Appendix C. Detailed segmentation statistics.

The tables is this appendix show distribution statistics, by finger position, for the segmentation algorithms tested as compared to the hand marked ground truth for 3-inch slap images. The differences between the segmentation algorithm and ground truth are sorted into bins based on the tolerances allowed for correct segmentation. Specifically, the left/right edges must be within -32/+64 pixels of the ground truth, top edge -64/+64 and bottom edge -64/+128. For each finger position there is a column for each of the four segmentation box edges (L, R, T and B).

The first row (“No Finger Found”) shows the counts for when a finger was not detected by the segmentation algorithm. The next four rows show statistics for segmentation edges that are within the specified minimum (MN) and maximum (MX) pixel tolerances compared to the ground truth, so these are considered good segmentations. Rows 1 (MN <= d < 0) and 3 (0 <= d <= MX) show the average value for all differences in that range and rows 3 and 5 show the total count occurring in that range.

Rows 6-9 also show average difference values and bin counts but for ranges MN-32 <= d < MN and MX < d <= MX+32, which are just outside the accepted tolerance ranges. Rows 10-13 tally everything greater than 32 pixels away from the accepted tolerance range, d < MN-32 and d > MX+32.

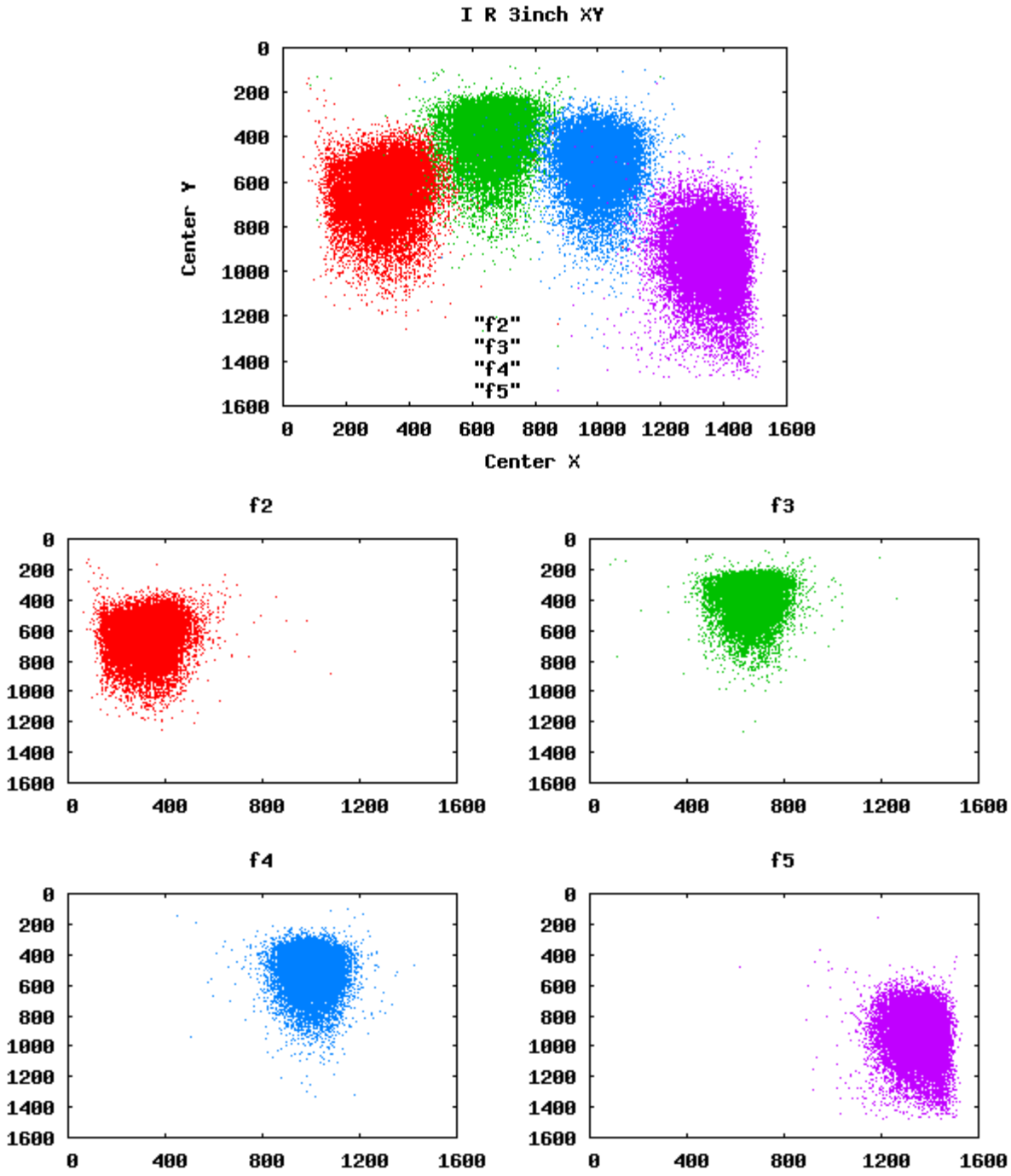
The last three rows show the total count for each bin, the overall average difference value and the standard deviation of all the difference values.

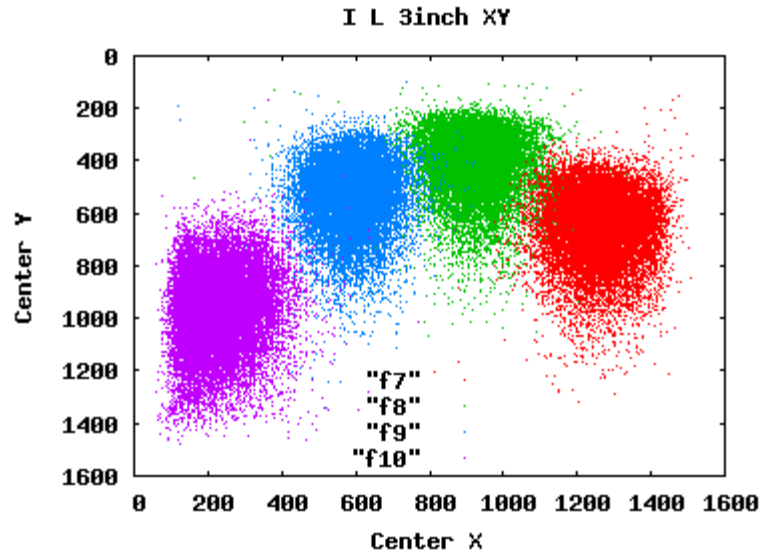
	R. Thumb				R. Index				R Middle				R. Ring				R. Little			
No Finger Found	27				127				12				18				50			
	L	R	T	B	L	R	T	B	L	R	T	B	L	R	T	B	L	R	T	B
MN <= d < 0	-9.79	-9.66	-16.49	-18.31	-8.48	-7.24	-12.63	-15.60	-6.47	-7.81	-12.35	-20.78	-7.23	-8.81	-13.32	-20.49	-10.01	-5.51	-15.66	-15.12
#	56	374	626	5931	381	345	259	1331	343	550	252	2088	122	1183	219	977	194	2095	145	976
0 <= d <= MX	37.35	32.14	28.94	27.65	18.23	20.67	23.04	27.67	17.22	18.74	23.13	31.84	20.05	18.63	23.69	33.97	20.45	16.66	35.22	31.33
#	24107	23572	22621	17538	24372	24368	24409	23102	24523	24302	24609	22167	24726	23549	24603	23184	23982	22333	23768	23004
MN-32 <= d < MN	-45.29	-44.95	-79.81	-78.07	-41.33	-44.20	-81.50	-76.88	-44.00	-40.33	-86.14	-79.16	-54.23	-37.36	-80.40	-81.94	-52.01	-42.87	-72.00	-73.07
#	21	57	27	319	3	10	4	26	6	6	7	159	13	22	5	95	146	15	1	15
MX < d <= MX+32	72.09	75.99	75.73	141.63	77.30	71.33	70.87	143.05	72.91	79.00	72.55	143.13	76.00	77.51	71.15	143.64	79.67	79.96	69.78	141.71
#	23	168	724	150	15	6	54	134	11	13	31	231	3	96	26	297	6	268	199	52
d < MN-32	-261.44	-393.20	-195.99	-524.44	-366.23	-350.05	-261.42	-670.17	-293.40	-359.36	-285.89	-245.10	-235.92	-678.32	-417.22	-270.95	-129.27	-645.86	-406.88	-679.02
#	96	85	53	367	53	184	12	246	59	29	14	129	72	33	81	97	522	122	793	72
d > MX+32	417.50	279.47	532.29	236.25	182.73	387.80	463.36	218.79	292.75	263.20	243.18	218.88	588.95	233.46	303.76	258.87	570.38	185.36	526.10	387.29
#	119	166	371	117	144	55	230	129	26	68	55	194	32	85	34	318	118	135	62	849
Total #	24422	24422	24422	24422	24968	24968	24968	24968	24968	24968	24968	24968	24968	24968	24968	24968	24968	24968	24968	24968
Average	37.88	31.82	36.21	8.51	17.98	18.34	26.68	19.98	16.46	18.40	23.11	27.79	19.87	17.32	22.35	34.39	19.27	13.12	22.38	39.74
Std Dev	41.27	49.32	79.48	88.90	24.27	38.75	47.56	81.95	21.43	23.16	19.35	41.64	29.26	36.96	32.13	47.65	57.51	66.99	86.75	84.39

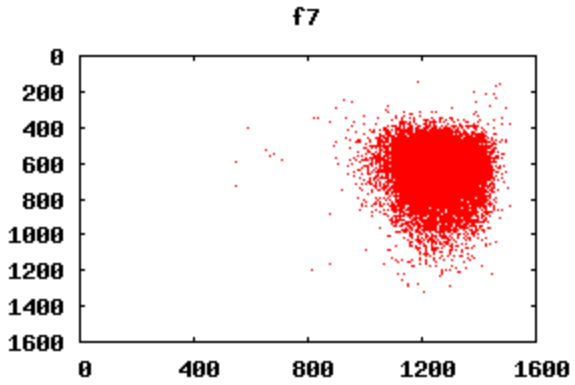
	L. Thumb				L. Index				L. Middle				L. Ring				L. Little			
No Finger Found	33				122				7				30				50			
	L	R	T	B	L	R	T	B	L	R	T	B	L	R	T	B	L	R	T	B
MN <= d < 0	-9.73	-8.45	-16.02	-17.89	-7.93	-9.23	-12.76	-14.78	-6.27	-8.00	-11.40	-20.68	-6.19	-9.48	-16.10	-18.33	-10.69	-10.69	-15.67	-14.38
#	270	93	557	5830	114	1093	249	1486	245	767	316	2316	315	356	131	1484	1645	444	165	1491
0 <= d <= MX	33.48	34.43	29.17	27.23	19.38	19.94	23.59	27.59	18.54	19.78	23.49	31.63	18.19	22.11	24.92	30.91	18.33	23.25	36.43	28.27
#	23479	24074	21527	17585	24641	23644	24501	22993	24601	24092	24566	21931	24439	24478	24700	22684	22807	23843	24014	22585
MN-32 <= d < MN	-47.64	-46.14	-75.67	-78.16	#DIV/0!	-43.23	-72.75	-80.28	-64.00	-46.21	-81.80	-78.47	-39.33	-48.47	-83.33	-79.97	-43.22	-50.10	-91.00	-74.26
#	36	14	12	300	0	13	8	36	1	14	5	206	3	17	3	115	16	152	1	19
MX < d <= MX+32	75.15	70.50	77.31	142.55	74.00	76.90	74.83	142.33	76.48	74.31	80.50	141.81	76.99	70.75	79.50	142.59	79.66	75.17	67.70	143.80
#	366	8	1570	209	7	10	12	118	29	16	8	189	80	4	5	256	254	18	46	44
d < MN-32	-185.72	-316.93	-274.12	-555.86	-319.48	-1170.40	-216.83	-690.67	-423.48	-449.59	-335.03	-216.36	-294.53	-363.18	-423.40	-289.46	-247.88	-134.17	-388.00	-803.35
#	63	123	34	373	49	151	9	201	27	50	32	138	19	90	84	127	73	424	683	68
d > MX+32	226.38	345.93	351.81	264.86	965.89	309.18	472.88	236.31	356.94	526.28	274.51	253.33	253.95	407.00	322.49	273.61	130.58	242.28	676.62	373.18
#	208	110	722	125	153	53	185	130	61	25	37	184	108	19	41	298	169	83	55	757
Total #	24422	24422	24422	24422	24964	24964	24964	24964	24964	24964	24964	24964	24964	24964	24964	24964	24964	24964	24964	24964
Average	34.59	33.87	40.30	8.46	24.41	12.07	26.46	20.76	18.71	18.49	22.96	26.96	18.85	20.53	23.68	29.88	16.98	20.30	25.94	34.04
Std Dev	28.24	40.41	85.47	95.91	81.21	101.29	44.39	76.97	29.03	35.03	21.46	43.14	24.09	32.24	34.11	52.05	22.76	29.59	80.48	82.79

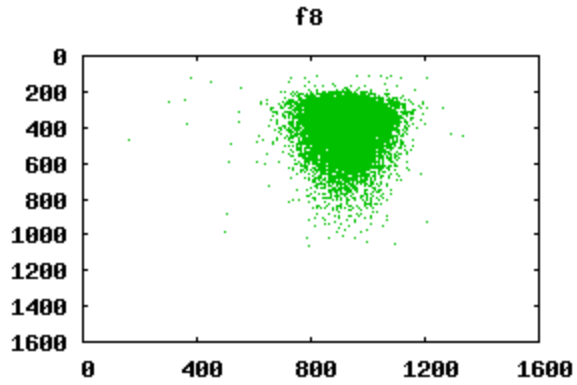
Appendix D. Plots of 3-inch segmentation box centers.

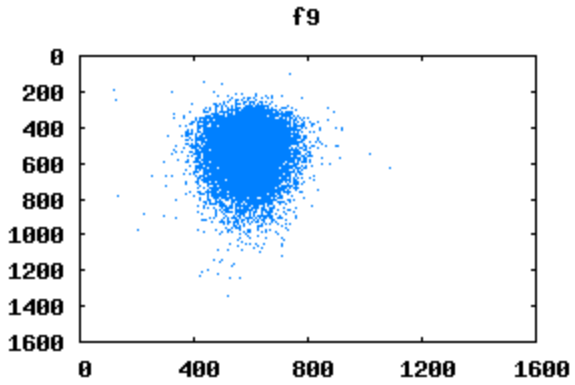
The plots in this appendix show the distribution of the segmentation box centers (x,y) for the 3-inch data. There is a combined plot for each slap image and then a smaller plot for each finger position. The individual finger plots are better for seeing the full “spread” of x,y positions detected. The plot for the ground truth (GT) is included as a baseline for comparison. The blank lines that appear in some of the plots are most likely caused by the segmentation algorithm doing some level of sampling of the input image. The reason the lines are not evenly distributed in some plots is an artifact of the sampling when scaling the images for displaying in the report.

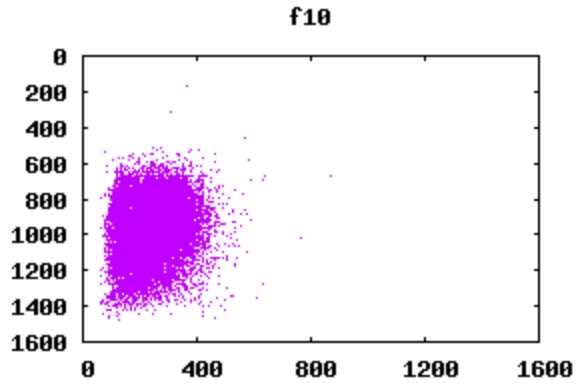

I R 3inch XY
Center Y
Center X
"f2"
"f3"
"f4"
"f5"
f2
f3
f4
f5

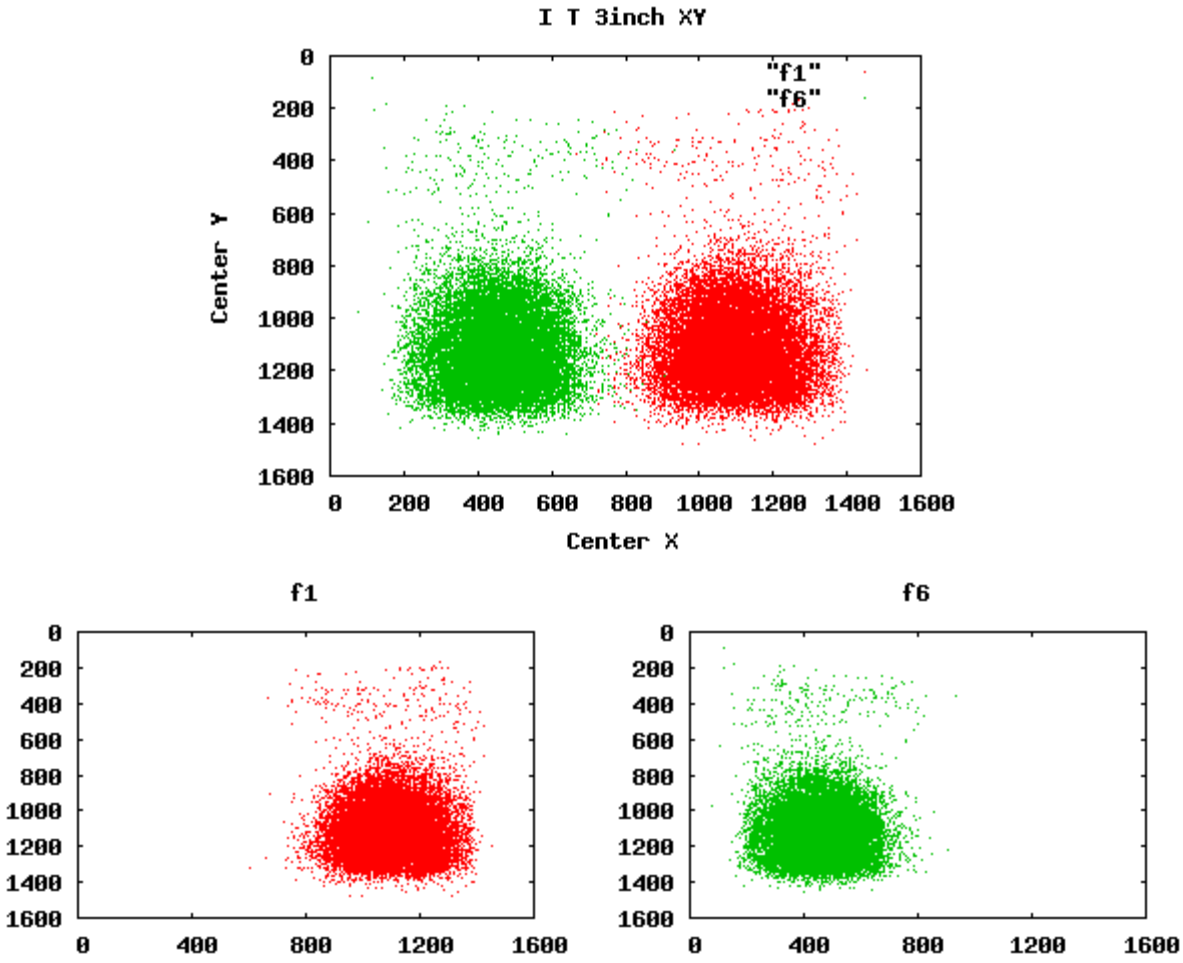

I L 3inch XY
Center Y
Center X
"f7"
"f8"
"f9"
"f10"


f7


f8

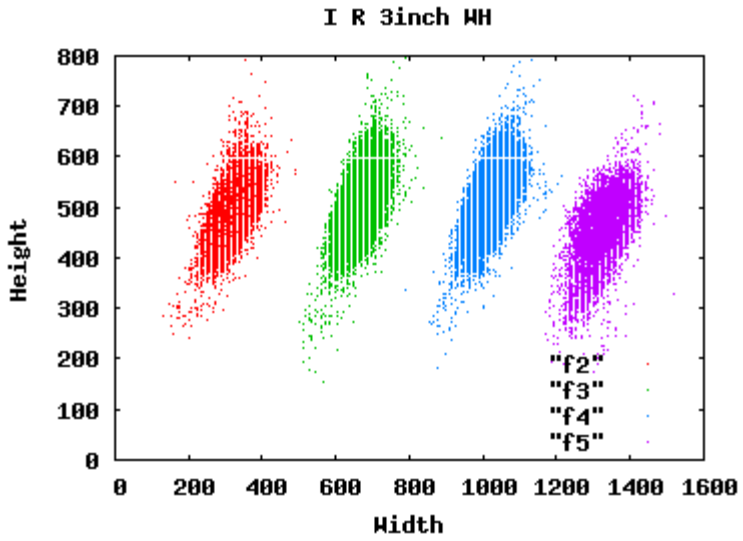

f9

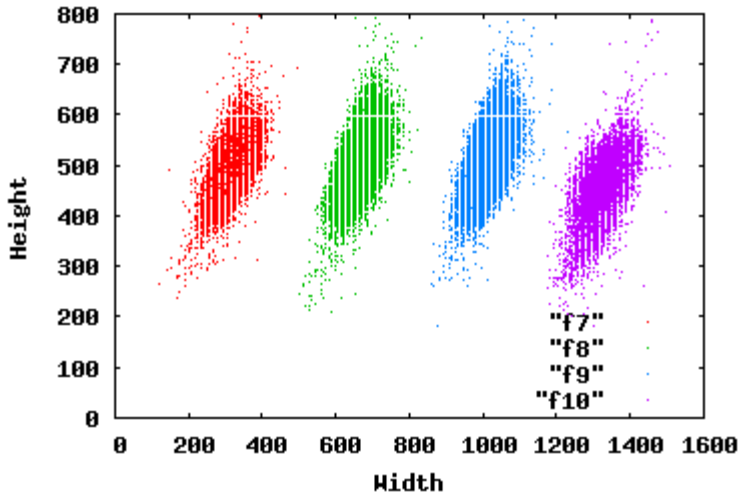

f10

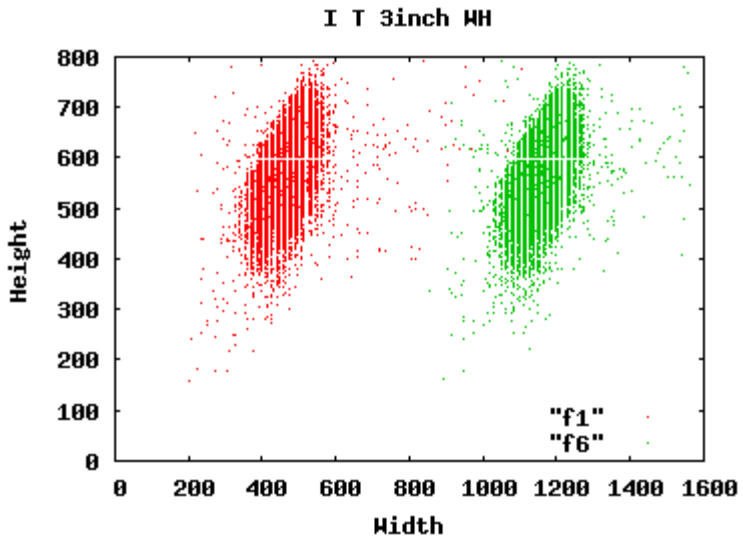

I T 3inch XY
"f1"
"f6"
Center Y
Center X
0
200
400
600
800
1000
1200
1400
1600
f1
f6

Appendix E. Plots of 3-inch segmentation box widths and heights.

The plots in this appendix show the distribution of the segmentation box widths and heights for the 3-inch data. There is a combined plot for each slap image and then a smaller plot for each finger position. The individual finger plots are better for seeing the full "spread" of widths and heights detected. The widths are "spread out" on the plot by adding 350, 750 and 1050 to the 2^{nd}, 3^{rd}, and 4^{th} widths plotted. The plot for the ground truth (GT) is included as a baseline for comparison. The blank lines that appear in some of the plots are most likely caused by the segmentation algorithm doing some level of sampling of the input image. The reason the lines are not evenly distributed in some plots is an artifact of the sampling when scaling the images for displaying in the report.

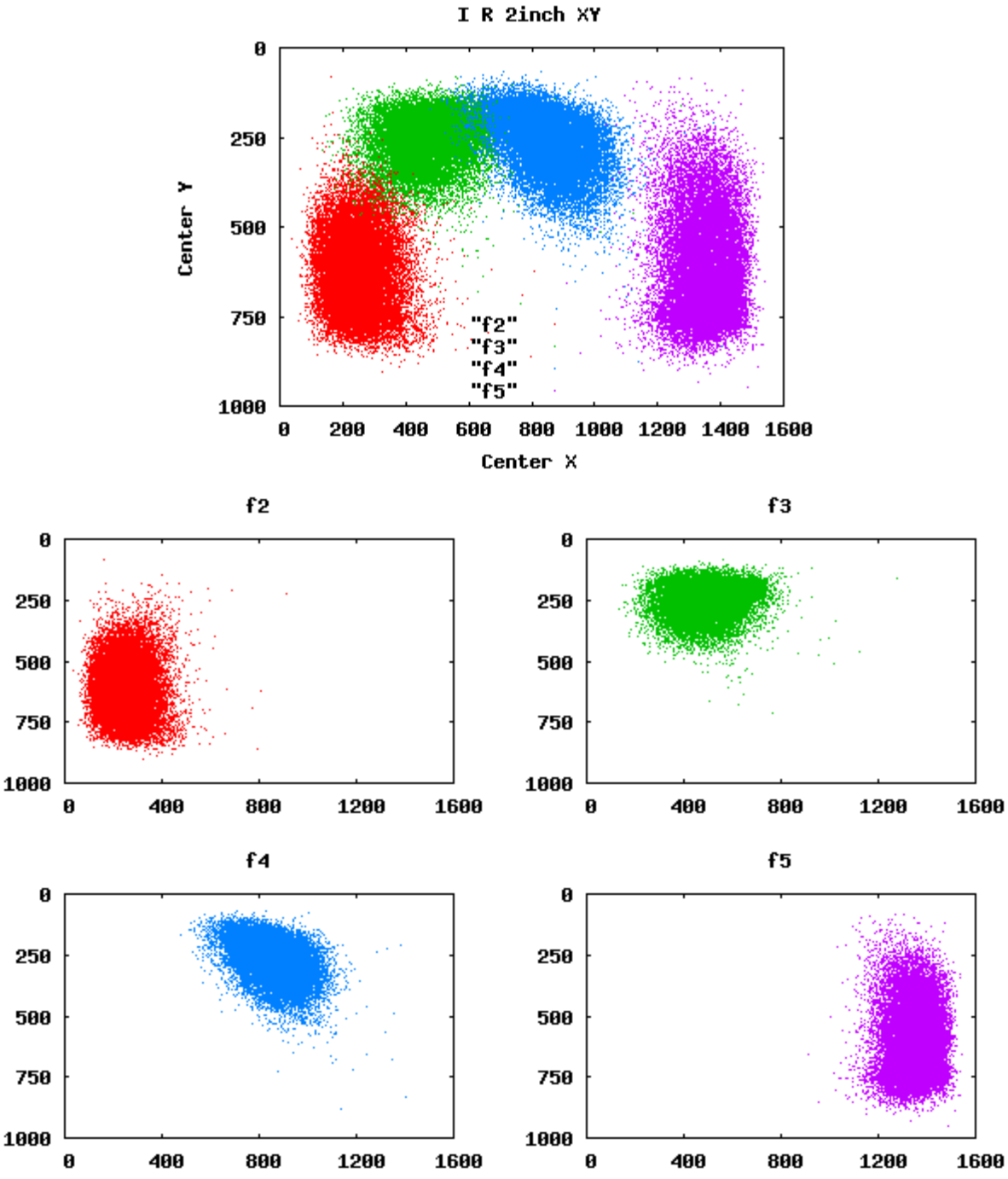

I R 3inch WH
Height
Width
"f2"
"f3"
"f4"
"f5"

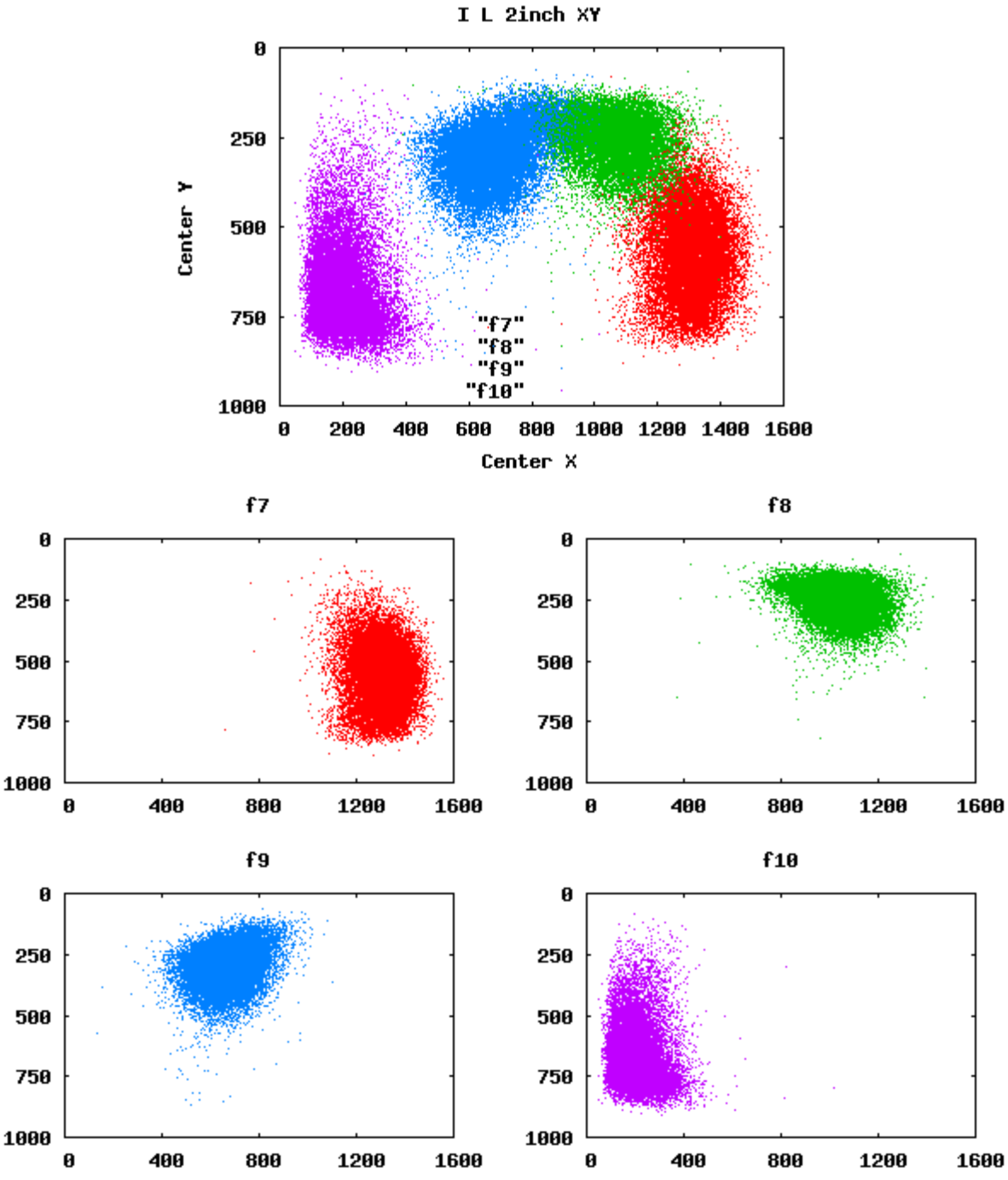

I L 3inch WH
Height
Width
"f7"
"f8"
"f9"
"f10"


I T 3inch WH
Height
Width
"f1"
"f6"

Appendix F. Plots of 2-inch segmentation box centers.

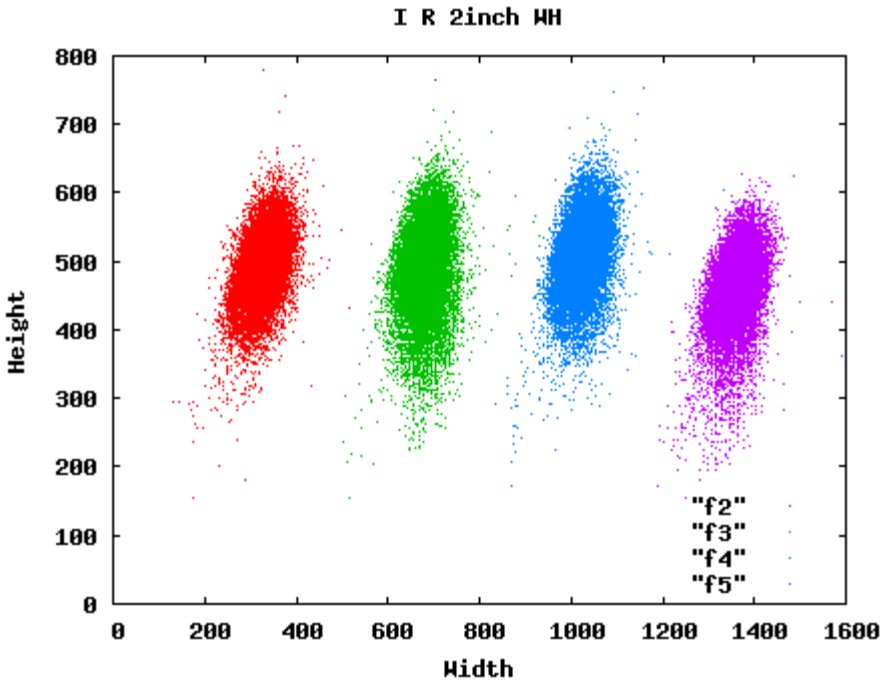
The plots in this appendix show the distribution of the segmentation box centers (x,y) for the 2-inch data. There is a combined plot for each slap image and then a smaller plot for each finger position. The individual finger plots are better for seeing the full “spread” of x,y positions detected. The plot for the ground truth (GT) is included as a baseline for comparison. The blank lines that appear in some of the plots are most likely caused by the segmentation algorithm doing some level of sampling of the input image. The reason the lines are not evenly distributed in some plots is an artifact of the sampling when scaling the images for displaying in the report.

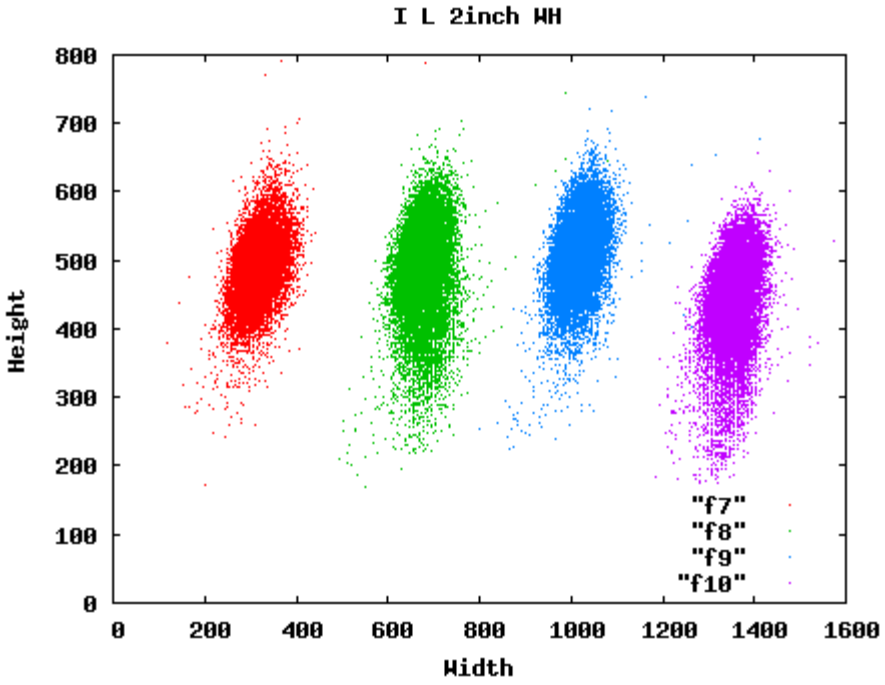

I R 2inch XY
Center Y
Center X
0
250
500
750
1000
0
200
400
600
800
1000
1200
1400
1600
"f2"
"f3"
"f4"
"f5"
f2
f3
f4
f5
0
400
800
1200
1600


I L 2inch XY
Center Y
Center X
"f7"
"f8"
"f9"
"f10"
f7
f8
f9
f10

Appendix G. Plots of 2-inch segmentation box widths and heights.

The plots in this appendix show the distribution of the segmentation box widths and heights for the 2-inch data. There is a combined plot for each slap image and then a smaller plot for each finger position. The individual finger plots are better for seeing the full "spread" of widths and heights detected. The widths are "spread out" on the plot by adding 350, 750 and 1050 to the 2nd, 3rd, and 4th widths plotted. The plot for the ground truth (GT) is included as a baseline for comparison. The blank lines that appear in some of the plots are most likely caused by the segmentation algorithm doing some level of sampling of the input image. The reason the lines are not evenly distributed in some plots is an artifact of the sampling when scaling the images for displaying in the report.


I R 2inch WH
Height
Width
0
100
200
300
400
500
600
700
800
0
200
400
600
800
1000
1200
1400
1600
"f2"
"f3"
"f4"
"f5"


I L 2inch WH
Height
Width
0
100
200
300
400
500
600
700
800
0
200
400
600
800
1000
1200
1400
1600
"f7"
"f8"
"f9"
"f10"