Simulation Results

2026-01-26

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 $\beta = 0$. 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]	0.083	0.024
theta[63]	0.038	0.044
theta[328]	0.019	0.016
theta[169]	0.015	0.005
total	0.039	0.022

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

	proposed	cgm
theta[62]	0.157	0.087

	proposed	cgm
theta[63]	0.159	0.079
theta[328]	0.000	0.000
theta[169]	0.000	0.000
total	0.079	0.041

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]	0.267	0.125
theta[63]	0.168	0.168
theta[328]	0.116	0.111
theta[169]	0.093	0.064
total	0.161	0.117

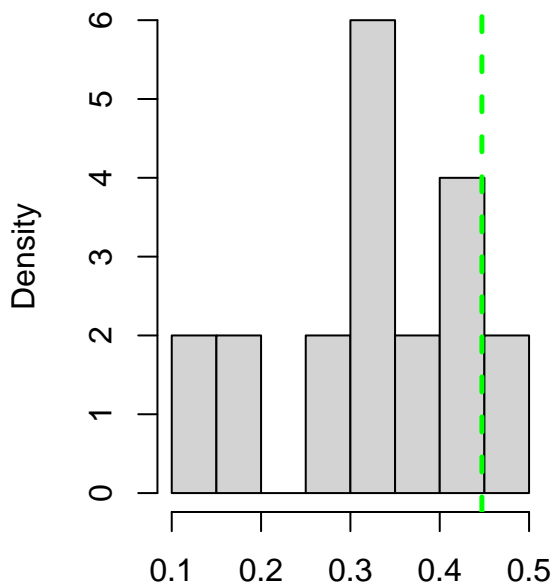Table 4: Mean Absolute Deviation of First-Step Parameter Estimates

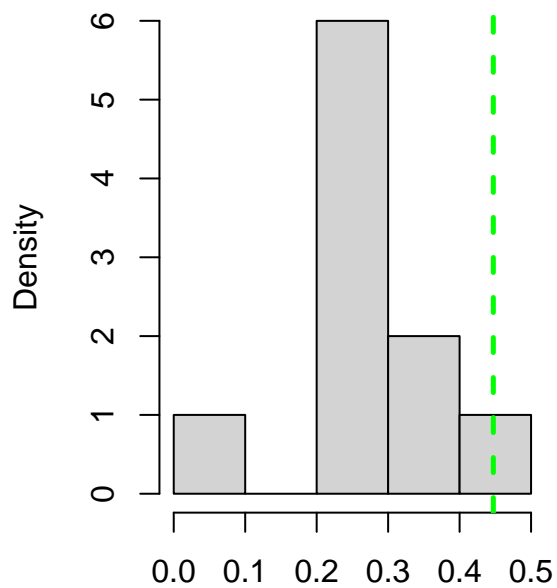|	proposed	cgm
theta[62]	0.392	0.260
theta[63]	0.390	0.243
theta[328]	0.000	0.000
theta[169]	0.000	0.001
total	0.196	0.126

Boxplots

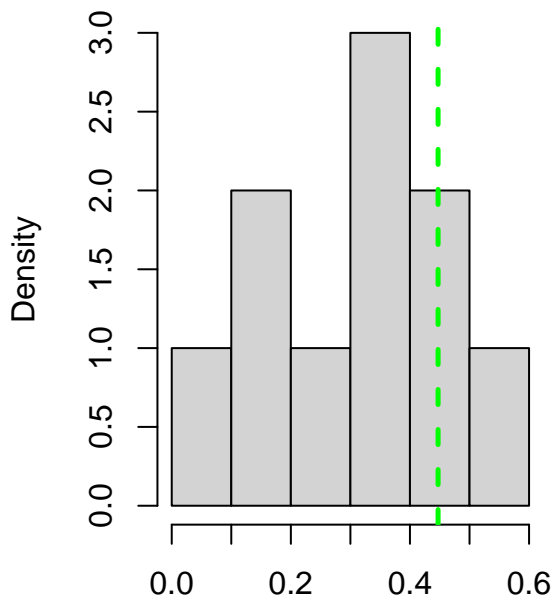**Histogram of proposed estimates for theta[62]=0.447**

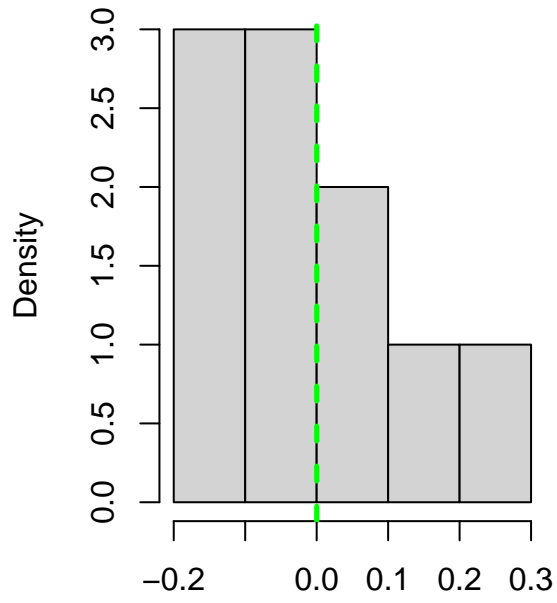**Histogram of cgm estimates for theta[62]=0.447**

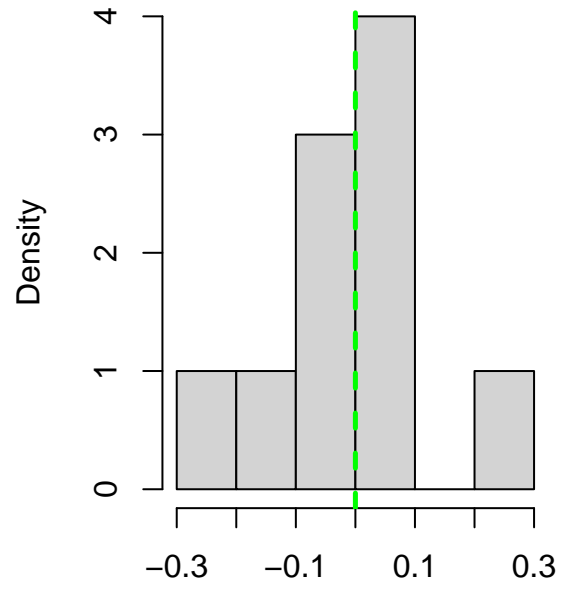**Histogram of proposed estimates for theta[63]=0.447**

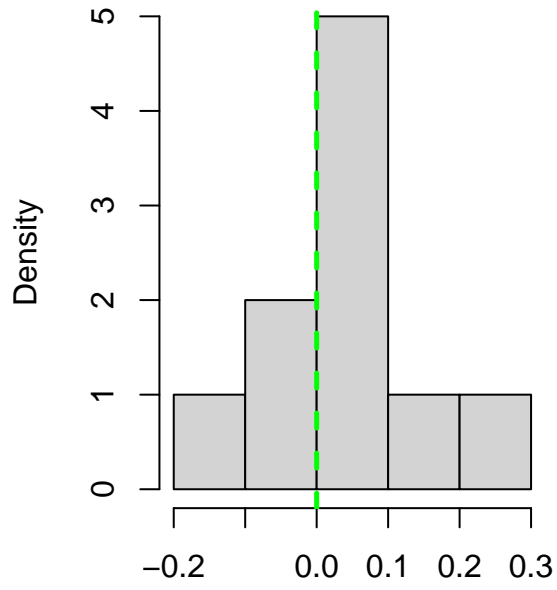**Histogram of cgm estimates for theta[63]=0.447**

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Histogram of proposed estimates for theta[328]=0   **Histogram of cgm estimates for theta[328]=0**
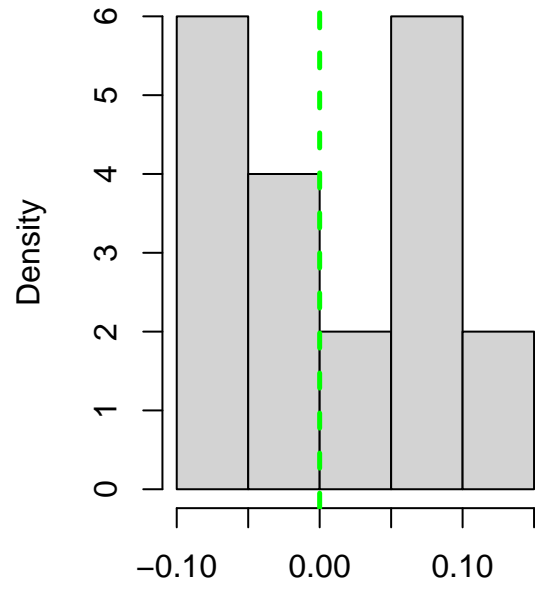
Histogram of proposed estimates for theta[169]=0

Histogram of cgm estimates for theta[169]=0

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]	0.181	0.110	-0.036	0.397	0.3
theta[63]	0.282	0.099	0.089	0.476	0.6
theta[328]	-0.003	0.109	-0.216	0.210	0.9
theta[169]	0.048	0.101	-0.151	0.246	0.9

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

	Estimate	SE	lower.CI	upper.CI	cvg
theta[62]	0.331	0.093	0.148	0.514	0.8
theta[63]	0.291	0.099	0.096	0.485	0.6
theta[328]	-0.016	0.097	-0.207	0.174	0.7
theta[169]	0.014	0.094	-0.170	0.198	1.0