

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)

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=200, p=50

Bayesian Lasso (95% confidence interval)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	6.033333	0.3	6.366667	1.966667
sd	1.159171	0.4660916	1.529781	1.542129

Bayesian Lasso Spike and Slab (MPM)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	6.4	0.8	6.133333	1.1
sd	0.9684684	0.9613209	1.683251	1.213431

LAD Bayesian Lasso (95% confidence interval)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	7.3	1.1	8.533333	3.633333
sd	0.7497126	1.241523	1.357821	2.484203

LAD Bayesian Lasso spike and slab (MPM)

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	7.233333	2.166667	11.6	19.56667
sd	0.8172002	1.205829	0.5632418	5.321935

n=200, p=50 (posterior median)

Bayesian Lasso

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	42	12	188
sd	0	0	0	0

Bayesian Lasso Spike and Slab

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	6.8	0.7333333	5.6	0.7666667
sd	0.8866831	0.9071871	1.67332	1.222866

LAD Bayesian Lasso

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	8	42	12	188
sd	0	0	0	0

LAD Bayesian Lasso spike and slab

	TP(main)	FP(main)	TP(interaction)	FP(interaction)
mean	7.433333	1.6	10.83333	14.8
sd	0.7738544	0.9684684	1.053183	4.77349