A Relaxed Symmetry-Constrained Non-negative Model for Large-Scale Undirected Weighted Network Representation: Supplementary File

Yurong Zhong, Xin Luo, *Senior Member*, *IEEE*, and Zidong Wang, *Fellow*, *IEEE*

This is the supplementary file for the paper entitled *A Relaxed Symmetry-Constrained Non-negative Model for Large-Scale Undirected Weighted Network Representation*. Some supplementary tables and figures illustrating the experimental results are put in this file and cited in the manuscript.

I. Supplementary Tables

TABLE S1. RMSE of M1-8 on D1-6, where ✪ indicates M8 has lower RMSE than the rival model.

No.	M1	M2	M3	M4	M5	M6	M7	M8✪
D1	0.1319±3.8E-4✪	0.1333±2.4E-4✪	0.1329±9.8E-5✪	0.1544±2.6E-4✪	0.1574±1.2E-4✪	0.1318±1.6E-4✪	0.1289±2.4E-4✪	**0.1280±1.8E-4**
D2	0.1290±9.4E-5✪	0.1330±2.0E-4✪	0.1324±4.5E-4✪	0.1649±2.7E-4✪	0.1813±1.6E-4✪	0.1297±1.4E-4✪	0.1272±1.0E-4✪	**0.1261±3.5E-4**
D3	0.1431±1.5E-3✪	0.1437±2.0E-4✪	0.1500±1.3E-3✪	0.1806±4.1E-4✪	0.1972±1.4E-4✪	0.1415±1.3E-4✪	0.1399±2.3E-4✪	**0.1389±2.3E-4**
D4	0.2301±8.6E-4✪	0.2559±5.5E-4✪	0.3148±8.3E-4✪	0.2297±1.3E-4✪	0.2369±6.8E-4✪	0.3079±7.2E-4✪	0.2269±2.2E-3✪	**0.2215±1.3E-4**
D5	0.0756±3.6E-4✪	0.0821±1.7E-5✪	0.1561±8.0E-4✪	0.0740±1.2E-5✪	0.0764±8.1E-5✪	0.1037±2.2E-4✪	0.0735±3.7E-4✪	**0.0728±3.6E-4**
D6	0.0423±7.7E-5✪	0.0464±1.3E-5✪	0.0931±4.9E-4✪	0.0415±8.5E-5✪	0.0430±5.3E-5✪	0.0631±6.9E-5✪	0.0412±8.1E-5✪	**0.0409±1.9E-4**
✪Win/ Loss	6/0	6/0	6/0	6/0	6/0	6/0	6/0	-
Friedman Rank	3.833	5.833	6.667	5	6.5	5.167	2	1

TABLE S2. Converging Iteration Count of M1-8 on D1-6, where ✪ indicates M8 has less converging iteration count than the rival model.

No.	M1	M2	M3	M4	M5	M6	M7	M8✪
D1	341±2.87✪	187±4.0✪	199±7.41✪	685±16.71✪	1000✪	89±1.78	**87±15.87**	108±7.97
D2	192±6.45✪	311±5.20✪	175±17.90✪	975±42.01✪	1000✪	**79±2.39**	93±14.46	101±17.86
D3	122±5.79✪	284±3.24✪	205±48.28✪	959±29.28✪	674±4.28✪	**86±1.61**	95±11.99	118±4.88
D4	967±4.76✪	40±2.49	88±4.15	**33±0.32**	69±0.89	135±1.0	39±4.42	205±10.35
D5	568±5.13✪	251±1.22✪	77±2.79	52±0.55	103	**42±0.71**	44±4.48	164±3.42
D6	582±2.13✪	227±1.26✪	51±1.37	**20±0.45**	357✪	30±0.91	91±1.67✪	81±1.33
✪Win/ Loss	6/0	5/1	3/3	3/3	4/2	0/6	1/5	-
Friedman Rank	6.5	5.333	4.333	4.5	6.5	2.167	2.333	4.333

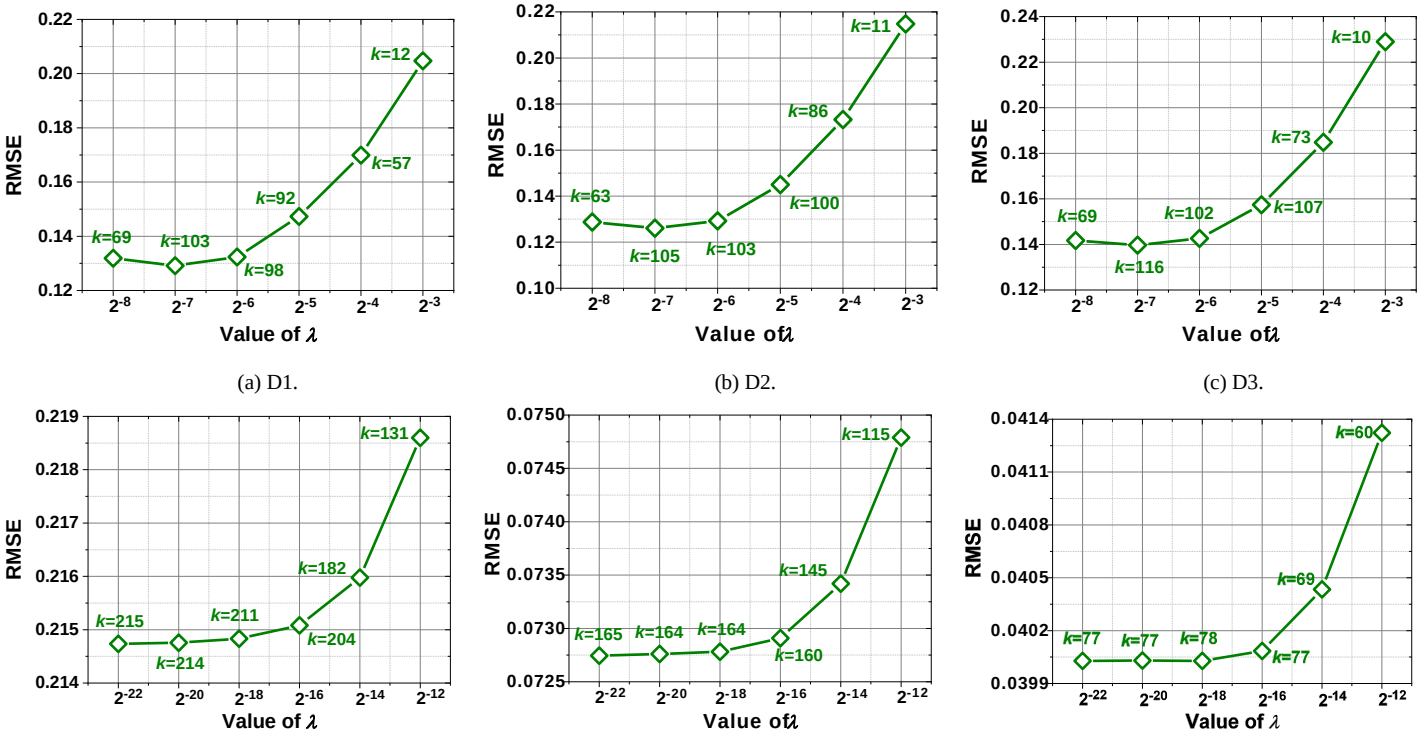
TABLE S3. Time Cost (Sec.) of M1-8 on D1-6, where ✪ indicates M8 has less Time Cost than the rival model.

No.	M1	M2	M3	M4	M5	M6	M7	M8✪
D1	64±2.01	349±17.29✪	6569±152.57✪	1043±30.48✪	2287±18.82✪	1086±165✪	**67±13.89**	88±6.55
D2	53±4.05	2272±38.06✪	12197±814.95✪	5759±504.90✪	9542±980.55✪	1106±188✪	**94±16.25**	112±19.04
D3	40±9.7	1103±74.94✪	48±11.67	2101±247.69✪	2477±131.54✪	1298±214✪	**120±29.15**	178±14.04
D4	19±2.51✪	109±7.98✪	2013±78.62✪	80±1.91✪	215±3.78✪	47±6.83✪	**2±0.31**	11±1.02
D5	41±7.21	5879±46.83✪	12527±389.87✪	872±26.98✪	2631±6.11✪	94±8.92✪	**19±0.99**	48±1.26
D6	74±6.61✪	18171±115.57✪	30029±651.33✪	1074±26.41✪	30074±128.59✪	162±15.37✪	44±2.92✪	**42±1.44**
✪Win/ Loss	3/3	6/0	6/0	6/0	6/0	6/0	1/5	-
Friedman Rank	1.833	5.5	6.833	5.5	7.167	4.667	1.833	2.667

TABLE S4. Results of Wilcoxon Signed-Ranks Test.

Comparison	RMSE			Converging Iteration Count			Time Cost		
	***R*+**	***R*-**	***p*-value**	***R*+**	***R*-**	***p*-value**	***R*+**	***R*-**	***p*-value**
M1 vs. M8	21	0	**0.0156**	21	0	**0.0156**	15	6	0.2188
M2 vs. M8	21	0	**0.0156**	17	4	0.1094	21	0	**0.0156**
M3 vs. M8	21	0	**0.0156**	10.5	10.5	0.5313	20	1	**0.0313**
M4 vs. M8	21	0	**0.0156**	15	6	0.2188	21	0	**0.0156**
M5 vs. M8	21	0	**0.0156**	18	3	0.0781	21	0	**0.0156**
M6 vs. M8	21	0	**0.0156**	21	0	**0.0156**	21	0	**0.0156**
M7 vs. M8	21	0	**0.0156**	19	2	**0.0469**	20	1	**0.0313**

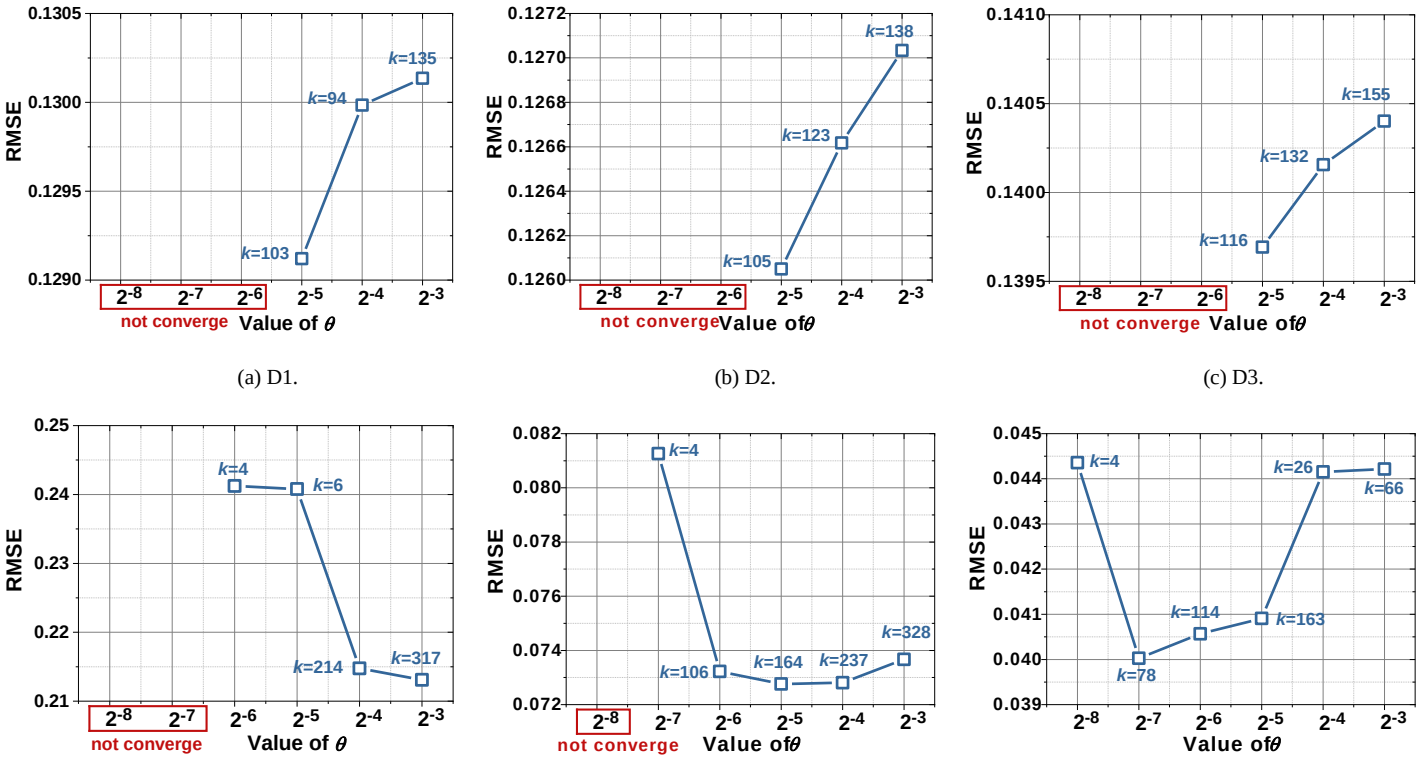
II. SUPPLEMENTARY FIGURES



(a) D1. (b) D2. (c) D3.

(d) D4. (e) D5. (f) D6.

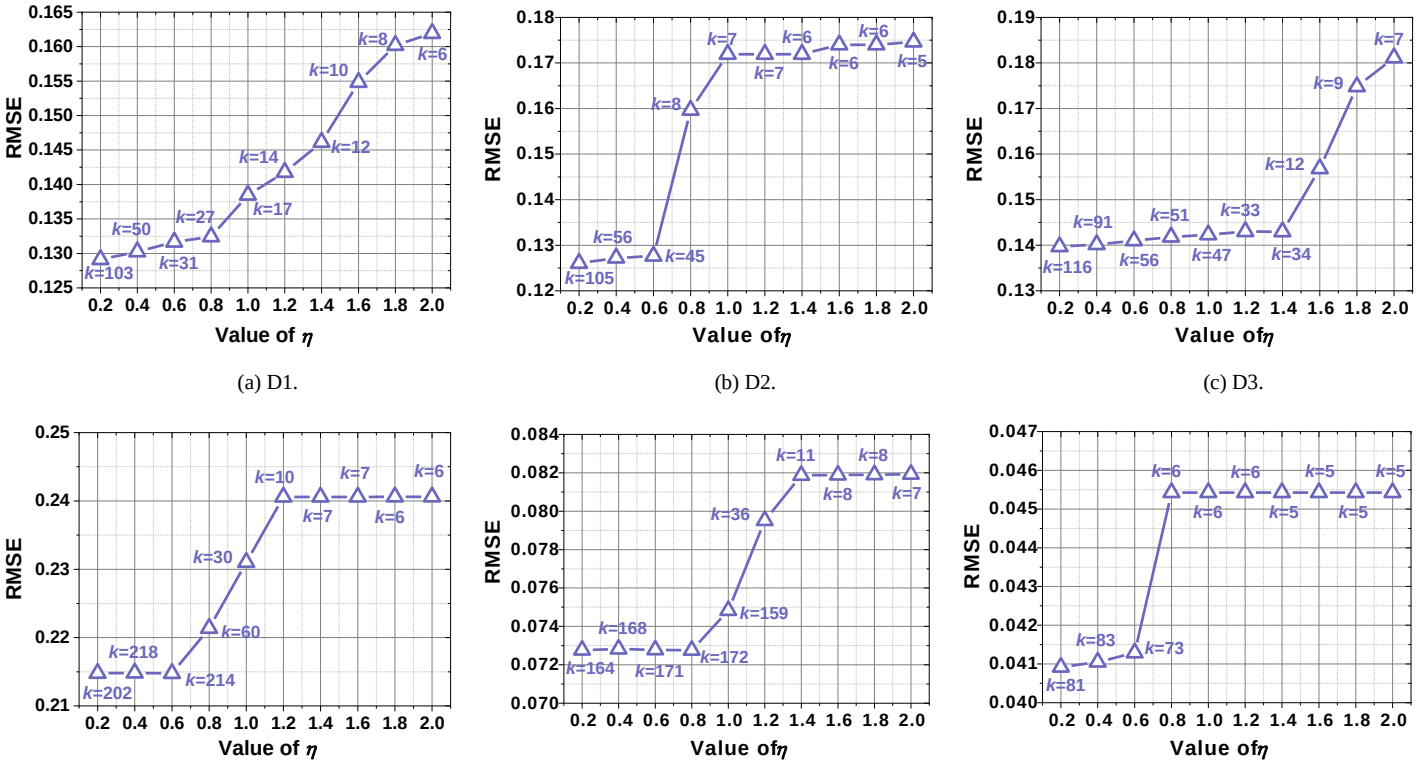
Fig. S1. Sensitive experiments of λ in RSCN with fixed θ and η. (a)-(c) θ=2^{-5}, η=0.2, (d) θ=2^{-4}, η=0.6, (e) θ=2^{-5}, η=0.2, and (f) θ=2^{-7}, η=0.2.



(a) D1. (b) D2. (c) D3.

(d) D4. (e) D5. (f) D6.

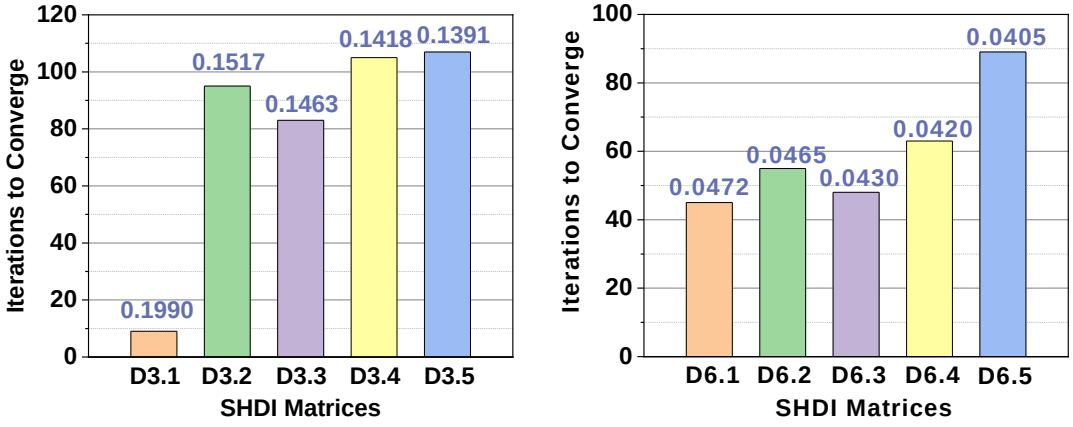
Fig. S2. Sensitive experiments of θ in RSCN with fixed λ and η. (a)-(c) λ=2^{-7}, η=0.2, (d) λ=2^{-20}, η=0.6, (e) λ=2^{-20}, η=0.2, and (f) λ=2^{-18}, η=0.2.



(a) D1. (b) D2. (c) D3.

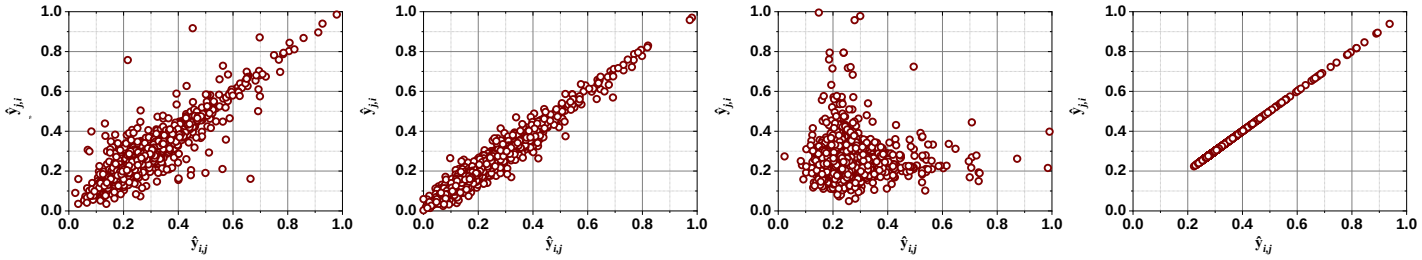
(d) D4. (e) D5. (f) D6.

Fig. S3. Sensitive experiments of η in RSCN with fixed λ and θ. (a)-(c) λ=2^{-7}, θ=2^{-5}, (d) λ=2^{-20}, θ=2^{-4}, (e) λ=2^{-20}, θ=2^{-5}, and (f) λ=2^{-18}, θ=2^{-7}.

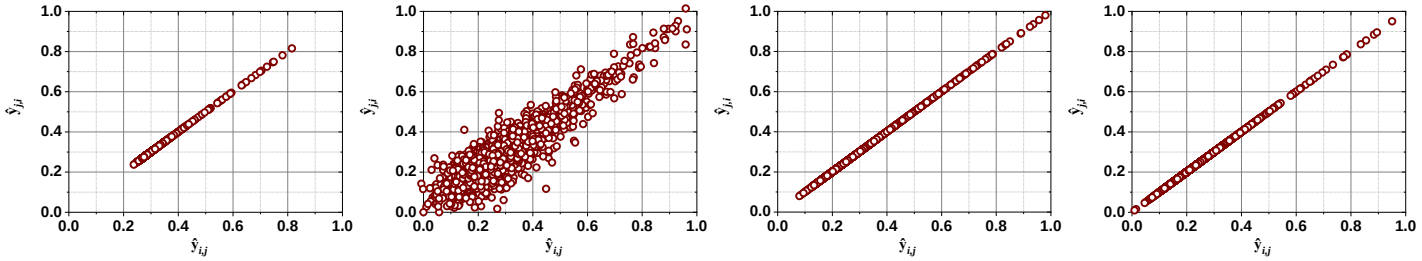


(a) (b)

Fig. S4. RSCN's Performance on D3 and D6 as data density varies.



(a) M1 (b) M2 (c) M3 (d) M4



(e) M5 (f) M6 (g) M7 (h) M8

Fig. S5. Symmetric representation of M1-8 on D1.