

Walsh [39] is the clear exception. As mentioned earlier, Walsh’s model is the only one of these models which attempted to reduce *brittleness*. As shown in Figure 5.2 the result of this is the creation of a clear boundary between the LR. Hence *brittleness* only exists at the boundary.

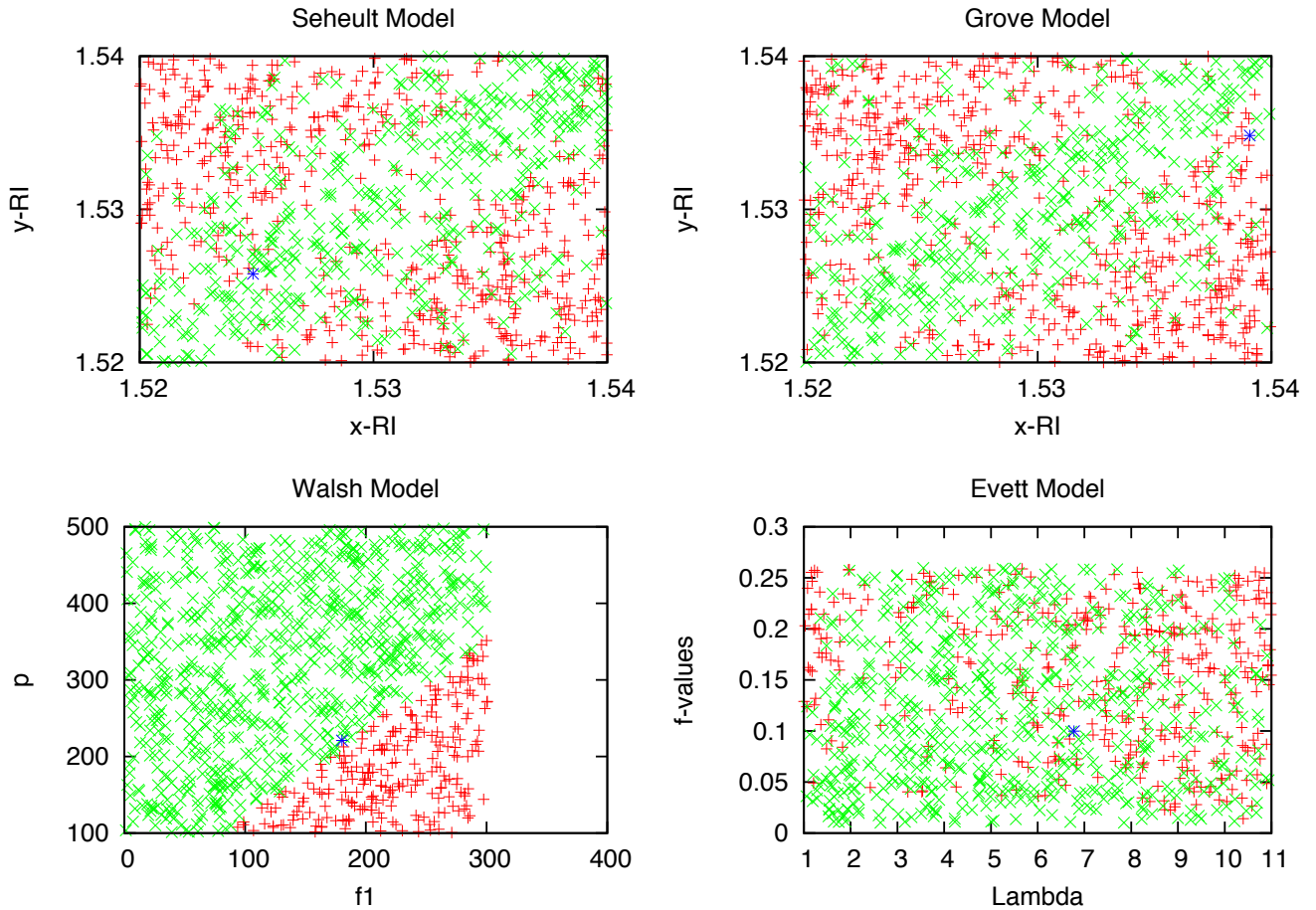


Figure 5.2: Visualization of four(4) glass forensic models.

From these visualizations it is obvious that the concern of the National Academy of Sciences report [35] mentioned earlier in this section is a valid one. So how can this concern be alleviated? We propose not only including a *brittleness* measure to a forensic method as a solution, but also moving away from forensic models which use surveys [13–15, 36, 39], and statistical assumptions [21, 36, 39].

The following sections gives details of CAM (the CLIFF Avoidance Model) as well as the data

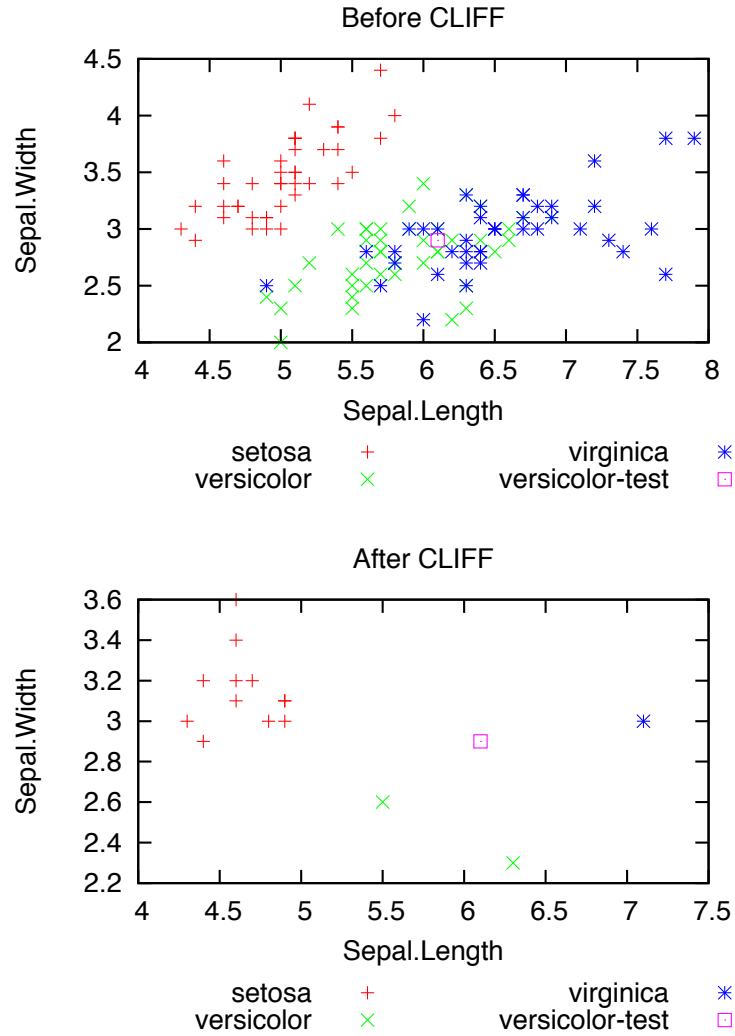
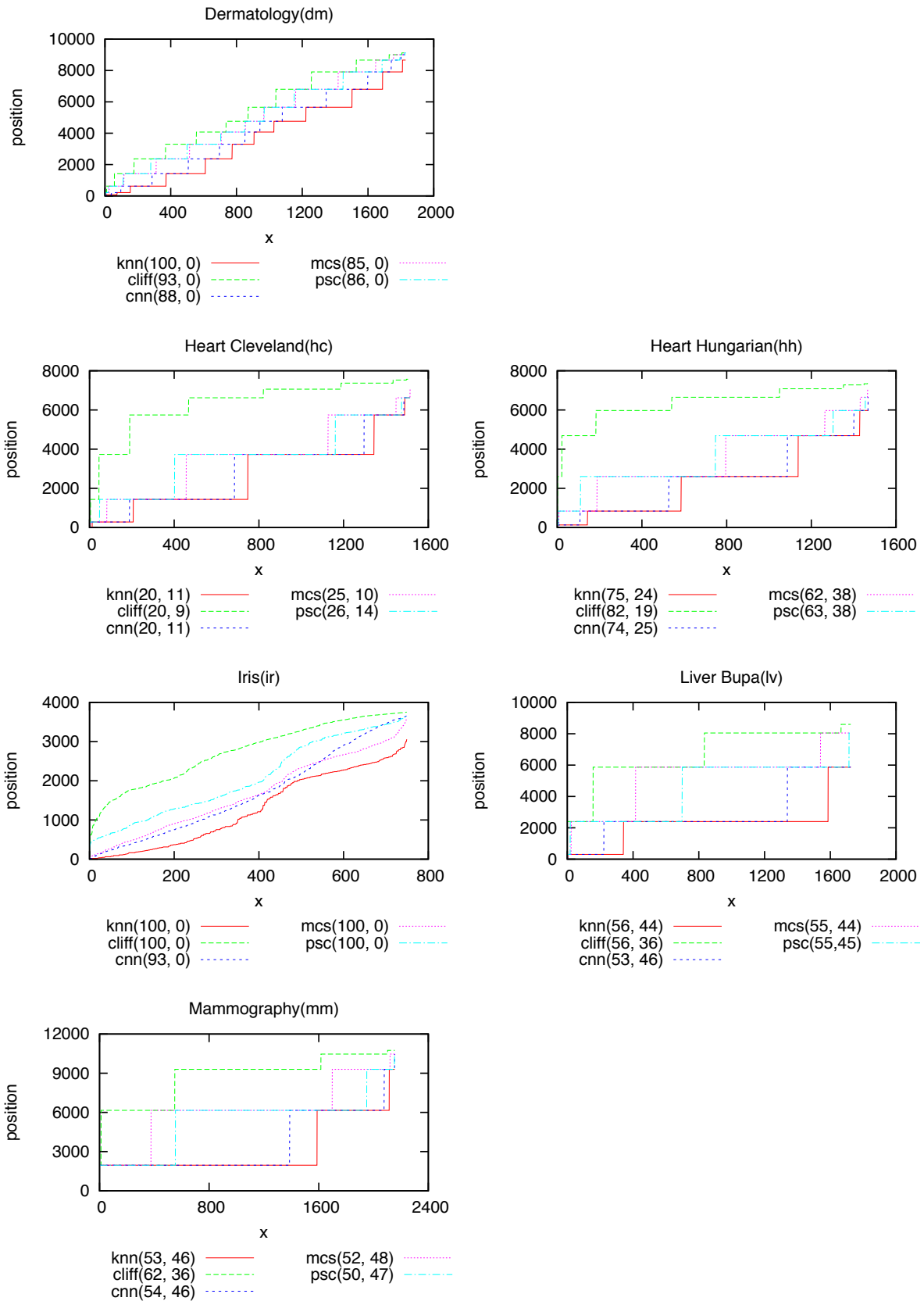


Figure 4.4

With this measure in mind, the goal here is to see how each prototype learning scheme studied here reduces the brittleness of the KNN model where $k=1$. Brittleness will be measured by distance each test instance moves before changing its original predicted target class. Intuitively, the further away the test instance has to move the less *brittle* the model. The experiment design for *brittleness* can be done in conjunction with Experiment 1 by collecting the distances of each test instance with a predicted target class to the nearest training instance with a different target class. This is done for



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Figure 4.5: Position of distance values for PLS

1 Handling Noise in Data

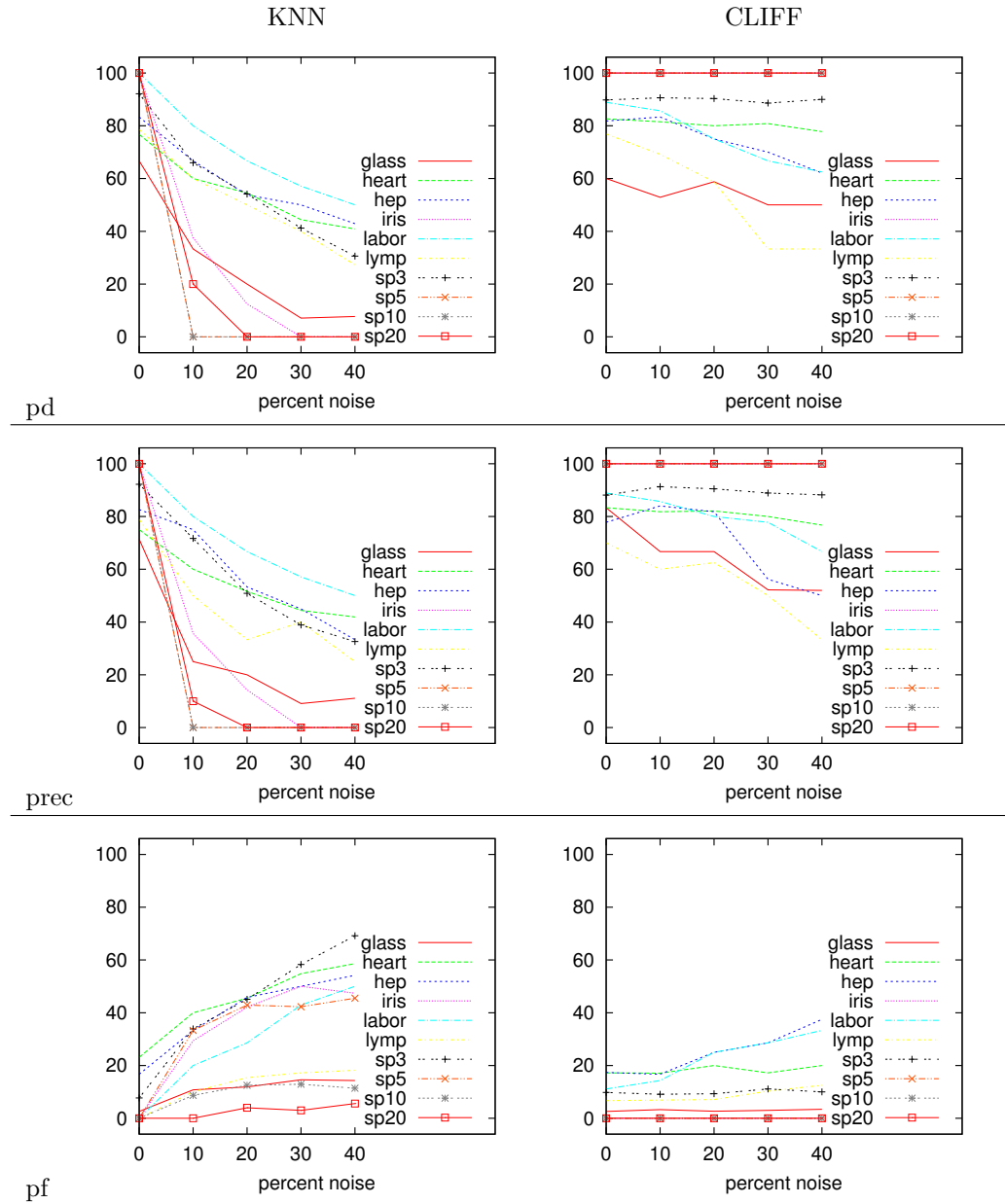


Figure 1: Effects of noise.

2 Is CLIFF better than Others?

		percent noise					
		0	10	20	30	40	sum
breast-cancer	knn	4	-2	-6	-1	-1	-1
	knn+cnr	4	-2	-1	2	5	1
	knn+mcs	-5	-9	-5	6	2	-2
	knn+psc	-8	-11	-12	-5	0	-7
ecoli	knn	5	-64	-66	-60	-50	-47
	knn+cnr	-23	-64	-66	-60	-50	-52
	knn+mcs	-23	-54	-60	-52	-46	-47
	knn+psc	-37	-64	-66	-60	-50	-55
glass	knn	6	-19	-38	-42	-42	-27
	knn+cnr	-10	-19	-27	-31	-30	-23
	knn+mcs	-10	-22	-27	-19	-18	-19
	knn+psc	-24	-45	-51	-50	-50	-44
heartc	knn	-5	-21	-25	-36	-36	-24
	knn+cnr	-8	-8	-19	-23	-22	-16
	knn+mcs	-28	-29	-27	-32	-27	-28
	knn+psc	-32	-46	-48	-46	-45	-43
hepatitis	knn	1	-16	-21	-20	-19	-15
	knn+cnr	-4	-11	-12	-12	-12	-10
	knn+mcs	-18	-31	-25	-20	-6	-20
	knn+psc	-20	-31	-30	-24	-19	-24
iris	knn	0	-62	-87	-100	-100	-69
	knn+cnr	-9	-30	-50	-61	-66	-43
	knn+mcs	-9	-42	-58	-38	-44	-38
	knn+psc	-9	-71	-87	-91	-100	-71
labor	knn	11	-5	-8	-9	-12	-4
	knn+cnr	2	-5	-8	-6	-2	-3
	knn+mcs	11	-10	-12	-16	-2	-5
	knn+psc	11	-23	-8	-22	-12	-10
lymph	knn	1	-9	-8	6	-5	-3
	knn+cnr	-10	-13	-15	10	0	-5
	knn+mcs	-8	-19	-20	6	-4	-9
	knn+psc	-18	-35	-30	-10	-8	-20
vote	knn	2	-24	-36	-47	-59	-32
	knn+cnr	0	-4	-9	-27	-34	-14
	knn+mcs	-19	-38	-42	-38	-38	-35
	knn+psc	-17	-61	-66	-62	-64	-54
spectra3	knn	0	-100	-100	-100	-100	-80
	knn+cnr	0	-81	-72	-88	-95	-67
	knn+mcs	0	-81	0	0	0	-16
	knn+psc	0	-100	-100	-100	-100	-80
spectra5	knn	0	-100	-100	-100	-100	-80
	knn+cnr	0	-100	-100	-100	-100	-80
	knn+mcs	0	-75	-66	-25	0	-33
	knn+psc	0	-100	-100	-100	-100	-80
spectra10	knn	0	-80	-100	-100	-100	-76
	knn+cnr	0	-50	-100	-100	-100	-70
	knn+mcs	0	0	0	0	0	0
	knn+psc	0	-100	-100	-100	-100	-80
spectra20	knn	0	-100	-100	-100	-100	-80
	knn+cnr	0	-100	-100	-100	-100	-80
	knn+mcs	0	-50	-66	-66	-50	-46
	knn+psc	0	-100	-100	-100	-100	-80
mean		0	0	-5	-44	-47	-82

Figure 2: PDs: other - (knn+cliff). Note: *negative* values means CLIFF is performing *better*.

		percent noise				sum	
		0	10	20	30		40
breast-cancer	knn	0	4	3	2	3	2
	knn+cnr	0	2	-1	-3	-2	0
	knn+mcs	11	11	6	-5	0	4
	knn+psc	13	9	10	5	2	7
ecoli	knn	0	5	6	8	7	5
	knn+cnr	0	3	4	4	5	3
	knn+mcs	0	3	3	3	2	2
	knn+psc	1	5	7	6	7	5
glass	knn	0	7	9	11	10	7
	knn+cnr	1	2	5	7	6	4
	knn+mcs	2	6	5	7	5	5
	knn+psc	6	11	11	11	12	10
heartc	knn	5	22	25	37	38	25
	knn+cnr	8	9	18	23	23	16
	knn+mcs	26	30	26	34	28	28
	knn+psc	32	47	46	48	45	43
hepatitis	knn	0	16	20	21	16	14
	knn+cnr	4	11	8	14	12	9
	knn+mcs	17	31	25	19	5	19
	knn+psc	21	31	25	25	19	24
iris	knn	0	29	42	50	47	33
	knn+cnr	4	9	20	27	30	18
	knn+mcs	4	20	23	13	19	15
	knn+psc	4	31	38	42	45	32
labor	knn	-11	5	3	14	16	5
	knn+cnr	-11	2	8	11	6	3
	knn+mcs	-11	7	8	21	6	6
	knn+psc	-11	14	8	27	16	10
lymph	knn	-6	3	8	6	5	3
	knn+cnr	-6	3	0	4	1	0
	knn+mcs	-6	5	10	7	5	4
	knn+psc	-3	11	14	11	6	7
vote	knn	-2	24	35	47	59	32
	knn+cnr	1	5	9	20	33	13
	knn+mcs	19	38	42	37	37	34
	knn+psc	17	61	66	62	64	54
spectra3	knn	0	33	42	42	45	32
	knn+cnr	0	20	23	26	30	19
	knn+mcs	0	9	0	0	0	1
	knn+psc	0	31	44	50	40	33
spectra5	knn	0	8	12	12	11	8
	knn+cnr	0	5	8	11	7	6
	knn+mcs	0	3	2	0	0	1
	knn+psc	0	8	12	12	8	8
spectra10	knn	0	0	4	3	5	2
	knn+cnr	0	0	0	0	2	0
	knn+mcs	0	0	0	0	0	0
	knn+psc	0	0	3	2	5	2
spectra20	knn	0	0	0	2	2	0
	knn+cnr	0	0	0	0	0	0
	knn+mcs	0	0	0	0	0	0
	knn+psc	0	0	0	2	2	0
mean		0	0	2	12	14	27

Figure 3: PFs: other - (knn+cliff). Note: *positive* values means CLIFF is performing *better*.

		percent noise					
		0	10	20	30	40	sum
breast-cancer	knn	0	-4	-14	-11	-8	-7
	knn+cnr	-2	-2	-4	-4	3	-1
	knn+mcs	-13	-12	-16	0	0	-8
	knn+psc	-18	-19	-21	-12	-11	-16
ecoli	knn	-8	-75	-75	-66	-68	-58
	knn+cnr	-37	-75	-75	-66	-68	-64
	knn+mcs	-43	-60	-65	-52	-62	-56
	knn+psc	-48	-75	-75	-66	-68	-66
glass	knn	-11	-41	-46	-43	-40	-36
	knn+cnr	-30	-33	-34	-32	-32	-32
	knn+mcs	-33	-39	-35	-22	-18	-29
	knn+psc	-50	-55	-60	-52	-52	-53
heartc	knn	-8	-21	-30	-35	-34	-25
	knn+cnr	-8	-10	-18	-17	-21	-14
	knn+mcs	-30	-30	-26	-30	-23	-27
	knn+psc	-33	-46	-46	-46	-42	-42
hepatitis	knn	4	-9	-28	-11	-16	-12
	knn+cnr	-6	-5	-20	5	5	-4
	knn+mcs	-9	-42	-43	-6	-3	-20
	knn+psc	-11	-28	-46	-20	-16	-24
iris	knn	0	-64	-85	-100	-100	-69
	knn+cnr	-11	-27	-45	-59	-65	-41
	knn+mcs	-10	-50	-55	-36	-43	-38
	knn+psc	-7	-75	-83	-91	-100	-71
labor	knn	11	-5	-13	-20	-16	-8
	knn+cnr	-3	-5	-8	-11	-6	-6
	knn+mcs	11	-7	-13	-17	-16	-8
	knn+psc	11	-19	-20	-27	-16	-14
lymph	knn	8	-10	-29	-10	-8	-9
	knn+cnr	-3	-7	-18	-12	3	-7
	knn+mcs	0	-10	-33	-16	-13	-14
	knn+psc	-6	-22	-37	-30	-13	-21
vote	knn	4	-19	-39	-50	-55	-31
	knn+cnr	0	-8	-14	-23	-34	-15
	knn+mcs	-15	-40	-39	-34	-37	-33
	knn+psc	-16	-59	-66	-65	-63	-53
spectra3	knn	0	-100	-100	-100	-100	-80
	knn+cnr	0	-80	-75	-85	-95	-67
	knn+mcs	0	-64	0	0	-6	-14
	knn+psc	0	-100	-100	-100	-100	-80
spectra5	knn	0	-100	-100	-100	-100	-80
	knn+cnr	0	-100	-100	-100	-100	-80
	knn+mcs	0	-71	-42	-12	0	-25
	knn+psc	0	-100	-100	-100	-100	-80
spectra10	knn	0	-90	-100	-100	-100	-78
	knn+cnr	0	-85	-100	-100	-100	-77
	knn+mcs	0	0	0	0	0	0
	knn+psc	0	-100	-100	-100	-100	-80
spectra20	knn	0	-100	-80	-100	-83	-72
	knn+cnr	-25	-100	-80	-100	-83	-77
	knn+mcs	0	-50	-40	-66	-33	-37
	knn+psc	0	-100	-80	-100	-83	-72
mean		0	0	-8	-47	-49	-86

Figure 4: PRECISION: other - (knn+cliff). Note: *negative* values means CLIFF is performing *better*.