Figure 1: Accuracy over time (max depth=6)
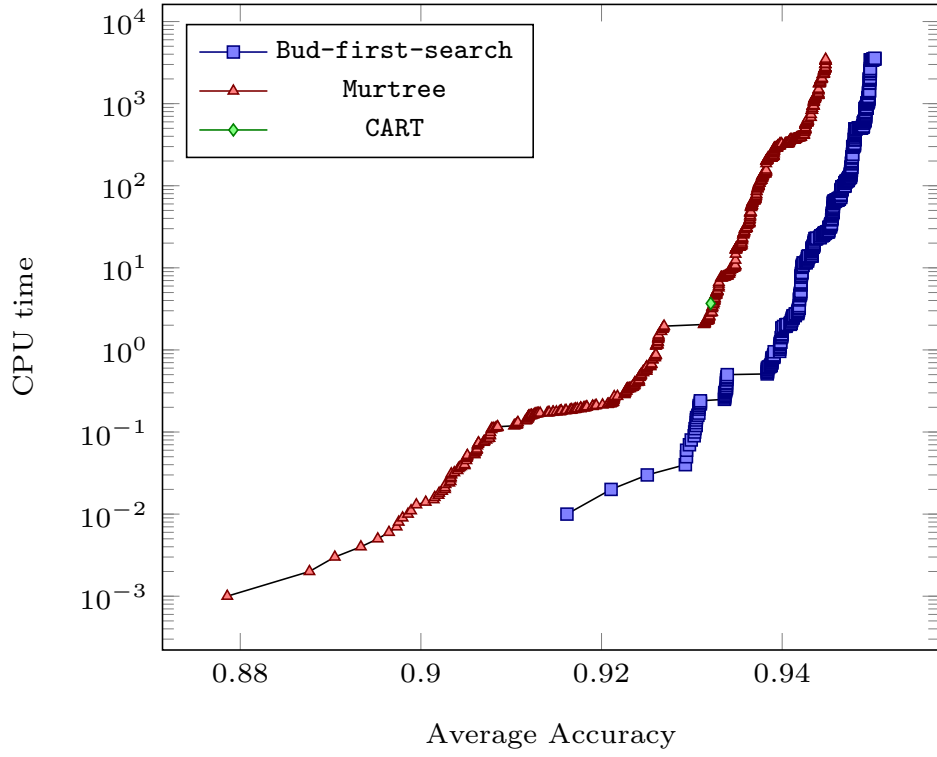

Figure 2: Accuracy over time (max depth=7)

	#ex.	#feat.	Bud-first-search			Murtree			DL8.5		
			error	time	opt.	error	time	opt.	error	time	opt.
adult_discretized	30299	59	5020	**0.3**	1.00	5020	0.5	1.00	5020	10.1	1.00
anneal	812	93	112	**0.0**	1.00	112	0.1	1.00	112	2.4	1.00
audiology	216	148	5	**0.1**	1.00	5	0.2	1.00	5	4.5	1.00
australian-credit	653	125	73	**0.1**	1.00	73	0.4	1.00	73	9.6	1.00
bank-un	45211	9531	**4453**	0.9	0.00	5289	**0.8**	0.00	4805	3603.1	0.00
breast-cancer-un	683	89	24	0.1	1.00	24	**0.1**	1.00	24	1.0	1.00
breast-wisconsin	683	120	15	**0.1**	1.00	15	0.2	1.00	15	6.4	1.00
car-un	1728	21	192	0.0	1.00	192	**0.0**	1.00	192	0.0	1.00
compas_discretized	6167	25	2004	**0.0**	1.00	2004	0.0	1.00	2004	0.2	1.00
diabetes	768	112	162	**0.1**	1.00	162	0.4	1.00	162	10.6	1.00
forest-fires-un	517	989	193	**19.9**	1.00	193	67.1	1.00	-	-	-
german-credit	1000	112	236	**0.3**	1.00	236	0.4	1.00	236	7.7	1.00
heart-cleveland	296	95	41	**0.1**	1.00	41	0.1	1.00	41	3.5	1.00
hepatitis	137	68	10	**0.0**	1.00	10	0.0	1.00	10	1.2	1.00
hypothyroid	3247	88	61	**0.1**	1.00	61	0.4	1.00	61	4.4	1.00
ionosphere	351	445	22	**4.3**	1.00	22	11.8	1.00	22	409.6	1.00
kr-vs-kp	3196	73	198	**0.1**	1.00	198	0.2	1.00	198	2.4	1.00
letter	20000	224	369	**10.3**	1.00	369	36.2	1.00	369	443.1	1.00
lymph	148	68	12	**0.0**	1.00	12	0.0	1.00	12	0.8	1.00
mnist_0	60000	784	2557	1722.8	1.00	2557	**576.8**	1.00	3319	3600.2	0.00
mnist_1	60000	784	3462	2043.6	1.00	3462	**532.0**	1.00	4552	3600.2	0.00
mnist_2	60000	784	3938	1751.6	1.00	3938	**663.5**	1.00	4289	3600.2	0.00
mnist_3	60000	784	4354	1733.0	1.00	4354	**630.0**	1.00	4974	3600.2	0.00
mnist_4	60000	784	4729	2044.4	1.00	4729	**645.1**	1.00	5580	3600.2	0.00
mnist_5	60000	784	3539	1985.7	1.00	3539	**660.6**	1.00	4379	3600.2	0.00
mnist_6	60000	784	2756	1960.2	1.00	2756	**606.0**	1.00	2756	3600.2	0.00
mnist_7	60000	784	3483	1955.1	1.00	3483	**559.8**	1.00	4546	3600.2	0.00
mnist_8	60000	784	3583	2050.2	1.00	3583	**580.5**	1.00	4609	3600.2	0.00
mnist_9	60000	784	4590	2056.1	1.00	4590	**613.5**	1.00	5253	3600.2	0.00
mushroom	8124	119	8	0.8	1.00	8	**0.5**	1.00	8	6.3	1.00
pendigits	7494	216	47	**3.7**	1.00	47	11.8	1.00	47	134.2	1.00
primary-tumor	336	31	46	**0.0**	1.00	46	0.0	1.00	46	0.1	1.00
segment	2310	235	0	**0.0**	1.00	0	0.1	1.00	0	2.3	1.00
soybean	630	50	29	**0.0**	1.00	29	0.0	1.00	29	0.3	1.00
splice-1	3190	287	224	10.2	1.00	224	**5.3**	1.00	224	113.8	1.00
surgical-deepnet-un	14635	6047	2512	**909.4**	0.00	2512	3426.9	0.00	-	-	-
taiwan_binarised	30000	205	5326	**45.2**	1.00	5326	46.6	1.00	5326	526.2	1.00
tic-tac-toe	958	27	216	**0.0**	1.00	216	0.0	1.00	216	0.1	1.00
titanic-un	887	333	143	**7.4**	1.00	143	11.8	1.00	143	166.7	1.00
vehicle	846	252	26	**1.1**	1.00	26	2.4	1.00	26	64.1	1.00
vote	435	48	12	0.0	1.00	12	**0.0**	1.00	12	0.3	1.00
weather-aus-un	142193	4759	1756	**13.8**	0.00	1756	613.1	0.00	-	-	-
wine1-un	178	1276	43	**16.1**	1.00	43	136.1	1.00	-	-	-
wine2-un	178	1276	49	**17.1**	1.00	49	162.8	1.00	-	-	-
wine3-un	178	1276	33	**15.9**	1.00	33	141.6	1.00	-	-	-
yeast	1484	89	403	**0.1**	1.00	403	0.3	1.00	403	6.1	1.00
zoo-1	101	36	0	**0.0**	1.00	0	0.0	1.00	0	0.0	1.00
Avg.	19792	784	**1299**	433.6	0.94	1317	**228.6**	0.94	41.00 1563	41.00 1013.2	41.00 0.73

Table 1: Comparaison: optimization of shallow trees (max depth=3)

	#ex.	#feat.	Bud-first-search			Murtree			DL8.5		
			error	time	opt.	error	time	opt.	error	time	opt.
adult_discretized	30299	59	4609	**14.3**	1.00	4609	16.9	1.00	4609	271.4	1.00
anneal	812	93	91	**1.3**	1.00	91	7.3	1.00	91	101.5	1.00
audiology	216	148	1	**4.0**	1.00	1	14.0	1.00	1	128.1	1.00
australian-credit	653	125	56	**11.6**	1.00	56	27.0	1.00	56	470.4	1.00
bank-un	45211	9531	**4326**	56.1	0.00	4686	**2.8**	0.00	4808	3603.5	0.00
breast-cancer-un	683	89	16	8.9	1.00	16	**3.4**	1.00	16	27.6	1.00
breast-wisconsin	683	120	7	**3.0**	1.00	7	13.5	1.00	7	245.1	1.00
car-un	1728	21	136	0.1	1.00	136	**0.1**	1.00	136	0.4	1.00
compas_discretized	6167	25	1954	**0.1**	1.00	1954	0.7	1.00	1954	3.5	1.00
diabetes	768	112	137	**6.2**	1.00	137	27.1	1.00	137	550.2	1.00
forest-fires-un	517	989	173	**14.1**	0.00	173	74.2	0.00	-	-	-
german-credit	1000	112	204	29.8	1.00	204	**25.8**	1.00	204	422.8	1.00
heart-cleveland	296	95	25	**3.0**	1.00	25	6.5	1.00	25	154.3	1.00
hepatitis	137	68	3	**0.4**	1.00	3	1.0	1.00	3	28.0	1.00
hypothyroid	3247	88	53	**2.8**	1.00	53	18.4	1.00	53	181.0	1.00
ionosphere	351	445	7	**850.9**	1.00	7	1931.7	1.00	-	-	-
kr-vs-kp	3196	73	144	**2.3**	1.00	144	8.4	1.00	144	88.3	1.00
letter	20000	224	261	**1107.5**	1.00	261	3372.4	1.00	335	3600.0	0.00
lymph	148	68	3	**0.9**	1.00	3	1.0	1.00	3	14.5	1.00
mnist_0	60000	784	2173	**1807.7**	0.00	**2040**	3512.8	0.00	3319	3600.3	0.00
mnist_1	60000	784	2332	3207.5	0.00	2332	**702.2**	0.00	4551	3600.2	0.00
mnist_2	60000	784	3143	3403.3	0.00	**3116**	**2582.4**	0.00	4289	3600.2	0.00
mnist_3	60000	784	3485	2563.8	0.00	3485	**1157.8**	0.00	4900	3600.2	0.00
mnist_4	60000	784	3670	2785.2	0.00	**3615**	**1702.3**	0.00	5580	3600.2	0.00
mnist_5	60000	784	3312	**222.1**	0.00	**3085**	1897.5	0.00	4373	3600.2	0.00
mnist_6	60000	784	1940	2723.7	0.00	1940	**1236.8**	0.00	2755	3600.2	0.00
mnist_7	60000	784	2793	**47.5**	0.00	**2773**	3379.8	0.00	4546	3600.2	0.00
mnist_8	60000	784	3165	1597.9	0.00	3165	**501.8**	0.00	4609	3600.2	0.00
mnist_9	60000	784	3977	1643.9	0.00	3977	**1236.2**	0.00	5252	3600.2	0.00
mushroom	8124	119	0	**0.0**	1.00	0	0.0	1.00	0	40.8	1.00
pendigits	7494	216	13	**250.6**	1.00	13	1021.6	1.00	-	-	-
primary-tumor	336	31	34	**0.0**	1.00	34	0.1	1.00	34	2.0	1.00
segment	2310	235	0	**0.0**	1.00	0	0.0	1.00	0	1.6	1.00
soybean	630	50	14	0.9	1.00	14	**0.6**	1.00	14	5.1	1.00
splice-1	3190	287	141	3145.4	1.00	141	**690.9**	1.00	-	-	-
surgical-deepnet-un	14635	6047	**2475**	2886.9	0.00	2506	**530.1**	0.00	-	-	-
taiwan_binarised	30000	205	5273	**7.1**	0.00	5273	34.0	0.00	5307	3600.0	0.00
tic-tac-toe	958	27	137	0.5	1.00	137	**0.2**	1.00	137	1.8	1.00
titanic-un	887	333	119	**1669.6**	1.00	119	2575.5	1.00	-	-	-
vehicle	846	252	12	**81.1**	1.00	12	256.8	1.00	-	-	-
vote	435	48	5	1.2	1.00	5	**0.5**	1.00	5	7.6	1.00
weather-aus-un	142193	4759	**1749**	2458.8	0.00	1750	**1484.8**	0.00	-	-	-
wine1-un	178	1276	**37**	**1654.9**	0.00	38	2852.9	0.00	-	-	-
wine2-un	178	1276	43	**16.7**	0.00	43	274.6	0.00	-	-	-
wine3-un	178	1276	28	**32.7**	0.00	28	421.1	0.00	-	-	-
yeast	1484	89	366	**3.7**	1.00	366	20.3	1.00	366	257.1	1.00
zoo-1	101	36	0	**0.0**	1.00	0	0.0	1.00	0	0.0	1.00
Avg.	19792	784	1120	730.4	0.62	**1119**	**715.4**	0.62	36.00 1739	36.00 1383.6	36.00 0.64

Table 2: Comparaison: optimization of shallow trees (max depth=4)

3

	#ex.	#feat.	Bud-first-search			Murtree			DL8.5		
			error	time	opt.	error	time	opt.	error	time	opt.
adult_discretized	30299	59	4423	805.3	1.00	4423	**490.1**	1.00	4442	3600.0	0.00
anneal	812	93	70	**49.1**	1.00	70	253.7	1.00	-	-	-
audiology	216	148	0	**0.0**	1.00	0	0.0	1.00	0	0.0	1.00
australian-credit	653	125	39	**794.2**	1.00	39	1181.3	1.00	-	-	-
bank-un	45211	9531	**4241**	**906.9**	0.00	4365	2094.4	0.00	4809	3603.0	0.00
breast-cancer-un	683	89	6	743.3	1.00	6	**97.6**	1.00	6	438.0	1.00
breast-wisconsin	683	120	0	**20.6**	1.00	0	183.8	1.00	-	-	-
car-un	1728	21	86	2.5	1.00	86	**0.9**	1.00	86	2.7	1.00
compas_discretized	6167	25	1919	**1.2**	1.00	1919	7.6	1.00	1919	26.4	1.00
diabetes	768	112	106	**349.6**	1.00	106	1231.1	1.00	-	-	-
forest-fires-un	517	989	**156**	**788.6**	0.00	163	2622.0	0.00	-	-	-
german-credit	1000	112	161	2822.9	1.00	161	**1139.2**	1.00	-	-	-
heart-cleveland	296	95	7	**112.4**	1.00	7	165.3	1.00	-	-	-
hepatitis	137	68	0	**0.0**	1.00	0	0.3	1.00	0	71.4	1.00
hypothyroid	3247	88	44	**101.0**	1.00	44	505.2	1.00	-	-	-
ionosphere	351	445	0	**570.7**	1.00	0	3399.2	1.00	-	-	-
kr-vs-kp	3196	73	81	**67.6**	1.00	81	197.3	1.00	-	-	-
letter	20000	224	**168**	3141.4	0.00	190	**795.4**	0.00	352	3600.0	0.00
lymph	148	68	0	**0.0**	1.00	0	0.0	1.00	0	14.0	1.00
mnist_0	60000	784	**1714**	**262.3**	0.00	2066	2054.0	0.00	3319	3600.2	0.00
mnist_1	60000	784	**1737**	**823.2**	0.00	1790	1110.4	0.00	4029	3600.2	0.00
mnist_2	60000	784	3365	**2237.4**	0.00	**2963**	2544.7	0.00	4026	3600.2	0.00
mnist_3	60000	784	3316	1175.4	0.00	**3184**	**369.2**	0.00	4900	3600.3	0.00
mnist_4	60000	784	3212	1789.8	0.00	**3164**	**109.5**	0.00	5580	3600.2	0.00
mnist_5	60000	784	3399	**478.8**	0.00	**3163**	2038.8	0.00	4376	3600.2	0.00
mnist_6	60000	784	1828	3581.8	0.00	**1653**	**624.8**	0.00	2753	3600.2	0.00
mnist_7	60000	784	2699	**254.8**	0.00	**2464**	2300.9	0.00	4542	3600.2	0.00
mnist_8	60000	784	2843	3174.8	0.00	**2818**	**1150.3**	0.00	4609	3600.2	0.00
mnist_9	60000	784	3682	**56.4**	0.00	**3521**	1159.3	0.00	5252	3600.2	0.00
mushroom	8124	119	0	**0.0**	1.00	0	0.0	1.00	0	35.6	1.00
pendigits	7494	216	0	**313.6**	1.00	0	2860.1	1.00	-	-	-
primary-tumor	336	31	26	**0.4**	1.00	26	2.2	1.00	26	24.0	1.00
segment	2310	235	0	**0.0**	1.00	0	0.0	1.00	0	1.0	1.00
soybean	630	50	8	21.1	1.00	8	**9.4**	1.00	8	63.1	1.00
splice-1	3190	287	101	**1728.2**	0.00	**100**	3121.5	**1.00**	-	-	-
surgical-deepnet-un	14635	6047	**2188**	2139.2	0.00	2337	**456.7**	0.00	-	-	-
taiwan_binarised	30000	205	**5200**	886.0	0.00	5261	**33.8**	0.00	5412	3600.0	0.00
tic-tac-toe	958	27	63	9.7	1.00	63	**2.0**	1.00	63	14.0	1.00
titanic-un	887	333	95	2149.8	0.00	95	**2119.2**	0.00	-	-	-
vehicle	846	252	**1**	**751.5**	0.00	2	2251.8	0.00	-	-	-
vote	435	48	1	26.0	1.00	1	**7.3**	1.00	1	45.0	1.00
weather-aus-un	142193	4759	1735	**390.9**	0.00	1735	1923.7	0.00	-	-	-
wine1-un	178	1276	**33**	**1133.2**	0.00	34	1977.9	0.00	-	-	-
wine2-un	178	1276	**39**	416.4	0.00	40	**133.3**	0.00	-	-	-
wine3-un	178	1276	25	**15.7**	0.00	25	289.6	**1.00**	-	-	-
yeast	1484	89	313	**147.4**	1.00	313	749.4	1.00	-	-	-
zoo-1	101	36	0	**0.0**	1.00	0	0.0	1.00	0	0.0	1.00
Avg.	19792	784	1045	**749.8**	0.53	**1032**	931.2	**0.57**	27.00 2241	27.00 1894.1	27.00 0.48

Table 3: Comparaison: optimization of shallow trees (max depth=5)

	#ex.	#feat.	Bud-first-search				Murtree				CART
			≤3s	≤10s	≤1m	error	≤3s	≤10s	≤1m	error	error
adult_discretized	30299	59	**4474**	**4474**	**4328**	4281	4534	4524	4505	4281	4532
anneal	812	93	**76**	**69**	**68**	**51**	82	76	76	53	106
audiology	216	148	0	0	0	0	0	0	0	0	1
australian-credit	653	125	**44**	37	**19**	15	46	**34**	33	15	56
bank-un	45211	9531	4151	4147	4147	4147	4867	4420	4420	4270	4245
breast-cancer-un	683	89	**6**	**5**	**3**	1	10	6	6	1	13
breast-wisconsin	683	120	**1**	**0**	0	0	7	7	0	0	7
car-un	1728	21	40	36	36	36	40	36	36	36	90
compas_discretized	6167	25	**1888**	1888	**1887**	1887	1917	1888	1888	1887	1955
diabetes	768	112	**94**	**70**	**67**	**60**	142	140	125	62	130
forest-fires-un	517	989	172	172	171	168	**166**	**166**	**161**	**150**	171
german-credit	1000	112	**147**	**147**	145	101	191	155	145	101	171
heart-cleveland	296	95	0	0	0	0	0	0	0	0	15
hepatitis	137	68	0	0	0	0	0	0	0	0	3
hypothyroid	3247	88	**33**	**33**	33	32	40	35	33	32	47
ionosphere	351	445	**3**	**0**	0	0	16	16	0	0	11
kr-vs-kp	3196	73	**79**	79	**51**	45	95	79	79	45	184
letter	20000	224	**203**	**157**	**157**	**132**	296	288	287	275	217
lymph	148	68	0	0	0	0	0	0	0	0	1
mnist_0	60000	784	**1753**	**1752**	**1747**	**1742**	2122	2122	2119	1885	1781
mnist_1	60000	784	**1473**	**1473**	**1465**	**1448**	1902	1900	1808	1778	1542
mnist_2	60000	784	**2791**	**2780**	**2773**	2773	3807	3734	3734	**2687**	2818
mnist_3	60000	784	**2766**	**2766**	**2766**	**2736**	3170	3170	3126	2923	2902
mnist_4	60000	784	**2515**	**2514**	**2514**	**2415**	3075	3072	3072	2973	2543
mnist_5	60000	784	**3278**	**3276**	3270	3267	3470	3325	**3182**	**3060**	3402
mnist_6	60000	784	**1668**	1668	1623	1607	2251	**1621**	**1614**	**1474**	1686
mnist_7	60000	784	**2140**	**2140**	**2115**	**2112**	3218	2470	2470	2304	2163
mnist_8	60000	784	**2485**	**2483**	**2480**	**2423**	3587	3586	3559	3228	2633
mnist_9	60000	784	**3267**	**3264**	**3220**	**3217**	4231	3648	3648	3327	3366
mushroom	8124	119	0	0	0	0	0	0	0	0	3
pendigits	7494	216	0	0	0	0	0	0	0	0	5
primary-tumor	336	31	**18**	18	18	18	21	18	18	18	28
segment	2310	235	0	0	0	0	0	0	0	0	0
soybean	630	50	**4**	**4**	3	3	7	7	3	3	15
splice-1	3190	287	**81**	**81**	**73**	**64**	127	127	127	80	87
surgical-deepnet-un	14635	6047	**1920**	**1916**	**1916**	**1914**	2704	2704	2704	2110	1969
taiwan_binarised	30000	205	**5185**	**5185**	**5185**	**5094**	5288	5288	5266	5169	5250
tic-tac-toe	958	27	14	13	12	12	14	13	12	12	49
titanic-un	887	333	116	**113**	**113**	**78**	**114**	114	114	108	119
vehicle	846	252	0	0	0	0	0	0	0	0	9
vote	435	48	0	0	0	0	0	0	0	0	2
weather-aus-un	142193	4759	**1728**	**1724**	**1724**	**1720**	1761	1761	1761	1736	1734
wine1-un	178	1276	33	33	33	**31**	33	33	33	32	36
wine2-un	178	1276	37	37	**34**	34	37	37	37	34	41
wine3-un	178	1276	26	**25**	25	22	26	26	25	22	27
yeast	1484	89	324	321	**272**	**245**	324	**303**	297	258	346
zoo-1	101	36	0	0	0	0	0	0	0	0	0
Avg.	19792	784	**958**	**955**	**947**	**935**	1143	1084	1075	988	990

Table 4: Error over time (max depth=6)

	#ex.	#feat.	Bud-first-search				Murtree			
			error	time (s)	time (p)	opt.	error	time (s)	time (p)	opt.
adult_discretized	30299	59	4281	1876.00	-	0.00	4281	**26.14**	**196.23**	**1.00**
anneal	812	93	**51**	**754.43**	**1551.40**	**1.00**	53	2492.35	-	0.00
audiology	216	148	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
australian-credit	653	125	15	**107.82**	-	0.00	15	748.72	-	0.00
bank-un	45211	9531	**4147**	**9.14**	-	0.00	4270	2970.73	-	0.00
breast-cancer-un	683	89	1	3329.40	-	0.00	1	**507.51**	**2338.50**	**1.00**
breast-wisconsin	683	120	0	**6.23**	**6.23**	1.00	0	15.99	59.69	1.00
car-un	1728	21	36	8.40	26.10	1.00	36	**0.00**	**4.22**	1.00
compas_discretized	6167	25	1887	**11.66**	**19.33**	1.00	1887	62.27	67.70	1.00
diabetes	768	112	**60**	3522.80	-	0.00	62	**0.01**	**694.82**	**1.00**
forest-fires-un	517	989	168	**235.91**	-	0.00	**150**	1464.22	-	0.00
german-credit	1000	112	101	3158.40	-	0.00	101	**2034.38**	-	0.00
heart-cleveland	296	95	0	**0.04**	**0.04**	1.00	0	0.14	0.19	1.00
hepatitis	137	68	0	**0.00**	**0.00**	1.00	0	0.01	0.01	1.00
hypothyroid	3247	88	32	348.06	**2870.80**	1.00	32	**0.29**	3488.14	1.00
ionosphere	351	445	0	**4.16**	**4.16**	1.00	0	24.28	24.40	1.00
kr-vs-kp	3196	73	45	**453.57**	**1619.40**	**1.00**	45	2385.16	-	0.00
letter	20000	224	**132**	2898.00	-	0.00	275	**171.78**	-	0.00
lymph	148	68	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
mnist_0	60000	784	**1742**	**929.88**	-	0.00	1885	3591.13	-	0.00
mnist_1	60000	784	**1448**	**2689.40**	-	0.00	1778	3586.73	-	0.00
mnist_2	60000	784	2773	**39.04**	-	0.00	**2687**	1160.72	-	0.00
mnist_3	60000	784	**2736**	**1328.30**	-	0.00	2923	1923.21	-	0.00
mnist_4	60000	784	**2415**	**1359.30**	-	0.00	2973	2185.04	-	0.00
mnist_5	60000	784	3267	**195.70**	-	0.00	**3060**	1215.94	-	0.00
mnist_6	60000	784	1607	**591.99**	-	0.00	**1474**	2711.43	-	0.00
mnist_7	60000	784	**2112**	**369.14**	-	0.00	2304	544.95	-	0.00
mnist_8	60000	784	**2423**	1743.10	-	0.00	3228	**95.93**	-	0.00
mnist_9	60000	784	**3217**	**954.64**	-	0.00	3327	1787.57	-	0.00
mushroom	8124	119	0	**0.00**	**0.00**	1.00	0	0.01	0.02	1.00
pendigits	7494	216	0	**0.01**	**0.01**	1.00	0	0.19	0.37	1.00
primary-tumor	336	31	18	**0.65**	**3.04**	1.00	18	2.17	23.13	1.00
segment	2310	235	0	**0.00**	**0.00**	1.00	0	0.01	0.02	1.00
soybean	630	50	3	**10.75**	376.51	1.00	3	15.40	**122.51**	1.00
splice-1	3190	287	**64**	2322.00	-	0.00	80	**0.03**	**1723.12**	**1.00**
surgical-deepnet-un	14635	6047	**1914**	554.55	-	0.00	2110	**230.90**	-	0.00
taiwan_binarised	30000	205	**5094**	**2839.60**	-	0.00	5169	3396.18	-	0.00
tic-tac-toe	958	27	12	52.87	120.25	1.00	12	**12.63**	**15.71**	1.00
titanic-un	887	333	**78**	**693.36**	-	0.00	108	1509.39	-	0.00
vehicle	846	252	0	0.10	**0.10**	1.00	0	**0.10**	0.63	1.00
vote	435	48	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
weather-aus-un	142193	4759	**1720**	**373.28**	-	0.00	1736	813.21	-	0.00
wine1-un	178	1276	**31**	2158.30	-	0.00	32	**1497.98**	-	0.00
wine2-un	178	1276	34	**43.96**	-	0.00	34	504.10	-	0.00
wine3-un	178	1276	22	94.45	-	0.00	22	**44.55**	**925.48**	**1.00**
yeast	1484	89	**245**	**452.30**	-	0.00	258	1736.64	-	0.00
zoo-1	101	36	0	**0.00**	0.00	1.00	0	0.00	0.00	1.00
Avg.	19792	784	**935**	**777.04**	20.00 329.87	0.43	988	882.34	23.00 421.08	**0.49**

Table 5: Comparaison: optimization of deep tree (max depth=6)

	#ex.	#feat.	Bud-first-search				Murtree				CART
			≤3s	≤10s	≤1m	error	≤3s	≤10s	≤1m	error	error
adult_discretized	30299	59	**4326**	**4326**	**4322**	4190	4411	4371	4352	**4137**	4481
anneal	812	93	**73**	**59**	**58**	**41**	80	77	67	50	96
audiology	216	148	0	0	0	0	0	0	0	0	0
australian-credit	653	125	**30**	**26**	**1**	0	40	40	35	0	43
bank-un	45211	9531	**3970**	**3968**	**3966**	**3964**	4866	4358	4358	4232	4038
breast-cancer-un	683	89	**2**	**2**	**1**	0	5	4	3	0	8
breast-wisconsin	683	120	0	0	0	0	0	0	0	0	4
car-un	1728	21	29	19	18	11	**19**	19	**11**	11	50
compas_discretized	6167	25	**1858**	**1857**	**1856**	1852	1926	1885	1859	1852	1941
diabetes	768	112	**54**	**52**	**32**	**21**	117	107	104	83	100
forest-fires-un	517	989	**161**	**159**	159	159	164	160	**156**	**145**	161
german-credit	1000	112	**114**	**110**	**73**	**56**	183	154	154	87	150
heart-cleveland	296	95	0	0	0	0	0	0	0	0	6
hepatitis	137	68	0	0	0	0	0	0	0	0	1
hypothyroid	3247	88	**27**	**24**	**24**	23	36	34	30	23	42
ionosphere	351	445	0	0	0	0	0	0	0	0	7
kr-vs-kp	3196	73	101	99	**37**	**18**	**63**	**63**	59	34	103
letter	20000	224	**142**	**119**	**118**	**70**	168	165	164	131	153
lymph	148	68	0	0	0	0	0	0	0	0	0
mnist_0	60000	784	**1264**	**1264**	**1263**	**1223**	1679	1676	1673	1601	1323
mnist_1	60000	784	**1095**	**1095**	**1093**	**1066**	1581	1551	1488	1488	1129
mnist_2	60000	784	**2457**	**2455**	**2450**	**2394**	3382	3382	3264	3121	2502
mnist_3	60000	784	**2182**	**2182**	**2169**	**2114**	2923	2923	2923	2492	2274
mnist_4	60000	784	**1999**	**1998**	**1998**	**1968**	3105	3105	3105	2807	2072
mnist_5	60000	784	**3023**	**3022**	**3014**	3007	3138	3099	3092	**2922**	3117
mnist_6	60000	784	**1460**	1458	**1423**	1408	1899	**1446**	1446	**1235**	1483
mnist_7	60000	784	**1761**	**1761**	**1757**	**1724**	2848	2416	2416	1957	1864
mnist_8	60000	784	**2015**	**2015**	**2010**	**1937**	2996	2991	2875	2819	2101
mnist_9	60000	784	**2754**	**2743**	**2736**	**2731**	3830	3231	3231	2946	2811
mushroom	8124	119	0	0	0	0	0	0	0	0	0
pendigits	7494	216	0	0	0	0	0	0	0	0	1
primary-tumor	336	31	**16**	**16**	16	16	25	25	16	16	26
segment	2310	235	0	0	0	0	0	0	0	0	0
soybean	630	50	**3**	**3**	**2**	2	7	4	3	2	11
splice-1	3190	287	**55**	**55**	**43**	**29**	102	101	67	47	58
surgical-deepnet-un	14635	6047	**1822**	**1822**	**1822**	**1814**	2245	2245	2245	1890	1871
taiwan_binarised	30000	205	**5084**	**5084**	**5083**	**5061**	5273	5272	5235	5189	5161
tic-tac-toe	958	27	1	1	0	0	1	**0**	0	0	22
titanic-un	887	333	**104**	**104**	**104**	**62**	113	109	106	97	111
vehicle	846	252	0	0	0	0	0	0	0	0	4
vote	435	48	0	0	0	0	0	0	0	0	2
weather-aus-un	142193	4759	**1705**	**1701**	**1700**	**1687**	31877	1751	1751	1724	1721
wine1-un	178	1276	31	31	30	**28**	**30**	**30**	30	29	33
wine2-un	178	1276	35	35	**31**	31	35	35	35	31	38
wine3-un	178	1276	**24**	24	23	**21**	25	24	23	22	24
yeast	1484	89	**276**	**270**	**270**	**203**	315	287	281	222	306
zoo-1	101	36	0	0	0	0	0	0	0	0	0
Avg.	19792	784	**852**	**850**	**845**	**828**	1692	1003	993	924	882

Table 6: Error over time (max depth=7)

	#ex.	#feat.	Bud-first-search				Murtree			
			error	time (s)	time (p)	opt.	error	time (s)	time (p)	opt.
adult_discretized	30299	59	4190	**1410.20**	-	0.00	**4137**	3336.82	-	0.00
anneal	812	93	**41**	3425.30	-	0.00	50	**2270.08**	-	0.00
audiology	216	148	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
australian-credit	653	125	0	**97.18**	**97.18**	1.00	0	308.17	344.49	1.00
bank-un	45211	9531	**3964**	**393.00**	-	0.00	4232	2012.47	-	0.00
breast-cancer-un	683	89	0	1016.50	1016.50	1.00	0	**228.51**	**228.52**	1.00
breast-wisconsin	683	120	0	**0.02**	**0.02**	1.00	0	0.34	0.35	1.00
car-un	1728	21	11	120.25	218.27	1.00	11	**14.70**	**24.05**	1.00
compas_discretized	6167	25	1852	126.74	**225.36**	1.00	1852	**0.88**	476.54	1.00
diabetes	768	112	**21**	**993.52**	-	0.00	83	3286.48	-	0.00
forest-fires-un	517	989	159	**2.47**	-	0.00	**145**	1267.99	-	0.00
german-credit	1000	112	**56**	1385.60	-	0.00	87	**492.27**	-	0.00
heart-cleveland	296	95	0	**0.00**	**0.00**	1.00	0	0.04	0.05	1.00
hepatitis	137	68	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
hypothyroid	3247	88	23	118.54	-	0.00	23	**0.01**	1230.55	**1.00**
ionosphere	351	445	0	**0.07**	**0.07**	1.00	0	0.30	0.43	1.00
kr-vs-kp	3196	73	**18**	2327.20	-	0.00	34	**934.18**	-	0.00
letter	20000	224	**70**	432.05	-	0.00	131	**137.00**	-	0.00
lymph	148	68	0	**0.00**	**0.00**	1.00	0	0.00	0.00	1.00
mnist_0	60000	784	**1223**	487.03	-	0.00	1601	**2.33**	878.04	**1.00**
mnist_1	60000	784	**1066**	748.40	-	0.00	1488	**47.54**	-	0.00
mnist_2	60000	784	**2394**	2080.60	-	0.00	3121	**1438.57**	-	0.00
mnist_3	60000	784	**2114**	**1064.30**	-	0.00	2492	1500.93	-	0.00
mnist_4	60000	784	**1968**	2504.60	-	0.00	2807	**1802.95**	-	0.00
mnist_5	60000	784	3007	**1099.60**	-	0.00	**2922**	2494.57	-	0.00
mnist_6	60000	784	1408	3575.00	-	0.00	**1235**	**1158.21**	-	0.00
mnist_7	60000	784	**1724**	1013.30	-	0.00	1957	**590.21**	-	0.00
mnist_8	60000	784	**1937**	**1439.20**	-	0.00	2819	1885.54	-	0.00
mnist_9	60000	784	**2731**	1793.90	-	0.00	2946	**1195.27**	-	0.00
mushroom	8124	119	0	**0.00**	**0.00**	1.00	0	0.01	0.02	1.00
pendigits	7494	216	0	**0.00**	**0.00**	1.00	0	0.05	0.14	1.00
primary-tumor	336	31	16	**0.17**	**16.61**	1.00	16	27.48	250.76	1.00
segment	2310	235	0	**0.00**	**0.00**	1.00	0	0.01	0.02	1.00
soybean	630	50	2	19.50	**19.50**	1.00	2	**18.24**	1710.30	1.00
splice-1	3190	287	**29**	3405.60	-	0.00	47	**836.90**	-	0.00
surgical-deepnet-un	14635	6047	**1814**	802.91	-	0.00	1890	**740.03**	-	0.00
taiwan_binarised	30000	205	**5061**	65.22	-	0.00	5189	**1.39**	2762.81	**1.00**
tic-tac-toe	958	27	0	25.15	25.15	1.00	0	**0.01**	**9.24**	1.00
titanic-un	887	333	**62**	3431.40	-	0.00	97	**245.28**	-	0.00
vehicle	846	252	0	**0.09**	**0.09**	1.00	0	0.49	0.56	1.00
vote	435	48	0	**0.00**	**0.00**	1.00	0	0.00	0.00	1.00
weather-aus-un	142193	4759	**1687**	**2673.90**	-	0.00	1724	3483.49	-	0.00
wine1-un	178	1276	**28**	**880.02**	-	0.00	29	936.04	-	0.00
wine2-un	178	1276	31	27.33	-	0.00	31	**1.16**	411.77	**1.00**
wine3-un	178	1276	**21**	518.25	-	0.00	22	**303.77**	-	0.00
yeast	1484	89	**203**	**299.73**	-	0.00	222	2360.33	-	0.00
zoo-1	101	36	0	0.00	**0.00**	1.00	0	0.00	0.00	1.00
Avg.	19792	784	**828**	846.89	19.00 85.20	0.40	924	**752.36**	23.00 362.12	**0.49**

Table 7: Comparaison: optimization of deep tree (max depth=7)

	#ex.	#feat.	Bud-first-search				Murtree				CART
			≤3s	≤10s	≤1m	error	≤3s	≤10s	≤1m	error	error
adult_discretized	30299	59	**4273**	**4273**	**4270**	**4146**	4393	4314	4293	4190	4399
anneal	812	93	**52**	**52**	**41**	**36**	61	61	61	40	88
audiology	216	148	0	0	0	0	0	0	0	0	0
australian-credit	653	125	**20**	**2**	**0**	0	30	28	1	0	33
bank-un	45211	9531	**3757**	**3752**	**3750**	**3747**	4930	4245	4245	4127	3814
breast-cancer-un	683	89	**2**	**1**	**0**	0	3	2	0	0	4
breast-wisconsin	683	120	0	0	0	0	0	0	0	0	0
car-un	1728	21	14	12	4	0	14	**4**	**0**	0	36
compas_discretized	6167	25	**1851**	**1840**	**1836**	1832	1921	1910	1858	1832	1904
diabetes	768	112	**19**	**18**	**6**	0	111	96	95	0	79
forest-fires-un	517	989	**153**	152	152	151	158	152	**150**	145	157
german-credit	1000	112	**92**	**79**	**51**	**23**	145	139	137	40	117
heart-cleveland	296	95	0	0	0	0	0	0	0	0	2
hepatitis	137	68	0	0	0	0	0	0	0	0	0
hypothyroid	3247	88	**25**	**23**	**18**	**17**	30	28	27	18	38
ionosphere	351	445	0	0	0	0	0	0	0	0	3
kr-vs-kp	3196	73	**38**	**34**	**34**	**13**	62	53	52	16	48
letter	20000	224	**70**	**70**	**69**	**66**	157	124	122	111	94
lymph	148	68	0	0	0	0	0	0	0	0	0
mnist_0	60000	784	**951**	**951**	**914**	**913**	1328	1320	1294	1242	991
mnist_1	60000	784	**766**	**765**	**762**	**756**	1273	1252	1205	1190	781
mnist_2	60000	784	**2200**	**2200**	**2197**	**2164**	2707	2641	2536	2496	2234
mnist_3	60000	784	**1651**	**1651**	**1637**	**1595**	2449	2449	2341	2341	1692
mnist_4	60000	784	**1591**	**1591**	**1590**	**1581**	2312	2312	2312	2228	1662
mnist_5	60000	784	**2696**	**2695**	**2693**	2685	2791	2791	2769	**2610**	2726
mnist_6	60000	784	**1318**	1317	**1290**	1280	1685	**1314**	1314	**1141**	1356
mnist_7	60000	784	**1504**	**1502**	**1490**	**1440**	2163	1880	1880	1753	1538
mnist_8	60000	784	**1612**	**1611**	**1606**	**1533**	2565	2565	2540	2535	1705
mnist_9	60000	784	**2307**	**2306**	**2271**	**2259**	3366	3038	3038	2639	2379
mushroom	8124	119	0	0	0	0	0	0	0	0	0
pendigits	7494	216	0	0	0	0	0	0	0	0	0
primary-tumor	336	31	**15**	**15**	**15**	15	26	26	24	15	22
segment	2310	235	0	0	0	0	0	0	0	0	0
soybean	630	50	**2**	**2**	**2**	2	5	3	3	2	8
splice-1	3190	287	**24**	**24**	**24**	**24**	68	51	51	31	34
surgical-deepnet-un	14635	6047	**1377**	**1374**	**1371**	**1368**	1969	1969	1969	1609	1400
taiwan_binarised	30000	205	**4976**	**4971**	**4965**	**4899**	5242	5241	5233	5172	5043
tic-tac-toe	958	27	0	0	0	0	0	0	0	0	13
titanic-un	887	333	**86**	**86**	**86**	**83**	103	101	99	88	105
vehicle	846	252	0	0	0	0	0	0	0	0	3
vote	435	48	0	0	0	0	0	0	0	0	1
weather-aus-un	142193	4759	**1693**	**1692**	**1692**	**1664**	31877	1734	1734	1709	1703
wine1-un	178	1276	28	28	**27**	27	28	28	28	27	30
wine2-un	178	1276	32	32	32	**30**	32	32	32	31	35
wine3-un	178	1276	**22**	22	22	**20**	23	22	**21**	21	24
yeast	1484	89	**211**	**198**	**171**	**132**	294	274	270	222	261
zoo-1	101	36	0	0	0	0	0	0	0	0	0
Avg.	19792	784	**754**	**752**	**747**	**734**	1581	898	888	843	778

Table 8: Error over time (max depth=8)

9

	#ex.	#feat.	Bud-first-search				Murtree			
			error	time (s)	time (p)	opt.	error	time (s)	time (p)	opt.
adult_discretized	30299	59	**4146**	**1991.50**	-	0.00	4190	2840.63	-	0.00
anneal	812	93	**36**	**2397.20**	-	0.00	40	2467.51	-	0.00
audiology	216	148	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
australian-credit	653	125	0	**13.21**	**13.21**	1.00	0	84.80	84.84	1.00
bank-un	45211	9531	**3747**	1225.20	-	0.00	4127	**1040.87**	-	0.00
breast-cancer-un	683	89	0	24.18	24.18	1.00	0	**13.12**	**13.13**	1.00
breast-wisconsin	683	120	0	**0.00**	**0.00**	1.00	0	0.01	0.02	1.00
car-un	1728	21	0	365.95	365.95	1.00	0	**40.65**	**58.52**	1.00
compas_discretized	6167	25	1832	1116.00	**1449.50**	1.00	1832	**488.57**	2878.08	1.00
diabetes	768	112	0	226.88	**226.88**	1.00	0	**0.04**	2895.41	1.00
forest-fires-un	517	989	151	182.45	-	0.00	**145**	**140.13**	-	0.00
german-credit	1000	112	**23**	**2727.90**	-	0.00	40	2979.35	-	0.00
heart-cleveland	296	95	0	**0.00**	**0.00**	1.00	0	0.01	0.02	1.00
hepatitis	137	68	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
hypothyroid	3247	88	**17**	**76.97**	**76.97**	**1.00**	18	1132.95	-	0.00
ionosphere	351	445	0	**0.01**	**0.01**	1.00	0	0.10	0.20	1.00
kr-vs-kp	3196	73	**13**	2662.90	-	0.00	16	**1617.73**	-	0.00
letter	20000	224	**66**	**752.64**	-	0.00	111	1907.94	-	0.00
lymph	148	68	0	0.00	**0.00**	1.00	0	0.00	0.00	1.00
mnist_0	60000	784	**913**	1816.40	-	0.00	1242	**571.98**	-	0.00
mnist_1	60000	784	**756**	**1757.40**	-	0.00	1190	1964.13	-	0.00
mnist_2	60000	784	**2164**	2660.30	-	0.00	2496	**2398.44**	-	0.00
mnist_3	60000	784	**1595**	1717.50	-	0.00	2341	**48.20**	-	0.00
mnist_4	60000	784	**1581**	**251.08**	-	0.00	2228	2908.70	-	0.00
mnist_5	60000	784	2685	**187.72**	-	0.00	**2610**	1963.43	-	0.00
mnist_6	60000	784	1280	**415.66**	-	0.00	**1141**	1113.91	-	0.00
mnist_7	60000	784	**1440**	2569.40	-	0.00	1753	**1700.85**	-	0.00
mnist_8	60000	784	**1533**	**1450.10**	-	0.00	2535	2521.67	-	0.00
mnist_9	60000	784	**2259**	3475.20	-	0.00	2639	**576.53**	-	0.00
mushroom	8124	119	0	**0.00**	**0.00**	1.00	0	0.01	0.02	1.00
pendigits	7494	216	0	**0.00**	**0.00**	1.00	0	0.03	0.11	1.00
primary-tumor	336	31	15	**0.01**	**0.01**	1.00	15	0.71	1814.68	1.00
segment	2310	235	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
soybean	630	50	2	**0.22**	**0.22**	**1.00**	2	88.79	-	0.00
splice-1	3190	287	**24**	**0.40**	-	0.00	31	1670.34	-	0.00
surgical-deepnet-un	14635	6047	**1368**	2876.20	-	0.00	1609	**147.51**	-	0.00
taiwan_binarised	30000	205	**4899**	1230.70	-	0.00	5172	**0.28**	**2489.30**	**1.00**
tic-tac-toe	958	27	0	**0.00**	**0.00**	1.00	0	0.01	0.01	1.00
titanic-un	887	333	**83**	**1654.00**	-	0.00	88	2490.95	-	0.00
vehicle	846	252	0	**0.00**	**0.00**	1.00	0	0.02	0.15	1.00
vote	435	48	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
weather-aus-un	142193	4759	**1664**	3251.20	-	0.00	1709	**1451.91**	-	0.00
wine1-un	178	1276	27	**43.31**	-	0.00	27	406.22	-	0.00
wine2-un	178	1276	**30**	**612.80**	-	0.00	31	1003.46	-	0.00
wine3-un	178	1276	**20**	420.18	-	0.00	21	**26.03**	-	0.00
yeast	1484	89	**132**	2259.70	-	0.00	222	**2259.49**	-	0.00
zoo-1	101	36	0	**0.00**	**0.00**	1.00	0	0.00	0.00	1.00
Avg.	19792	784	**734**	902.39	21.00 102.71	**0.45**	843	**852.51**	20.00 511.73	0.43

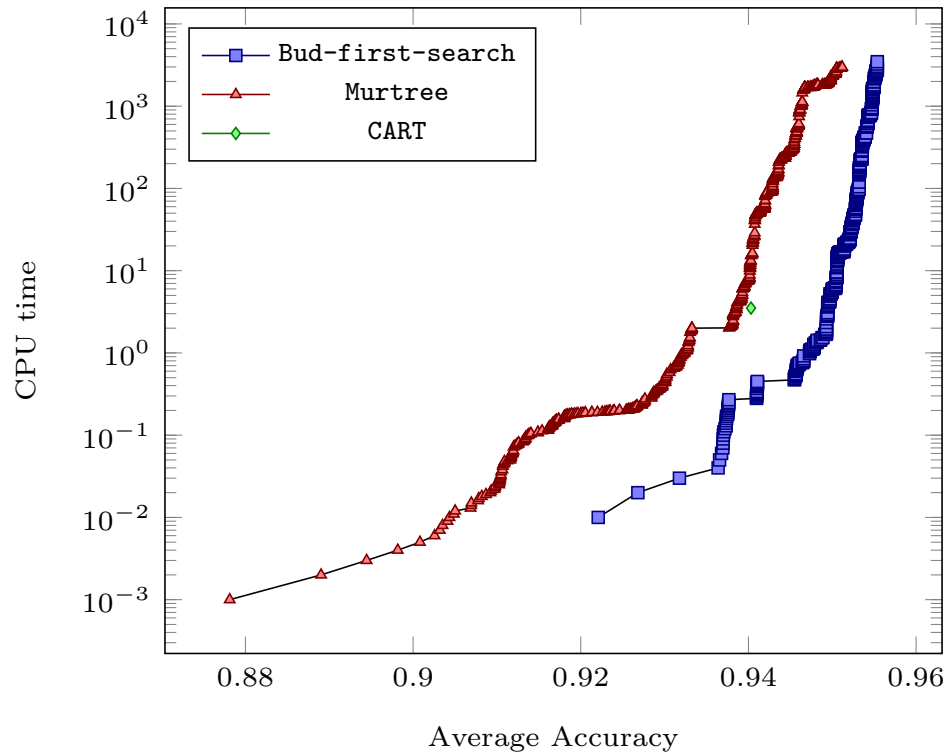Table 9: Comparaison: optimization of deep tree (max depth=8)
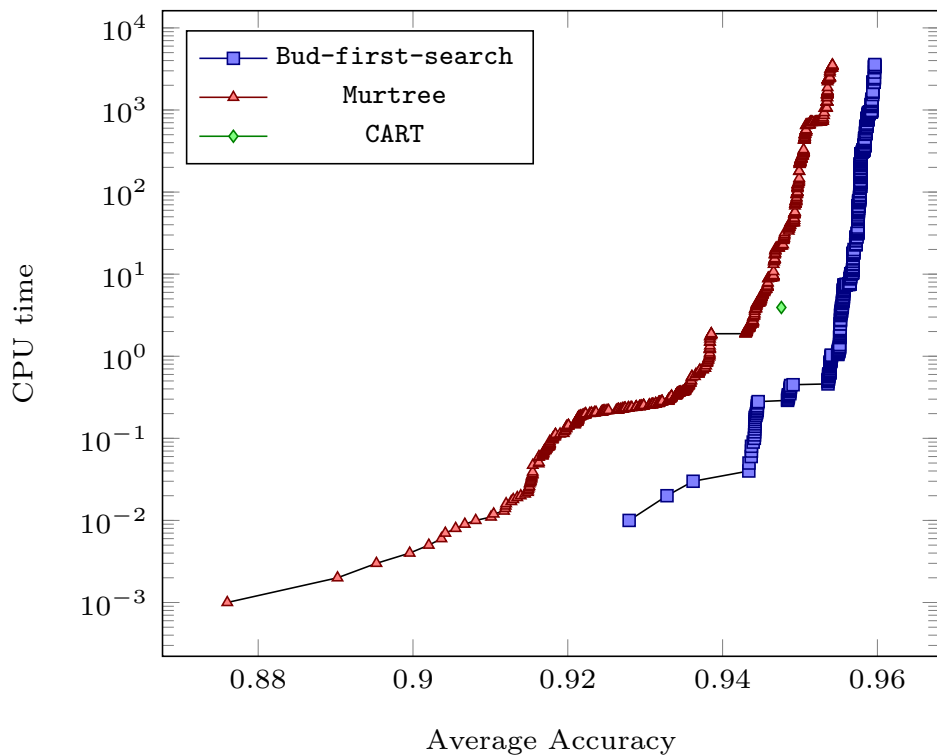
Figure 3: Accuracy over time (max depth=8)

Figure 4: Accuracy over time (max depth=9)

	#ex.	#feat.	Bud-first-search				Murtree				CART
			≤3s	≤10s	≤1m	error	≤3s	≤10s	≤1m	error	error
adult_discretized	30299	59	**4174**	**4174**	**4173**	**4034**	4382	4282	4282	4094	4252
anneal	812	93	**53**	**39**	**39**	**35**	72	68	48	46	74
audiology	216	148	0	0	0	0	0	0	0	0	0
australian-credit	653	125	**1**	0	0	0	27	0	0	0	19
bank-un	45211	9531	**3520**	**3513**	**3508**	**3482**	4882	4036	4036	3955	3575
breast-cancer-un	683	89	1	0	0	0	1	0	0	0	1
breast-wisconsin	683	120	0	0	0	0	0	0	0	0	0
car-un	1728	21	**6**	2	2	0	14	2	**0**	0	15
compas_discretized	6167	25	**1836**	**1832**	**1829**	1828	1923	1901	1890	1828	1891
diabetes	768	112	**3**	**0**	0	0	29	23	0	0	55
forest-fires-un	517	989	150	150	150	150	**149**	**141**	**140**	**140**	152
german-credit	1000	112	**42**	**39**	**18**	**15**	126	125	118	19	97
heart-cleveland	296	95	0	0	0	0	0	0	0	0	0
hepatitis	137	68	0	0	0	0	0	0	0	0	0
hypothyroid	3247	88	**22**	**19**	**17**	**17**	26	26	23	18	36
ionosphere	351	445	0	0	0	0	0	0	0	0	0
kr-vs-kp	3196	73	**13**	**13**	**13**	**5**	35	35	34	32	23
letter	20000	224	**28**	**27**	**26**	24	102	102	101	**4**	48
lymph	148	68	0	0	0	0	0	0	0	0	0
mnist_0	60000	784	**692**	**692**	**683**	**575**	1146	1146	1084	1084	710
mnist_1	60000	784	**563**	**563**	**561**	**554**	953	943	870	846	573
mnist_2	60000	784	**2013**	**2012**	**2011**	**1973**	2391	2236	2236	2158	2058
mnist_3	60000	784	**1381**	**1381**	**1376**	**1321**	2085	2080	2053	2022	1442
mnist_4	60000	784	**1224**	**1224**	**1219**	**1207**	1913	1909	1894	1870	1306
mnist_5	60000	784	**2466**	**2465**	**2458**	2454	2553	2535	2505	**2327**	2553
mnist_6	60000	784	**1227**	1226	1193	1188	1483	**1169**	**1169**	**1070**	1245
mnist_7	60000	784	**1321**	**1320**	**1306**	**1294**	1864	1612	1612	1576	1371
mnist_8	60000	784	**1207**	**1207**	**1197**	**1164**	2075	2074	2054	2051	1267
mnist_9	60000	784	**2023**	**1997**	**1970**	**1969**	2690	2649	2649	2479	2110
mushroom	8124	119	0	0	0	0	0	0	0	0	0
pendigits	7494	216	0	0	0	0	0	0	0	0	0
primary-tumor	336	31	**15**	**15**	**15**	15	25	24	24	15	21
segment	2310	235	0	0	0	0	0	0	0	0	0
soybean	630	50	**2**	**2**	**2**	2	6	5	3	2	5
splice-1	3190	287	**14**	**14**	**14**	**12**	47	37	37	24	18
surgical-deepnet-un	14635	6047	**1166**	**1159**	**1159**	**1149**	1871	1871	1511	1503	1193
taiwan_binarised	30000	205	**4819**	**4805**	**4805**	**4669**	5154	5153	5142	5123	4911
tic-tac-toe	958	27	0	0	0	0	0	0	0	0	10
titanic-un	887	333	**72**	**71**	**68**	**67**	96	92	91	85	93
vehicle	846	252	0	0	0	0	0	0	0	0	1
vote	435	48	0	0	0	0	0	0	0	0	1
weather-aus-un	142193	4759	**1669**	**1667**	**1667**	**1664**	1761	1721	1721	1694	1677
wine1-un	178	1276	26	26	**25**	**24**	26	26	26	25	27
wine2-un	178	1276	**29**	**29**	**29**	**27**	31	30	30	28	32
wine3-un	178	1276	**20**	20	20	18	22	20	**19**	**17**	18
yeast	1484	89	**167**	**142**	**121**	**61**	268	246	243	207	232
zoo-1	101	36	0	0	0	0	0	0	0	0	0
Avg.	19792	784	**680**	**678**	**674**	**660**	856	815	801	773	705

Table 10: Error over time (max depth=9)

	#ex.	#feat.	Bud-first-search				Murtree			
			error	time (s)	time (p)	opt.	error	time (s)	time (p)	opt.
adult_discretized	30299	59	**4034**	**1107.00**	-	0.00	4094	2210.81	-	0.00
anneal	812	93	**35**	363.86	-	0.00	46	**84.74**	-	0.00
audiology	216	148	0	**0.00**	0.00	1.00	0	0.00	0.01	1.00
australian-credit	653	125	0	**2.17**	**2.17**	1.00	0	9.15	9.18	1.00
bank-un	45211	9531	**3482**	1343.40	-	0.00	3955	**740.54**	-	0.00
breast-cancer-un	683	89	0	9.39	9.39	1.00	0	**6.20**	**6.20**	1.00
breast-wisconsin	683	120	0	**0.00**	**0.00**	1.00	0	0.01	0.02	1.00
car-un	1728	21	0	63.51	63.51	1.00	0	**0.18**	**26.66**	1.00
compas_discretized	6167	25	1828	166.31	**166.31**	1.00	1828	**1.75**	3531.58	1.00
diabetes	768	112	0	3.35	**3.35**	1.00	0	**0.08**	42.76	1.00
forest-fires-un	517	989	150	**0.02**	-	0.00	**140**	56.60	-	0.00
german-credit	1000	112	**15**	**674.51**	-	0.00	19	2469.27	-	0.00
heart-cleveland	296	95	0	**0.00**	**0.00**	1.00	0	0.01	0.01	1.00
hepatitis	137	68	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
hypothyroid	3247	88	**17**	**59.26**	**59.26**	**1.00**	18	2316.67	-	0.00
ionosphere	351	445	0	**0.00**	**0.00**	1.00	0	0.10	0.18	1.00
kr-vs-kp	3196	73	**5**	3580.90	-	0.00	32	**1069.30**	-	0.00
letter	20000	224	24	**84.39**	-	0.00	**4**	3368.60	-	0.00
lymph	148	68	0	0.00	**0.00**	1.00	0	0.00	0.00	1.00
mnist_0	60000	784	**575**	1691.20	-	0.00	1084	**43.34**	-	0.00
mnist_1	60000	784	**554**	448.82	-	0.00	846	**6.14**	1530.48	1.00
mnist_2	60000	784	**1973**	**1315.80**	-	0.00	2158	3275.10	-	0.00
mnist_3	60000	784	**1321**	**372.54**	-	0.00	2022	659.43	-	0.00
mnist_4	60000	784	**1207**	**139.01**	-	0.00	1870	1050.32	-	0.00
mnist_5	60000	784	2454	**182.96**	-	0.00	**2327**	1272.60	-	0.00
mnist_6	60000	784	1188	**861.58**	-	0.00	**1070**	1626.46	-	0.00
mnist_7	60000	784	**1294**	2894.80	-	0.00	1576	**560.89**	-	0.00
mnist_8	60000	784	**1164**	3270.80	-	0.00	2051	**99.69**	-	0.00
mnist_9	60000	784	**1969**	**211.29**	-	0.00	2479	541.78	-	0.00
mushroom	8124	119	0	**0.00**	**0.00**	1.00	0	0.00	0.02	1.00
pendigits	7494	216	0	**0.00**	**0.00**	1.00	0	0.02	0.10	1.00
primary-tumor	336	31	15	**0.00**	**0.00**	1.00	15	4.60	668.41	1.00
segment	2310	235	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
soybean	630	50	2	0.04	**0.04**	1.00	2	**0.02**	929.14	1.00
splice-1	3190	287	**12**	**220.16**	-	0.00	24	300.27	-	0.00
surgical-deepnet-un	14635	6047	**1149**	693.44	-	0.00	1503	**543.21**	-	0.00
taiwan_binarised	30000	205	**4669**	3384.60	-	0.00	5123	**1880.42**	-	0.00
tic-tac-toe	958	27	0	**0.00**	**0.00**	1.00	0	0.01	0.01	1.00
titanic-un	887	333	**67**	2480.30	-	0.00	85	3146.19	-	0.00
vehicle	846	252	0	**0.00**	**0.00**	1.00	0	0.02	0.07	1.00
vote	435	48	0	**0.00**	**0.00**	1.00	0	0.00	0.00	1.00
weather-aus-un	142193	4759	**1664**	970.97	-	0.00	1694	**666.19**	-	0.00
wine1-un	178	1276	**24**	1543.70	-	0.00	25	**252.77**	-	0.00
wine2-un	178	1276	**27**	**505.50**	-	0.00	28	860.19	-	0.00
wine3-un	178	1276	18	**319.34**	-	0.00	**17**	3237.01	-	0.00
yeast	1484	89	**61**	2386.80	-	0.00	207	**801.72**	-	0.00
zoo-1	101	36	0	**0.00**	0.00	1.00	0	0.00	0.00	1.00
Avg.	19792	784	**660**	**667.06**	21.00 14.48	0.45	773	705.58	21.00 321.18	0.45

Table 11: Comparaison: optimization of deep tree (max depth=9)

	#ex.	#feat.	Bud-first-search				Murtree				CART
			≤3s	≤10s	≤1m	error	≤3s	≤10s	≤1m	error	error
adult_discretized	30299	59	**4073**	**4071**	**3993**	**3881**	4276	4266	4166	4052	4148
anneal	812	93	**43**	**41**	**34**	**34**	64	60	60	39	59
audiology	216	148	0	0	0	0	0	0	0	0	0
australian-credit	653	125	0	0	0	0	0	0	0	0	12
bank-un	45211	9531	**3260**	**3246**	**3241**	**3241**	4874	3814	3814	3767	3327
breast-cancer-un	683	89	0	0	0	0	0	0	0	0	0
breast-wisconsin	683	120	0	0	0	0	0	0	0	0	0
car-un	1728	21	0	0	0	0	0	0	0	0	11
compas_discretized	6167	25	**1828**	**1828**	**1828**	**1828**	1902	1888	1877	1843	1871
diabetes	768	112	**0**	**0**	0	0	25	22	0	0	35
forest-fires-un	517	989	**126**	**126**	**126**	**113**	141	132	131	131	146
german-credit	1000	112	**21**	**15**	**3**	**0**	98	92	90	0	66
heart-cleveland	296	95	0	0	0	0	0	0	0	0	0
hepatitis	137	68	0	0	0	0	0	0	0	0	0
hypothyroid	3247	88	**17**	**17**	**17**	17	26	26	18	17	31
ionosphere	351	445	0	0	0	0	0	0	0	0	0
kr-vs-kp	3196	73	**7**	**6**	**2**	**0**	37	37	25	24	12
letter	20000	224	**12**	**12**	**1**	**0**	19	19	19	0	21
lymph	148	68	0	0	0	0	0	0	0	0	0
mnist_0	60000	784	**467**	**467**	**467**	**412**	936	936	885	880	477
mnist_1	60000	784	**411**	**411**	**411**	**405**	653	642	618	610	439
mnist_2	60000	784	**1839**	**1839**	**1829**	**1801**	2108	1969	1969	1899	1959
mnist_3	60000	784	**1113**	**1113**	**1097**	**1050**	1616	1608	1574	1568	1169
mnist_4	60000	784	**957**	**956**	**956**	**908**	1550	1548	1520	1517	1010
mnist_5	60000	784	**2161**	**2161**	**2144**	2142	2440	2440	2398	**2088**	2266
mnist_6	60000	784	**1156**	1154	1139	1115	1355	**1090**	**1090**	**952**	1211
mnist_7	60000	784	**1175**	**1173**	**1152**	**1126**	1538	1395	1395	1264	1263
mnist_8	60000	784	**864**	**863**	**855**	**836**	1666	1666	1663	1560	916
mnist_9	60000	784	**1658**	**1657**	**1628**	**1597**	2379	2251	2251	2221	1722
mushroom	8124	119	0	0	0	0	0	0	0	0	0
pendigits	7494	216	0	0	0	0	0	0	0	0	0
primary-tumor	336	31	**15**	**15**	**15**	15	22	22	21	15	20
segment	2310	235	0	0	0	0	0	0	0	0	0
soybean	630	50	**2**	**2**	**2**	2	4	4	4	2	2
splice-1	3190	287	**9**	**9**	**7**	**5**	29	24	22	13	12
surgical-deepnet-un	14635	6047	**1060**	**1043**	**1042**	**1040**	1400	1400	1385	1382	1089
taiwan_binarised	30000	205	**4599**	**4565**	**4538**	**4410**	5036	5028	5026	4993	4710
tic-tac-toe	958	27	0	0	0	0	0	0	0	0	6
titanic-un	887	333	**64**	**63**	**58**	**53**	91	91	88	80	78
vehicle	846	252	0	0	0	0	0	0	0	0	0
vote	435	48	0	0	0	0	0	0	0	0	0
weather-aus-un	142193	4759	**1633**	**1629**	**1628**	**1628**	1761	1703	1703	1675	1642
wine1-un	178	1276	**23**	**23**	**23**	**22**	25	24	24	23	25
wine2-un	178	1276	27	27	**26**	**24**	27	27	27	27	29
wine3-un	178	1276	19	19	18	16	**18**	**18**	18	**15**	19
yeast	1484	89	**104**	**88**	**88**	**26**	228	204	204	170	185
zoo-1	101	36	0	0	0	0	0	0	0	0	0
Avg.	19792	784	**612**	**609**	**604**	**590**	773	733	725	698	638

Table 12: Error over time (max depth=10)

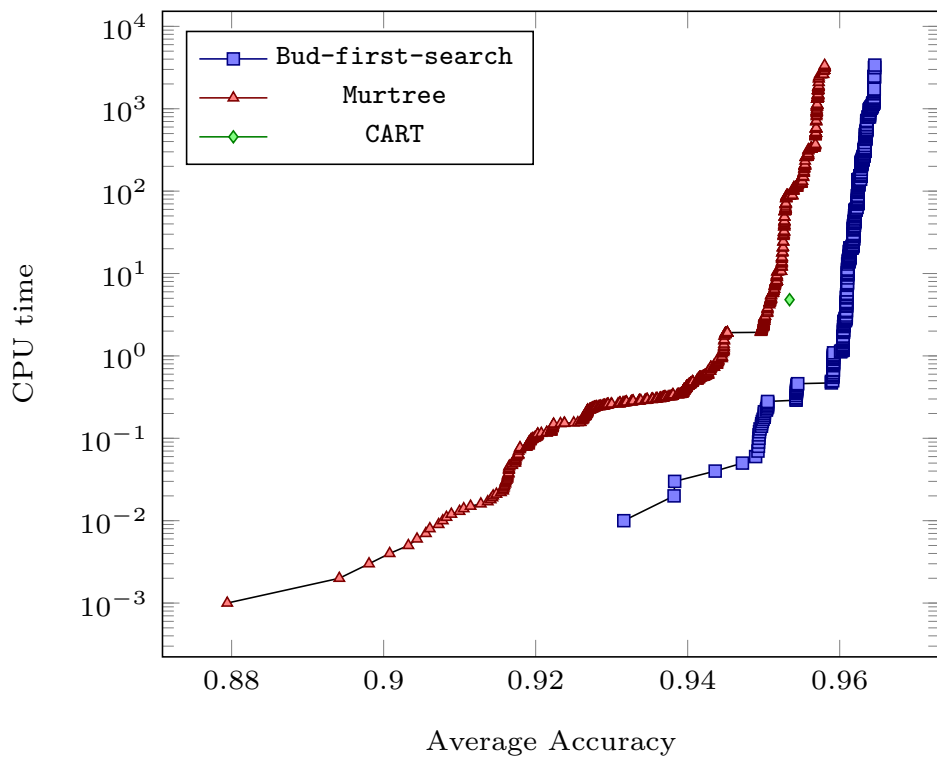|	#ex.	#feat.	Bud-first-search				Murtree			
			error	time (s)	time (p)	opt.	error	time (s)	time (p)	opt.
adult_discretized	30299	59	**3881**	1647.20	-	0.00	4052	**1634.51**	-	0.00
anneal	812	93	**34**	**21.76**	**21.76**	**1.00**	39	831.70	-	0.00
audiology	216	148	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
australian-credit	653	125	0	**0.03**	**0.03**	1.00	0	0.59	0.61	1.00
bank-un	45211	9531	**3241**	**21.21**		-	3767	3246.77	-	0.00
breast-cancer-un	683	89	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
breast-wisconsin	683	120	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
car-un	1728	21	0	**0.23**	**0.23**	1.00	0	0.52	0.52	1.00
compas_discretized	6167	25	**1828**	0.67	**0.67**	1.00	1843	**0.46**	2942.77	1.00
diabetes	768	112	0	0.55	**0.55**	1.00	0	**0.03**	10.71	1.00
forest-fires-un	517	989	**113**	1023.80	-	0.00	131	**59.52**	-	0.00
german-credit	1000	112	0	**70.63**	**70.63**	1.00	0	109.86	122.54	1.00
heart-cleveland	296	95	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
hepatitis	137	68	0	0.00	**0.00**	1.00	0	**0.00**	0.00	1.00
hypothyroid	3247	88	17	**0.96**	**0.96**	**1.00**	17	1053.16	-	0.00
ionosphere	351	445	0	**0.00**	**0.00**	1.00	0	0.03	0.12	1.00
kr-vs-kp	3196	73	**0**	1719.00	1719.00	1.00	24	2085.82	-	0.00
letter	20000	224	0	**74.31**	**74.31**	1.00	0	511.46	887.98	1.00
lymph	148	68	0	0.00	**0.00**	1.00	0	0.00	0.00	1.00
mnist_0	60000	784	**412**	1172.00		-	880	**125.33**	-	0.00
mnist_1	60000	784	**405**	**1383.90**		-	610	3247.70	-	0.00
mnist_2	60000	784	**1801**	**958.94**		-	1899	3235.74	-	0.00
mnist_3	60000	784	**1050**	1258.00		-	1568	**327.43**	-	0.00
mnist_4	60000	784	**908**	245.97	-	0.00	1517	**0.62**	459.37	**1.00**
mnist_5	60000	784	2142	**96.58**		-	**2088**	1066.82	-	0.00
mnist_6	60000	784	1115	2491.30		-	**952**	**1118.92**	-	0.00
mnist_7	60000	784	**1126**	**836.01**		-	1264	1696.16	-	0.00
mnist_8	60000	784	**836**	**720.50**		-	1560	2308.91	-	0.00
mnist_9	60000	784	**1597**	**2446.40**		-	2221	3366.83	-	0.00
mushroom	8124	119	0	**0.00**	**0.00**	1.00	0	0.00	0.02	1.00
pendigits	7494	216	0	**0.00**	**0.00**	1.00	0	0.02	0.11	1.00
primary-tumor	336	31	15	**0.00**	**0.00**	1.00	15	20.85	2612.14	1.00
segment	2310	235	0	**0.00**	**0.00**	1.00	0	0.00	0.01	1.00
soybean	630	50	2	**0.00**	**0.00**	1.00	2	110.44	380.19	1.00
splice-1	3190	287	**5**	1200.00	-	0.00	13	**992.55**	-	0.00
surgical-deepnet-un	14635	6047	**1040**	1737.20	-	0.00	1382	**1134.34**	-	0.00
taiwan_binarised	30000	205	**4410**	452.75	-	0.00	4993	**15.77**	**1334.85**	**1.00**
tic-tac-toe	958	27	0	**0.00**	**0.00**	1.00	0	0.00	0.00	1.00
titanic-un	887	333	**53**	3388.20	-	0.00	80	**1856.78**	-	0.00
vehicle	846	252	0	**0.00**	**0.00**	1.00	0	0.02	0.07	1.00
vote	435	48	0	0.00	**0.00**	1.00	0	0.00	0.00	1.00
weather-aus-un	142193	4759	**1628**	**38.02**		-	1675	2103.26	-	0.00
wine1-un	178	1276	**22**	541.46	-	0.00	23	**132.03**	-	0.00
wine2-un	178	1276	**24**	424.82	-	0.00	27	**0.56**	-	0.00
wine3-un	178	1276	16	**265.97**	-	0.00	**15**	2619.22	-	0.00
yeast	1484	89	**26**	1244.00	-	0.00	170	3113.11	-	0.00
zoo-1	101	36	0	0.00	**0.00**	1.00	0	0.00	0.00	1.00
Avg.	19792	784	**590**	**542.18**	₍25.00₎ 75.53	**0.53**	698	811.23	₍24.00₎ 364.67	0.51

Table 13: Comparaison: optimization of deep tree (max depth=10)

Figure 5: Accuracy over time (max depth=10)