

data generating model:

$$Y = Cb + E\alpha + G\beta + W\eta + \varepsilon$$

C: clinical factor

$C = (C_1, \dots, C_{q_1})$, $b = (b_1, \dots, b_{q_1})^T$, $q_1=3$, b is generated from unif (1, 2.2)

E: environmental factor

$E = (E_1, \dots, E_{q_2})$, $\alpha = (\alpha_1, \dots, \alpha_{q_2})^T$, $q_2=4$, α is generated from unif (1.2, 2.5)

E have 2 continuous variables and 2 discrete variables.

G: genes

$G = (G_1, \dots, G_P)$, $\beta = (\beta_1, \dots, \beta_P)^T$, $P=100$, the nonzero $(\beta_1, \dots, \beta_8)$ is generated from unif(1, 2.5) and other β is 0.

#nonzero: 8

W: GxE interactions

$W = (G_1 \times E_1, \dots, G_1 \times E_{q_2}, \dots, G_p \times E_1, \dots, G_p \times E_{q_2}, \dots)$, $\eta = (\eta_1, \dots, \eta_{PXq_2})^T$

the nonzero $\eta_1, \eta_{10}, \eta_{19}, \eta_{32}, \eta_{57}, \eta_{70}, \eta_{96}, \eta_{97}, \eta_{138}, \eta_{144}, \eta_{157}, \eta_{170}$ are generated from unif(1.8, 2.5) and other η is 0.

#nonzero: 12

Estimate the coefficients of β and η with marginal model:

$$Y = Cb + E\alpha + X\beta + W'\eta' + \varepsilon$$

$X = G_j$, $W' = (X \times E_1, \dots, X \times E_{q_2})$, $\eta' = (\eta'_1, \dots, \eta'_{q_2})^T$

Simulation Results

n=300, p=200, error distribution: N(0,1)

Bayesian Lasso

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	12	7	41.53
sd	0	2.86	1.64	9.77

Bayesian Lasso Spike and Slab

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	3	6.47	13.9
sd	0	1.46	1.83	5.46

LAD Bayesian Lasso

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	8.1	5.9	17.97
sd	0	4.05	1.65	6.9

LAD Bayesian Lasso spike and slab

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	37.37	10.67	181.27
sd	0	8.52	1.09	38.04

n=300, p=200, error distribution: t(2)

Bayesian Lasso

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	11.9	6.9	42.1
sd	0	3.145	1.73	10.79

Bayesian Lasso Spike and Slab

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	3.4	6.4	12.6
sd	0	1.77	6.4	1.072

LAD Bayesian Lasso

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	8.5	6.4	17.13
sd	0	3.5	1.75	5.96

LAD Bayesian Lasso spike and slab

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	38.47	10.53	186.53
sd	0	8.85	1.43	35.73

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E: environmental factor

$E = (E_1, \dots, E_{q_2})$, $\alpha = (\alpha_1, \dots, \alpha_{q_2})^T$, $q_2=4$, α is generated from unif (1.2, 2.5)

G: genes

$G = (G_1, \dots, G_P)$, $\beta = (\beta_1, \dots, \beta_P)^T$, $P=100$, the nonzero $(\beta_1, \dots, \beta_8)$ is generated from unif(1, 2.5) and other β is 0.

#nonzero: 8

W: GxE interactions

$W = (G_1 \times E_1, \dots, G_1 \times E_{q_2}, \dots, G_p \times E_1, \dots, G_p \times E_{q_2})$, $\eta = (\eta_1, \dots, \eta_{PXq_2})^T$

the nonzero $(\eta_1, \eta_2, \eta_3), \eta_8, (\eta_9, \eta_{10}), \eta_{16}, (\eta_{17}, \eta_{18}), \eta_{24}, (\eta_{25}, \eta_{26})$ are generated from unif(1.8, 2.5) and other η is 0.

#nonzero: 12

Estimate the coefficients of β and η with marginal model:

$$Y = Cb + E\alpha + X\beta + W'\eta' + \varepsilon$$

$X = G_j$, $W' = (X \times E_1, \dots, X \times E_{q_2})$, $\eta' = (\eta'_1, \dots, \eta'_{q_2})^T$

Simulation Results

n=300, p=200, error distribution: $N(0,1)$

Bayesian Lasso (95% confidence interval)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	9.36	11.17	50.7
sd	0	3.71	0.98	11.16

Bayesian Lasso Spike and Slab (MPM)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	7.96	1.83	11.7	24.2
sd	0.18	1.15	0.467	6.58

LAD Bayesian Lasso (95% confidence interval)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	5.57	11.7	19.46
sd	0	2.67	0.53	5.21

LAD Bayesian Lasso spike and slab (MPM)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	20.46	12	102.63
sd	0	5.41	0	23.25

Simulation Results

n=300, p=200, error distribution: t(2)

Bayesian Lasso (95% confidence interval)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	7.5	8.03	11	53.67
sd	0.73	3.03	1.08	12.32

Bayesian Lasso Spike and Slab (MPM)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	7.17	1.33	11.13	15.37
sd	1.05	1.12	0.97	5.013

LAD Bayesian Lasso (95% confidence interval)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	7.43	5.07	11.17	23.47
sd	0.77	3.17	0.79	7

LAD Bayesian Lasso spike and slab (MPM)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	7.9	20.1	11.97	104.37
sd	0.25	5.58	0.18	26.6