1 Numerical Result

Table 1: Variable Selection and outliers detection Results for Example 1 ($\beta = (3, 2, 1.5, 0, 0, 0, 0, 0)'$ with 10% outliers)

Case	Method	Variable Selection					Outliers detection			TIME
		CFR	OFR	PDR	FDR	AN	M	S	JD	
A	ALasso	74	23	99	7.5	3.29	-	-	-	0.91
	MMNNG	68	25	97	8.2	3.25	-	-	-	691.33
	SROS	21	76	99	27.6	4.31	-	-	-	56.67
	SROS-2	46	53	99.7	15.4	3.66	0	2.24	100	13.49
	ASROS-2	71	24	98.3	7.3	3.24	0	2.2	100	13.66
	SLTS	9	89	99.3	46.4	6.19	0	10.94	100	358.85
	PAWLS	38	56	98	17.3	3.68	0	7.88	100	16.41
	APAWLS	61	28	96.3	9.4	3.27	0	4.8	100	20.04
B	ALasso	63	25	95.7	8.9	3.25	-	-	-	0.83
	MMNNG	88	12	100	3.2	3.13	-	-	-	682.07
	SROS	31	69	100	24.6	4.24	-	-	-	51.79
	SROS-2	67	33	100	9	3.38	0	15.46	100	13.09
	ASROS-2	87	13	100	3.4	3.14	0	7.44	100	13.81
	SLTS	14	86	100	43.1	5.92	0	14.56	100	357.24
	PAWLS	64	36	100	9.9	3.42	0	9.56	100	19.32
	APAWLS	89	11	100	2.8	3.11	0	5.6	100	20.18
C	ALasso	3	2	50	14.7	1.94	-	-	-	0.87
	MMNNG	72	12	94	3.2	2.95	-	-	-	673.93
	SROS	41	50	97	17.5	3.7	-	-	-	50.24
	SROS-2	45	53	99.3	16.9	3.76	0	12.33	100	13.44
	ASROS-2	78	17	98.3	5.5	3.18	0	0	100	14.06
	SLTS	28	72	100	34.7	5.34	0	4.36	100	384.69
	PAWLS	52	44	98.7	14.5	3.64	0	7.49	100	21.1
	APAWLS	74	20	98	5.7	3.19	0	0	100	21.78
D	ALasso	0	19	60.3	19.9	2.52	-	-	-	1.15
	MMNNG	63	16	92	10.7	3.25	-	-	-	682.47
	SROS	8	80	96	37.1	4.76	-	-	-	50.31
	SROS-2	61	32	97.7	17.2	3.91	16.4	14.24	76	15.04
	ASROS-2	70	17	95.3	11.7	3.42	19.6	0.04	74	15.74
	SLTS	21	79	100	39.5	5.71	8.2	6.02	80	398.44
	PAWLS	98	0	99.3	0	2.98	0	5.71	100	22.83
	APAWLS	97	0	99	0	2.97	0	0.02	100	23.66
E	ALasso	5	10	58	22.3	2.72	-	-	-	0.92
	MMNNG	73	10	94	5.2	3.04	-	-	-	675.46
	SROS	26	61	95.7	30.2	4.45	-	-	-	50.08
	SROS-2	29	40	89.3	25.7	3.91	9.2	15.2	86	13.78
	ASROS-2	48	14	86.7	14	3.26	14.2	0.31	78	14.51
	SLTS	23	77	100	39.2	5.7	3.4	5.22	94	383.1
	PAWLS	55	39	98	12.4	3.48	0.8	5.96	99	21.01
	APAWLS	79	15	98	5.2	3.16	1.4	0.04	98	22.5

Table 2: Variable Selection and outliers detection Results for Example 1 ($\beta = (3, 2, 1.5, 0, 0, 0, 0, 0)'$ with 20% outliers)

Case	Method	Variable Selection					Outliers detection			TIME
		CFR	OFR	PDR	FDR	AN	M	S	JD	
	ALasso	74	23	99	7.5	3.29	-	-	-	0.91
	MMNNG	68	25	97	8.2	3.25	-	-	-	691.33
	SROS	21	76	99	27.6	4.31	-	-	-	56.67
A	SROS-2	46	53	99.7	15.4	3.66	0	2.24	100	13.49
	ASROS-2	71	24	98.3	7.3	3.24	0	2.2	100	13.66
	SLTS	9	89	99.3	46.4	6.19	0	10.94	100	358.85
	PAWLS	38	56	98	17.3	3.68	0	7.88	100	16.41
	APAWLS	61	28	96.3	9.4	3.27	0	4.8	100	20.04
	ALasso	63	25	95.7	8.9	3.25	-	-	-	0.83
	MMNNG	88	12	100	3.2	3.13	-	-	-	682.07
	SROS	31	69	100	24.6	4.24	-	-	-	51.79
B	SROS-2	67	33	100	9	3.38	0	15.46	100	13.09
	ASROS-2	87	13	100	3.4	3.14	0	7.44	100	13.81
	SLTS	14	86	100	43.1	5.92	0	14.56	100	357.24
	PAWLS	64	36	100	9.9	3.42	0	9.56	100	19.32
	APAWLS	89	11	100	2.8	3.11	0	5.6	100	20.18
	ALasso	1	2	31	11.3	1.22	-	-	-	0.86
	MMNNG	65	5	90	1.6	2.76	-	-	-	470.24
	SROS	47	45	97.3	15.5	3.62	-	-	-	50.14
C	SROS-2	36	52	95.7	18	3.64	0	20.85	100	13.65
	ASROS-2	65	20	94.7	6.4	3.1	0	0.1	100	14.01
	SLTS	25	75	100	34.4	5.18	0	1.33	100	426.53
	PAWLS	47	49	98.3	15.7	3.65	0	8.55	100	21.51
	APAWLS	78	12	96.3	3.3	3.02	0	0.02	100	22.14
	ALasso	1	4	41.7	16.3	1.68	-	-	-	1.38
	MMNNG	31	33	87.7	27.2	3.96	-	-	-	473.42
	SROS	3	75	92.7	44.3	5.15	-	-	-	50.54
D	SROS-2	57	33	96.7	15.3	3.69	9.9	19.6	77	15.83
	ASROS-2	64	23	95.7	12.1	3.46	20.4	0.02	70	16.6
	SLTS	17	82	99.7	44	6.1	25	4.58	45	440.39
	PAWLS	95	0	98.3	0.5	2.97	0.9	7.35	99	24.83
	APAWLS	92	0	97.3	0.5	2.94	0.9	0.02	99	25.29
	ALasso	3	3	32.3	9.9	1.29	-	-	-	0.87
	MMNNG	54	3	83.7	12.3	3.06	-	-	-	688.65
	SROS	23	49	90.3	35	4.64	-	-	-	51.28
E	SROS-2	21	43	87.3	27.9	3.95	6.4	20.08	84	14.33
	ASROS-2	41	11	82.3	15.9	3.17	13.6	0.02	72	15.35
	SLTS	27	73	100	33.6	5.16	7	2.15	84	417.6
	PAWLS	53	42	98.3	13.2	3.52	0	7	100	21.57
	APAWLS	64	10	90	4	2.86	6.5	0	82	23.87

Table 3: Variable Selection and outliers detection Results for Example 1 ($\beta = (3, 2, 1.5, 0, 0, 0, 0, 0)'$ with 30% outliers)

| Case | Method | Variable Selection | | | | | Outliers detection | | | |
		CFR	OFR	PDR	FDR	AN	M	S	JD	TIME
A	ALasso	74	23	99	7.5	3.29	-	-	-	0.91
	MMNNG	68	25	97	8.2	3.25	-	-	-	691.33
	SROS	21	76	99	27.6	4.31	-	-	-	56.67
	SROS-2	46	53	99.7	15.4	3.66	0	2.24	100	13.49
	ASROS-2	71	24	98.3	7.3	3.24	0	2.2	100	13.66
	SLTS	9	89	99.3	46.4	6.19	0	10.94	100	358.85
	PAWLS	38	56	98	17.3	3.68	0	7.88	100	16.41
	APAWLS	61	28	96.3	9.4	3.27	0	4.8	100	20.04
B	ALasso	63	25	95.7	8.9	3.25	-	-	-	0.83
	MMNNG	88	12	100	3.2	3.13	-	-	-	682.07
	SROS	31	69	100	24.6	4.24	-	-	-	51.79
	SROS-2	67	33	100	9	3.38	0	15.46	100	13.09
	ASROS-2	87	13	100	3.4	3.14	0	7.44	100	13.81
	SLTS	14	86	100	43.1	5.92	0	14.56	100	357.24
	PAWLS	64	36	100	9.9	3.42	0	9.56	100	19.32
	APAWLS	89	11	100	2.8	3.11	0	5.6	100	20.18
C	ALasso	2	0	19	5.5	0.68	-	-	-	0.89
	MMNNG	38	1	75.3	NaN	2.3	-	-	-	465.41
	SROS	49	38	95.7	13.7	3.5	-	-	-	51.07
	SROS-2	29	54	94.3	22.8	3.91	0	19.77	100	13.54
	ASROS-2	61	17	92.3	7.3	3.06	0.07	0.03	99	14.41
	SLTS	1	34	72.7	NaN	4.52	20.67	0.14	0	421.79
	PAWLS	45	47	97.3	13.9	3.5	0	7.91	100	21.54
	APAWLS	77	10	95.7	2.8	2.98	0	0	100	22.41
D	ALasso	0	3	25.7	9.1	0.96	-	-	-	1.68
	MMNNG	5	41	79.3	42.5	4.29	-	-	-	477.06
	SROS	1	76	92.3	45.7	5.17	-	-	-	53.23
	SROS-2	53	36	96.3	18.6	3.95	11.4	16.69	67	16.29
	ASROS-2	51	31	93.7	16	3.61	23.33	0	62	17.14
	SLTS	0	95	98.3	56.2	6.84	46.33	3.6	0	459.78
	PAWLS	93	0	97.7	0	2.93	0	7.77	100	26.08
	APAWLS	89	0	96.3	0	2.89	0	0	100	26.66
E	ALasso	0	3	25.3	15.3	1.15	-	-	-	0.9
	MMNNG	6	21	70.7	38.1	3.97	-	-	-	704.12
	SROS	9	44	82.3	47.7	5.1	-	-	-	52.25
	SROS-2	9	37	78.3	40	4.32	9.8	18.31	64	14.81
	ASROS-2	14	10	68.7	31	3.48	27.33	0.14	42	15.38
	SLTS	0	76	94.7	60.5	7.1	45.2	3.31	0	428.75
	PAWLS	54	21	91	8.2	3.06	0.67	6.51	97	21.85
	APAWLS	52	4	83.3	2	2.57	7.67	0.09	77	24.28

Table 4: Variable Selection and outliers detection Results for Example 2 ($\beta = (\mathbf{2}'_{10}, \mathbf{0}'_{p-10})'$ with 10% outliers)

Case	Method	Variable Selection					Outliers detection			
		CFR	OFR	PDR	FDR	AN	M	S	JD	TIME
	ALasso	97	0	99.6	0	9.96	-	-	-	4.78
	SROS-2	6	94	100	27.1	14.54	0	0.37	100	301.31
	ASROS-2	96	1	99.6	0.1	9.97	0	0.21	100	339.64
A	SLTS	0	84	97.9	84	61.38	0	24.81	100	3.16×10^4
	PAWLS	6	94	100	30.5	15.65	0	0.71	100	348.92
	APAWLS	94	1	98.8	0.1	9.89	0	0.93	100	399.08
	ALasso	84	1	97.1	0.4	9.75	-	-	-	4.94
	SROS-2	8	92	100	26.5	14.19	0	6.76	100	302.06
	ASROS-2	97	0	99.7	0	9.97	0	5.17	100	338.11
B	SLTS	0	93	99.2	82.8	58.23	0	24.75	100	3.03×10^4
	PAWLS	5	95	100	27.2	14.29	0	2.9	100	356.33
	APAWLS	91	0	95	0	9.5	0	6.08	100	421.68
	ALasso	0	0	54.5	10	6.25	-	-	-	6.09
	SROS-2	1	98	99.9	42.3	18.9	0	13.59	100	383.85
	ASROS-2	60	1	95.1	0.3	9.54	0	1.87	100	425.27
C	SLTS	0	95	99.1	84.1	62.58	0.2	16.56	99	3.11×10^4
	PAWLS	3	96	99.9	34.1	16.12	0	0.72	100	525.96
	APAWLS	85	0	98.3	0.1	9.84	0	0.53	100	575.21
	ALasso	0	0	55.6	12.8	6.69	-	-	-	6.14
	SROS-2	1	98	99.9	42.1	18.75	4.3	15.12	92	387.58
	ASROS-2	56	3	94.6	1.2	9.59	5.5	2.32	92	429.07
D	SLTS	0	96	99.4	84.1	62.73	0.2	16.5	98	3.09×10^4
	PAWLS	3	96	99.9	34.3	16.19	0	0.7	100	492.91
	APAWLS	85	0	98.3	0.1	9.84	0	0.54	100	541.23
	ALasso	0	0	54.4	12.3	6.71	-	-	-	6.02
	SROS-2	2	97	99.9	41.4	18.34	0	14.36	100	382.04
	ASROS-2	57	1	94.2	0.3	9.45	0	2.08	100	422.2
E	SLTS	0	97	99.2	84.1	62.63	0.2	16.6	99	3.11×10^4
	PAWLS	4	96	100	33.8	16.35	0	0.64	100	524.59
	APAWLS	88	0	98.8	0	9.88	0	0.42	100	569.03

Table 5: Variable Selection and outliers detection Results for Example 2 ($\beta = (\mathbf{2}'_{10}, \mathbf{0}'_{p-10})'$ with 20% outliers)

Case	Method	Variable Selection					Outliers detection			
		CFR	OFR	PDR	FDR	AN	M	S	JD	TIME
A	ALasso	97	0	99.6	0	9.96	-	-	-	4.78
	SROS-2	6	94	100	27.1	14.54	0	0.37	100	301.31
	ASROS-2	96	1	99.6	0.1	9.97	0	0.21	100	339.64
	SLTS	0	84	97.9	84	61.38	0	24.81	100	3.16×10^4
	PAWLS	6	94	100	30.5	15.65	0	0.71	100	348.92
	APAWLS	94	1	98.8	0.1	9.89	0	0.93	100	399.08
B	ALasso	84	1	97.1	0.4	9.75	-	-	-	4.94
	SROS-2	8	92	100	26.5	14.19	0	6.76	100	302.06
	ASROS-2	97	0	99.7	0	9.97	0	5.17	100	338.11
	SLTS	0	93	99.2	82.8	58.23	0	24.75	100	3.03×10^4
	PAWLS	5	95	100	27.2	14.29	0	2.9	100	356.33
	APAWLS	91	0	95	0	9.5	0	6.08	100	421.68
C	ALasso	0	0	37.3	13.9	5.7	-	-	-	6.53
	SROS-2	0	82	97.5	51.2	21.38	0.05	25.8	99	441.69
	ASROS-2	22	0	80.6	1.4	8.15	0.05	5.88	99	483.7
	SLTS	0	69	92.4	85.9	65.89	6.4	7.78	56	3.17×10^4
	PAWLS	1	98	99.1	37.1	16.67	0.1	0.81	99	633.1
	APAWLS	79	0	95.6	1	9.6	0.1	0.73	99	670.79
D	ALasso	0	0	38	16.6	6.15	-	-	-	6.82
	SROS-2	0	82	97.7	52.3	22.1	2.8	24.79	89	449.96
	ASROS-2	22	3	81.9	2.1	8.38	5.35	5.33	89	480.19
	SLTS	0	96	99.6	84.3	63.61	1.75	6.45	88	3.15×10^4
	PAWLS	1	98	99.2	38.5	17.23	1.5	0.7	97	588.62
	APAWLS	82	0	96	1.3	9.73	0.8	0.61	98	624.28
E	ALasso	0	0	35.8	17.8	6.14	-	-	-	6.57
	SROS-2	0	79	96.9	52	21.43	0.1	25.52	99	439.69
	ASROS-2	20	0	79.1	1.4	8.01	0.15	6.88	98	473.42
	SLTS	0	68	93.6	85.8	66.41	6.35	7.79	49	3.18×10^4
	PAWLS	0	99	99.1	38.1	16.89	0.1	0.81	99	629.49
	APAWLS	78	0	95.8	0.8	9.62	0.1	0.71	99	665.07

Table 6: Variable Selection and outliers detection Results for Example 2 ($\beta = (\mathbf{2}'_{10}, \mathbf{0}'_{p-10})'$ with 30% outliers)

Case	Method	Variable Selection					Outliers detection			
		CFR	OFR	PDR	FDR	AN	M	S	JD	TIME
A	ALasso	97	0	99.6	0	9.96	-	-	-	4.78
	SROS-2	6	94	100	27.1	14.54	0	0.37	100	301.31
	ASROS-2	96	1	99.6	0.1	9.97	0	0.21	100	339.64
	SLTS	0	84	97.9	84	61.38	0	24.81	100	3.16×10^4
	PAWLS	6	94	100	30.5	15.65	0	0.71	100	348.92
	APAWLS	94	1	98.8	0.1	9.89	0	0.93	100	399.08
B	ALasso	84	1	97.1	0.4	9.75	-	-	-	4.94
	SROS-2	8	92	100	26.5	14.19	0	6.76	100	302.06
	ASROS-2	97	0	99.7	0	9.97	0	5.17	100	338.11
	SLTS	0	93	99.2	82.8	58.23	0	24.75	100	3.03×10^4
	PAWLS	5	95	100	27.2	14.29	0	2.9	100	356.33
	APAWLS	91	0	95	0	9.5	0	6.08	100	421.68
C	ALasso	0	0	24.1	19.6	6.26	-	-	-	7.15
	SROS-2	0	29	84.9	63.6	26.66	1.43	23.09	80	479.79
	ASROS-2	3	1	61.4	11.5	7.17	1.77	9.83	79	508.84
	SLTS	0	0	58.8	91.6	70.39	26.37	4.14	0	3.21×10^4
	PAWLS	5	80	91.3	41.7	17.36	2.23	2.34	87	703.58
	APAWLS	40	0	82.1	8.3	8.94	2.23	2.31	87	737.98
D	ALasso	0	0	25.2	21.6	7.03	-	-	-	7.36
	SROS-2	0	30	85.3	63.9	26.62	2.83	23.01	71	485.56
	ASROS-2	3	1	63	12.6	7.44	6	9.29	71	516.55
	SLTS	0	79	97.3	85	65	33.13	6.71	0	3.19×10^4
	PAWLS	3	88	96.2	41.2	17.81	8.47	1.36	82	661.14
	APAWLS	40	3	86.5	4.1	8.94	5.47	1.33	86	695.01
E	ALasso	0	0	24	19.7	6.1	-	-	-	7.33
	SROS-2	0	31	82.7	65.3	27.87	2.1	22.77	75	486.7
	ASROS-2	3	0	58.4	12.5	6.9	2.67	10.11	72	516.53
	SLTS	0	0	63.3	90.9	70.03	27.77	4.76	0	3.22×10^4
	PAWLS	3	81	91.1	41.8	17.36	2.67	2.94	85	715.17
	APAWLS	38	0	80.6	8.8	8.76	2.67	2.9	85	748.69