Supplementary Material for
IPBoost – Non-Convex Boosting via Integer Programming

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1. Detailed Computational Results

In the following tables, we report detailed computational results for our tests. We report problem size statistics in Table 1 and running time statistics in Table 2.

For $\rho = 0.1, 0.075, 0.05, 0.025, 0.01$, we present train results in Tables 3, 5, 7, 11 and test results in Tables 4, 6, 8, 12.

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Table 1. Statistics on LIBSVM instances.

name	train set				test set			
	d	N	class -1	class 1	d	N	class -1	class 1
a1a	119	1605	1210	395	–	–	–	–
a2a	119	2265	1693	572	–	–	–	–
a3a	122	3185	2412	773	–	–	–	–
a4a	122	4781	3593	1188	–	–	–	–
a5a	122	6414	4845	1569	–	–	–	–
a6a	122	11 220	8528	2692	–	–	–	–
a7a	122	16 100	12 182	3918	–	–	–	–
a9a	123	32 561	24 720	7841	–	–	–	–
australian_scale	14	690	383	307	–	–	–	–
breast-cancer_scale	10	683	444	239	–	–	–	–
cod-rna	8	59 535	39 690	19 845	8	271 617	181 078	90 539
colon-cancer	2000	62	40	22	–	–	–	–
duke	7129	44	21	23	7129	38	16	22
german.numer	24	1000	700	300	–	–	–	–
gisette_scale	5000	6000	3000	3000	5000	1000	500	500
diabetes_scale	8	768	268	500	–	–	–	–
fourclass_scale	2	862	555	307	–	–	–	–
german.numer_scale	24	1000	700	300	–	–	–	–
heart_scale	13	270	150	120	–	–	–	–
ijcnn1	22	49 990	45 137	4853	22	91 701	82 989	8712
ionosphere_scale	34	351	126	225	–	–	–	–
leu	7129	38	11	27	7129	34	14	20
liver-disorders	5	145	90	55	5	200	100	100
madelon	500	2000	1000	1000	500	600	300	300
phishing	68	11 055	4898	6157	–	–	–	–
skin_nonskin	3	245 057	50 859	194 198	–	–	–	–
sonar_scale	60	208	111	97	–	–	–	–
splice	60	1000	483	517	60	2175	1044	1131
svmguide1	4	3089	1089	2000	4	4000	2000	2000
svmguide3	22	1243	947	296	22	41	41	0
w1a	300	2477	2405	72	300	47 272	45 865	1407
w2a	300	3470	3363	107	300	46 279	44 907	1372
w3a	300	4912	4769	143	300	44 837	43 501	1336
w4a	300	7366	7150	216	300	42 383	41 120	1263
w5a	300	9888	9607	281	300	39 861	38 663	1198
w8a	300	49 749	48 270	1479	300	14 951	14 497	454

Table 2. Statistics for LIBSVM on average run times (in seconds) of different algorithms with $\rho = 0.05$ for 10 different seeds; "# optimal" gives the number of instances solved to optimality, "# time out" the number of instances that ran into the time limit of 1 hour, and "best sol. time" the average time at which the best solution was found.

| | IPBoost | | | | | | |
name	total time	# nodes	# optimal	# time out	best sol. time	LPBoost time	AdaBoost time
a1a	97.26	6669.9	0	0	26.08	0.15	0.40
a2a	257.97	8186.6	0	0	128.55	0.26	0.59
a3a	464.05	9096.6	0	0	230.18	0.37	0.59
a4a	770.89	9769.9	0	0	381.76	0.73	0.83
a5a	904.72	10 186.5	0	0	465.58	1.11	1.16
a6a	1712.09	7763.4	0	1	736.32	2.76	1.76
a7a	2946.71	8986.1	0	3	1542.57	5.40	2.74
a8a	3251.73	6370.4	0	8	2217.36	9.33	3.51
a9a	3247.98	4094.4	0	7	1461.27	17.96	4.89
australian_scale	66.84	7400.4	1	0	23.78	0.07	0.17
breast-cancer_scale	435.32	7183.9	0	1	29.21	0.06	0.15
cod-rna	3603.83	77.4	0	10	304.28	3281.72	30.13
colon-cancer	0.09	6.8	10	0	0.02	0.04	0.21
duke	0.25	7.9	10	0	0.03	0.14	0.37
german.numer	78.61	7215.8	0	0	19.77	0.09	0.20
gisette_scale	3439.67	3709.8	0	8	1991.59	18.87	16.31
diabetes_scale	116.58	7313.7	0	0	47.29	0.07	0.17
fourclass_scale	165.46	9932.6	0	0	102.16	0.07	0.16
german.numer_scale	120.73	9495.2	0	0	62.95	0.09	0.20
heart_scale	43.55	10 170.0	0	0	21.58	0.03	0.14
ijcnn1	3604.29	1197.2	0	10	708.19	206.01	5.95
ionosphere_scale	67.56	7375.7	0	0	24.33	0.08	0.16
leu	0.20	5.8	10	0	0.02	0.11	0.34
liver-disorders	48.69	9768.9	0	0	24.51	0.04	0.14
madelon	2387.03	7619.7	0	5	1354.16	1.59	0.90
mushrooms	968.38	6761.5	0	0	248.43	2.45	1.42
phishing	977.76	6726.0	0	0	268.98	3.76	1.03
skin_nonskin	3576.38	2251.6	0	8	861.25	2967.50	9.39
sonar_scale	61.81	6531.4	0	0	19.13	0.07	0.15
splice	128.63	5767.6	0	0	25.33	0.32	0.28
svmguide1	1375.33	9187.1	0	0	685.39	0.97	0.39
svmguide3	671.57	10 522.1	0	0	400.04	0.38	0.22
w1a	673.90	8291.2	0	0	240.40	3.28	6.05
w2a	927.73	7860.0	0	0	353.33	3.53	6.23
w3a	1665.23	8071.0	0	0	601.93	3.80	6.30
w4a	2442.22	8113.1	0	3	1256.18	3.97	6.36
w5a	2583.16	8091.4	0	2	1027.12	4.53	6.55
w6a	3607.69	5791.5	0	10	1881.83	6.17	7.42
w7a	3607.88	4362.3	0	10	2106.27	7.79	7.97
w8a	3611.46	3204.5	0	10	2022.04	18.14	11.50
averages	1367.78	6528.4	0.8	2.4	597.53	164.35	3.59

Table 3. Averages of the *train* accuracies and standard deviations for three algorithms with $\rho = 0.1$ for 10 different seeds on LIBSVM; best solutions are marked with *; using class probabilities for prediction and voting.

name		IPBoost score	L		LPBoost score	L		AdaBoost score	L
a1a	*	79.23 ± 1.93	4.8		77.41 ± 1.23	4.1		77.31 ±1.00	9.3
a2a	*	78.20 ± 1.82	4.1		77.00 ± 1.79	5.7		76.42 ±0.94	9.6
a3a	*	77.42 ± 1.02	4.2		76.41 ± 0.80	4.6		77.00 ±1.10	10.9
a4a	*	77.02 ± 1.03	4.0		75.89 ± 0.82	4.6		76.84 ±1.07	11.0
a5a	*	77.75 ± 0.97	4.3		76.39 ± 0.87	4.0		77.19 ±0.99	11.0
a6a	*	77.45 ± 0.79	3.9		76.99 ± 1.02	4.3		77.30 ±1.03	11.0
a7a	*	77.11 ± 1.00	3.7		76.37 ± 1.08	3.8	*	77.11 ±1.09	11.0
a8a	*	77.89 ± 2.84	2.9		76.00 ± 0.32	3.8		76.56 ±0.61	11.0
a9a	*	77.34 ± 2.20	3.0		76.09 ± 0.34	3.6		76.58 ±0.65	10.9
australian_scale	*	76.56 ± 10.27	4.4		74.55 ± 9.16	4.7		76.03 ±8.71	24.1
breast-cancer_scale	*	95.89 ± 1.46	6.2		95.32 ± 1.50	8.4		95.27 ±1.65	20.2
cod-rna		67.89 ± 3.82	1.3		67.87 ± 3.80	2.4	*	68.00 ±4.21	55.3
colon-cancer		99.00 ± 1.41	7.6		95.20 ± 3.01	6.4	*	100.00 ±0.00	58.7
duke		99.09 ± 1.59	6.4		95.91 ± 2.79	4.8	*	100.00 ±0.00	56.7
german.numer	*	71.65 ± 1.41	4.3		70.66 ± 1.19	3.9		71.34 ±1.62	19.1
gisette_scale	*	82.38 ± 4.23	4.8		79.49 ± 6.40	9.1		82.23 ±3.26	95.1
diabetes_scale		69.20 ± 4.23	4.2		69.28 ± 3.85	4.9	*	73.54 ±3.60	46.2
fourclass_scale		73.16 ± 1.93	3.1		73.65 ± 1.79	4.2	*	76.41 ±1.40	38.0
german.numer_scale	*	71.66 ± 1.43	4.6		70.66 ± 1.19	3.9		71.34 ±1.62	19.1
heart_scale	*	77.27 ± 3.83	4.3		75.05 ± 3.57	4.6		77.13 ±5.64	20.1
ijcnn1		90.31 ± 0.08	3.5	*	90.45 ± 0.46	5.3		90.34 ±0.06	71.6
ionosphere_scale		90.00 ± 2.89	6.4		89.61 ± 2.89	10.3	*	97.62 ±2.07	49.1
leu		98.42 ± 1.84	3.4		92.37 ± 3.15	2.7	*	100.00 ±0.00	36.9
liver-disorders		77.17 ± 1.76	5.4		75.93 ± 2.61	6.2	*	84.83 ±1.81	37.5
madelon		55.80 ± 2.57	6.0		55.08 ± 2.85	3.1	*	67.29 ±1.79	97.2
mushrooms	*	86.78 ± 9.01	5.2		78.89 ± 10.42	6.1		77.60 ±6.31	9.7
phishing	*	79.39 ± 10.55	2.5		76.63 ± 12.79	3.9		71.67 ±8.51	8.0
skin_nonskin		83.04 ± 4.50	2.4		82.88 ± 4.69	3.1	*	83.33 ±4.64	50.4
sonar_scale		79.34 ± 4.62	5.1		80.36 ± 4.25	13.0	*	99.46 ±0.82	64.6
splice		65.68 ± 7.26	3.7		64.68 ± 7.70	6.5	*	66.89 ±6.23	21.0
svmguide1		92.61 ± 3.80	5.5		92.28 ± 4.00	6.5	*	92.92 ±3.71	62.9
svmguide3		78.87 ± 1.46	4.8		78.21 ± 1.32	6.0	*	81.36 ±2.38	70.7
w1a	*	97.76 ± 0.14	6.6		97.47 ± 0.18	5.3		97.31 ±0.15	14.9
w2a	*	97.54 ± 0.14	6.1		97.22 ± 0.16	4.8		97.13 ±0.10	15.5
w3a	*	97.56 ± 0.17	6.1		97.31 ± 0.10	5.3		97.25 ±0.12	16.1
w4a	*	97.52 ± 0.12	6.0		97.28 ± 0.08	5.5		97.21 ±0.10	16.1
w5a	*	97.56 ± 0.07	6.3		97.29 ± 0.05	4.6		97.28 ±0.10	16.1
w6a	*	97.32 ± 0.13	5.9		97.16 ± 0.11	5.7		97.11 ±0.13	16.1
w7a	*	97.38 ± 0.12	5.9		97.18 ± 0.11	5.5		97.16 ±0.11	16.1
w8a	*	97.40 ± 0.12	5.8		97.21 ± 0.10	5.6		97.19 ±0.11	16.5
averages	25	83.52 ± 2.51	4.7	1	82.29 ± 2.61	5.3	15	84.36 ±1.99	31.4

Table 4. Averages of the *test* accuracies and standard deviations for three algorithms with $\rho = 0.1$ for 10 different seeds on LIBSVM; best solutions are marked with *; using class probabilities for prediction and voting.

name		IPBoost score	L		LPBoost score	L		AdaBoost score	L
a1a	*	78.32 ± 3.25	4.8		76.70 ± 2.94	4.1		76.04 ± 3.30	9.3
a2a	*	77.88 ± 2.23	4.1		76.51 ± 2.30	5.7		75.67 ± 1.57	9.6
a3a	*	77.47 ± 1.39	4.2		75.64 ± 1.62	4.6		76.84 ± 1.03	10.9
a4a	*	76.44 ± 1.93	4.0		75.23 ± 1.75	4.6		76.18 ± 1.72	11.0
a5a	*	77.18 ± 1.51	4.3		75.70 ± 1.85	4.0		76.72 ± 1.77	11.0
a6a		77.77 ± 1.22	3.9		77.58 ± 1.35	4.3	*	77.84 ± 1.31	11.0
a7a		77.23 ± 1.26	3.7		76.52 ± 1.10	3.8	*	77.28 ± 1.39	11.0
a8a	*	77.96 ± 2.69	2.9		75.97 ± 0.49	3.8		76.46 ± 0.64	11.0
a9a	*	77.35 ± 2.29	3.0		76.24 ± 0.58	3.6		76.54 ± 0.82	10.9
australian_scale	*	75.00 ± 10.15	4.4		72.32 ± 9.84	4.7		72.61 ± 9.54	24.1
breast-cancer_scale	*	93.97 ± 1.89	6.2		93.09 ± 2.53	8.4		93.01 ± 2.48	20.2
cod-rna		67.82 ± 3.66	1.3		67.78 ± 3.51	2.4	*	67.94 ± 4.03	55.3
colon-cancer		71.67 ± 13.15	7.6		70.83 ± 9.82	6.4	*	76.67 ± 14.59	58.7
duke		98.95 ± 1.84	6.4		95.53 ± 3.05	4.8	*	100.00 ± 0.00	56.7
german.numer	*	72.35 ± 3.64	4.3		71.90 ± 3.26	3.9		71.80 ± 3.32	19.1
gisette_scale	*	81.40 ± 4.69	4.8		79.05 ± 5.96	9.1		80.40 ± 3.62	95.1
diabetes_scale		67.32 ± 6.22	4.2	*	68.04 ± 4.97	4.9		66.80 ± 5.07	46.2
fourclass_scale		72.33 ± 5.19	3.1	*	72.44 ± 4.29	4.2		72.09 ± 4.02	38.0
german.numer_scale	*	72.25 ± 3.63	4.6		71.90 ± 3.26	3.9		71.80 ± 3.32	19.1
heart_scale	*	73.70 ± 6.52	4.3		71.30 ± 4.80	4.6		69.81 ± 5.09	20.1
ijcnn1		90.34 ± 0.22	3.5	*	90.63 ± 0.89	5.3		90.30 ± 0.28	71.6
ionosphere_scale		84.71 ± 5.43	6.4		85.57 ± 4.18	10.3	*	86.71 ± 4.86	49.1
leu		70.29 ± 7.26	3.4		73.24 ± 8.48	2.7	*	80.88 ± 7.50	36.9
liver-disorders		54.35 ± 2.70	5.4	*	55.95 ± 3.20	6.2		55.90 ± 3.02	37.5
madelon		53.30 ± 4.44	6.0	*	53.67 ± 4.22	3.1		52.12 ± 1.82	97.2
mushrooms	*	87.08 ± 8.65	5.2		79.35 ± 10.05	6.1		77.70 ± 6.29	9.7
phishing	*	79.02 ± 10.87	2.5		76.63 ± 12.76	3.9		71.27 ± 8.52	8.0
skin_nonskin		83.06 ± 4.56	2.4		82.91 ± 4.76	3.1	*	83.35 ± 4.71	50.4
sonar_scale		66.83 ± 8.54	5.1	*	69.27 ± 9.14	13.0		63.90 ± 11.14	64.6
splice		65.14 ± 7.83	3.7		64.67 ± 8.02	6.5	*	65.19 ± 6.65	21.0
svmguide1	*	90.77 ± 4.88	5.5		90.69 ± 4.78	6.5		90.40 ± 5.01	62.9
svmguide3		79.76 ± 18.54	4.8	*	86.10 ± 16.78	6.0		63.90 ± 23.36	70.7
w1a	*	97.29 ± 0.17	6.6		97.21 ± 0.12	5.3		97.11 ± 0.14	14.9
w2a	*	97.38 ± 0.13	6.1		97.21 ± 0.09	4.8		97.15 ± 0.11	15.5
w3a	*	97.35 ± 0.11	6.1		97.21 ± 0.10	5.3		97.18 ± 0.11	16.1
w4a	*	97.37 ± 0.16	6.0		97.18 ± 0.10	5.5		97.17 ± 0.12	16.1
w5a	*	97.37 ± 0.11	6.3		97.13 ± 0.08	4.6		97.14 ± 0.11	16.1
w6a	*	97.38 ± 0.13	5.9		97.23 ± 0.09	5.7		97.22 ± 0.11	16.1
w7a	*	97.39 ± 0.12	5.9		97.21 ± 0.10	5.5		97.21 ± 0.11	16.1
w8a	*	97.26 ± 0.12	5.8		97.13 ± 0.10	5.6		97.12 ± 0.10	16.5
averages	24	80.70 ± 4.08	4.7	7	80.16 ± 3.93	5.3	9	79.79 ± 3.82	31.4

Table 5. Averages of the *train* accuracies and standard deviations for three algorithms with $\rho = 0.075$ for 10 different seeds on LIBSVM; best solutions are marked with *; using class probabilities for prediction and voting.

name		IPBoost score	L		LPBoost score	L		AdaBoost score	L
a1a	*	79.35 ± 2.14	5.5		77.37 ± 1.20	4.7		77.31 ±1.00	9.3
a2a	*	78.68 ± 1.60	5.4		77.25 ± 1.88	6.3		76.42 ±0.94	9.6
a3a	*	78.05 ± 1.11	6.0		76.43 ± 0.82	5.0		77.00 ±1.10	10.9
a4a	*	77.73 ± 0.95	6.0		75.90 ± 0.82	4.5		76.84 ±1.07	11.0
a5a	*	78.18 ± 1.28	5.3		76.40 ± 0.87	4.4		77.19 ±0.99	11.0
a6a	*	77.68 ± 0.99	4.6		76.73 ± 0.95	3.9		77.30 ±1.03	11.0
a7a	*	77.45 ± 1.22	5.4		76.37 ± 1.08	3.7		77.11 ±1.09	11.0
a8a	*	77.84 ± 2.45	3.6		76.01 ± 0.32	3.8		76.56 ±0.61	11.0
a9a	*	76.87 ± 1.76	3.0		76.09 ± 0.34	3.6		76.58 ±0.65	10.9
australian_scale		76.00 ± 9.33	5.6		74.66 ± 9.10	4.9	*	76.03 ±8.71	24.1
breast-cancer_scale	*	96.36 ± 1.01	7.5		95.36 ± 1.51	9.7		95.27 ±1.65	20.2
cod-rna		67.89 ± 3.82	1.5		67.87 ± 3.80	2.4	*	68.00 ±4.21	55.3
colon-cancer		98.80 ± 1.40	6.3		94.40 ± 1.58	5.1	*	100.00 ±0.00	58.7
duke		98.41 ± 1.87	5.9		96.14 ± 2.84	5.0	*	100.00 ±0.00	56.7
german.numer	*	71.84 ± 1.64	5.1		70.67 ± 1.19	4.2		71.34 ±1.62	19.1
gisette_scale	*	83.14 ± 3.31	5.5		81.94 ± 4.56	13.5		82.23 ±3.26	95.1
diabetes_scale		69.98 ± 4.30	5.7		69.67 ± 4.12	5.3	*	73.54 ±3.60	46.2
fourclass_scale		74.13 ± 1.81	4.0		74.26 ± 1.43	5.5	*	76.41 ±1.40	38.0
german.numer_scale	*	71.73 ± 1.51	5.5		70.67 ± 1.19	4.2		71.34 ±1.62	19.1
heart_scale	*	78.84 ± 3.54	6.3		75.42 ± 3.80	5.3		77.13 ±5.64	20.1
ijcnn1		90.42 ± 0.23	4.4	*	90.45 ± 0.46	6.1		90.34 ±0.06	71.6
ionosphere_scale		91.28 ± 2.72	7.1		91.00 ± 2.98	13.9	*	97.62 ±2.07	49.1
leu		98.68 ± 1.86	3.4		92.37 ± 3.15	2.7	*	100.00 ±0.00	36.9
liver-disorders		78.14 ± 2.03	6.7		76.07 ± 2.43	7.4	*	84.83 ±1.81	37.5
madelon		56.13 ± 2.84	9.9		55.47 ± 2.88	3.6	*	67.29 ±1.79	97.2
mushrooms	*	88.14 ± 7.75	6.0		79.50 ± 10.21	6.0		77.60 ±6.31	9.7
phishing	*	83.89 ± 7.85	3.5		76.54 ± 12.87	4.1		71.67 ±8.51	8.0
skin_nonskin		83.04 ± 4.54	2.0		82.91 ± 4.73	3.6	*	83.33 ±4.64	50.4
sonar_scale		80.30 ± 4.68	6.1		83.11 ± 4.81	17.6	*	99.46 ±0.82	64.6
splice		65.83 ± 7.11	4.8		64.76 ± 7.64	7.2	*	66.89 ±6.23	21.0
svmguide1		92.73 ± 3.73	6.3		92.34 ± 3.90	6.8	*	92.92 ±3.71	62.9
svmguide3		79.40 ± 1.59	6.4		78.54 ± 1.24	7.0	*	81.36 ±2.38	70.7
w1a	*	97.88 ± 0.15	7.9		97.46 ± 0.20	5.6		97.31 ±0.15	14.9
w2a	*	97.67 ± 0.21	8.5		97.23 ± 0.18	5.0		97.13 ±0.10	15.5
w3a	*	97.65 ± 0.16	7.9		97.31 ± 0.11	6.0		97.25 ±0.12	16.1
w4a	*	97.59 ± 0.10	8.4		97.28 ± 0.09	5.8		97.21 ±0.10	16.1
w5a	*	97.61 ± 0.12	7.6		97.30 ± 0.05	4.8		97.28 ±0.10	16.1
w6a	*	97.45 ± 0.15	7.9		97.16 ± 0.11	5.8		97.11 ±0.13	16.1
w7a	*	97.43 ± 0.11	7.2		97.19 ± 0.11	5.6		97.16 ±0.11	16.1
w8a	*	97.42 ± 0.12	7.2		97.21 ± 0.10	5.7		97.19 ±0.11	16.5
averages	24	83.94 ± 2.38	5.8	1	82.52 ± 2.54	5.9	15	84.36 ±1.99	31.4

Table 6. Averages of the *test* accuracies and standard deviations for three algorithms with $\rho = 0.075$ for 10 different seeds on LIBSVM; best solutions are marked with *; using class probabilities for prediction and voting.

name		IPBoost score	L		LPBoost score	L		AdaBoost score	L
a1a	*	78.60 ± 3.49	5.5		76.73 ± 2.94	4.7		76.04 ± 3.30	9.3
a2a	*	78.28 ± 1.69	5.4		76.62 ± 2.35	6.3		75.67 ± 1.57	9.6
a3a	*	77.60 ± 1.19	6.0		75.60 ± 1.60	5.0		76.84 ± 1.03	10.9
a4a	*	76.90 ± 2.10	6.0		75.23 ± 1.75	4.5		76.18 ± 1.72	11.0
a5a	*	77.46 ± 1.71	5.3		75.73 ± 1.87	4.4		76.72 ± 1.77	11.0
a6a	*	78.08 ± 1.23	4.6		77.42 ± 1.05	3.9		77.84 ± 1.31	11.0
a7a	*	77.52 ± 1.33	5.4		76.52 ± 1.10	3.7		77.28 ± 1.39	11.0
a8a	*	77.84 ± 2.40	3.6		75.97 ± 0.49	3.8		76.46 ± 0.64	11.0
a9a	*	76.91 ± 2.09	3.0		76.24 ± 0.58	3.6		76.54 ± 0.82	10.9
australian_scale		72.46 ± 9.38	5.6		72.54 ± 9.86	4.9	*	72.61 ± 9.54	24.1
breast-cancer_scale	*	93.46 ± 2.18	7.5		93.24 ± 2.13	9.7		93.01 ± 2.48	20.2
cod-rna		67.82 ± 3.66	1.5		67.77 ± 3.50	2.4	*	67.94 ± 4.03	55.3
colon-cancer		70.83 ± 9.82	6.3		71.67 ± 10.54	5.1	*	76.67 ±14.59	58.7
duke		98.16 ± 2.17	5.9		95.79 ± 3.09	5.0	*	100.00 ± 0.00	56.7
german.numer	*	72.50 ± 3.44	5.1		71.85 ± 3.22	4.2		71.80 ± 3.32	19.1
gisette_scale	*	82.38 ± 4.17	5.5		81.28 ± 4.22	13.5		80.40 ± 3.62	95.1
diabetes_scale		66.80 ± 5.09	5.7	*	67.58 ± 4.02	5.3		66.80 ± 5.07	46.2
fourclass_scale		72.50 ± 4.64	4.0	*	73.08 ± 3.80	5.5		72.09 ± 4.02	38.0
german.numer_scale	*	72.10 ± 3.21	5.5		71.85 ± 3.22	4.2		71.80 ± 3.32	19.1
heart_scale	*	71.48 ± 6.88	6.3		71.11 ± 4.55	5.3		69.81 ± 5.09	20.1
ijcnn1		90.42 ± 0.34	4.4	*	90.60 ± 0.90	6.1		90.30 ± 0.28	71.6
ionosphere_scale		86.14 ± 5.68	7.1		86.14 ± 5.47	13.9	*	86.71 ± 4.86	49.1
leu		71.18 ± 7.57	3.4		73.24 ± 8.48	2.7	*	80.88 ± 7.50	36.9
liver-disorders		54.90 ± 3.16	6.7		55.85 ± 3.11	7.4	*	55.90 ± 3.02	37.5
madelon		52.88 ± 4.27	9.9	*	53.45 ± 4.24	3.6		52.12 ± 1.82	97.2
mushrooms	*	88.17 ± 8.18	6.0		79.76 ± 9.96	6.0		77.70 ± 6.29	9.7
phishing	*	83.72 ± 8.15	3.5		76.46 ± 12.91	4.1		71.27 ± 8.52	8.0
skin_nonskin		83.03 ± 4.61	2.0		82.94 ± 4.79	3.6	*	83.35 ± 4.71	50.4
sonar_scale		67.32 ± 9.97	6.1	*	69.76 ± 8.70	17.6		63.90 ±11.14	64.6
splice		65.03 ± 7.84	4.8		64.69 ± 8.00	7.2	*	65.19 ± 6.65	21.0
svmguide1	*	90.93 ± 4.72	6.3		90.92 ± 4.48	6.8		90.40 ± 5.01	62.9
svmguide3		78.29 ± 18.09	6.4	*	83.17 ± 17.83	7.0		63.90 ±23.36	70.7
w1a	*	97.31 ± 0.22	7.9		97.19 ± 0.11	5.6		97.11 ± 0.14	14.9
w2a	*	97.45 ± 0.14	8.5		97.21 ± 0.09	5.0		97.15 ± 0.11	15.5
w3a	*	97.40 ± 0.14	7.9		97.20 ± 0.11	6.0		97.18 ± 0.11	16.1
w4a	*	97.46 ± 0.11	8.4		97.20 ± 0.10	5.8		97.17 ± 0.12	16.1
w5a	*	97.42 ± 0.14	7.6		97.14 ± 0.08	4.8		97.14 ± 0.11	16.1
w6a	*	97.47 ± 0.14	7.9		97.23 ± 0.09	5.8		97.22 ± 0.11	16.1
w7a	*	97.42 ± 0.08	7.2		97.21 ± 0.11	5.6		97.21 ± 0.11	16.1
w8a	*	97.27 ± 0.13	7.2		97.13 ± 0.11	5.7		97.12 ± 0.10	16.5
averages	25	80.77 ± 3.89	5.8	6	80.21 ± 3.89	5.9	9	79.79 ± 3.82	31.4

Table 7. Averages of the *train* accuracies and standard deviations for three algorithms with $\rho = 0.05$ for 10 different seeds on LIBSVM; best solutions are marked with *; using class probabilities for prediction and voting.

name		IPBoost score	L		LPBoost score	L		AdaBoost score	L
a1a	*	79.97 ± 1.80	7.0		77.41 ± 1.23	4.6		77.31 ±1.00	9.3
a2a	*	79.06 ± 1.73	6.2		76.66 ± 1.01	6.5		76.42 ±0.94	9.6
a3a	*	78.67 ± 1.08	7.9		76.37 ± 0.83	5.0		77.00 ±1.10	10.9
a4a	*	78.24 ± 1.27	7.8		75.93 ± 0.82	4.8		76.84 ±1.07	11.0
a5a	*	78.46 ± 1.18	7.8		76.41 ± 0.87	4.4		77.19 ±0.99	11.0
a6a	*	77.94 ± 0.84	6.7		76.94 ± 0.96	4.9		77.30 ±1.03	11.0
a7a	*	77.69 ± 1.05	7.1		76.37 ± 1.09	4.2		77.11 ±1.09	11.0
a8a	*	78.11 ± 2.44	4.5		76.01 ± 0.32	4.1		76.56 ±0.61	11.0
a9a		76.31 ± 0.58	2.9		76.09 ± 0.34	3.7	*	76.58 ±0.65	10.9
australian_scale	*	77.52 ± 9.86	7.3		74.86 ± 8.97	5.8		76.03 ±8.71	24.1
breast-cancer_scale	*	96.49 ± 1.43	9.6		95.63 ± 1.56	9.8		95.27 ±1.65	20.2
cod-rna	*	68.10 ± 4.49	1.8		67.90 ± 3.91	2.4		68.00 ±4.21	55.3
colon-cancer		98.20 ± 1.48	5.5		94.20 ± 1.48	5.1	*	100.00 ±0.00	58.7
duke		97.73 ± 1.86	5.6		96.14 ± 2.84	5.0	*	100.00 ±0.00	56.7
german.numer	*	71.90 ± 1.92	6.5		70.67 ± 1.19	4.4		71.34 ±1.62	19.1
gisette_scale	*	84.60 ± 2.93	7.0		83.90 ± 3.73	20.9		82.23 ±3.26	95.1
diabetes_scale		71.07 ± 3.75	7.4		69.93 ± 3.89	6.6	*	73.54 ±3.60	46.2
fourclass_scale		76.29 ± 1.56	8.6		74.33 ± 1.58	6.1	*	76.41 ±1.40	38.0
german.numer_scale	*	72.01 ± 1.98	6.5		70.68 ± 1.19	4.4		71.34 ±1.62	19.1
heart_scale	*	81.02 ± 2.90	7.3		75.79 ± 4.08	6.4		77.13 ±5.64	20.1
ijcnn1	*	90.47 ± 0.47	5.8	*	90.47 ± 0.45	7.9		90.34 ±0.06	71.6
ionosphere_scale		92.56 ± 2.59	9.2		92.21 ± 3.06	19.5	*	97.62 ±2.07	49.1
leu		98.68 ± 1.86	3.5		92.37 ± 3.15	2.7	*	100.00 ±0.00	36.9
liver-disorders		80.28 ± 2.16	9.1		77.38 ± 2.00	9.5	*	84.83 ±1.81	37.5
madelon		56.45 ± 3.08	31.4		56.69 ± 2.67	14.0	*	67.28 ±1.79	97.2
mushrooms	*	87.86 ± 7.83	8.6		81.60 ± 8.18	7.0		77.60 ±6.31	9.7
phishing	*	80.86 ± 10.96	3.5		76.96 ± 12.46	4.0		71.67 ±8.51	8.0
skin_nonskin		83.12 ± 4.60	2.5		82.91 ± 4.73	3.7	*	83.33 ±4.64	50.4
sonar_scale		83.53 ± 3.76	12.3		88.08 ± 4.43	25.4	*	99.46 ±0.82	64.6
splice		66.25 ± 6.92	5.0		65.74 ± 6.97	7.6	*	66.89 ±6.23	21.0
svmguide1		92.90 ± 3.78	8.6		92.53 ± 3.84	6.9	*	92.92 ±3.71	62.9
svmguide3		79.69 ± 1.79	8.6		78.65 ± 1.35	8.9	*	81.36 ±2.38	70.7
w1a	*	98.07 ± 0.19	10.8		97.46 ± 0.18	5.2		97.31 ±0.15	14.9
w2a	*	97.78 ± 0.22	10.7		97.25 ± 0.17	5.5		97.13 ±0.10	15.5
w3a	*	97.75 ± 0.16	11.0		97.33 ± 0.15	6.6		97.25 ±0.12	16.1
w4a	*	97.67 ± 0.13	10.9		97.31 ± 0.10	6.0		97.21 ±0.10	16.1
w5a	*	97.68 ± 0.13	11.1		97.32 ± 0.08	5.0		97.28 ±0.10	16.1
w6a	*	97.49 ± 0.16	10.2		97.17 ± 0.11	5.7		97.11 ±0.13	16.1
w7a	*	97.48 ± 0.12	10.1		97.19 ± 0.12	5.6		97.16 ±0.11	16.1
w8a	*	97.52 ± 0.11	9.8		97.20 ± 0.10	5.6		97.19 ±0.11	16.5
averages	26	84.34 ± 2.43	8.1	1	82.90 ± 2.40	7.0	14	84.36 ±1.99	31.4

Table 8. Averages of the *test* accuracies and standard deviations for three algorithms with $\rho = 0.05$ for 10 different seeds on LIBSVM; best solutions are marked with *; using class probabilities for prediction and voting.

name		IPBoost score	L		LPBoost score	L		AdaBoost score	L
a1a	*	79.10 ± 3.44	7.0		76.70 ± 2.99	4.6		76.04 ± 3.30	9.3
a2a	*	78.08 ± 2.22	6.2		75.83 ± 2.36	6.5		75.67 ± 1.57	9.6
a3a	*	78.32 ± 1.42	7.9		75.54 ± 1.46	5.0		76.84 ± 1.03	10.9
a4a	*	77.55 ± 2.21	7.8		75.26 ± 1.78	4.8		76.18 ± 1.72	11.0
a5a	*	77.39 ± 1.25	7.8		75.74 ± 1.88	4.4		76.72 ± 1.77	11.0
a6a	*	78.48 ± 1.13	6.7		77.54 ± 1.27	4.9		77.84 ± 1.31	11.0
a7a	*	77.86 ± 1.20	7.1		76.52 ± 1.10	4.2		77.28 ± 1.39	11.0
a8a	*	77.98 ± 2.37	4.5		75.97 ± 0.49	4.1		76.46 ± 0.64	11.0
a9a		76.36 ± 0.67	2.9		76.24 ± 0.58	3.7	*	76.54 ± 0.82	10.9
australian_scale	*	74.35 ± 10.93	7.3		72.75 ± 9.47	5.8		72.61 ± 9.54	24.1
breast-cancer_scale	*	93.97 ± 2.19	9.6		93.68 ± 1.90	9.8		93.01 ± 2.48	20.2
cod-rna	*	68.08 ± 4.48	1.8		67.82 ± 3.64	2.4		67.94 ± 4.03	55.3
colon-cancer		75.00 ± 13.03	5.5		72.50 ± 11.82	5.1	*	76.67 ± 14.59	58.7
duke		97.37 ± 2.15	5.6		95.79 ± 3.09	5.0	*	100.00 ± 0.00	56.7
german.numer		71.65 ± 3.67	6.5	*	71.85 ± 3.22	4.4		71.80 ± 3.32	19.1
gisette_scale	*	83.69 ± 3.52	7.0		83.14 ± 3.84	20.9		80.40 ± 3.62	95.1
diabetes_scale		66.93 ± 5.60	7.4	*	67.84 ± 3.47	6.6		66.80 ± 5.07	46.2
fourclass_scale		72.38 ± 4.59	8.6	*	73.43 ± 3.73	6.1		72.09 ± 4.02	38.0
german.numer_scale	*	71.85 ± 3.57	6.5	*	71.85 ± 3.22	4.4		71.80 ± 3.32	19.1
heart_scale	*	73.89 ± 7.43	7.3		71.11 ± 4.55	6.4		69.81 ± 5.09	20.1
ijcnn1	*	90.60 ± 0.92	5.8		90.52 ± 0.93	7.9		90.30 ± 0.28	71.6
ionosphere_scale		85.43 ± 5.16	9.2		85.86 ± 4.88	19.5	*	86.71 ± 4.86	49.1
leu		70.59 ± 7.59	3.5		73.24 ± 8.48	2.7	*	80.88 ± 7.50	36.9
liver-disorders		54.25 ± 2.85	9.1		55.70 ± 2.37	9.5	*	55.90 ± 3.02	37.5
madelon		52.40 ± 4.42	31.4	*	52.78 ± 4.16	14.0		52.12 ± 1.82	97.2
mushrooms	*	87.91 ± 7.92	8.6		81.77 ± 7.78	7.0		77.70 ± 6.29	9.7
phishing	*	80.85 ± 10.96	3.5		76.66 ± 12.71	4.0		71.27 ± 8.52	8.0
skin_nonskin		83.15 ± 4.65	2.5		82.94 ± 4.79	3.7	*	83.35 ± 4.71	50.4
sonar_scale		66.34 ± 8.03	12.3	*	68.78 ± 7.07	25.4		63.90 ± 11.14	64.6
splice		65.13 ± 7.75	5.0		65.01 ± 7.78	7.6	*	65.19 ± 6.65	21.0
svmguide1	*	90.93 ± 4.81	8.6		90.70 ± 4.66	6.9		90.40 ± 5.01	62.9
svmguide3		73.66 ± 19.30	8.6	*	83.90 ± 16.87	8.9		63.90 ± 23.36	70.7
w1a	*	97.37 ± 0.26	10.8		97.16 ± 0.13	5.2		97.11 ± 0.14	14.9
w2a	*	97.49 ± 0.21	10.7		97.20 ± 0.13	5.5		97.15 ± 0.11	15.5
w3a	*	97.48 ± 0.15	11.0		97.22 ± 0.11	6.6		97.18 ± 0.11	16.1
w4a	*	97.47 ± 0.12	10.9		97.21 ± 0.11	6.0		97.17 ± 0.12	16.1
w5a	*	97.49 ± 0.15	11.1		97.16 ± 0.10	5.0		97.14 ± 0.11	16.1
w6a	*	97.53 ± 0.13	10.2		97.23 ± 0.09	5.7		97.22 ± 0.11	16.1
w7a	*	97.48 ± 0.10	10.1		97.21 ± 0.11	5.6		97.21 ± 0.11	16.1
w8a	*	97.37 ± 0.11	9.8		97.12 ± 0.11	5.6		97.12 ± 0.10	16.5
averages	26	80.78 ± 4.07	8.1	7	80.31 ± 3.73	7.0	8	79.79 ± 3.82	31.4

Table 9. Averages of the *train* accuracies and standard deviations for three algorithms with $\rho = 0.025$ for 10 different seeds on LIBSVM; best solutions are marked with *; using class probabilities for prediction and voting.

name		IPBoost score	L		LPBoost score	L		AdaBoost score	L
a1a	*	80.80 ± 1.83	10.8		77.38 ± 1.21	4.9		77.31 ±1.00	9.3
a2a	*	79.71 ± 1.46	10.7		76.72 ± 1.02	5.7		76.42 ±0.94	9.6
a3a	*	78.77 ± 1.20	11.9		76.43 ± 0.82	4.9		77.00 ±1.10	10.9
a4a	*	78.26 ± 1.42	11.4		75.90 ± 0.82	4.6		76.84 ±1.07	11.0
a5a	*	78.99 ± 1.46	11.6		76.41 ± 0.87	4.5		77.19 ±0.99	11.0
a6a	*	78.06 ± 1.17	8.6		76.75 ± 0.96	4.6		77.30 ±1.03	11.0
a7a	*	77.56 ± 1.08	8.6		76.37 ± 1.09	4.3		77.11 ±1.09	11.0
a8a	*	78.66 ± 3.08	5.9		76.01 ± 0.32	4.3		76.56 ±0.61	11.0
a9a	*	77.11 ± 1.81	5.2		76.09 ± 0.34	3.5		76.58 ±0.65	10.9
australian_scale	*	78.24 ± 9.62	9.0		75.27 ± 8.74	7.2		76.03 ±8.71	24.1
breast-cancer_scale	*	96.82 ± 1.49	11.9		95.89 ± 1.62	12.1		95.27 ±1.65	20.2
cod-rna	*	68.13 ± 4.59	2.2		67.90 ± 3.90	3.3		68.00 ±4.21	55.3
colon-cancer		97.60 ± 1.26	5.4		94.20 ± 1.48	5.1	*	100.00 ±0.00	58.7
duke		95.91 ± 2.58	5.1		95.23 ± 2.92	4.8	*	100.00 ±0.00	56.7
german.numer	*	72.25 ± 1.76	8.2		70.91 ± 1.35	4.6		71.34 ±1.62	19.1
gisette_scale		85.06 ± 3.48	13.2	*	85.31 ± 4.74	42.6		82.23 ±3.26	95.1
diabetes_scale		72.49 ± 3.36	12.1		71.01 ± 3.73	11.2	*	73.54 ±3.60	46.2
fourclass_scale	*	76.88 ± 1.26	11.1		75.59 ± 1.47	7.7		76.41 ±1.40	38.0
german.numer_scale	*	72.29 ± 1.78	8.4		70.91 ± 1.35	4.6		71.34 ±1.62	19.1
heart_scale	*	80.14 ± 4.41	9.3		76.81 ± 4.89	7.9		77.13 ±5.64	20.1
ijcnn1	*	90.56 ± 0.62	11.9		90.53 ± 0.60	12.8		90.34 ±0.06	71.6
ionosphere_scale		95.12 ± 2.41	21.9		95.09 ± 2.39	36.1	*	97.62 ±2.07	49.1
leu		98.68 ± 1.86	3.3		92.37 ± 3.15	2.7	*	100.00 ±0.00	36.9
liver-disorders		83.10 ± 2.28	14.4		79.93 ± 1.94	12.8	*	84.83 ±1.81	37.5
madelon		57.26 ± 3.17	9.4		59.02 ± 2.24	34.7	*	67.28 ±1.79	97.2
mushrooms	*	92.71 ± 5.86	12.3		81.88 ± 9.32	7.7		77.60 ±6.31	9.7
phishing	*	80.02 ± 10.35	5.8		77.03 ± 12.40	3.9		71.67 ±8.51	8.0
skin_nonskin		83.20 ± 4.69	3.8		83.00 ± 4.84	4.2	*	83.33 ±4.64	50.4
sonar_scale		91.02 ± 3.30	42.1		92.93 ± 3.79	42.8	*	99.46 ±0.82	64.6
splice	*	67.26 ± 6.44	7.7		66.28 ± 6.61	9.7		66.89 ±6.23	21.0
svmguide1	*	93.11 ± 3.74	12.0		92.71 ± 3.76	13.9		92.92 ±3.71	62.9
svmguide3		80.29 ± 1.69	12.7		79.61 ± 1.60	13.0	*	81.36 ±2.38	70.7
w1a	*	98.24 ± 0.19	20.4		97.44 ± 0.17	4.9		97.31 ±0.15	14.9
w2a	*	97.98 ± 0.21	16.7		97.29 ± 0.21	5.9		97.13 ±0.10	15.5
w3a	*	97.94 ± 0.19	17.7		97.31 ± 0.15	5.5		97.25 ±0.12	16.1
w4a	*	97.83 ± 0.14	17.5		97.32 ± 0.10	5.5		97.21 ±0.10	16.1
w5a	*	97.79 ± 0.17	17.5		97.33 ± 0.09	5.3		97.28 ±0.10	16.1
w6a	*	97.62 ± 0.11	16.9		97.17 ± 0.11	5.7		97.11 ±0.13	16.1
w7a	*	97.60 ± 0.15	14.8		97.20 ± 0.12	5.6		97.16 ±0.11	16.1
w8a	*	97.58 ± 0.11	14.1		97.23 ± 0.10	6.0		97.19 ±0.11	16.5
averages	29	84.97 ± 2.44	11.8	1	83.39 ± 2.43	9.8	10	84.36 ±1.99	31.4

Table 10. Averages of the *test* accuracies and standard deviations for three algorithms with $\rho = 0.025$ for 10 different seeds on LIBSVM; best solutions are marked with *; using class probabilities for prediction and voting.

name		IPBoost score	L		LPBoost score	L		AdaBoost score	L
a1a	*	80.12 ± 2.80	10.8		76.70 ± 2.99	4.9		76.04 ± 3.30	9.3
a2a	*	78.98 ± 1.83	10.7		75.96 ± 2.26	5.7		75.67 ± 1.57	9.6
a3a	*	78.15 ± 1.64	11.9		75.60 ± 1.60	4.9		76.84 ± 1.03	10.9
a4a	*	76.98 ± 1.75	11.4		75.23 ± 1.75	4.6		76.18 ± 1.72	11.0
a5a	*	77.81 ± 1.72	11.6		75.74 ± 1.88	4.5		76.72 ± 1.77	11.0
a6a	*	78.40 ± 1.23	8.6		77.44 ± 1.04	4.6		77.84 ± 1.31	11.0
a7a	*	77.61 ± 1.08	8.6		76.52 ± 1.10	4.3		77.28 ± 1.39	11.0
a8a	*	78.67 ± 2.93	5.9		75.97 ± 0.49	4.3		76.46 ± 0.64	11.0
a9a	*	77.18 ± 1.97	5.2		76.24 ± 0.58	3.5		76.54 ± 0.82	10.9
australian_scale	*	74.28 ± 10.40	9.0		72.68 ± 9.54	7.2		72.61 ± 9.54	24.1
breast-cancer_scale	*	93.46 ± 1.85	11.9		93.38 ± 1.70	12.1		93.01 ± 2.48	20.2
cod-rna	*	68.11 ± 4.60	2.2		67.81 ± 3.63	3.3		67.94 ± 4.03	55.3
colon-cancer		70.00 ± 9.78	5.4		73.33 ± 10.97	5.1	*	76.67 ± 14.59	58.7
duke		95.79 ± 2.54	5.1		94.74 ± 3.28	4.8	*	100.00 ± 0.00	56.7
german.numer		71.65 ± 3.07	8.2		71.70 ± 3.21	4.6	*	71.80 ± 3.32	19.1
gisette_scale		84.29 ± 3.58	13.2	*	84.35 ± 4.95	42.6		80.40 ± 3.62	95.1
diabetes_scale		66.27 ± 4.58	12.1	*	67.45 ± 3.56	11.2		66.80 ± 5.07	46.2
fourclass_scale		71.74 ± 4.67	11.1	*	72.44 ± 4.19	7.7		72.09 ± 4.02	38.0
german.numer_scale		71.55 ± 3.13	8.4		71.70 ± 3.21	4.6	*	71.80 ± 3.32	19.1
heart_scale		70.56 ± 7.33	9.3	*	71.30 ± 4.96	7.9		69.81 ± 5.09	20.1
ijcnn1	*	90.51 ± 0.79	11.9		90.49 ± 0.81	12.8		90.30 ± 0.28	71.6
ionosphere_scale		85.57 ± 6.48	21.9		85.43 ± 5.75	36.1	*	86.71 ± 4.86	49.1
leu		70.88 ± 8.02	3.3		73.24 ± 8.48	2.7	*	80.88 ± 7.50	36.9
liver-disorders		54.85 ± 2.49	14.4		55.80 ± 2.39	12.8	*	55.90 ± 3.02	37.5
madelon	*	52.83 ± 3.83	9.4		52.60 ± 4.13	34.7		52.12 ± 1.82	97.2
mushrooms	*	92.83 ± 6.11	12.3		81.94 ± 9.51	7.7		77.70 ± 6.29	9.7
phishing	*	79.46 ± 10.76	5.8		76.95 ± 12.43	3.9		71.27 ± 8.52	8.0
skin_nonskin		83.23 ± 4.76	3.8		83.03 ± 4.91	4.2	*	83.35 ± 4.71	50.4
sonar_scale		67.56 ± 7.97	42.1	*	70.24 ± 11.02	42.8		63.90 ± 11.14	64.6
splice		65.26 ± 7.52	7.7	*	65.38 ± 7.51	9.7		65.19 ± 6.65	21.0
svmguide1	*	90.55 ± 4.78	12.0		90.33 ± 4.62	13.9		90.40 ± 5.01	62.9
svmguide3		70.00 ± 20.44	12.7	*	79.02 ± 17.10	13.0		63.90 ± 23.36	70.7
w1a	*	97.30 ± 0.20	20.4		97.17 ± 0.12	4.9		97.11 ± 0.14	14.9
w2a	*	97.47 ± 0.19	16.7		97.27 ± 0.14	5.9		97.15 ± 0.11	15.5
w3a	*	97.53 ± 0.16	17.7		97.20 ± 0.12	5.5		97.18 ± 0.11	16.1
w4a	*	97.58 ± 0.17	17.5		97.20 ± 0.12	5.5		97.17 ± 0.12	16.1
w5a	*	97.52 ± 0.15	17.5		97.15 ± 0.11	5.3		97.14 ± 0.11	16.1
w6a	*	97.64 ± 0.13	16.9		97.23 ± 0.09	5.7		97.22 ± 0.11	16.1
w7a	*	97.56 ± 0.11	14.8		97.22 ± 0.12	5.6		97.21 ± 0.11	16.1
w8a	*	97.41 ± 0.14	14.1		97.15 ± 0.10	6.0		97.12 ± 0.10	16.5
averages	25	80.63 ± 3.94	11.8	7	80.21 ± 3.91	9.8	8	79.79 ± 3.82	31.4

Table 11. Averages of the *train* accuracies and standard deviations for three algorithms with $\rho = 0.01$ for 10 different seeds on LIBSVM; best solutions are marked with *; using class probabilities for prediction and voting.

name		IPBoost score	L		LPBoost score	L		AdaBoost score	L
a1a	*	79.97 ± 2.23	10.3		77.41 ± 1.23	4.5		77.31 ±1.00	9.3
a2a	*	79.18 ± 1.86	11.8		76.74 ± 0.92	5.4		76.42 ±0.94	9.6
a3a	*	78.63 ± 1.54	13.9		76.39 ± 0.82	4.5		77.00 ±1.10	10.9
a4a	*	78.68 ± 1.55	13.7		75.90 ± 0.82	4.6		76.84 ±1.07	11.0
a5a	*	79.05 ± 1.57	14.7		76.31 ± 0.80	4.4		77.19 ±0.99	11.0
a6a	*	78.33 ± 1.31	11.5		76.73 ± 0.96	4.4		77.30 ±1.03	11.0
a7a	*	78.30 ± 1.42	12.5		76.37 ± 1.09	4.3		77.11 ±1.09	11.0
a8a	*	79.05 ± 2.84	8.2		76.01 ± 0.32	4.2		76.56 ±0.61	11.0
a9a	*	77.07 ± 1.71	5.9		76.09 ± 0.34	3.5		76.58 ±0.65	10.9
australian_scale	*	77.41 ± 9.06	11.9		75.80 ± 8.55	8.6		76.03 ±8.71	24.1
breast-cancer_scale	*	96.93 ± 1.75	15.0		96.00 ± 1.70	12.8		95.27 ±1.65	20.2
cod-rna	*	68.20 ± 4.80	3.4		67.90 ± 3.90	3.3		68.00 ±4.21	55.3
colon-cancer		97.60 ± 1.26	5.9		94.00 ± 1.63	5.0	*	100.00 ±0.00	58.7
duke		95.68 ± 2.26	5.0		95.23 ± 2.92	4.8	*	100.00 ±0.00	56.7
german.numer	*	72.32 ± 2.04	9.6		71.01 ± 1.43	5.7		71.34 ±1.62	19.1
gisette_scale		86.14 ± 4.28	33.7	*	88.01 ± 3.94	106.5		82.23 ±3.26	95.1
diabetes_scale	*	74.18 ± 3.53	19.1		72.50 ± 3.83	18.8		73.54 ±3.60	46.2
fourclass_scale	*	77.33 ± 1.39	13.8		76.55 ± 1.38	11.2		76.41 ±1.40	38.0
german.numer_scale	*	72.27 ± 1.99	9.3		71.01 ± 1.43	5.7		71.34 ±1.62	19.1
heart_scale	*	81.06 ± 8.01	12.5		77.87 ± 6.09	12.6		77.13 ±5.64	20.1
ijcnn1	*	90.59 ± 0.60	28.9		90.54 ± 0.56	33.2		90.34 ±0.06	71.6
ionosphere_scale		98.72 ± 1.75	44.9	*	98.86 ± 1.65	47.0		97.62 ±2.07	49.1
leu		98.42 ± 1.84	3.3		92.37 ± 3.15	2.7	*	100.00 ±0.00	36.9
liver-disorders	*	88.55 ± 1.27	23.5		86.69 ± 1.72	26.4		84.83 ±1.81	37.5
madelon		60.06 ± 2.92	21.7		64.33 ± 1.21	85.7	*	67.28 ±1.79	97.2
mushrooms	*	93.52 ± 4.28	14.6		82.54 ± 7.77	8.1		77.60 ±6.31	9.7
phishing	*	81.05 ± 11.22	7.5		77.00 ± 12.43	3.9		71.67 ±8.51	8.0
skin_nonskin		83.30 ± 4.67	4.2		83.03 ± 4.88	4.2	*	83.33 ±4.64	50.4
sonar_scale		99.82 ± 0.40	52.4	*	99.88 ± 0.25	54.2		99.46 ±0.82	64.6
splice	*	67.92 ± 6.69	7.1		66.70 ± 6.37	11.6		66.89 ±6.23	21.0
svmguide1	*	93.35 ± 3.77	27.7		93.10 ± 3.71	29.0		92.92 ±3.71	62.9
svmguide3		81.33 ± 1.90	22.4		80.88 ± 1.67	34.1	*	81.36 ±2.38	70.7
w1a	*	98.49 ± 0.21	33.8		97.47 ± 0.18	5.1		97.31 ±0.15	14.9
w2a	*	98.19 ± 0.25	32.3		97.26 ± 0.21	5.4		97.13 ±0.10	15.5
w3a	*	98.17 ± 0.24	35.3		97.30 ± 0.13	5.2		97.25 ±0.12	16.1
w4a	*	97.99 ± 0.18	30.6		97.33 ± 0.15	5.4		97.21 ±0.10	16.1
w5a	*	97.94 ± 0.20	25.4		97.34 ± 0.11	5.4		97.28 ±0.10	16.1
w6a	*	97.73 ± 0.16	25.7		97.17 ± 0.11	5.8		97.11 ±0.13	16.1
w7a	*	97.62 ± 0.13	20.2		97.21 ± 0.12	5.8		97.16 ±0.11	16.1
w8a	*	97.64 ± 0.10	21.7		97.23 ± 0.10	6.2		97.19 ±0.11	16.5
averages	31	85.69 ± 2.48	18.1	3	84.20 ± 2.26	15.5	6	84.36 ±1.99	31.4

Table 12. Averages of the *test* accuracies and standard deviations for three algorithms with $\rho = 0.01$ for 10 different seeds on LIBSVM; best solutions are marked with *; using class probabilities for prediction and voting.

name		IPBoost score	L		LPBoost score	L		AdaBoost score	L
a1a	*	78.47 ± 3.33	10.3		76.73 ± 2.94	4.5		76.04 ± 3.30	9.3
a2a	*	77.75 ± 1.97	11.8		76.03 ± 2.36	5.4		75.67 ± 1.57	9.6
a3a	*	78.02 ± 1.50	13.9		75.59 ± 1.56	4.5		76.84 ± 1.03	10.9
a4a	*	77.63 ± 2.54	13.7		75.23 ± 1.75	4.6		76.18 ± 1.72	11.0
a5a	*	77.96 ± 1.64	14.7		75.59 ± 1.86	4.4		76.72 ± 1.77	11.0
a6a	*	78.72 ± 1.32	11.5		77.42 ± 1.04	4.4		77.84 ± 1.31	11.0
a7a	*	78.40 ± 1.55	12.5		76.52 ± 1.10	4.3		77.28 ± 1.39	11.0
a8a	*	78.93 ± 2.79	8.2		75.97 ± 0.49	4.2		76.46 ± 0.64	11.0
a9a	*	77.06 ± 2.04	5.9		76.24 ± 0.58	3.5		76.54 ± 0.82	10.9
australian_scale	*	73.84 ± 9.59	11.9		72.90 ± 9.29	8.6		72.61 ± 9.54	24.1
breast-cancer_scale	*	93.38 ± 2.48	15.0		93.16 ± 1.43	12.8		93.01 ± 2.48	20.2
cod-rna	*	68.19 ± 4.87	3.4		67.82 ± 3.63	3.3		67.94 ± 4.03	55.3
colon-cancer		73.33 ± 14.05	5.9		73.33 ± 10.97	5.0	*	76.67 ± 14.59	58.7
duke		95.53 ± 2.17	5.0		94.74 ± 3.28	4.8	*	100.00 ± 0.00	56.7
german.numer	*	71.90 ± 3.43	9.6		71.85 ± 2.97	5.7		71.80 ± 3.32	19.1
gisette_scale		84.72 ± 4.34	33.7	*	86.27 ± 3.89	106.5		80.40 ± 3.62	95.1
diabetes_scale		65.49 ± 4.03	19.1		65.49 ± 4.51	18.8	*	66.80 ± 5.07	46.2
fourclass_scale		71.10 ± 4.44	13.8	*	72.73 ± 3.72	11.2		72.09 ± 4.02	38.0
german.numer_scale	*	72.00 ± 3.32	9.3		71.85 ± 2.97	5.7		71.80 ± 3.32	19.1
heart_scale	*	73.15 ± 5.03	12.5		68.89 ± 5.00	12.6		69.81 ± 5.09	20.1
ijcnn1	*	90.46 ± 0.83	28.9		90.44 ± 0.78	33.2		90.30 ± 0.28	71.6
ionosphere_scale		83.43 ± 5.05	44.9		83.14 ± 6.05	47.0	*	86.71 ± 4.86	49.1
leu		70.59 ± 7.59	3.3		73.24 ± 8.48	2.7	*	80.88 ± 7.50	36.9
liver-disorders	*	56.30 ± 3.17	23.5		55.25 ± 2.62	26.4		55.90 ± 3.02	37.5
madelon		53.18 ± 2.92	21.7	*	53.42 ± 3.73	85.7		52.12 ± 1.82	97.2
mushrooms	*	93.69 ± 4.27	14.6		82.61 ± 7.74	8.1		77.70 ± 6.29	9.7
phishing	*	80.56 ± 11.70	7.5		76.88 ± 12.50	3.9		71.27 ± 8.52	8.0
skin_nonskin		83.28 ± 4.74	4.2		83.05 ± 4.94	4.2	*	83.35 ± 4.71	50.4
sonar_scale		65.85 ± 9.55	52.4	*	66.83 ± 6.82	54.2		63.90 ± 11.14	64.6
splice		65.13 ± 7.19	7.1	*	65.46 ± 7.41	11.6		65.19 ± 6.65	21.0
svmguide1		90.20 ± 4.59	27.7		89.98 ± 4.56	29.0	*	90.40 ± 5.01	62.9
svmguide3		65.37 ± 16.97	22.4	*	69.76 ± 14.82	34.1		63.90 ± 23.36	70.7
w1a		97.09 ± 0.25	33.8	*	97.14 ± 0.14	5.1		97.11 ± 0.14	14.9
w2a	*	97.41 ± 0.17	32.3		97.24 ± 0.10	5.4		97.15 ± 0.11	15.5
w3a	*	97.54 ± 0.25	35.3		97.19 ± 0.12	5.2		97.18 ± 0.11	16.1
w4a	*	97.55 ± 0.17	30.6		97.22 ± 0.12	5.4		97.17 ± 0.12	16.1
w5a	*	97.55 ± 0.20	25.4		97.16 ± 0.13	5.4		97.14 ± 0.11	16.1
w6a	*	97.70 ± 0.17	25.7		97.24 ± 0.10	5.8		97.22 ± 0.11	16.1
w7a	*	97.59 ± 0.11	20.2		97.23 ± 0.12	5.8		97.21 ± 0.11	16.1
w8a	*	97.47 ± 0.11	21.7		97.15 ± 0.10	6.2		97.12 ± 0.10	16.5
averages	26	80.59 ± 3.91	18.1	7	79.80 ± 3.67	15.5	7	79.79 ± 3.82	31.4