

Table 1: Spectral gap changes for ProxyDelete, ProxyAdd, and FoSR

Dataset	Cora	Citeseer	Pubmed	Cornell	Texas	Wisconsin	Chameleon	Squirrel	Actor
Gap Before	0.0047	0.0015	0.0140	0.0797	0.06322	0.0765	0.0063	0.051	0.032
ProxyDelete	0.0059	0.0018	0.0140	0.0834	0.06326	0.0815	0.0064	0.053	0.040
ProxyAdd	0.024	0.012	0.01518	0.0998	0.1407	0.09617	0.018	0.069	0.08354
FoSR	0.0099	0.0027	0.01413	0.0929	0.0632	0.0770	0.0085	0.052	0.03268
Deletions	50	50	50	5	5	5	50	50	50

Table 2: Comparing GCN performance on FoSR, ProxyDelete, and RandomDelete

Dataset	Cora	Citeseer	Pubmed	Cornell	Wisconsin	Texas	Chameleon	Squirrel	Actor
Baseline	87.22	77.35	86.96	50.74	53.52	50.40	31.15	26.00	29.12
GCN	± 0.40	± 0.70	± 0.17	± 7.24	± 7.80	± 10.01	± 0.84	± 0.69	± 0.24
FoSR	91.44 ± 3.16	82.13 ± 4.29	91.49 ± 1.89	53.91 ± 8.67	58.78 ± 3.22	60.25 ± 4.97	46.64 ± 7.70	50.73 ± 6.93	38.01 ± 7.48
Random	87.30	78.34	87.15	63.97	61.71	63.97	44.07	40.63	29.57
Delete	± 0.31	± 0.38	± 0.16	± 2.50	± 2.73	± 5.41	± 1.04	± 0.41	± 0.44
Proxy	87.51	78.68	87.39	66.60	66.36	72.36	55.88	48.90	43.52
Delete	± 0.81	± 0.55	± 0.11	± 6.50	± 7.17	± 7.88	± 5.48	± 7.68	± 9.64

Table 3: Number of edges that satisfy the Eldan criterion for deletions

Dataset	Cornell	Texas	Wisconsin	Chameleon	Squirrel
GapBefore	0.079707	0.06322	0.07652	0.0063079	0.05138
Gap EldanDelete	0.08230	0.06325	0.08030	0.00784	0.053
Braess Edges	4	3	12	2255	33849
Total number of edges	277	279	450	8854	46998

Table 4: Comparison with DropEdge. We adopt experimental setup of DropEdge for 2 layers. We average over 3 runs and report test accuracy. We use the recommended hyperparameters from the authors.

Dataset	Cora	Citeseer	Pubmed
Baseline-GCN	80.89 $\pm$ 0.49	71.53 $\pm$ 0.16	79.13 $\pm$ 0.26
DropEdge	81.89 $\pm$ 1.07	70.89 $\pm$ 0.58	78.89 $\pm$ 0.28
ProxyDelete	81.39 $\pm$ 0.14	71.56 $\pm$ 0.28	79.00 $\pm$ 0.00

Table 5: Comparing GCN performance on Long Range Benchmark Datasets with FoSR

Dataset	PascalVOC-SP (Test F1 $\uparrow$)	Peptides-Func (Test AP $\uparrow$)	Peptides-struct (Test MAE $\downarrow$)
GCN Baseline	0.1268 $\pm$ 0.0060	0.5930 $\pm$ 0.0023	0.3496 $\pm$ 0.0013
DRew+GCN	0.1848 $\pm$ 0.0107	0.6996$\pm$0.0076	0.2781 $\pm$ 0.0028
FoSR+GCN	0.2157 $\pm$ 0.0057	0.6526 $\pm$ 0.0014	0.2499 $\pm$ 0.0006
ProxyAdd+GCN	0.2213$\pm$0.0011	0.6789 $\pm$ 0.0002	0.2465$\pm$0.0004
ProxyDelete+GCN	0.2170$\pm$0.0015	0.6908 $\pm$ 0.0007	0.2470$\pm$0.0080

Table 6: GCN performance comparison with BORF

Dataset	Cora	Citeseer	Texas	Cornell	Wisconsin	Chameleon
GCN	86.7 $\pm$ 0.3	72.3 $\pm$ 0.3	44.2 $\pm$ 1.5	41.5 $\pm$ 1.8	44.6 $\pm$ 1.4	59.2 $\pm$ 0.6
GCN+BORF	87.5 $\pm$ 0.2	73.8 $\pm$ 0.2	49.4 $\pm$ 1.2	50.8 $\pm$ 1.1	50.3 $\pm$ 0.9	61.5 $\pm$ 0.4
GCN+FoSR	91.44$\pm$3.16	82.13$\pm$4.29	60.25 $\pm$ 4.97	53.91 $\pm$ 8.67	58.78 $\pm$ 3.22	46.64 $\pm$ 7.70
GCN+ProxyAdd	89.10 $\pm$ 0.70	78.94 $\pm$ 0.54	74.21$\pm$10.64	66.54 $\pm$ 9.56	67.75 $\pm$ 7.96	54.30 $\pm$ 6.27
GCN+ProxyDelete	87.51 $\pm$ 0.81	78.68 $\pm$ 0.55	72.36 $\pm$ 7.88	66.60 $\pm$ 6.50	66.36 $\pm$ 7.17	55.88$\pm$5.48
GCN+EldanAdd	88.38 $\pm$ 0.12	79.45 $\pm$ 0.37	67.10 $\pm$ 8.91	69.05$\pm$6.17	64.08 $\pm$ 6.58	48.09 $\pm$ 7.30
GCN+EldanDelete	87.60 $\pm$ 0.18	78.68 $\pm$ 0.54	70.53 $\pm$ 6.70	65.13 $\pm$ 13.02	67.84$\pm$7.65	52.51 $\pm$ 8.12