Simulation Results

2026-01-21

Simulation Setup

This simulation is performed with $n = 400$ and $d = 200$, using the 2-d lattice as the underlying graph. $s = 20$ parameters are set to be nonzero, and the beta parameter is chosen to be $\beta = 0.4$. The attached results are for a 10-replication simulation. The parameter vector θ has sparse components other than the following:

Parameter.Index	Value
2	0.224
23	0.224
38	-0.224
39	0.224
51	-0.224
53	0.224
57	-0.224
60	0.224
81	-0.224
82	-0.224
83	0.224
89	-0.224
120	-0.224
123	-0.224
125	0.224
129	-0.224
162	0.224
174	0.224
177	-0.224
187	0.224

but for brevity, our simulation only estimates the indices of θ in $\mathcal{C} = \{$ 2, 23, 76, 186$\}$ 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[2]	0.021	0.017
theta[23]	0.009	0.025
theta[76]	0.008	0.008
theta[186]	0.007	0.014
total	0.011	0.016

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

	proposed	cgm
theta[2]	0.044	0.019
theta[23]	0.045	0.018
theta[76]	0.000	0.008
theta[186]	0.000	0.004
total	0.022	0.012

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

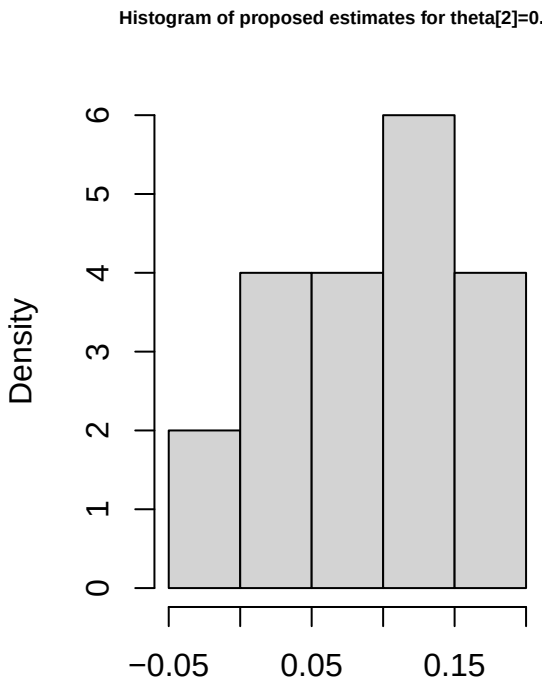
Table 3: Mean Absolute Deviation of Parameter Estimates

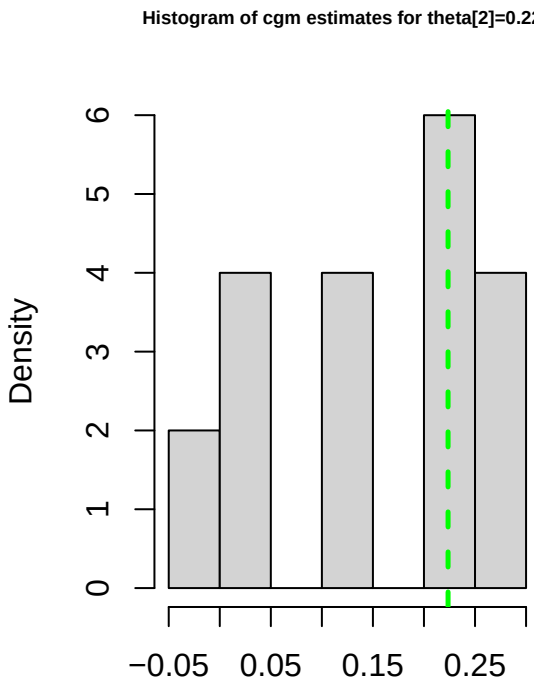
	proposed	cgm
theta[2]	0.129	0.096
theta[23]	0.063	0.108
theta[76]	0.076	0.075
theta[186]	0.062	0.098
total	0.083	0.094

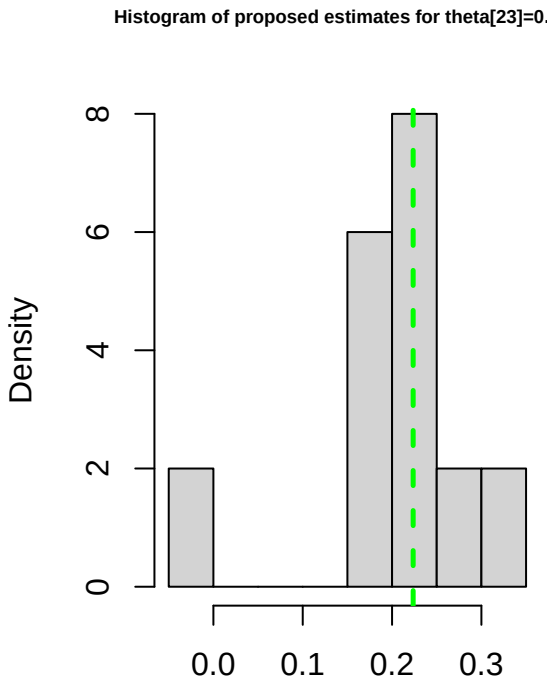
Table 4: Mean Absolute Deviation of First-Step Parameter Estimates

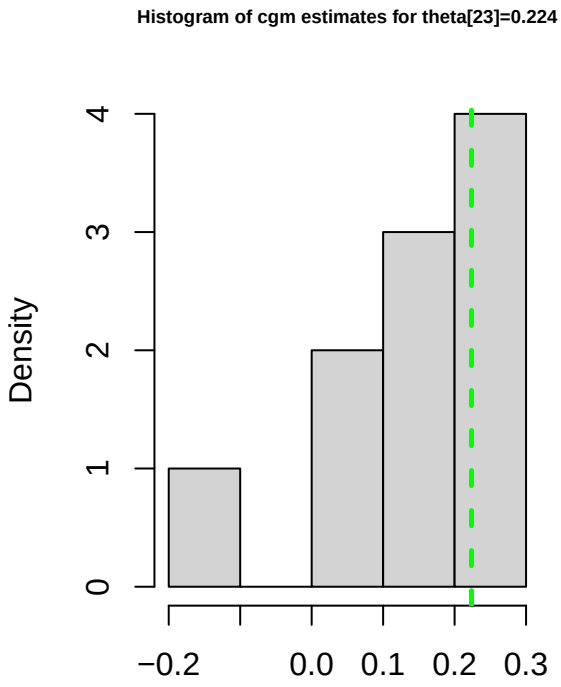
	proposed	cgm
theta[2]	0.208	0.120
theta[23]	0.209	0.107
theta[76]	0.000	0.028
theta[186]	0.000	0.027
total	0.104	0.071

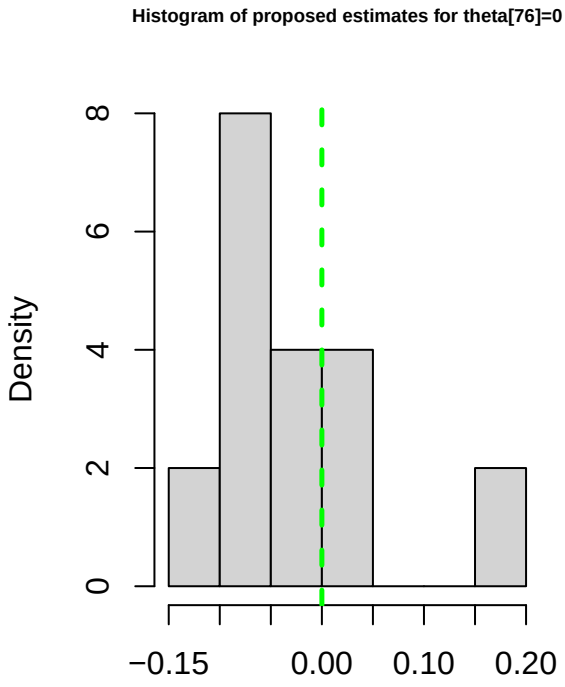
Boxplots

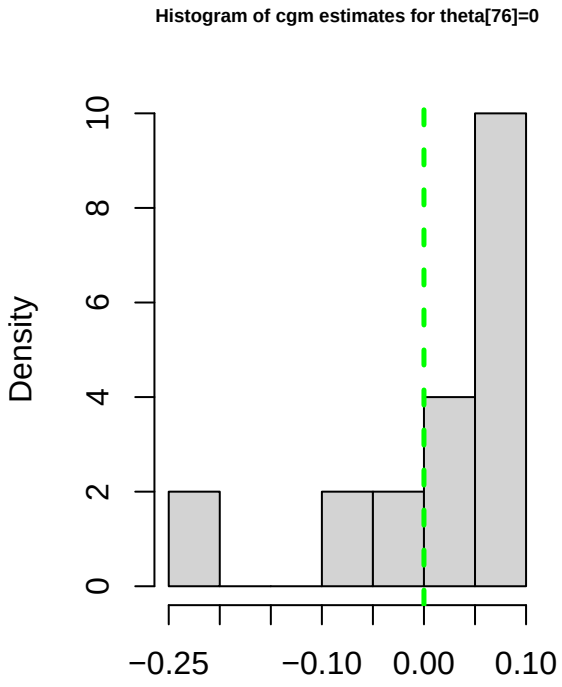

Histogram of proposed estimates for theta[2]=0.224
Density
0
1
2
3
4
5
6
−0.05
0.05
0.15

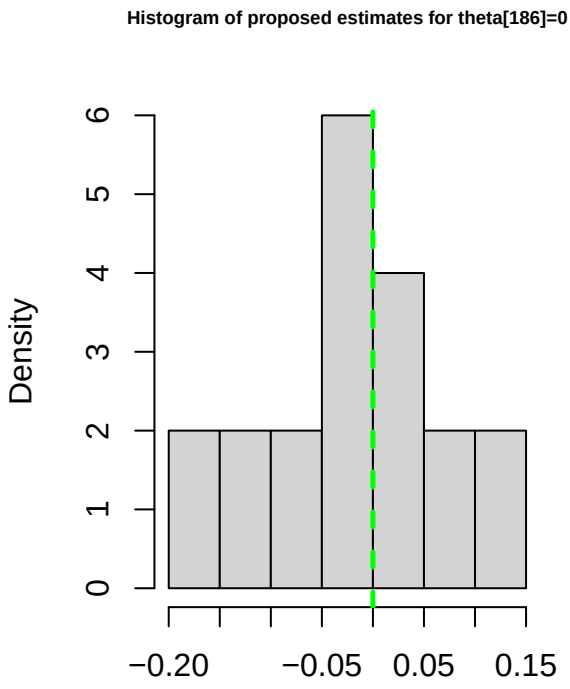

Histogram of cgm estimates for theta[2]=0.224
Density
0
1
2
3
4
5
6
−0.05
0.05
0.15
0.25

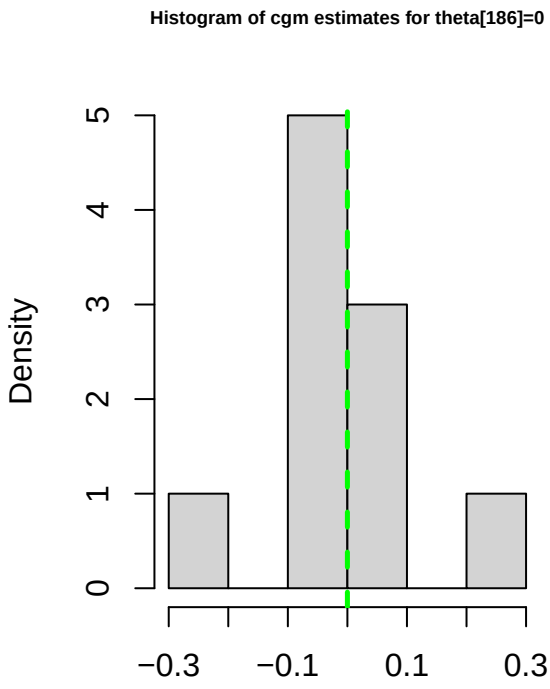

Histogram of proposed estimates for theta[23]=0.224
Density
0
2
4
6
8
0.0
0.1
0.2
0.3


Histogram of cgm estimates for theta[23]=0.224
Density
0
1
2
3
4
−0.2
0.0
0.1
0.2
0.3


Histogram of proposed estimates for theta[76]=0
Density
0
2
4
6
8
−0.15
0.00
0.10
0.20


Histogram of cgm estimates for theta[76]=0
Density
0
2
4
6
8
10
−0.25
−0.10
0.00
0.10


Histogram of proposed estimates for theta[186]=0
Density
0
1
2
3
4
5
6
−0.20
−0.05
0.05
0.15


Histogram of cgm estimates for theta[186]=0
Density
0
1
2
3
4
5
−0.3
−0.1
0.1
0.3

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[2]	0.094	0.094	-0.090	0.278	0.7
theta[23]	0.197	0.108	-0.014	0.409	0.9
theta[76]	-0.024	0.103	-0.225	0.177	1.0
theta[186]	-0.021	0.103	-0.222	0.180	1.0

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

	Estimate	SE	lower.CI	upper.CI	cvg
theta[2]	0.147	0.084	-0.018	0.312	0.7
theta[23]	0.133	0.090	-0.043	0.309	0.9
theta[76]	0.016	0.084	-0.148	0.180	0.9
theta[186]	0.003	0.087	-0.167	0.173	0.8