1 Supplementary Results

We first evaluate the MdMRE and Pred(25) results for each dataset and then present the win-tie-loss values. In this paper, we include only Cocomo81 results due to 2 reasons: 1) We have strict page restrictions and result tables consume too much space, 2) observations from one dataset are valid for other datasets, i.e. non-uniform weighting never improves standad ABE. For other tables please contact one of the authors or see

1.1 Evaluation of AR, MdMRE and Pred(25) Results

1.1.1 Results for Nasa93

Figure 1 lists the MdMRE as well as Pred(25) results for Nasa93 dataset. As we can see from Figure 1, different kernel types generate very similar results for various k values. In other words, change of kernel does not have a considerable effect on the performance of N-ABE. Furthermore, small performance changes due to different kernels do not follow a particular pattern.

Like the change of kernel, changing bandwidth has almost a non-existent effect. We see in Figure 1 that different bandwidths generate very close MdMRE and Pred(25) results for N-ABE methods. More importantly there is no observable pattern in small changes due to kernel or bandwidth alterations. Another property of Nasa93 results is that uniform weighting in ABE0 gains higher estimation accuracies (lower MdMRE and higher Pred(25) values) than corresponding N-ABE methods. Lastly, we need to mention that similar to our use of Cocomo81 dataset, for Nasa93 we use all 93 instances and all 17 features in our treatments as well.

1.1.2 Results for Desharnais

We provide the MdMRE and Pred(25) values for Desharnais dataset in Figure 2. Among all kernel-bandwidth combinations we do not see a case where use of non-uniform weighting improves the performance of uniform weighting. Therefore, particular characteristic of previous datasets in terms of being indifferent to different kernel methods is also valid for Desharnais dataset. Furthermore, what we see from Figure 2 is that instead of improving ABE0 methods, N-ABE methods generate considerably worse MdMRE and Pred(25) results. In the experiments we used 81 instances from Desharnais dataset. For missing attributes of 4 projects in Desharnais, simple mean imputation is employed.

1.2 Evaluation of WIN-TIE-LOSS Results

1.2.1 Results for Nasa93

Figure 3 shows the win-tie-loss results for Nasa93 dataset. The results for Nasa93 are extremely similar to Cocomo81, that is in all cases the highest *win* values belong to $k = 3$ and *tie* values are usually around 25% of 180 comparisons. Furthermore, application of different kernels for N-ABE does not yield a considerable difference. For instance, for the treatment $k = 3$ and $h = 1/sqrt(size)$ the difference between

		h=1/sqrt(size)		h=2		h=4		h=8		h=16	
	k	MdMRE	Pred(25)%	MdMRE	Pred(25)%	MdMRE	Pred(25)%	MdMRE	Pred(25)%	MdMRE	Pred(25)%
Uniform	3	0.40	14.35	0.23	14.19	0.20	14.95	0.43	14.95	0.43	12.96
	5	0.43	13.28	0.26	12.58	0.21	13.17	0.43	11.45	0.44	12.96
	7	0.43	12.90	0.33	12.10	0.25	13.28	0.43	11.99	0.44	11.40
	9	0.43	10.86	0.35	10.54	0.29	11.56	0.43	11.67	0.44	9.57
	d	0.81	9.68	0.30	8.12	0.42	11.02	0.43	11.83	0.49	10.38
	3+N	0.83	3.92	0.77	8.92	0.75	9.62	0.78	7.69	0.79	7.15
	5+N	0.90	3.12	0.86	6.88	0.85	7.53	0.87	6.72	0.88	5.27
	7+N	0.93	3.28	0.90	4.68	0.89	5.97	0.91	5.00	0.91	5.00
	9+N	0.94	4.25	0.92	5.38	0.92	5.43	0.93	5.48	0.93	2.69
	d+N	0.90	11.45	0.83	1.40	0.97	4.09	0.93	3.23	0.97	95.55
Triangular	3	0.32	13.66	0.30	13.76	0.45	12.90	0.29	14.35	0.30	14.35
	5	0.40	11.72	0.40	12.47	0.46	12.42	0.31	12.69	0.40	12.37
	7	0.43	12.20	0.40	11.72	0.47	11.88	0.37	12.74	0.41	12.58
	9	0.42	10.32	0.40	11.83	0.47	11.67	0.37	11.18	0.40	11.24
	d	0.32	11.29	0.40	8.92	0.50	8.17	0.31	11.77	0.44	12.58
	3+N	0.83	3.23	0.76	6.34	0.79	5.91	0.78	5.92	0.80	6.88
	5+N	0.90	2.20	0.77	9.84	0.78	8.01	0.77	8.92	0.78	8.60
	7+N	0.92	3.17	0.76	9.95	0.77	9.78	0.76	10.32	0.78	8.98
	9+N	0.94	4.14	0.75	11.24	0.76	10.32	0.75	10.43	0.77	10.48
	d+N	0.83	2.47	0.74	8.23	0.73	8.28	0.77	11.40	0.74	8.98
Epanechnikov	3	0.29	12.80	0.34	13.49	0.45	13.92	0.45	14.57	0.48	14.09
	5	0.39	13.17	0.40	12.85	0.45	12.69	0.46	13.01	0.48	12.96
	7	0.39	12.15	0.41	13.49	0.46	12.20	0.47	13.49	0.49	12.80
	9	0.39	10.91	0.40	12.42	0.46	12.15	0.47	12.47	0.49	11.08
	d	0.40	11.13	0.57	13.49	0.45	11.67	0.47	9.41	0.62	11.08
	3+N	0.83	3.06	0.74	7.90	0.76	7.96	0.75	7.20	0.80	7.15
	5+N	0.90	2.58	0.71	9.25	0.74	10.65	0.72	10.54	0.75	10.91
	7+N	0.93	2.80	0.68	11.45	0.72	9.78	0.70	11.61	0.73	9.89
	9+N	0.95	2.74	0.67	11.88	0.70	10.91	0.68	11.51	0.71	11.13
	d+N	0.96	5.48	0.66	11.45	0.68	10.65	0.69	9.89	0.68	12.63
Gaussian	3	0.29	13.76	0.41	14.03	0.43	13.17	0.25	14.30	0.46	13.01
	5	0.37	13.55	0.41	12.80	0.43	12.20	0.28	12.96	0.47	13.01
	7	0.38	14.41	0.44	13.98	0.44	12.31	0.32	12.85	0.49	13.06
	9	0.38	11.24	0.42	12.26	0.43	11.13	0.33	10.81	0.49	12.15
	d	0.36	9.09	0.67	10.22	0.48	11.83	0.30	10.32	0.51	9.52
	3+N	0.83	3.39	0.78	8.39	0.69	6.40	0.72	6.61	0.78	6.83
	5+N	0.90	2.74	0.76	10.91	0.67	10.00	0.70	10.70	0.74	11.77
	7+N	0.93	3.87	0.73	11.18	0.66	9.95	0.69	10.70	0.72	11.34
	9+N	0.94	3.60	0.71	11.29	0.65	10.75	0.67	11.24	0.70	11.29
	d+N	0.93	9.73	0.70	9.89	0.63	10.81	0.71	9.46	0.66	9.62

Fig. 1: MdMRE and Pred(25) results for Nasa93 dataset. Neither change of kernel nor the change of bandwidth generates a considerable difference in results. Furthermore, small changes in MdMRE and Pred(25) values due to different kernel-bandwidth combinations do not follow a certain pattern. Another conclusion from this figure is that N-ABE methods fail to improve ABE0.

the highest and the lowest *win* value (141 and 122 respectively) is only 19, which is around 10% of all 180 comparisons. Similar to the effect of changing kernels, changing bandwidth also falls short of providing any noticable increase or decrease in estimation performance. Furthermore, we need to point out hat in none of the *k* values have N-ABE methods provided any improvement in estimation accuracy. This shows us that like Cocomo81 dataset, Nasa93 dataset does not favor non-uniform weighting over uniform weighting.

		h=1/sqrt(size)		h=2		h=4		h=8		h=16	
	k	MdMRE	Pred(25)%	MdMRE	Pred(25)%	MdMRE	Pred(25)%	MdMRE	Pred(25)%	MdMRE	Pred(25)%
Uniform	3	0.39	34.14	0.40	35.43	0.40	35.12	0.40	34.69	0.37	35.62
	5	0.36	37.96	0.37	38.70	0.36	37.16	0.37	36.98	0.35	38.46
	7	0.36	36.91	0.37	38.52	0.36	36.85	0.37	36.67	0.36	37.47
	9	0.37	35.74	0.37	36.42	0.37	34.94	0.37	35.37	0.36	36.05
	d	0.37	34.88	0.36	31.67	0.37	32.84	0.36	31.98	0.36	33.58
	3+N	0.81	2.53	0.70	5.86	0.69	5.19	0.70	5.12	0.69	5.31
	5+N	0.86	0.93	0.82	1.30	0.81	2.28	0.82	1.79	0.81	2.22
	7+N	0.89	0.37	0.87	0.19	0.86	0.12	0.87	0.19	0.86	0.12
	9+N	0.91	0.19	0.89	0.00	0.89	0.00	0.90	0.00	0.89	0.00
	d+N	0.93	0.12	0.88	0.00	0.96	0.00	0.94	0.00	0.89	0.00
Triangular	3	0.38	36.05	0.36	34.81	0.38	35.49	0.36	34.88	0.39	34.07
	5	0.36	38.27	0.35	37.35	0.36	38.40	0.36	37.65	0.36	37.10
	7	0.36	37.10	0.36	37.35	0.36	38.15	0.36	37.16	0.36	36.54
	9	0.36	35.93	0.36	36.17	0.36	34.44	0.36	36.42	0.37	35.00
	d	0.41	32.59	0.36	33.33	0.37	34.44	0.47	35.43	0.36	32.84
	3+N	0.44	25.80	0.62	10.06	0.61	9.94	0.61	10.31	0.60	11.54
	5+N	0.41	30.93	0.55	14.75	0.54	15.06	0.53	16.05	0.54	16.73
	7+N	0.39	34.75	0.50	17.35	0.51	17.35	0.50	19.26	0.51	18.95
	9+N	0.38	34.38	0.48	20.74	0.49	20.37	0.48	22.47	0.49	21.54
	d+N	0.41	31.31	0.42	25.00	0.39	20.37	0.46	16.79	0.47	30.43
Epanechnikov	3	0.36	34.94	0.40	37.59	0.39	35.43	0.36	35.62	0.38	35.56
	5	0.36	37.96	0.34	38.64	0.36	37.28	0.35	37.47	0.36	37.72
	7	0.36	35.74	0.36	37.10	0.36	36.73	0.36	36.98	0.36	36.98
	9	0.36	34.51	0.36	36.85	0.36	35.49	0.37	34.94	0.36	35.68
	d	0.36	32.59	0.36	32.41	0.37	36.73	0.35	31.91	0.40	30.62
	3+N	0.80	0.80	0.58	10.93	0.58	12.16	0.58	10.93	0.57	11.98
	5+N	0.87	0.31	0.50	17.35	0.50	17.10	0.49	17.41	0.51	16.67
	7+N	0.90	0.00	0.46	23.15	0.47	21.85	0.46	22.65	0.47	20.93
	9+N	0.92	0.12	0.45	24.26	0.45	24.14	0.44	24.57	0.44	23.70
	d+N	0.92	0.12	0.42	30.43	0.38	21.85	0.49	30.00	0.41	30.43
Gaussian	3	0.39	34.01	0.37	35.06	0.40	37.35	0.40	35.25	0.39	35.43
	5	0.36	37.90	0.36	38.02	0.39	38.70	0.36	37.72	0.36	38.21
	7	0.36	36.98	0.37	36.67	0.39	37.53	0.37	37.10	0.36	37.41
	9	0.36	34.81	0.37	34.88	0.37	36.05	0.37	33.77	0.37	35.19
	d	0.35	33.89	0.36	31.54	0.39	34.81	0.36	31.60	0.36	38.21
	3+N	0.80	1.73	0.60	11.42	0.61	10.68	0.60	11.23	0.58	12.35
	5+N	0.86	0.19	0.51	17.78	0.52	16.36	0.50	17.22	0.50	18.64
	7+N	0.90	0.06	0.47	22.41	0.49	20.12	0.46	21.30	0.45	23.15
	9+N	0.91	0.00	0.45	24.81	0.47	23.64	0.45	23.77	0.44	25.80
	d+N	0.93	0.93	0.47	30.00	0.49	25.68	0.43	30.42	0.38	18.64

Fig. 2: MdMRE and Pred(25) results for Desharnais dataset. None of the different kernel-bandwidth combinations can improve the performance of N-ABE methods to a point where they outperform the U-ABE method of ABE0.

1.2.2 Results for Desharnais

The win-tie-loss values for our last dataset are given in Figure 4. The interpretation of Figure 4 shows us a similar scenario to previous two datasets: Highest *win* values were attained by $k = 3$ and the treatments are statistically different from one another for most of the cases. Furthermore, just like the Cocomo81 and Nasa93 datasets, the effect of different kernels as well as the effect of various bandwidths are negligible and do not follow a certain pattern. Another similarity is that in none of the kernel-bandwidth combinations has N-ABE yielded higher estimation performance than ABE0.

		h=1/sqrt(size)			h=2			h=4			h=8			h=16		
	k	**WIN**	**TIE**	**LOSS**	**WIN**	**TIE**	**LOSS**	**WIN**	**TIE**	**LOSS**	**WIN**	**TIE**	**LOSS**	**WIN**	**TIE**	**LOSS**
Uniform	3	141	39	0	138	42	0	146	34	0	138	42	0	146	34	0
	5	135	45	0	127	52	1	130	49	1	129	51	0	133	46	1
	7	120	52	8	111	56	13	119	46	15	120	53	7	118	50	12
	9	119	32	29	105	50	25	116	36	28	120	39	21	114	35	31
	d	100	2	78	100	38	42	100	13	67	100	1	79	100	13	67
	3+N	76	4	100	80	0	100	80	0	100	80	0	100	80	0	100
	5+N	51	10	119	60	0	120	60	0	120	60	0	120	60	0	120
	7+N	27	18	135	40	0	140	40	0	140	40	0	140	40	0	140
	9+N	16	15	149	20	0	160	20	0	160	20	0	160	20	0	160
	d+N	2	9	169	0	0	180	0	0	180	0	0	180	0	0	180
Triangular	3	122	47	11	119	46	15	125	43	12	128	40	12	110	53	17
	5	115	52	13	107	57	16	115	54	11	120	49	11	98	63	19
	7	103	60	17	97	58	25	104	57	19	110	49	21	88	61	31
	9	99	41	40	91	52	37	104	46	30	109	35	36	83	36	61
	d	90	32	58	85	39	56	90	14	76	89	5	86	98	63	19
	3+N	91	44	45	71	68	41	50	57	73	55	62	63	77	77	26
	5+N	59	12	109	11	59	110	11	50	119	3	60	117	7	73	100
	7+N	32	20	128	6	67	107	15	53	112	9	61	110	2	77	101
	9+N	16	22	142	10	68	102	19	54	107	12	59	109	9	66	105
	d+N	0	16	164	17	58	105	37	32	111	33	44	103	7	73	100
Epanechnikov	3	139	41	0	135	43	2	144	35	1	133	47	0	137	43	0
	5	126	54	0	118	61	1	133	47	0	124	55	1	121	58	1
	7	122	48	10	108	56	16	122	48	10	112	62	6	111	59	10
	9	121	41	18	103	56	21	119	31	30	112	49	19	112	53	15
	d	100	0	80	102	52	26	99	4	77	100	25	55	100	25	55
	3+N	77	3	100	0	22	158	0	22	158	0	15	165	0	7	173
	5+N	48	13	119	16	34	130	16	34	130	15	28	137	16	28	136
	7+N	21	24	135	24	44	112	26	42	112	27	32	121	24	36	120
	9+N	14	24	142	27	49	104	34	40	106	38	30	112	39	34	107
	d+N	2	12	166	42	33	105	39	33	108	61	13	106	57	23	100
Gaussian	3	124	44	12	122	45	13	102	60	18	127	41	12	117	52	11
	5	113	54	13	113	54	13	92	70	18	119	50	11	114	56	10
	7	97	63	20	103	57	20	86	71	23	108	55	17	105	61	14
	9	90	53	37	105	46	29	83	66	31	108	38	34	107	52	21
	d	88	42	50	88	13	79	83	61	36	85	8	87	90	13	77
	3+N	92	48	40	60	52	68	75	60	45	50	47	83	50	46	84
	5+N	55	16	109	7	38	135	20	37	123	13	37	130	8	32	140
	7+N	23	33	124	16	50	114	17	56	107	16	48	116	17	49	114
	9+N	4	40	136	25	44	111	19	61	100	23	48	109	26	46	108
	d+N	0	35	145	44	35	101	24	56	100	48	34	98	47	31	102

Fig. 3: Win-tie-loss results for Nasa93. Results we have for Nasa93 are very similar to Cocomo81 dataset: Neither changing kernels nor the bandwidths provides a noticable change in win-tie-loss values. Also uniform weighting always outperform non-uniform weighting.

References

		h=1/sqrt(size)			h=2			h=4			h=8			h=16		
	k	**WIN**	**TIE**	**LOSS**	**WIN**	**TIE**	**LOSS**	**WIN**	**TIE**	**LOSS**	**WIN**	**TIE**	**LOSS**	**WIN**	**TIE**	**LOSS**
Uniform	3	123	55	2	123	57	0	120	60	0	120	59	1	126	54	0
	5	124	56	0	121	59	0	118	62	0	119	61	0	121	59	0
	7	116	61	3	116	62	2	115	64	1	115	64	1	114	64	2
	9	116	53	11	115	56	9	115	59	6	115	59	6	115	50	15
	d	101	15	64	100	16	64	100	19	61	101	17	62	101	19	60
	3+N	79	1	100	80	0	100	80	0	100	80	0	100	80	0	100
	5+N	52	9	119	60	0	120	60	0	120	60	0	120	60	0	120
	7+N	26	21	133	40	0	140	40	0	140	40	0	140	40	0	140
	9+N	18	16	146	20	0	160	20	0	160	20	0	160	20	0	160
	d+N	0	3	177	0	0	180	0	0	180	0	0	180	0	0	180
Triangular	3	120	60	0	122	58	0	122	57	1	114	65	1	112	68	0
	5	116	64	0	122	58	0	120	60	0	108	72	0	103	77	0
	7	102	76	2	115	63	2	114	65	1	100	79	1	100	76	4
	9	101	64	15	111	56	13	104	69	7	100	70	10	100	65	15
	d	96	48	36	100	25	55	101	27	52	100	70	10	104	76	0
	3+N	0	0	180	2	34	144	0	44	136	0	46	134	0	47	133
	5+N	20	15	145	3	53	124	5	59	116	3	65	112	8	66	106
	7+N	33	50	97	14	53	113	12	62	106	11	63	106	16	64	100
	9+N	36	49	95	23	54	103	17	61	102	19	61	100	26	53	101
	d+N	39	48	93	42	38	100	27	52	101	19	61	100	3	64	113
Epanechnikov	3	132	48	0	130	50	0	126	54	0	123	57	0	123	57	0
	5	118	61	1	126	53	1	118	61	1	120	60	0	123	57	0
	7	116	56	8	119	59	2	105	73	2	114	65	1	117	60	3
	9	114	57	9	118	49	13	100	68	12	114	53	13	110	61	9
	d	103	12	65	93	10	77	100	46	34	100	23	57	100	19	61
	3+N	80	0	100	1	26	153	0	21	159	0	12	168	0	18	162
	5+N	57	2	121	9	41	130	10	43	127	12	36	132	11	36	133
	7+N	34	8	138	23	42	115	18	59	103	23	42	115	21	49	110
	9+N	20	8	152	34	35	111	29	51	100	35	36	109	30	46	104
	d+N	0	0	180	49	31	100	32	48	100	54	26	100	47	33	100
Gaussian	3	121	59	0	122	58	0	126	54	0	126	54	0	123	57	0
	5	121	59	0	115	65	0	120	60	0	119	61	0	115	64	1
	7	117	62	1	113	65	2	118	59	3	113	65	2	113	65	2
	9	115	55	10	109	63	8	118	53	9	113	55	12	108	65	7
	d	100	17	63	101	29	50	98	12	70	100	23	57	102	27	51
	3+N	80	0	100	0	17	163	0	21	159	0	19	161	0	14	166
	5+N	54	4	122	10	30	140	10	44	126	10	38	132	10	36	134
	7+N	35	11	134	25	36	119	20	48	112	17	45	118	23	43	114
	9+N	20	7	153	36	36	108	32	36	112	31	37	112	33	40	107
	d+N	0	0	180	59	21	100	50	29	101	65	15	100	55	25	100

Fig. 4: Win-tie-loss results for Desharnais. The implications we have observed in Cocomo81 and Nasa93 repeat for Desharnais dataset: Change of kernels does not provide a significant change in win-tie-loss values and neither does the change of bandwidths. There are only some small changes in different kernel-bandwidth combinations but we can not observe a pattern. Furthermore, ABE0 has a better estimation performance than all N-ABE methods.