Simulation Results

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Settings

The covaraites in $\mathbf{X}$ are multivariate normal with mean $\mathbf{0}$ and covariance I_P.

For each respones, we randomly select p_0 covariated to be its true features, where $p_0 = 4n^{0.16}$. Let $u \sim Bernoulli(0.4)$, and z be a normal random variable with mean 0 and satsifying that $P(|z| \geq 0.1) = 0.25$. The true features' coefficients are independently generated from the random variable \$(-1)^{u(4n}\{-0.15\}+|z|), the rest coefficients are 0.

The random error matrix E generated from in-built function `huge.generator` in R package `huge`. It will generated n samples which follow q-dimensional multivariate normal distribution with sparisity precision matrix. Then use two functions, CDF transformation or Power transformation, to generated the Nonparanormal distribution.

We will compared our methods with 3 other methods:

- Seperate Lasso
- MRCE
- Simulataneous Variable Selection

The results are tested under 24 different circumstances with $n = 100, 500, 1000$ and $p = 100, 200, 500, 1000$, q is settle to be constant 10.

Simulation results

Table 1: CDF Transformation

n=		100		500		1000	
p	Method	FDR	PDR	FDR	PDR	FDR	PDR
100	Our Method	0.2105	0.5422	0.1265	0.6449	0.1733	0.5905
	Sep Lasso	0.7976	1.0000	0.7958	1.0000	0.7687	1.0000
	MRCE	0.9032	0.1446	0.8133	1.0000	0.7558	1.0000
	Simultaneous	0.6981	0.1928	0.6563	0.2056	0.5313	0.1429
200	Our Method	0.1525	0.6329	0.1940	0.6279	0.1707	0.5913
	Sep Lasso	0.8686	1.0000	0.8549	1.0000	0.8252	1.0000
	MRCE	0.9559	0.1139	0.9264	1.0000	0.8491	1.0000
	Simultaneous	0.8871	0.0886	0.7742	0.2442	0.6977	0.1130
500	Our Method	0.2000	0.4706	0.1818	0.6058	0.2286	0.5806
	Sep Lasso	0.9277	1.0000	0.9042	1.0000	0.8911	1.0000
	MRCE	0.9896	0.2941	0.9792	0.3846	0.9517	1.0000
	Simultaneous	NA	NA	NA	NA	NA	NA
1000	Our Method	0.2564	0.3671	0.1600	0.5478	0.1807	0.6018
	Sep Lasso	0.9473	1.0000	0.9109	1.0000	0.9198	1.0000
	MRCE	0.9886	0.5641	0.9859	0.4500	0.9864	0.3939
	Simultaneous	NA	NA	NA	NA	NA	NA

Table 2: Power Transformation

n=		100		500		1000	
p	Method	FDR	PDR	FDR	PDR	FDR	PDR
100	Our Method	0.1667	0.6000	0.1803	0.5882	0.1917	0.5268
	Sep Lasso	0.7826	1.0000	0.7529	1.0000	0.7466	1.0000
	MRCE	0.9505	0.0667	0.3103	0.2352	0.0000	0.0535
	Simultaneous	0.7209	0.1600	0.7200	0.2471	0.6216	0.1250
200	Our Method	0.1136	0.5132	0.1298	0.6262	0.1447	0.5804
	Sep Lasso	0.8886	1.0000	0.8205	1.0000	0.8333	1.0000
	MRCE	0.0000	0.0526	0.1111	0.0748	0.0000	0.0179
	Simultaneous	0.8085	0.1184	0.6964	0.1589	0.7629	0.2054
500	Our Method	0.2439	0.3605	0.1973	0.6289	0.1538	0.5739
	Sep Lasso	0.9167	1.0000	0.8983	1.0000	0.8714	1.0000
	MRCE	0.0000	0.0116	0.6364	0.0825	0.0000	0.0522
	Simultaneous	NA	NA	NA	NA	NA	NA
1000	Our Method	0.2683	0.3793	0.1667	0.5652	0.1392	0.6018
	Sep Lasso	0.9360	1.0000	0.9196	1.0000	0.9327	1.0000
	MRCE	0.9929	0.1392	0.9859	0.4500	0.9865	0.3939
	Simultaneous	NA	NA	NA	NA	NA	NA

Improvement

Next time, We can test the special structure of X and test more specific pattern of the precision matrix. Another important thing is that we still need to improve the calculation speed when estimate of β for the given features.