1 Numerical Result

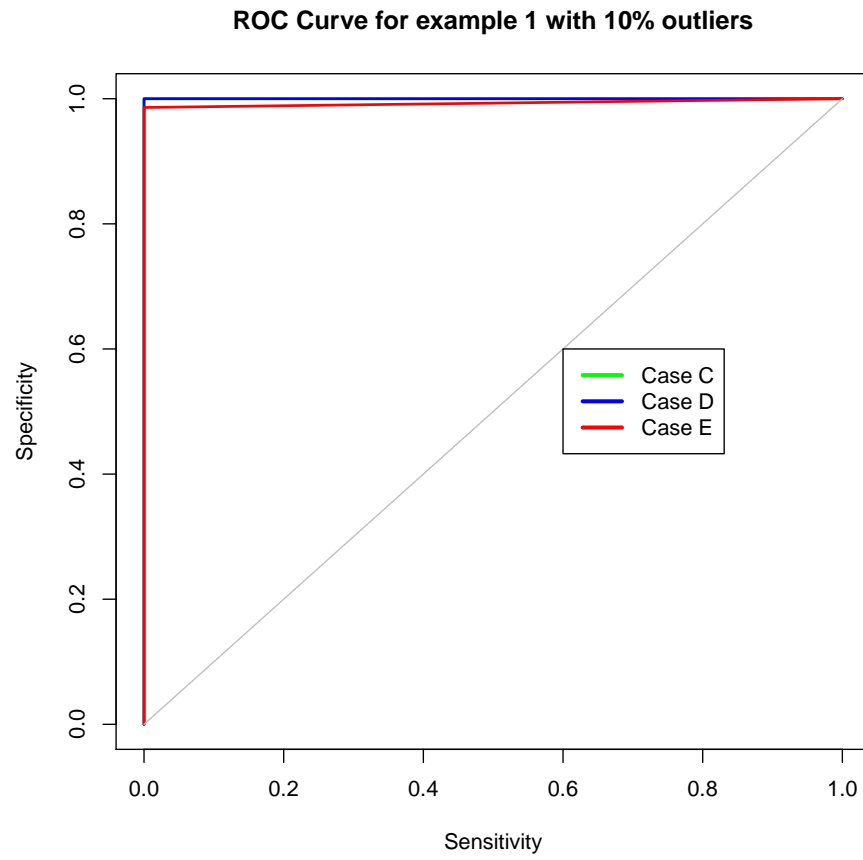**ROC Curve for example 1 with 10% outliers**

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

Method	CFR (%)	OFR (%)	AN	TIME	CFR (%)	OFR (%)	AN	TIME
		Case A				**Case B**		
ALasso	74	23	3.29	0.8	63	25	3.25	0.78
sLTS	9	89	6.19	358.85	14	86	5.92	357.24
MMNNG	68	25	3.25	691.33	88	12	3.13	682.07
SROS	21	76	4.31	56.67	31	69	4.24	51.79
SROS-2	46	53	3.66	13.49	67	33	3.38	13.09
ASROS-2	71	24	3.24	13.66	87	13	3.14	13.81
PAWLS	38	56	3.68	16.41	64	36	3.42	19.32
APAWLS	61	28	3.27	20.04	89	11	3.11	20.18
		Case C				**Case D**		
ALasso	3	2	1.94	0.73	0	19	2.52	0.99
sLTS	28	72	5.34	384.69	21	79	5.71	398.44
MMNNG	72	12	2.95	673.93	63	16	3.25	682.47
SROS	41	50	3.7	50.24	8	80	4.76	50.31
SROS-2	45	53	3.76	13.44	61	32	3.91	15.04
ASROS-2	78	17	3.18	14.06	70	17	3.42	15.74
PAWLS	52	44	3.64	21.1	98	0	2.98	22.83
APAWLS	74	20	3.19	21.78	97	0	2.97	23.66
		Case E						
ALasso	5	10	2.72	0.72				
sLTS	23	77	5.7	383.1				
MMNNG	73	10	3.04	675.46				
SROS	26	61	4.45	50.08				
SROS-2	29	40	3.91	13.78				
ASROS-2	48	14	3.26	14.51				
PAWLS	55	39	3.48	21.01				
APAWLS	79	15	3.16	22.5				

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

Method	CFR (%)	OFR (%)	AN	TIME	CFR (%)	OFR (%)	AN	TIME
		Case C				**Case D**		
ALasso	1	2	1.22	0.7	1	4	1.68	1.19
sLTS	25	75	5.18	426.53	17	82	6.1	440.39
MMNNG	65	5	2.76	470.24	31	33	3.96	473.42
SROS	47	45	3.62	50.14	3	75	5.15	50.54
SROS-2	36	52	3.64	13.65	57	33	3.69	15.83
ASROS-2	65	20	3.1	14.01	64	23	3.46	16.6
PAWLS	47	49	3.65	21.51	95	0	2.97	24.83
APAWLS	78	12	3.02	22.14	92	0	2.94	25.29
		Case E						
ALasso	3	3	1.29	0.79				
sLTS	27	73	5.16	417.6				
MMNNG	54	3	3.06	688.65				
SROS	23	49	4.64	51.28				
SROS-2	21	43	3.95	14.33				
ASROS-2	41	11	3.17	15.35				
PAWLS	53	42	3.52	21.57				
APAWLS	64	10	2.86	23.87				

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

Method	CFR (%)	OFR (%)	AN	TIME	CFR (%)	OFR (%)	AN	TIME
		Case C				Case D		
ALasso	2	0	0.68	0.78	0	3	0.96	1.34
sLTS	1	34	4.52	421.79	0	95	6.84	459.78
MMNNG	38	1	2.3	465.41	5	41	4.29	477.06
SROS	49	38	3.5	51.07	1	76	5.17	53.23
SROS-2	29	54	3.91	13.54	53	36	3.95	16.29
ASROS-2	61	17	3.06	14.41	51	31	3.61	17.14
PAWLS	45	47	3.5	21.54	93	0	2.93	26.08
APAWLS	77	10	2.98	22.41	89	0	2.89	26.66
		Case E						
ALasso	0	3	1.15	0.79				
sLTS	0	76	7.1	428.75				
MMNNG	6	21	3.97	704.12				
SROS	9	44	5.1	52.25				
SROS-2	9	37	4.32	14.81				
SROS-2	14	10	3.48	15.38				
PAWLS	54	21	3.06	21.85				
PAWLS	52	4	2.57	24.28				

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

Method	CFR (%)	OFR (%)	AN	TIME	CFR (%)	OFR (%)	AN	TIME
		Case A				**Case B**		
ALasso	97	0	9.96	3.4	84	1	9.75	3.41
sLTS	0	84	61.38	3.16×10^4	0	93	58.23	3.03×10^4
SROS-2	6	94	14.54	301.31	8	92	14.19	302.06
ASROS-2	96	1	9.97	339.64	97	0	9.97	338.11
PAWLS	6	94	15.65	348.92	5	95	14.29	356.33
APAWLS	94	1	9.89	399.08	91	0	9.5	421.68
		Case C				**Case D**		
ALasso	0	0	6.25	4.07	0	1	6.89	4.07
sLTS	0	95	62.58	3.11×10^4	0	96	62.73	3.09×10^4
SROS-2	1	98	18.9	383.85	1	98	18.75	387.58
ASROS-2	60	1	9.54	425.27	56	3	9.59	429.07
PAWLS	3	96	16.12	525.96	3	96	16.19	492.91
APAWLS	85	0	9.84	575.21	85	0	9.84	541.23
		Case E						
ALasso	0	0	12.18	4.06				
sLTS	0	97	62.63	3.11×10^4				
SROS-2	2	97	18.34	382.04				
ASROS-2	57	1	9.45	422.2				
PAWLS	4	96	16.35	524.59				
APAWLS	88	0	9.88	569.03				

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

Method	CFR (%)	OFR (%)	AN	TIME	CFR (%)	OFR (%)	AN	TIME
			Case C				**Case D**	
ALasso	0	0	5.7	6.45	0	0	6.15	6.89
sLTS	0	69	65.89	3.17×10^4	0	96	63.61	3.15×10^4
SROS-2	0	82	21.38	441.69	0	82	22.1	449.96
ASROS-2	22	0	8.15	483.7	22	3	8.38	480.19
PAWLS	1	98	16.67	633.1	1	98	17.23	588.62
APAWLS	79	0	9.6	670.79	82	0	9.73	624.28
			Case E					
ALasso	0	0	17.41	6.3				
sLTS	0	68	66.41	3.18×10^4				
SROS-2	0	79	21.43	439.69				
ASROS-2	20	0	8.01	473.42				
PAWLS	0	99	16.89	629.49				
APAWLS	78	0	9.62	665.07				

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

Method	CFR (%)	OFR (%)	AN	TIME	CFR (%)	OFR (%)	AN	TIME
			Case C				**Case D**	
ALasso	0	0	6.26	7.26	0	0	7.03	7.28
sLTS	0	0	70.39	3.21×10^4	0	79	65	3.19×10^4
SROS-2	0	29	26.66	479.79	0	30	26.62	485.56
ASROS-2	3	1	7.17	508.84	3	1	7.44	516.55
PAWLS	5	80	17.36	703.58	3	88	17.81	661.14
APAWLS	40	0	8.94	737.98	40	3	8.94	695.01
			Case E					
ALasso	0	0	17.89	6.67				
sLTS	0	0	70.03	3.22×10^4				
SROS-2	0	31	27.87	486.7				
ASROS-2	3	0	6.9	516.53				
PAWLS	3	81	17.36	715.17				
APAWLS	38	0	8.76	748.69				

Table 7: Outlier Detection Evaluation in Example 1 and 2 with 10% outliers

| | Model | sLTS | | | PAWLS | | |
		M (%)	S (%)	JD(%)	M (%)	S (%)	JD(%)
Example 1	Case A	0	0.11	1	0	0.05	1
	Case B	0	0.15	1	0	0.06	1
	Case C	0	0.04	1	0	0	1
	Case D	0.08	0.06	0.8	0	2.22×10^{-4}	1
	Case E	0.03	0.05	0.94	0.01	4.44×10^{-4}	0.98
Example 2	Case A	0	0.25	1	0	0.01	1
	Case B	0	0.25	1	0	0.06	1
	Case C	0	0.17	0.99	0	0.01	1
	Case D	0	0.16	0.98	0	0.01	1
	Case E	0	0.17	0.99	0	0	1

Table 8: Outlier Detection Evaluation in Example 1 and 2 with 10% outliers

| | Model | sLTS | | | ASROS-2 | | |
		M (%)	S (%)	JD(%)	M (%)	S (%)	JD(%)
Example 1	Case A	0	0.11	1	0	0.02	1
	Case B	0	0.15	1	0	0.07	1
	Case C	0	0.04	1	0	0	1
	Case D	0.08	0.06	0.8	0.2	4.44×10^{-4}	0.74
	Case E	0.03	0.05	0.94	0.14	0	0.78
Example 2	Case A	0	0.25	1	0	0	1
	Case B	0	0.25	1	0	0.05	1
	Case C	0	0.17	0.99	0	0.02	1
	Case D	0	0.16	0.98	0.06	0.02	0.92
	Case E	0	0.17	0.99	0	0.02	1

Table 9: Outlier Detection Evaluation in Example 1 and 2 with 20% outliers

	Model	sLTS M (%)	S (%)	JD(%)	PAWLS M (%)	S (%)	JD(%)
	Case C	0	0.01	1	0	2.5×10^{-4}	1
Example 1	Case D	0.25	0.05	0.45	0.01	2.5×10^{-4}	0.99
	Case E	0.07	0.02	0.84	0.06	0	0.82
	Case C	0.06	0.08	0.56	0	0.01	0.99
Example 2	Case D	0.02	0.06	0.88	0.01	0.01	0.98
	Case E	0.06	0.08	0.49	0	0.01	0.99

Table 10: Outlier Detection Evaluation in Example 1 and 2 with 20% outliers

	Model	sLTS M (%)	S (%)	JD(%)	ASROS-2 M (%)	S (%)	JD(%)
	Case C	0	0.01	1	0	0	1
Example 1	Case D	0.25	0.05	0.45	0.2	2.5×10^{-4}	0.7
	Case E	0.07	0.02	0.84	0.14	2.5×10^{-4}	0.72
	Case C	0.06	0.08	0.56	5×10^{-4}	0.06	0.99
Example 2	Case D	0.02	0.06	0.88	0.05	0.05	0.89
	Case E	0.06	0.08	0.49	0	0.07	0.98

Table 11: Outlier Detection Evaluation in Example 1 and 2 with 30% outliers

	Model	sLTS M (%)	S (%)	JD(%)	PAWLS M (%)	S (%)	JD(%)
	Case C	0.21	0	0	0	0	1
Example 1	Case D	0.46	0.04	0	0	0	1
	Case E	0.45	0.03	0	0.08	8.57×10^{-4}	0.77
	Case C	0.26	0.04	0	0.02	0.02	0.87
Example 2	Case D	0.33	0.07	0	0.05	0.01	0.86
	Case E	0.28	0.05	0	0.03	0.03	0.85

Table 12: Outlier Detection Evaluation in Example 1 and 2 with 30% outliers

| | Model | sLTS | | | ASROS-2 | | |
		M (%)	S (%)	JD(%)	M (%)	S (%)	JD(%)
Example 1	Case C	0.21	0	0	6.67×10^{-4}	2.86×10^{-4}	0.99
	Case D	0.46	0.04	0	0.23	0	0.62
	Case E	0.45	0.03	0	0.27	0	0.42
Example 2	Case C	0.26	0.04	0	0.02	0.1	0.79
	Case D	0.33	0.07	0	0.06	0.09	0.71
	Case E	0.28	0.05	0	0.03	0.1	0.72

Table 13: Outlier Detection Evaluation in Example 1

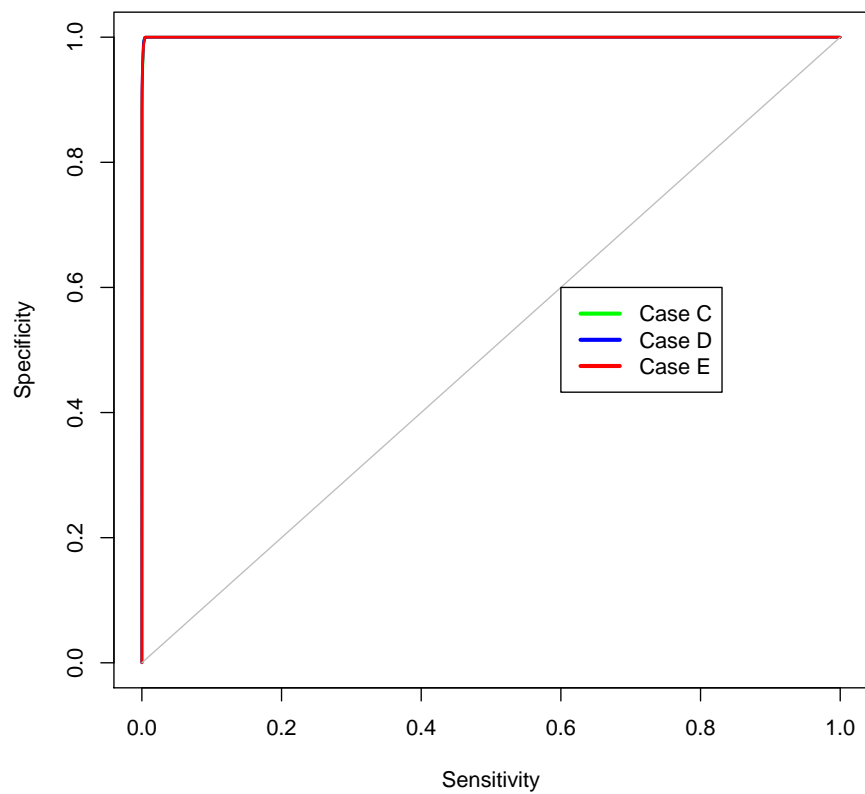| | Model | IPOD | | | PAWLS | | |
		M (%)	S (%)	JD(%)	M (%)	S (%)	JD(%)
Example 1	Case A	0	0	1	0	0.05	1
	Case B	0	0.1	1	0	0.06	1
	Case C	0	0.08	1	0	0	1
	Case D	0.49	0.02	0.07	0	2.22×10^{-4}	1
	Case E	0.22	0.05	0.31	0.01	4.44×10^{-4}	0.98

ROC Curve for example 1 with 20% outliers
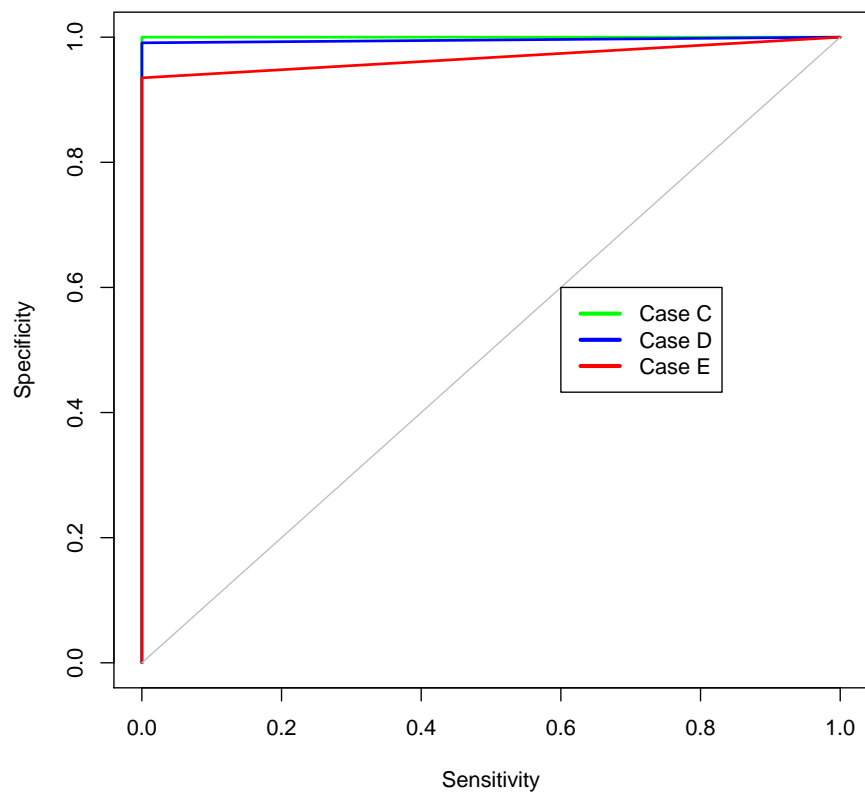
ROC Curve for example 1 with 30% outliers
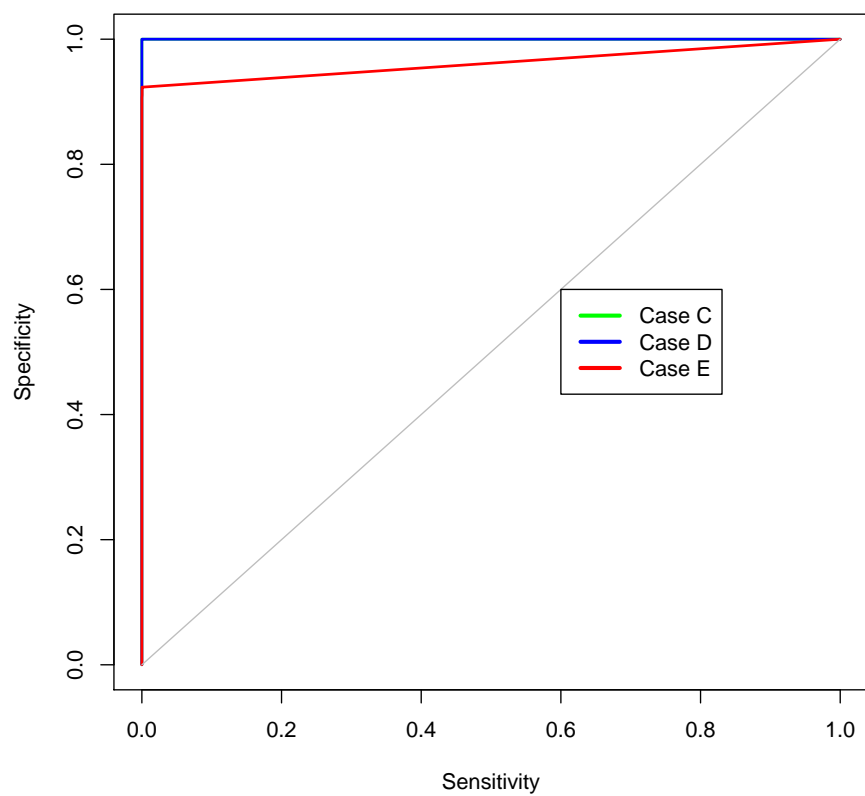
ROC Curve for example 2 with 10% outliers

Specificity (y-axis), Sensitivity (x-axis)

Legend:
- Case C
- Case D
- Case E

ROC Curve for example 2 with 20% outliers
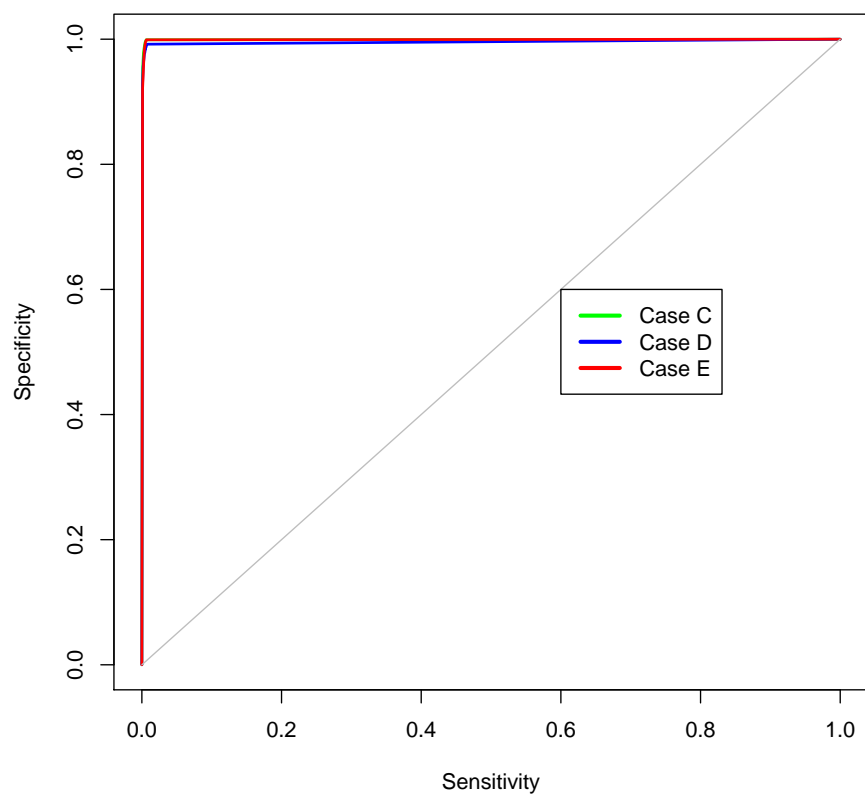
ROC Curve for example 2 with 30% outliers