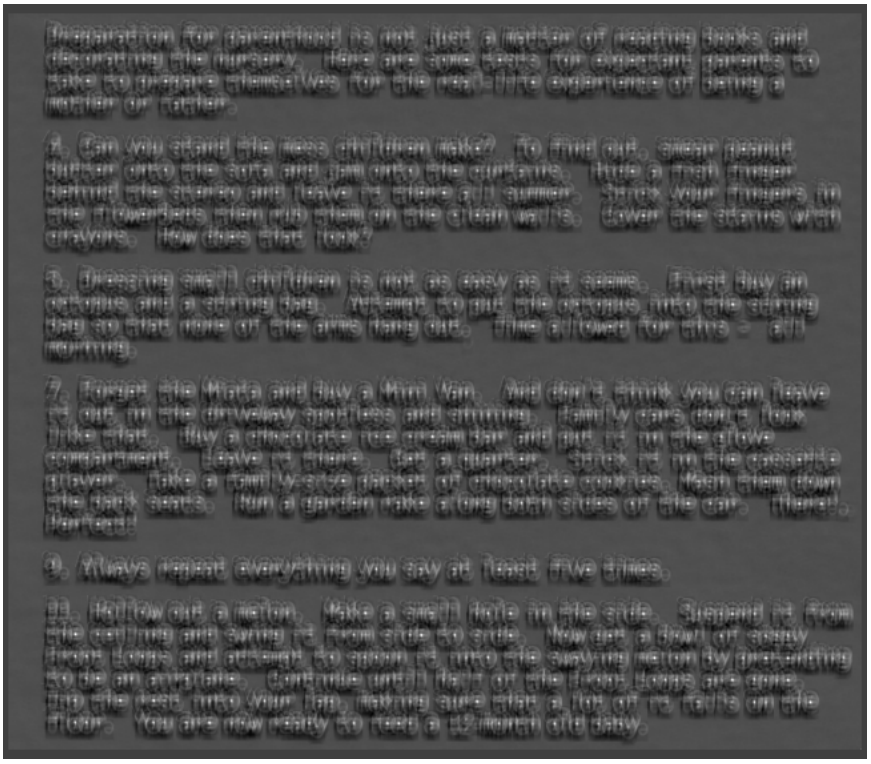


Figure 4: 8-bit MSF Normalized Image (No Threshold)

Threshold	TP	FP	FN	TN	TPR	FPR	PPV
0	151	1111	0	0	1	1	0.88
5	151	1111	0	0	1	1	0.88
10	151	1111	0	0	1	1	0.88
15	151	1111	0	0	1	1	0.88
20	151	1111	0	0	1	1	0.88
25	151	1111	0	0	1	1	0.88
30	151	1111	0	0	1	1	0.88
35	151	1111	0	0	1	1	0.88
40	151	1111	0	0	1	1	0.88
45	151	1111	0	0	1	1	0.88
50	151	1111	0	0	1	1	0.88
55	151	1111	0	0	1	1	0.88
60	151	1111	0	0	1	1	0.88
65	151	1111	0	0	1	1	0.88
70	151	1111	0	0	1	1	0.88
75	151	1111	0	0	1	1	0.88
80	151	1111	0	0	1	1	0.88
85	151	1111	0	0	1	1	0.88
90	151	1111	0	0	1	1	0.88
95	151	1111	0	0	1	1	0.88
100	151	1111	0	0	1	1	0.88
105	151	1109	0	2	1	1	0.88
110	151	1108	0	3	1	1	0.88
115	151	1106	0	5	1	1	0.88
120	151	1091	0	20	1	0.98	0.88
125	151	1063	0	48	1	0.96	0.88
130	151	1036	0	75	1	0.93	0.87
135	151	1009	0	102	1	0.91	0.87
140	151	972	0	139	1	0.87	0.87
145	151	908	0	203	1	0.82	0.86
150	151	824	0	287	1	0.74	0.85
155	151	723	0	388	1	0.65	0.83
160	151	616	0	495	1	0.55	0.8
165	151	534	0	577	1	0.48	0.78
170	151	465	0	646	1	0.42	0.75
175	151	393	0	718	1	0.35	0.72
180	151	322	0	789	1	0.29	0.68
185	150	246	1	865	0.99	0.22	0.62
190	149	173	2	938	0.99	0.16	0.54
195	148	118	3	993	0.98	0.11	0.44
200	147	87	4	1024	0.97	0.08	0.37
205	142	58	9	1053	0.94	0.05	0.29
210	138	42	13	1069	0.91	0.04	0.23
215	123	27	28	1084	0.81	0.02	0.18
220	106	14	45	1097	0.7	0.01	0.12
225	87	6	64	1105	0.58	0.01	0.06
230	64	4	87	1107	0.42	0	0.06
235	42	0	109	1111	0.28	0	0
240	30	0	121	1111	0.2	0	0
245	12	0	139	1111	0.08	0	0
250	3	0	148	1111	0.02	0	0
255	1	0	150	1111	0.01	0	0

Figure 5: Truth Table

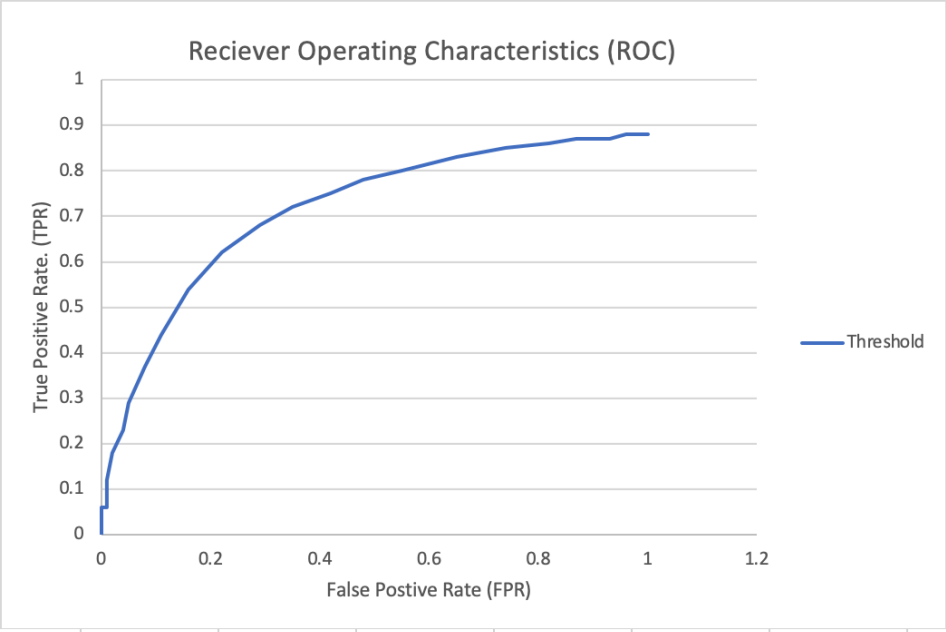


Figure 6: ROC Graph

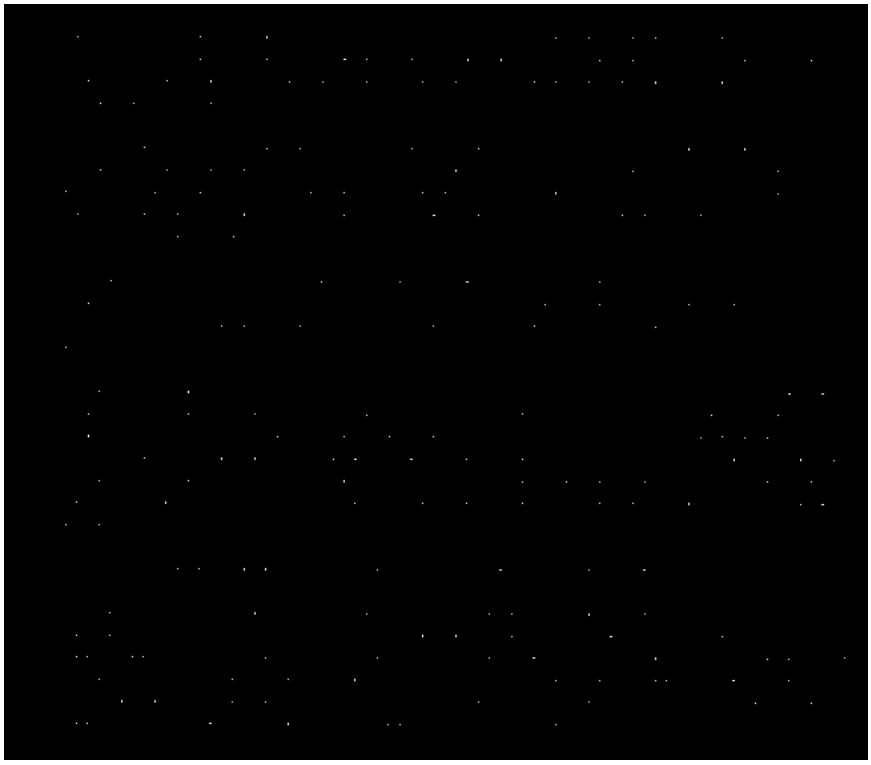


Figure 7: 8-bit Normalized MSF Image with 200 Threshold

Conclusion:
Based on the ROC graph, I have determined that the best threshold is near the “knee” of the curve. The threshold that I choose is 200. At that threshold, it gives me the best tradeoff for the performance of the threshold.