Simulation Results

2026-01-21

Simulation Setup

This simulation is performed with $n = 200$ and $d = 400$, using the 2-d lattice as the underlying graph. $s = 5$ parameters are set to be nonzero, and the beta parameter is chosen to be $\beta = 0.2$. The attached results are for a 10-replication simulation. The parameter vector θ has sparse components other than the following:

Parameter.Index	Value
62	0.447
63	0.447
297	0.447
324	0.447
354	0.447

but for brevity, our simulation only estimates the indices of θ in $\mathcal{C} = \{$ 62, 63, 328, 169$\}$ elements of θ. Accordingly, **all statistics and visuals are indicative of performance only on the set $\mathcal{C}$.**

The results from our code are compared to those of Cai, Guo, and Ma (2021).

The attached results include the mean-squared error for each parameter estimate, as well as boxplots for a selection of nonzero and zero-valued parameters. In the boxplots, the green line represents the true value of the estimated parameter.

After these, I show coverage statistics for 95% symmetric confidence intervals for each of the parameters.

Results

Mean-squared error comparison

Table 1: Mean-Squared Error of Parameter Estimates

	proposed	cgm
theta[62]	0.081	0.119
theta[63]	0.068	0.223
theta[328]	0.021	0.052
theta[169]	0.010	0.028
total	0.045	0.105

Table 2: Mean-Squared Error of First-Step Parameter Estimates

	proposed	cgm
theta[62]	0.143	0.080

	proposed	cgm
theta[63]	0.180	0.039
theta[328]	0.000	0.005
theta[169]	0.002	0.003
total	0.081	0.032

Mean absolute deviation comparison $(\frac{1}{n.sim}\sum_{i=1}^{n.sim} \frac{1}{|\mathcal C|}\|\hat

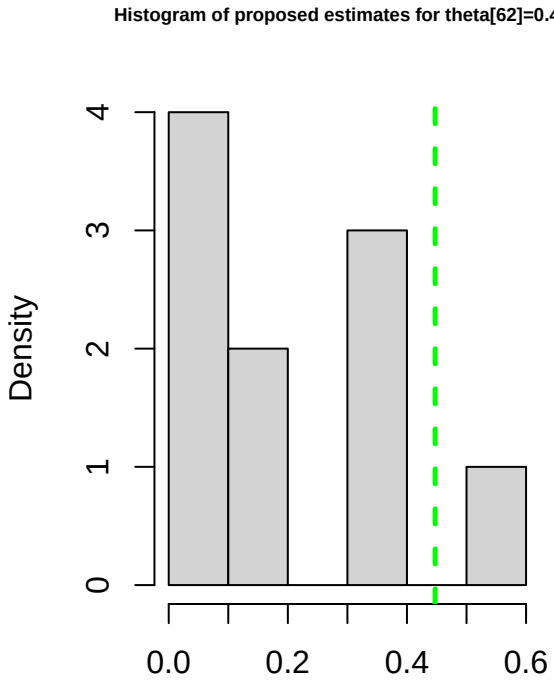
Table 3: Mean Absolute Deviation of Parameter Estimates

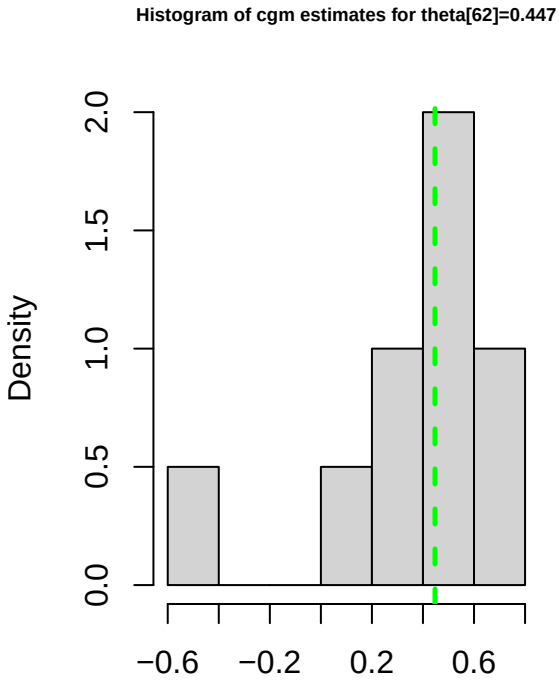
	proposed	cgm
theta[62]	0.260	0.239
theta[63]	0.234	0.230
theta[328]	0.112	0.184
theta[169]	0.087	0.124
total	0.173	0.194

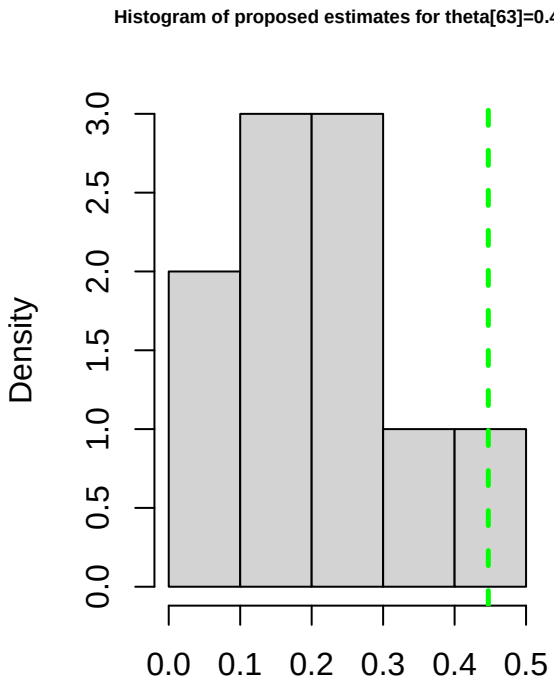
Table 4: Mean Absolute Deviation of First-Step Parameter Estimates

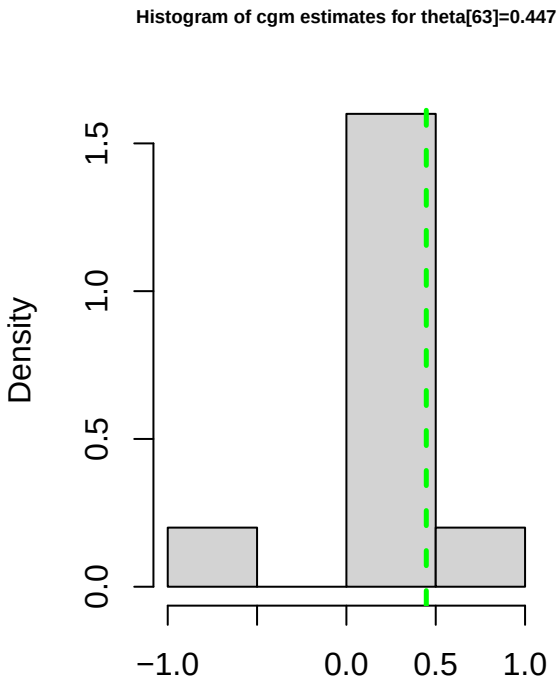
	proposed	cgm
theta[62]	0.358	0.254
theta[63]	0.423	0.159
theta[328]	0.000	0.030
theta[169]	0.017	0.025
total	0.200	0.117

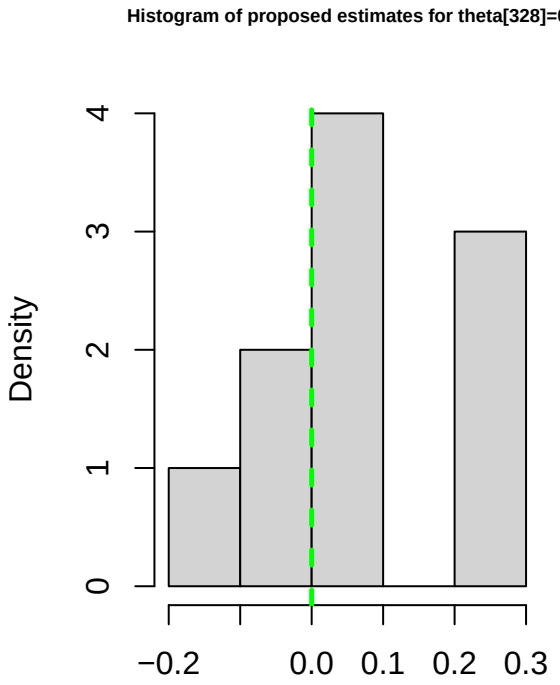
Boxplots

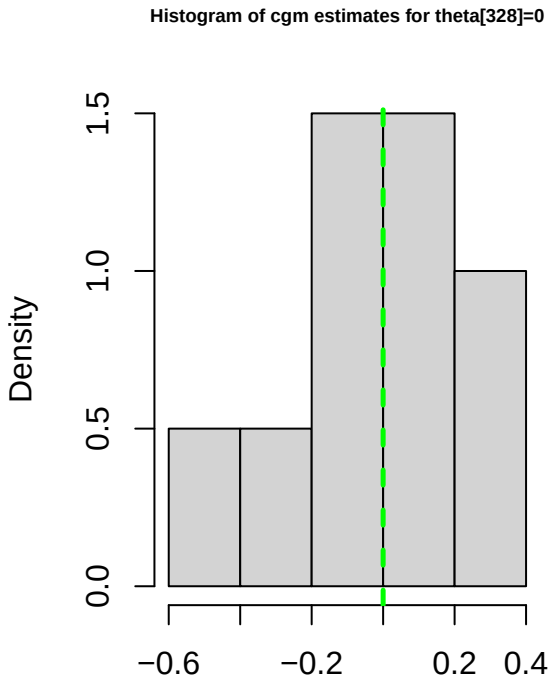

Histogram of proposed estimates for theta[62]=0.447
Density
0
1
2
3
4
0.0
0.2
0.4
0.6

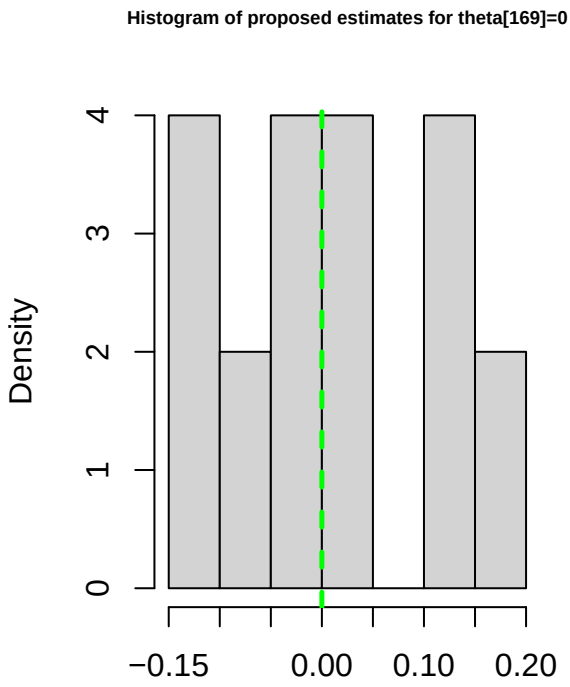

Histogram of cgm estimates for theta[62]=0.447
Density
0.0
0.5
1.0
1.5
2.0
−0.6
−0.2
0.2
0.6

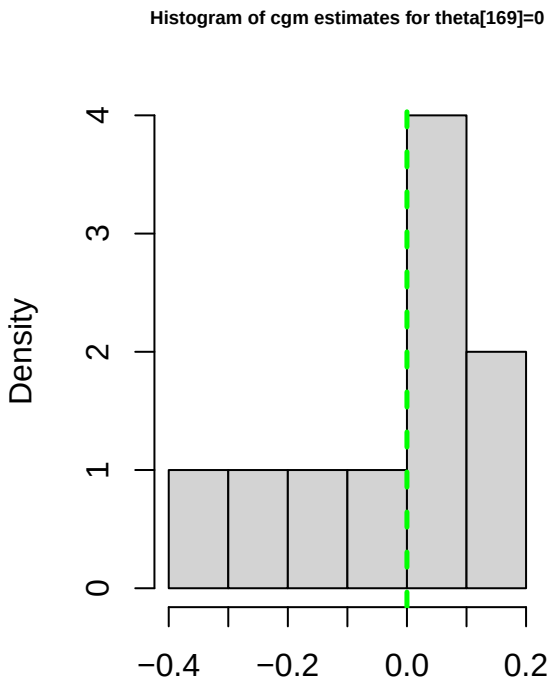

Histogram of proposed estimates for theta[63]=0.447
Density
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0.0
0.1
0.2
0.3
0.4
0.5


Histogram of cgm estimates for theta[63]=0.447
Density
0.0
0.5
1.0
1.5
−1.0
0.0
0.5
1.0


Histogram of proposed estimates for theta[328]=0
Density
0
1
2
3
4
−0.2
0.0
0.1
0.2
0.3


Histogram of cgm estimates for theta[328]=0
Density
0.0
0.5
1.0
1.5
−0.6
−0.2
0.2
0.4


Histogram of proposed estimates for theta[169]=0
Density
0
1
2
3
4
−0.15
0.00
0.10
0.20


Histogram of cgm estimates for theta[169]=0
Density
0
1
2
3
4
−0.4
−0.2
0.0
0.2

Statistics and 95% Confidence Intervals from per-Replicate Estimates

Statistics for Theoretical 95% Confidence Intervals

Table 5: Theoretical 95% Confidence Interval Statistics (averaged across replications) for proposed Estimates

	Estimate	SE	lower.CI	upper.CI	cvg
theta[62]	0.209	0.116	-0.018	0.435	0.4
theta[63]	0.213	0.102	0.013	0.414	0.3
theta[328]	0.058	0.113	-0.163	0.279	0.7
theta[169]	0.010	0.104	-0.194	0.215	1.0

Table 6: Theoretical 95% Confidence Interval Statistics (averaged across replications) for cgm Estimates

	Estimate	SE	lower.CI	upper.CI	cvg
theta[62]	0.345	0.121	0.108	0.583	0.8
theta[63]	0.275	0.134	0.011	0.538	0.8
theta[328]	-0.037	0.133	-0.297	0.224	0.7
theta[169]	-0.038	0.124	-0.280	0.205	0.9